# Urban and Suburban Arterial Safety Performance Functions: Final Report

WA-RD 857.1

Venky Shankar Narayan Venkataraman Jungyeol Hong Barad Hariharan Daniel Kwon June 2016





WSDOT Research Report

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### Urban and Suburban Arterial Safety Performance Functions

### **Final Report**

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#### 16. Abstract

This report documents findings from a comprehensive set of safety performance functions developed for the entire urban-suburban arterial road segment system on the state highway system in Washington. Conventional urban suburban safety performance functions on the basis of cross sectional classifications were developed using random parameter negative binomial models. Total crashes, as well as crashes by severity type were modeled. It was found that out of 20 statistically significant variables, number of lanes, roadway width, shoulder width, point of vertical tangent grade (PVT), vertical curve point of vertical curve grade (PVC) horizontal curve maximum super elevation (e), curve central angle (delta), horizontal curve radius (R) were found to be random parameters. In addition, derived measures such as degree of curve, absolute vertical grade difference (A), and rate of vertical curvature (K) were also found to be random. The majority of the statistically significant effects were geometric. In addition, functional class indicators such as minor arterial indicator were also found to be random. Roadside information was not fully evaluated due to inconsistencies in matching roadside inventories for all homogeneous segments. An alternative classification of the safety performance functions on the basis of ADT-population thresholds was also considered. Similar patterns of parameter randomness were found. In the absence of roadside and land use information, it appears from the 173 advanced random parameter models that were developed, that the treatment of geometric parameters as random is justified, due to significant unobserved heterogeneity in the urban-suburban arterial crash context.

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### **1.0 Introduction**

The scope of this study is to provide a detailed analysis of all Washington State highway crashes from 2010 to 2012 with specific attention focused on addressing the manner in which urban-suburban functional classes are assigned to highway segments or various stretches of roadway within the Washington State highway network. The conventional method of assigning highway functional class type in transportation applications is to base the functional classifications on surrounding land-use definitions that include such factors as census information, population density, and property boundaries. Efforts by the Washington State Department of Transportation (WSDOT) have aimed to establish a more detailed methodology for assigning highway functional classifications that are based on the afore mentioned metrics as illustrated by the Detailed Functional Classification Criteria document (prior to October 2013) and the more recent release of WSDOT's report on Guidelines for Amending Functional Classification in Washington State (October 2013).

These existing methods of highway functional classification incorporate additional metrics that are not necessarily conducive to highway safety analysis. Multiple factors that influence highway segment functional class or geographic class misrepresent how highway crashes should be evaluated because of the way in which the roadway is defined. In transportation safety analysis, Annual Average Daily Traffic (AADT) is a crucial component in safety modeling. By utilizing AADT as a means for determining highway functional class, it is hypothesized that such a classification system would result in more robust crash prediction with respect to functional class and geographic class type. This report will compare two core methodologies of highway geographic classification: 1) land-use population estimates and 2) AADT counts. The two methods of classification will be compared and the differences in approach will be explained. The intent of this report and the resulting SPF methodology is to offer clarity and assist WSDOT in their efforts for establishing a standard safety protocol for developing SPFs for various urban-suburban classifications.

#### 1.1 Overview of Study Area

The study area for this research focuses on all highways in Washington State, which totals 187 routes. The following figure displays all state routes for Washington as shown in an available state highway map downloaded from the WSDOT Highway Map webpage.

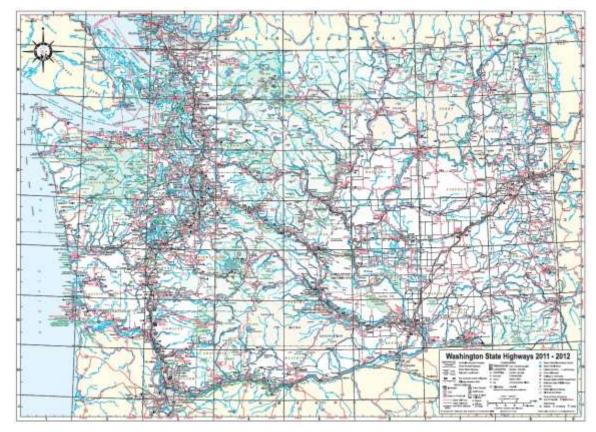


Figure 1.1: Washington State Highway Map 2011-2012.

The next three tables list all of the routes from Washington State that are included in the study from 2010, 2011, and 2012. The routes are listed by number with their associated route mileage shown in parentheses. The tables show consistent mileage for all state routes across the three-year time span and minimal changes in total mileage, with a total centerline mileage of 6,867.68 miles for 2010, 6,864.38 miles for 2011, and 6,864.30 miles for 2012.

From 2010 to 2011, there was a recorded reduction of 3.0 centerline miles across the state highway network, of which 2.63 miles were reduced for State Route 527. From 2011 to 2012, the reduction in centerline miles across the Washington State highway network totaled 0.08 miles, with State Route 7 reducing 0.07 miles between 2011 and 2012.

| Table 1.1: 2010 Washington State Routes and Total Mileage.         State Route # (Mileage)-2010 |                  |                  |                   |                  |
|---|------------------|------------------|-------------------|------------------|
| 2(322.72 miles)   |                  |                  |                   |                  |
| 3(59.82 miles)  | 107(7.83 miles)  | 181(5.96 miles)  | 292(5.89 miles)   | 524(14.61 miles) |
| 4(62.24 miles)  | 108(11.92 miles) | 182(15.04 miles) | 300(3.31 miles)   | 525(30.47 miles) |
| 5(276.58 miles)   | 109(40.18 miles) | 193(2.11 miles)  | 302(16.75 miles)  | 526(4.47 miles)  |
| 6(51.36 miles)  | 110(3.3 miles)   | 194(13.98 miles) | 303(9.19 miles)   | 527(9.21 miles)  |
| 7(58.25 miles)  | 112(61.24 miles) | 195(93.26 miles) | 304(3.02 miles)   | 528(3.25 miles)  |
| 8(20.66 miles)  | 113(9.58 miles)  | 197(2.48 miles)  | 305(13.31 miles)  | 529(7.7 miles)   |
| 9(91.58 miles)  | 115(2.24 miles)  | 202(30.47 miles) | 307(5.19 miles)   | 530(50.32 miles) |
| 10(16.09 miles)   | 116(5.91 miles)  | 203(24.24 miles) | 308(3.38 miles)   | 531(9.84 miles)  |
| 11(21.23 miles)   | 117(1.36 miles)  | 204(2.34 miles)  | 310(1.85 miles)   | 532(10.02 miles) |
| 12(324.4 miles)   | 119(9.28 miles)  | 205(10.55 miles) | 395(186.42 miles) | 534(4.92 miles)  |
| 14(179.97 miles)  | 121(7.62 miles)  | 206(15.28 miles) | 397(22.15 miles)  | 536(5.22 miles)  |
| 16(27.06 miles)   | 122(7.71 miles)  | 207(4.32 miles)  | 401(12.1 miles)   | 538(3.48 miles)  |
| 17(135.02 miles)  | 123(16.33 miles) | 211(15.13 miles) | 405(30.18 miles)  | 539(14.91 miles) |
| 18(28.29 miles)   | 124(44.61 miles) | 213(.22 miles)   | 409(3.77 miles)   | 542(57.16 miles) |
| 19(12.53 miles)   | 125(23.63 miles) | 215(6.19 miles)  | 410(107.07 miles) | 543(1.05 miles)  |
| 20(395.16 miles)  | 127(26.87 miles) | 221(25.92 miles) | 411(13.28 miles)  | 544(8.89 miles)  |
| 21(179.26 miles)  | 128(.51 miles)   | 223(3.69 miles)  | 432(10.23 miles)  | 546(7.78 miles)  |
| 22(35.76 miles)   | 129(42.48 miles) | 224(9.98 miles)  | 433(.87 miles)    | 547(9.53 miles)  |
| 23(65.91 miles)   | 131(1.99 miles)  | 225(11.31 miles) | 500(22.15 miles)  | 548(13.78 miles) |
| 24(78.71 miles)   | 141(25.99 miles) | 231(72.07 miles) | 501(13.82 miles)  | 599(1.73 miles)  |
| 25(121.13 miles)  | 142(35.2 miles)  | 240(40.05 miles) | 502(7.57 miles)   | 702(9.19 miles)  |
| 26(133.59 miles)  | 150(10.91 miles) | 241(25.08 miles) | 503(53.05 miles)  | 704(.61 miles)   |
| 27(89.85 miles)   | 153(30.76 miles) | 243(28.21 miles) | 504(51.7 miles)   | 705(1.48 miles)  |
| 28(135.23 miles)  | 155(78.31 miles) | 260(37.97 miles) | 505(19.28 miles)  | 706(13.63 miles) |
| 31(26.74 miles)   | 160(7.45 miles)  | 261(56.12 miles) | 506(11.49 miles)  | 730(5.99 miles)  |
| 41(.31 miles)   | 161(32.2 miles)  | 262(20.04 miles) | 507(43.42 miles)  | 821(25.09 miles) |
| 82(132.5 miles)   | 162(17.34 miles) | 263(9.11 miles)  | 508(32.74 miles)  | 823(5.14 miles)  |
| 90(297.5 miles)   | 163(3.33 miles)  | 270(9.84 miles)  | 509(29.24 miles)  | 900(15.28 miles) |
| 92(7.96 miles)  | 164(14.59 miles) | 271(8.37 miles)  | 510(13.05 miles)  | 902(12.28 miles) |
| 96(6.68 miles)  | 165(20.25 miles) | 272(18.91 miles) | 512(12.04 miles)  | 903(10.02 miles) |
| 97(250.59 miles)  | 166(4.93 miles)  | 274(1.89 miles)  | 513(3.33 miles)   | 904(16.9 miles)  |
| 99(49.09 miles)   | 167(28.53 miles) | 278(2.76 miles)  | 515(7.73 miles)   | 906(2.64 miles)  |
| 100(4.54 miles)   | 169(25.22 miles) | 281(10.2 miles)  | 516(16.47 miles)  | 970(10.14 miles) |
| 101(365.47 miles)   | 170(3.57 miles)  | 282(4.9 miles)   | 518(3.4 miles)    | 971(10.37 miles) |
| 103(16.48 miles)  | 171(3.75 miles)  | 283(14.52 miles) | 519(.79 miles)    | Total Length     |
| 104(31.55 miles)  | 172(34.93 miles) | 285(5.03 miles)  | 520(12.73 miles)  | (Mainline Only)  |
| 105(48.54 miles)  | 173(11.51 miles) | 290(17.7 miles)  | 522(24.31 miles)  | 6867.683 miles   |

 Table 1.1: 2010 Washington State Routes and Total Mileage.

| Table 1.2: 2011 Washington State Routes and Total Mileage.<br>State Route # (Mileage)-2011 |                  |                  |                   |                  |
|--|------------------|------------------|-------------------|------------------|
| 2(322.72 miles) 106(20.07 miles) 174(40.52 miles) 291(23.35 miles) 523(1.61 miles)         |                  |                  |                   |                  |
| 3(59.82 miles)   | 107(7.83 miles)  | 181(5.96 miles)  | 292(5.89 miles)   | 524(14.61 miles) |
| 4(62.24 miles)   | 108(11.92 miles) | 182(15.04 miles) | 300(3.31 miles)   | 525(30.47 miles) |
| 5(276.58 miles)  | 109(40.18 miles) | 193(2.11 miles)  | 302(16.75 miles)  | 526(4.47 miles)  |
| 6(51.36 miles)   | 110(3.3 miles)   | 194(13.98 miles) | 303(9.19 miles)   | 527(6.58 miles)  |
| 7(58.25 miles)   | 112(61.24 miles) | 195(93.26 miles) | 304(3.02 miles)   | 528(3.25 miles)  |
| 8(20.66 miles)   | 113(9.58 miles)  | 197(2.48 miles)  | 305(13.31 miles)  | 529(7.7 miles)   |
| 9(91.58 miles)   | 115(2.24 miles)  | 202(30.47 miles) | 307(5.19 miles)   | 530(50.25 miles) |
| 10(16.09 miles)  | 116(5.91 miles)  | 203(24.24 miles) | 308(3.38 miles)   | 531(9.84 miles)  |
| 11(21.23 miles)  | 117(1.36 miles)  | 204(2.34 miles)  | 310(1.85 miles)   | 532(10.02 miles) |
| 12(324.43 miles)   | 119(9.28 miles)  | 205(10.55 miles) | 395(186.42 miles) | 534(4.92 miles)  |
| 14(179.97 miles)   | 121(7.62 miles)  | 206(15.28 miles) | 397(22.15 miles)  | 536(5.22 miles)  |
| 16(27.21 miles)  | 122(7.71 miles)  | 207(4.32 miles)  | 401(12.1 miles)   | 538(3.48 miles)  |
| 17(135.02 miles)   | 123(16.33 miles) | 211(15.13 miles) | 405(30.18 miles)  | 539(14.91 miles) |
| 18(28.29 miles)  | 124(44.61 miles) | 213(.22 miles)   | 409(3.77 miles)   | 542(57.16 miles) |
| 19(12.53 miles)  | 125(23.63 miles) | 215(6.19 miles)  | 410(107.07 miles) | 543(1.05 miles)  |
| 20(395.16 miles)   | 127(26.87 miles) | 221(25.92 miles) | 411(13.28 miles)  | 544(8.89 miles)  |
| 21(179.26 miles)   | 128(.51 miles)   | 223(3.69 miles)  | 432(10.23 miles)  | 546(7.78 miles)  |
| 22(35.76 miles)  | 129(42.48 miles) | 224(9.98 miles)  | 433(.87 miles)    | 547(9.53 miles)  |
| 23(65.91 miles)  | 131(1.99 miles)  | 225(11.31 miles) | 500(22.15 miles)  | 548(13.78 miles) |
| 24(78.71 miles)  | 141(25.99 miles) | 231(72.07 miles) | 501(13.82 miles)  | 599(1.73 miles)  |
| 25(121.13 miles)   | 142(35.2 miles)  | 240(40.05 miles) | 502(7.57 miles)   | 702(9.19 miles)  |
| 26(133.59 miles)   | 150(10.91 miles) | 241(25.08 miles) | 503(53.05 miles)  | 704(.61 miles)   |
| 27(89.85 miles)  | 153(30.76 miles) | 243(28.21 miles) | 504(51.7 miles)   | 705(1.48 miles)  |
| 28(135.23 miles)   | 155(78.31 miles) | 260(37.97 miles) | 505(19.28 miles)  | 706(13.63 miles) |
| 31(26.74 miles)  | 160(7.45 miles)  | 261(56.12 miles) | 506(11.49 miles)  | 730(5.99 miles)  |
| 41(.31 miles)  | 161(32.2 miles)  | 262(20.04 miles) | 507(43.42 miles)  | 821(25.09 miles) |
| 82(132.5 miles)  | 162(17.34 miles) | 263(9.11 miles)  | 508(32.74 miles)  | 823(5.08 miles)  |
| 90(297.48 miles)   | 163(3.33 miles)  | 270(9.84 miles)  | 509(29.24 miles)  | 900(15.28 miles) |
| 92(7.96 miles)   | 164(14.59 miles) | 271(8.37 miles)  | 510(13.05 miles)  | 902(12.28 miles) |
| 96(6.68 miles)   | 165(20.25 miles) | 272(18.91 miles) | 512(12.04 miles)  | 903(10.02 miles) |
| 97(250.59 miles)   | 166(4.93 miles)  | 274(1.89 miles)  | 513(3.33 miles)   | 904(16.9 miles)  |
| 99(48.39 miles)  | 167(28.53 miles) | 278(2.76 miles)  | 515(7.73 miles)   | 906(2.64 miles)  |
| 100(4.54 miles)  | 169(25.22 miles) | 281(10.2 miles)  | 516(16.47 miles)  | 970(10.14 miles) |
| 101(365.47 miles)  | 170(3.57 miles)  | 282(4.9 miles)   | 518(3.4 miles)    | 971(10.37 miles) |
| 103(16.48 miles)   | 171(3.75 miles)  | 283(14.52 miles) | 519(.79 miles)    | Total Length     |
| 104(31.55 miles)   | 172(34.93 miles) | 285(5.03 miles)  | 520(12.73 miles)  | (Mainline Only)  |
| 105(48.54 miles)   | 173(11.51 miles) | 290(17.7 miles)  | 522(24.31 miles)  | 6864.38 miles    |

 Table 1.2: 2011 Washington State Routes and Total Mileage.

| Table 1.3: 2012 washington State Routes and Total Mileage.         State Route # (Mileage)-2012 |                  |                  |                   |                  |
|---|------------------|------------------|-------------------|------------------|
| 2(322.72 miles)   | 106(20.07 miles) | 174(40.52 miles) | 291(23.35 miles)  | 523(1.61 miles)  |
| 3(59.82 miles)  | 107(7.83 miles)  | 181(5.96 miles)  | 292(5.89 miles)   | 524(14.61 miles) |
| 4(62.24 miles)  | 108(11.92 miles) | 182(15.04 miles) | 300(3.31 miles)   | 525(30.47 miles) |
| 5(276.58 miles)   | 109(40.18 miles) | 193(2.11 miles)  | 302(16.75 miles)  | 526(4.47 miles)  |
| 6(51.36 miles)  | 110(3.3 miles)   | 194(13.98 miles) | 303(9.19 miles)   | 527(6.58 miles)  |
| 7(58.25 miles)  | 112(61.24 miles) | 195(93.26 miles) | 304(3.02 miles)   | 528(3.25 miles)  |
| 8(20.66 miles)  | 113(9.58 miles)  | 197(2.48 miles)  | 305(13.31 miles)  | 529(7.7 miles)   |
| 9(91.58 miles)  | 115(2.24 miles)  | 202(30.47 miles) | 307(5.19 miles)   | 530(50.25 miles) |
| 10(16.09 miles)   | 116(5.91 miles)  | 203(24.24 miles) | 308(3.38 miles)   | 531(9.84 miles)  |
| 11(21.23 miles)   | 117(1.36 miles)  | 204(2.34 miles)  | 310(1.85 miles)   | 532(10.02 miles) |
| 12(324.43 miles)  | 119(9.28 miles)  | 205(10.55 miles) | 395(186.39 miles) | 534(4.92 miles)  |
| 14(179.95 miles)  | 121(7.62 miles)  | 206(15.28 miles) | 397(22.15 miles)  | 536(5.22 miles)  |
| 16(27.21 miles)   | 122(7.71 miles)  | 207(4.32 miles)  | 401(12.1 miles)   | 538(3.48 miles)  |
| 17(135.02 miles)  | 123(16.33 miles) | 211(15.13 miles) | 405(30.18 miles)  | 539(14.91 miles) |
| 18(28.29 miles)   | 124(44.65 miles) | 213(.22 miles)   | 409(3.77 miles)   | 542(57.16 miles) |
| 19(12.53 miles)   | 125(23.63 miles) | 215(6.19 miles)  | 410(107.07 miles) | 543(1.05 miles)  |
| 20(395.16 miles)  | 127(26.87 miles) | 221(25.92 miles) | 411(13.28 miles)  | 544(8.89 miles)  |
| 21(179.26 miles)  | 128(.51 miles)   | 223(3.69 miles)  | 432(10.23 miles)  | 546(7.78 miles)  |
| 22(35.76 miles)   | 129(42.48 miles) | 224(9.98 miles)  | 433(.87 miles)    | 547(9.53 miles)  |
| 23(65.91 miles)   | 131(1.99 miles)  | 225(11.31 miles) | 500(22.15 miles)  | 548(13.78 miles) |
| 24(78.71 miles)   | 141(25.99 miles) | 231(72.07 miles) | 501(13.82 miles)  | 599(1.73 miles)  |
| 25(121.13 miles)  | 142(35.2 miles)  | 240(40.05 miles) | 502(7.57 miles)   | 702(9.19 miles)  |
| 26(133.59 miles)  | 150(10.91 miles) | 241(25.08 miles) | 503(53.05 miles)  | 704(.61 miles)   |
| 27(89.85 miles)   | 153(30.76 miles) | 243(28.21 miles) | 504(51.7 miles)   | 705(1.48 miles)  |
| 28(135.16 miles)  | 155(78.31 miles) | 260(37.97 miles) | 505(19.28 miles)  | 706(13.63 miles) |
| 31(26.74 miles)   | 160(7.45 miles)  | 261(56.12 miles) | 506(11.49 miles)  | 730(5.99 miles)  |
| 41(.31 miles)   | 161(32.2 miles)  | 262(20.04 miles) | 507(43.42 miles)  | 821(25.09 miles) |
| 82(132.5 miles)   | 162(17.34 miles) | 263(9.11 miles)  | 508(32.74 miles)  | 823(5.08 miles)  |
| 90(297.48 miles)  | 163(3.33 miles)  | 270(9.84 miles)  | 509(29.24 miles)  | 900(15.28 miles) |
| 92(7.96 miles)  | 164(14.59 miles) | 271(8.37 miles)  | 510(13.05 miles)  | 902(12.28 miles) |
| 96(6.68 miles)  | 165(20.25 miles) | 272(18.91 miles) | 512(12.04 miles)  | 903(10.02 miles) |
| 97(250.59 miles)  | 166(4.93 miles)  | 274(1.89 miles)  | 513(3.33 miles)   | 904(16.9 miles)  |
| 99(48.39 miles)   | 167(28.53 miles) | 278(2.76 miles)  | 515(7.73 miles)   | 906(2.64 miles)  |
| 100(4.54 miles)   | 169(25.22 miles) | 281(10.2 miles)  | 516(16.47 miles)  | 970(10.14 miles) |
| 101(365.47 miles)   | 170(3.57 miles)  | 282(4.9 miles)   | 518(3.4 miles)    | 971(10.37 miles) |
| 103(16.48 miles)  | 171(3.75 miles)  | 283(14.52 miles) | 519(.79 miles)    | Total Length     |
| 104(31.55 miles)  | 172(34.93 miles) | 285(5.03 miles)  | 520(12.73 miles)  | (Mainline Only)  |
| 105(48.54 miles)  | 173(11.51 miles) | 290(17.7 miles)  | 522(24.31 miles)  | (6864.30 miles)  |

 Table 1.3: 2012 Washington State Routes and Total Mileage.

#### **1.2 WSDOT Functional Classification Methodology**

The Federal Highway Administration (FHWA) Directive 23 CFR 470 dictates that state transportation agencies maintain the primary responsibility for determining statewide highway functional classifications in rural and urban areas. At the state level, the Washington State Legislature in *RCW* 47.05.021 dictates WSDOT to "analyze the entire state highway system to 'subdivide', classify, and sub-classify all designated state highways according to their function and importance. These two directives serve as the driver for WSDOT's functional classification initiative, as described on the WSDOT Functional Classification webpage. Within recent years, WSDOT has updated their methodology for determining highway functional class. Here, a brief history will be presented on how WSDOT developed their methodology for assigning functional class designations and what standards they currently follow.

Prior to October 2013, WSDOT outlined their protocol for assigning functional classifications through their *Detailed Functional Classification Criteria* document. This document lists the criteria for establishing functional classes that WSDOT adheres according to:

- Type and magnitude of travel generators.
- Route feasibility and directness of travel.
- Traffic characteristics and trip length.
- Spacing between types of functional classes.
- Continuity of various functional classes.
- Multiple service capability (accommodation of other modes of transportation).
- Relationships of functional classes to transportation plan(s).
- Miles and travel classification control values.
- Integration of classification of adjoining jurisdictions.

The criteria related to type and magnitude of travel generators are referenced to the generators that concern: travel, population, recreational/cultural, industrial, commercial, and governmental. Each type of travel generator describes the thresholds for classifying a particular functional class within the framework of principal arterial, minor arterial, major collector, or minor collector, respectively, in either the rural or urban type setting. Feasibility of route and directness of travel are considered where a choice of routes between areas has less than a 10% difference in distance. Traffic characteristics relate to trip purpose and type of travel service the route is intended to provide: interstate and statewide, interregional, interregional and intercounty, and intracounty. Spacing is another element that serves as a qualifier for accomplishment of service, where travel setting affects the manner in which traffic flow is accommodated to travel generators. System continuity impacts the functional classification for principal and minor arterials, with ending termini at a junction with an equal or higher functionally classified facility. Multiple service capability weighs the impact that other transportation modes have on normal traffic flow. Relationship of route to transportation plan is only considered in situations in the classification evaluation process where transportation plans have been developed. Classification controls deal with miles by functional class and travel by functional class within rural and urban systems; these controls are more directly tied to incorporated zonal limits and area boundaries. System integration represents the final step in the classification process which reviews the classifications of individual roadways, within the larger

context of areas and regions, involving interagency collaborations to present a statewide classification of roadways.

In 2013, WSDOT, in cooperation with the FHWA, implemented procedures for adjusting the Urban Area (UA) boundaries due in part to the 2010 Census. Thus, the 2010 Census Adjusted Urban Area (AUA) Boundaries program recognizes the impact that changes in boundary determination will have on defining breaks between rural and urban areas. In response to these changes, WSDOT provides various guides that define the requirements and procedures for local agencies and Metropolitan Planning Organizations (MPOs) for requesting changes to the UA boundaries on the 2010 Census Adjusted AUA Boundaries webpage. As a result of the 2010 Census, WSDOT released the 2010 Census Urbanized Areas and Urban Clusters Map that highlights urban areas according to information provided by the US Census Bureau.

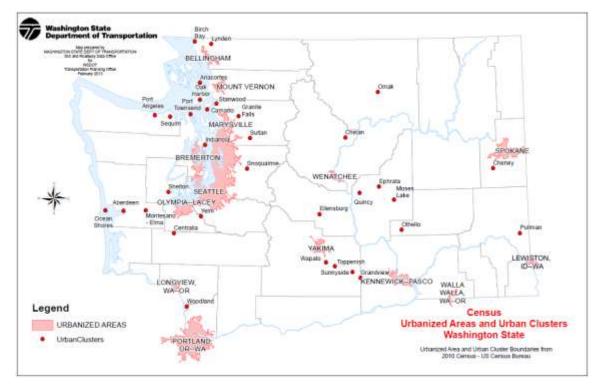
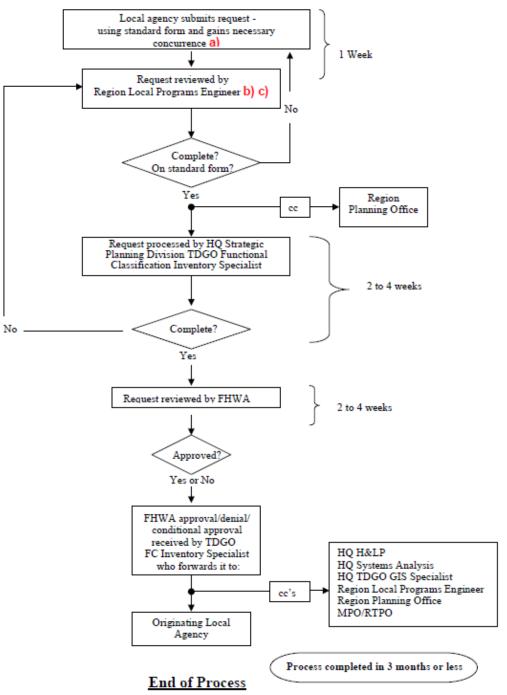


Figure 1.2: WSDOT Census Urbanized Areas and Urban Clusters Map.

As outlined by WSDOT's *Guidance for Urban Area Boundary Adjustment in Washington State*, UA boundary adjustments are negotiated among MPOs, local officials, and WSDOT before being submitted for approval by the FHWA. As defined by the US Census for population size, Urban Area Types are defined as 'Urban Clusters' for populations of 2,500 - 49,999 and 'Urban Areas' as 50,000+. The FHWA defines Urban Area Types as 'Small Urban Area' for populations of 5,000 - 49,999 and 'Urbanized Area (UZA)' for populations 50,000+. Most importantly, the UA boundary adjustment procedure must be completed before any functional classification adjustments can be made.

The Boundary Review Team is responsible for reviewing boundary adjustment proposals from MPOs and local regional planning agencies, and coordinating adjustment decisions to the various stakeholders involved in the boundary determination process before submitting AUA

recommendations for FHWA approval. In the summer of 2013, the FHWA approved the resulting Highway Urban Area (HUA) boundaries as a result of the AUA process. Subsequently, all counties and MPOs affected by the HUA boundary changes had been asked to review their roads on August 13, 2013 and October 16, 2013, respectively. Figure 1.3 illustrates the basic steps required in the functional classification change request process.



Begin Functional Classification Request Process

Figure 1.3: WSDOT Functional Classification Request Flow Chart.

The functional classification process was scheduled to occur from July 3, 2013 to December 31, 2013 where arterial or collector changes in classification were to be submitted to WSDOT for approval and input into WSDOT systems.

WSDOT released the *Guidelines for Amending Functional Classification in Washington State* document in October 2013 to assist state authorities in the functional classification process. This document builds upon the *Highway Functional Classification: Concepts, Criteria and Procedures,* 2013 Edition by providing additional details and clarification to the methods and considerations involved in the process. This comprehensive guidance document explains the critical concepts and criteria while also providing some real-world examples of applying the functional classification methodology throughout the procedure. Some key changes covered in the *Guidelines for Amending Functional Classification in Washington State* document includes:

- Upgrading the functional classification of rural/urban should predominantly be driven by an actual change in function, as opposed to the location of an urban/rural boundary.
- All available classification categories now exist in both urban and rural areas, rather than different codes systems for rural and urban areas that existed in the previous Highway Performance Monitoring System (HPMA).
- For Washington State, the Functional Class (FC) numbering system is clarified by the FHWA by including additional subdivisions to ensure the symmetry in the categories for urban and rural classifications: Urban Collector subdivision included in Major and Minor Collector; Rural Other Principal Arterial subdivision into Other Freeway/Expressway and Other Principal Arterial.

The functional classification concepts are discussed to outline the role that the roadway segment plays in accommodating traffic flow in the network. Among the considerations that are referenced in in the *Guidelines for Amending Functional Classification in Washington State*, roadway access and mobility, efficiency of travel, collectors, access points, speed limit, route spacing, usage in terms of AADT volumes and Vehicle Miles of Travel (VMT), number of travel lanes, regional and statewide significance, and system continuity. The criteria that govern functional classification are presented in the different types of roadway functional class:

- Interstates the highest classification of arterials offering high levels of mobility.
- Other Freeways and Expressways similar to interstates, but with separated directional travel lanes, limited on- and off-ramp locations, and very limited at-grade intersections.
- Other Principal Arterials provides high degree of mobility while also directly serving abutting land uses in major centers of metropolitan areas.
- Minor Arterials offers connectivity to higher arterial systems while also providing intracommunity continuity; typically provides high overall travel speeds in rural areas.
- Major and Minor Collectors in general, major collector routes are longer in length with lower connecting driveway densities, higher speed limits, greater space intervals, higher AADT, and more travel lanes than minor collectors.
- Local Roads accounts for the greatest mileage of all roadways; are not intended for long distance travel aside, from the origin/destination terminal of a trip, because of direct access to abutting land.

The decision process for assigning functional classifications stems from the characterization of the travel service provided by the roadway. The overall decision process in the functional classification system, as shown in the *Guidelines for Amending Functional Classification in Washington State*, is displayed in Figure 1.4.

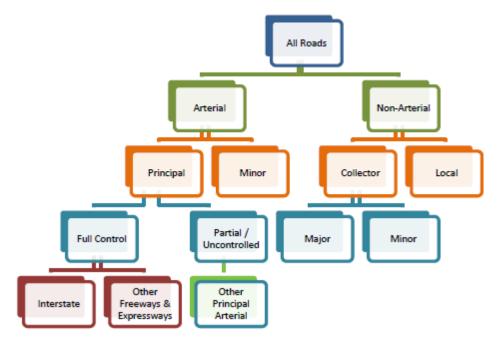


Figure 1.4: Federal Functional Classification Decision Tree (FHWA).

It is important to note the emphasis on roadway function and service over the urban/rural distinction. While land development patterns are considered in the peripheral of the functional classification process, the determination should be explicitly based on actual functional criteria rather than the location of the roadway within an urban or rural context. On December 31, 2013 WSDOT submitted the boundaries and functional classification changes to the FHWA for approval, with the resulting data to be reported by June 15, 2014.

The methodology employed by WSDOT and FHWA incorporates various elements in the determination of roadway functional class. The many concepts and considerations in the evaluation process make the task of assigning functional classifications complex. If the functional classifications were to be limited to key elements, the task of assigning functional classifications will become simplified. This report will present two methods of assigning functional class: by population and by AADT. The motivation of isolating functional classifications to a single qualifier is two-fold: 1) to demonstrate a simplistic, efficient and effective methodology for assigning functional class and 2) illustrate the impact that functional classifications may have on safety modeling with the two methods of functional class determination. The ramifications of such a method would have wide ranging policy implications concerning WSDOT and FHWA functional class determination. That is, if this demonstration of assigning functional class aray be able to consolidate their efforts to focus on the single-determining factor of functional class assignment. This would essentially streamline the request and review process that local, MPO, regional, and

state agencies must undergo in order to classify/reclassify roadway functional class to satisfy the directives set forth by the FHWA.

#### **1.3 Organization of Report**

The report is organized in the following manner:

Data Description – the four data sources of accident, roadway geometrics, AADT, and functional class will be described in their source formats as they were obtained from WSDOT. The final database, expressed in the format of homogeneous roadway segments, will be explained and the parameters within the dataset will be presented.

Functional Classification (Centerline Miles) – geographical classifications of Rural, Small Urban, Small Urbanized, Large Urbanized, and Metropolitan will be described and the manner in which they are assigned according to population and AADT based metrics will be introduced. The method for validating the functional class centerline miles with the WS Highway Log centerline miles will be discussed. Comparison tables between the population and AADT based methods will be presented in several matrices in units of centerline miles.

Functional Classification (Segments) – the population and AADT comparison matrices will be expressed in counts of homogeneous roadway segments based on WSDOT's definition of function class: Interstate, Principal Arterial, Minor Arterial, and Collector roadways. The matrices will evaluate segments of all functional class types as well as each functional class individually. The chapter will conclude by examining the comparison matrices for all Non-Interstate related homogeneous roadway segments.

Crash Summary – the report will conclude with crash summaries being shown for the crash descriptors of total crash count, impact location, collision severity, number of vehicles involved, and collision type. The tables will be presented in the first section on the basis of roadway functional class, followed by roadway geographic class in the second section. The functional classification tables will show the four functional class types disaggregated by Urban and Rural area. The geographic classification crash tables will compare and contrast the differences in the crash counts between the AADT and population based methods of assignment.

### 2.0 Data Description

All data has been provided by or obtained from WSDOT sources. The crash data analysis centers on the accident records for three years of raw crash data, 2010 to 2012, for all highways in Washington State. Roadway geometric data includes information pertaining to horizontal and vertical alignment, as well as lane and roadway and shoulder configurations. AADT information was extracted from the ArcGIS metadata files downloaded from WSDOT's GeoData Distribution Catalog webpage; the final crash database utilizes the AADT obtained from Traffic Section counts. Similarly, State Route Functional Class data was also extracted from the ArcGIS metadata file from the same GeoData webpage. This data file provides both the federal functional class description and the state functional class description on a segmentation basis. Both the AADT counts and the State Route Functional Class data were cross-referenced with Washington State Highway Logs to account for and ensure consistency across all recorded highway segments. These four sources of data have been combined and integrated to create a homogeneous segments crash database segmented according to roadway geometric features. Of particular interest with the final crash database is the manner of assigning functional class designations by AADT and population counts. This chapter will describe the source data obtained from WSDOT, introduce the AADT and population based functional classification assignments, and will conclude with presentation of the complete three-year crash database.

#### 2.1 Source Accident Data

The accident data, which is the most extensive of all WSDOT provided data, is presented in one single dataset that encompasses years 2010-2012. The accident data was requested from the WSDOT Transportation Data and GIS Office (TDGO), formally known as STCDO. This dataset includes 794,914 recorded observations for the 2010-2012 time frame with 210 columns. The extensive nature of the accident data encompasses information pertaining to collision identification, date and time, locational data, facility type, collision specific information, driver and passenger information, environmental conditions, and vehicle description. A portion of the crash descriptors refer to internal codes used by WSDOT and other agencies involved with crash investigation, however, most of the parameters thoroughly describe related factors that may have contributed or influenced the accident. This section will focus on the most pertinent crash related parameters while also briefly describe the general nature of the data recorded in the WSDOT source accident data. Table 2.1 on the subsequent pages lists all of the available parameters, in order of accident record, catalogued in the WSDOT source accident dataset.

 Table 2.1: WSDOT Source Accident Dataset Parameters.

| Parameter                                      |   |  |  |  |
|--|---|--|--|--|
| Collision Report Number                        | City Secondary Trafficway 1                             |  |  |  |
| State Reportable Indicator                     | City Secondary Trafficway 2                             |  |  |  |
| Intentional                                    | State Route ID  |  |  |  |
| Legal Intervention                             | State Route Mile Post                                   |  |  |  |
| Medically Caused                               | State Route Mile Post Ahead_Back Indicator              |  |  |  |
| County Name                                    | State Route Accumulated Route Milepost or ARM           |  |  |  |
| City Name                                      | State Route Number                                      |  |  |  |
| Collision Report Type                          | State Route Related Roadway Type                        |  |  |  |
| Date   | State Route Related Roadway Qualifier                   |  |  |  |
| Year   | State Route History_Suspense Indicator                  |  |  |  |
| Yearmo   | State Route Region Name                                 |  |  |  |
| Month Name                                     | State Route_State Functional Class Code                 |  |  |  |
| Month Number                                   | State Route Urban Rural                                 |  |  |  |
| Day Of Week                                    | State Route Urban Rural Code                            |  |  |  |
| Quarter Number                                 | State Route Federal Functional Class Name               |  |  |  |
| Full Time                                      | State Route Federal Functional Class Number             |  |  |  |
| Full Time 24                                   | State Route Vehicle 1 Compass Direction<br>Description  |  |  |  |
| Hour 24  | State Route Vehicle 1 Compass Direction<br>Code         |  |  |  |
| Number Of Fatalities                           | State Route Vehicle 1 Movement Description              |  |  |  |
| Number Of Injuries                             | State Route Vehicle 1 Movement Code                     |  |  |  |
| Number Of Pedal Cyclists Involved              | State Route Vehicle 1 Milepost Direction<br>Description |  |  |  |
| Number Of Pedestrians Involved                 | State Route Vehicle 1 Milepost Direction<br>Code        |  |  |  |
| Number Of Motor Vehicles Involved              | State Route Diagram Collision Type<br>Description       |  |  |  |
| City Primary Trafficway                        | State Route Diagram Collision Type Code                 |  |  |  |
| City Block Number                              | State Route Vehicle 2 Compass Direction<br>Description  |  |  |  |
| City Intersecting Trafficway                   | State Route Vehicle 2 Compass Direction<br>Code         |  |  |  |
| City Distance From Reference Point             | State Route Vehicle 2 Movement Description              |  |  |  |
| City Reference Point Miles_Feet Indicator      | State Route Vehicle 2 Movement Code                     |  |  |  |
| City Compass Direction From Reference<br>Point | State Route Vehicle 2 Milepost Direction<br>Description |  |  |  |
| City Reference Point Name                      | State Route Vehicle 2 Milepost Direction<br>Code        |  |  |  |

Table 2.1 (continued): WSDOT Source Accident Dataset Parameters.

| Parameter   |   |  |  |  |
|---|---|--|--|--|
| First Impact Location_Effective Date<br>1_1_10 for City_County and Misc Traf        | Most Severe Sobriety Type Code          |  |  |  |
| First Impact Location Code_Effective Date<br>1_1_10 for City_County and Misc Traf   | First Collision Type                    |  |  |  |
| Second Impact Location_Effective Date<br>1_1_10 for City_County and Misc Traf       | First Collision Type Code               |  |  |  |
| Second Impact Position Code_Effective<br>Date 1_1/_10 for City_County and Misc Traf | First Object Struck                     |  |  |  |
| County Road Number  | First Object Struck Code                |  |  |  |
| County Road Milepost  | Second Collision Type                   |  |  |  |
| County Road Mile Post Ahead_Back<br>Indicator                                       | Second Collision Type Code              |  |  |  |
| County_Intersecting County Road Number  | Second Object Struck                    |  |  |  |
| County_Intersecting County Road Milepost  | Second Object Struck Code               |  |  |  |
| County_Intersecting County Road Mile Post<br>Ahead_Back Indicator                   | Junction Relationship                   |  |  |  |
| County_Federal Functional Class Name  | Junction Relationship Code              |  |  |  |
| Miscellaneous Trafficway Type   | Weather                                 |  |  |  |
| Miscellaneous Trafficway Primary<br>Trafficway                                      | Weather Code                            |  |  |  |
| Miscellaneous Trafficway Block Number   | Roadway Surface Condition               |  |  |  |
| Miscellaneous Trafficway Intersecting<br>Trafficway                                 | Roadway Surface Condition Code          |  |  |  |
| Miscellaneous Trafficway Distance From<br>Reference Point                           | Lighting Condition                      |  |  |  |
| Miscellaneous Trafficway Reference Point<br>Miles_Feet Indicator                    | Lighting Condition Code                 |  |  |  |
| Miscellaneous Trafficway Compass Direction  | Location Characteristics                |  |  |  |
| Miscellaneous Trafficway Reference Name   | Location Characteristics Code           |  |  |  |
| Miscellaneous Trafficway Number   | Roadway Characteristic                  |  |  |  |
| Miscellaneous Trafficway Mile Post  | Roadway Characteristic Code             |  |  |  |
| Miscellaneous Trafficway Secondary<br>Trafficway 1                                  | Workzone                                |  |  |  |
| Miscellaneous Trafficway Secondary<br>Trafficway 2                                  | Workzone Code                           |  |  |  |
| Most Severe Injury Type   | Work Zone Construction Type Description |  |  |  |
| Most Severe Injury Type Code  | Working Vehicle Ownership Desc          |  |  |  |
| Collision Severity  | Working Vehicle Ownership Code          |  |  |  |
| Collision Severity Code   | Investigative Agency                    |  |  |  |
| Most Severe Sobriety Type   | Investigative Agency Code               |  |  |  |

| Parameter   |   |  |
|---|---|--|
| Ori #   | Contributing Circumstance 3                     |  |
| Reporting Agency Long Name                                      | Contributing Circumstance Code 3                |  |
| Reporting Agency Short Name                                     | MV Driver Miscellaneous Action 1                |  |
| Hazardous Material  | MV Driver Miscellaneous Action Code 1           |  |
| Hazardous Material Code   | MV Driver Miscellaneous Action 2                |  |
| Fire  | MV Driver Miscellaneous Action Code 2           |  |
| Stolen  | MV Driver Miscellaneous Action 3                |  |
| Hit And Run   | MV Driver Miscellaneous Action Code 3           |  |
| Unit Number   | Vehicle Type                                    |  |
| Unit Type Description   | Vehicle Type Code                               |  |
| Damage Threshold Met Indicator                                  | Towed Indicator                                 |  |
| Involved Person Type  | Government Owned Indicator                      |  |
| Age   | Vehicle Make                                    |  |
| Gender  | Vehicle Model                                   |  |
| Air Bag Type  | Vehicle Style                                   |  |
| Ejection Status   | Vehicle Year                                    |  |
| Restraining System Type   | Traffic Control Type Description                |  |
| Helmet Use  | Posted Speed Limit                              |  |
| Injury Type   | Roadway Type Description                        |  |
| Seat Position   | Roadway Type Code                               |  |
| Sobriety Level  | Vehicle Classification                          |  |
| Alcohol Test Result   | Vehicle Use                                     |  |
| Dre Assessment Description 1                                    | Registered State                                |  |
| Dre Assessment Code 1   | Vehicle Action 1                                |  |
| Dre Assessment Description 2                                    | Vehicle Condition 1                             |  |
| Dre Assessment Code 2   | Vehicle Condition Code 1                        |  |
| Liability Insurance   | Vehicle Condition 2                             |  |
| Unlicensed Driver   | Vehicle Condition Code 2                        |  |
| On Duty Indicator   | Vehicle Condition 3                             |  |
| Pedestrian_Pedalcyclist Clothing Visibility<br>Type             | Vehicle Condition Code 3                        |  |
| Pedestrian Pedacyclist Was Using                                | Sequence Of Event 1                             |  |
| Pedestrian Pedacyclist Type                                     | Sequence Of Event Code 1                        |  |
| Pedacyclist Actions   | Sequence Of Event 2                             |  |
| Pedestrian Actions  | Sequence Of Event Code 2                        |  |
| Contributing Circumstance 1                                     | Sequence Of Event 3                             |  |
|   | Sequence Of Event 5                             |  |
|   | Sequence Of Event S<br>Sequence Of Event Code 3 |  |
| Contributing Circumstance Code 1<br>Contributing Circumstance 2 |   |  |

Table 2.1 (continued): WSDOT Source Accident Dataset Parameters.

| Parameter                          |                          |  |
|------------------------------------|--------------------------|--|
| Compass Direction From             | Gvwr                     |  |
| Compass Direction To               | Hazardous Material Name  |  |
| Commercial Carrier Address         | Interstate Intrastate    |  |
| Commercial Carrier City Name       | Number Of Axles          |  |
| Commercial Carrier State Code      | Placard Number           |  |
| Commercial Carrier Zip Code        | Placard Suffix Type Code |  |
| Commercial Vehicle Cargo Body Type | Usdot Number             |  |
| Commercial Vehicle Class           | State Plane X            |  |
| Commercial Vehicle Name Source     | State Plane Y            |  |

Table 2.1 (continued): WSDOT Source Accident Dataset Parameters.

The WSDOT identification parameters are based on unique identifiers assigned to each crash observation, reflected by such descriptors as: Collision Report Number, State Reportable Indicator, and Collision Report Type. The Collision Report Number serves as the identification number to distinguish each observation. As such, repeated Collision Report Numbers corresponds to multiple persons or vehicles involved in a single crash. Additional information related to the type of Collision Report is described in location-related identifiers such as County and City name. All observations in the three-year crash dataset are listed as having Collision Report type of City Street, County Road, Miscellaneous Trafficway, or State Route.

Date and Time information listed for each observation is extensive in that the date and time descriptors are expressed in various ways. For example, the Date of the accident is also further described by separate columns such as Month, Day of Week, and Quarter Number, which is more indicative of the time of year to imply seasonal considerations.

Location related information is of particular importance for matters related to assigning crash counts to the correct corresponding roadway segment within the proper milepost limits. Each recorded crash is assigned milepost markers and route identifiers. The milepost parameters include State Route Mile Post, State Route Mile Post Ahead/Back Indicator, and State Route ARM. In relation to the final crash database, the State Route ARM is the basis that the segments are disaggregated. Additionally, XY coordinate information is also available for some crash observations that provide a point location for the accident.

Roadway facility type data is expressed in attributes that describe the roadway or refer to the classification of the roadway where the accident occurred. State Route Related Roadway Type (RRT) and State Route Related Roadway Qualifier (RRQ) classify the roadway facility based on the identifying acronyms established by WSDOT. Perhaps most relevant for the purposes of this study, the functional class codes that describe the roadway are listed in the columns for State Route State Functional Class Code, State Route Urban Rural, State Route Federal Functional Class Name, and State Route Federal Functional Class Number. The State Functional Class Code consists of a two-character identification code with the prefix of R or U signifying rural or urban arterial classification. The numerical value associated with the R/U prefix is predicated on the classification code consistent with WSDOT and FHWA guidelines. The Urban Rural column simply lists whether the facility is considered as an urban or rural arterial, while the Federal Functional Class Name uses the FHWA standards for naming the facility (see FHWA Directive 23 CFR 470).

The category that contains the most extensive amount of information is the data describing the collision. This information will serve as the basis for the inputting crash severity, number of vehicles involved, and collision type attributes in the final homogeneous segments crash database. The crash severity data is captured in the columns of Collision Severity (Fatal, injury, or Property Damage Only (PDO)) and Injury Type (Dead at Scene, Dead on Arrival, Died in Hospital, Evident Injury, No Injury, Possible Injury, Serious Injury, or Unknown). The number of vehicles involved in the accident is captured in the vehicle prefix descriptors; in some cases, like hit-fixed-object crashes, the Vehicle 2 prefix in not applicable. Collision type information is presented in the column for First Collision Type (Same Direction Rear End, One Park One Moving, Entering at Angle, Same Direction Sideswipe, etc.). The WSDOT source data also provides other columns to describe the accident in more detail with parameters such as: Contributing Circumstance 1, MV Driver Miscellaneous Action 1, and State Route Diagram Collision Type Description.

Data determined to be related to driver information includes role of the individual (passenger, driver, pedestrian) in the accident identified in the column Involved Person Type, as well as some basic demographic related data (Age, Gender). Some driver/vehicle related crash outcomes are also described in relation to deployment of airbag, ejection status of occupant, and most importantly, the resulting Injury Type to the individual involved in the crash. Crash contributing factors are described by Sobriety Level, Alcohol Test Result, Restraining System Type, and Seat Position. For pedestrians and bicyclists, the source data presents columns to describe those nonmotorized travelers with Pedestrian/Pedacyclist Clothing Visibility Type, Pedestrian Pedacyclist Type, Pedacyclist Actions, and Pedestrian Actions.

Environmental conditions data depict the physical environment at the time of the reported crash. These environmental descriptors detail the roadway environment, weather conditions, and special circumstances in columns such as Weather, Roadway Surface Condition, and Lighting Condition. Weather succinctly illustrates the climate conditions at the time of the reported crash; the Weather classifications are limited to visibility-related designations. Similarly, the Roadway Surface Condition category identifies the elements on the roadway at the time of the reported crash and are appropriately labeled as dry, ice, oil, other, sand/mud/dirt, snow/slush, standing water, unknown, or wet. Lighting Conditions identifies the source of illumination while loosely implying the time of day by indicating daylight or dark with or without street lights. Location Characteristics highlight unique features (bridge, parking lot, shopping mall, tunnel, etc.) of the arterial that may have some involvement with those particular crashes; for the majority of the observations, this column remains blank. Roadway Characteristic provides a concise description of the geometrics for the arterial; these descriptions simply identify if the roadway was straight or had some type of curve. The Work Zone descriptor is not applicable to all observations as it is contingent on the presence of a work zone at the location of the reported crash.

Vehicle descriptors in the WSDOT source accident data define both personal and commercial vehicles involved in the accident. Of note, commercial carrier and commercial vehicle information only applies if those type of vehicles were involved in the reported accident. The vehicle involved in the crash, regardless of personal or commercial transport classification, is described by Vehicle Type, Vehicle Make, Vehicle Model, Vehicle Style, Vehicle Year, and Registered State. Vehicle Action 1 describes what activity the vehicle was engaged in at the time of the crash, while Vehicle Condition 1 pertains to the operating condition of the vehicle prior to involvement in the crash. For

instance, if the vehicle's headlights were not in operating condition prior to the crash, it may be a contributing factor to causing the accident.

#### 2.2 Source Roadway Geometrics Data

The WSDOT TDGO provided the roadway data for horizontal alignment, vertical alignment, number of lanes and roadway width, and shoulder width information. These files compile the geometric data for 2010 and 2011; the 2012 geometric data utilized the same information as 2011 since 2012 geometric data was unavailable at the time of request. The roadway geometric data will be included in the complete crash database that contains elements of horizontal and vertical alignment, number of lanes and roadway width, and shoulder width.

The WSDOT horizontal alignment data lists the main components of each horizontal curve captured in 19 columns. All of the horizontal curves listed progress in the increasing mile post direction expressed in segments by mile post and includes 17,769 observations for the 2010 dataset, and 17,870 observations for 2011, an increase of 101 additional curves in a two year time span. The horizontal curve elements included in this dataset are listed in Table 2.2.

| Horizontal Alignment Attribute         | Definition                                    |
|--|---|
| LRS_Date                               | Date input into Linear Referencing System     |
| SRID                                   | State Route ID                                |
| SR                                     | State Route                                   |
| RRT                                    | Related Route Type                            |
| RRQ                                    | Related Route Qualifier                       |
| BegARM                                 | Beginning Accumulated Route Mileage           |
| EndARM                                 | Ending Accumulated Route Mileage              |
| BegMP                                  | Beginning Mile Post                           |
| BegAB                                  | Beginning Mile Post Ahead/Back                |
| EndMP                                  | Ending Mile Post                              |
| EndAB                                  | Ending Mile Post Ahead/Back                   |
| HorizontalCurvePointOfTangencyArm      | Horizontal Curve PT Accumulated Route Mileage |
| HorizontalCurvePointOfCurvatureArm     | Horizontal Curve PC Accumulated Route Mileage |
| HorizontalCurveType                    | Horizontal Curve or Angle                     |
| HorizontalCurveRadius                  | Radius of Curve (R)                           |
| HorizontalCurveMaximum(Super)Elevation | Max Super Elevation (e)                       |
| HorizontalCurveLength                  | Length of Curve (L) in feet                   |
| HorizontalCurveDirection               | Curve Left or Curve Right                     |
| HorizontalCurveCentralAngle            | Angle of Deflection ( $\Delta$ ) in degrees   |

The horizontal curve data is expressed on a segment basis according to accumulated route mileage (ARM) markers. The addition of 101 observations between 2010 and 2011 is reflected in the difference among average values for horizontal alignment characteristics between 2010 and 2011, as shown in Table 2.3 on the next page.

| Year                                   | 2010    | 2011    |
|--|---------|---------|
| HorizontalCurvePointOfTangencyArm      | 69.79   | 69.42   |
| HorizontalCurvePointOfCurvatureArm     | 69.68   | 69.30   |
| HorizontalCurveRadius                  | 2265.28 | 2274.17 |
| HorizontalCurveMaximum(Super)Elevation | 0.01    | 0.01    |
| HorizontalCurveLength                  | 585.43  | 584.53  |
| HorizontalCurveCentralAngle            | 2609.74 | 2607.78 |

Table 2.3: Average WSDOT Horizontal Alignment Values for 2010 and 2011.

Between the two databases, the maximum values are consistent from 2010 to 2011 and report the same locations. The maximum curve radius identified is designed at 70,000 feet between ARM 67.02 and 67.32 along SR 82. The maximum super elevation of 0.2 is located along SR 3 between ARM 53.19 and 53.48. The greatest curve length of 12,683 feet is located between ARM 104.63 and 107.03 on SR 82. The largest central angle is located on a horizontal curve that spans from ARM 0.08 to 0.22 on SR 167.

The vertical alignment data includes all pertinent vertical curvature information for all State Routes described in 23 columns. For 2010, there are 34,260 recorded vertical curves while 2011 maintains 34,426 observations, an increase of 226 additional vertical curves over the course of two years. This WSDOT provided vertical alignment data uses different nomenclature to reference all vertical curve attributes to mile post markers. For instance, instead of using the definition of Vertical Point of Curvature (VPC), the raw data references the Beginning Vertical Curve Accumulated Route Mileage. A description of the WSDOT vertical alignment data is displayed in Table 2.4 on the following page.

| Table 2.4: | WSDOT | Vertical | Alignment Data. |
|------------|-------|----------|-----------------|
|------------|-------|----------|-----------------|

| Vertical Alignment Attribute          | Definition   |
|---------------------------------------|--|
| LRS_Date                              | Date input into Linear Referencing System                |
| SRID                                  | State Route ID   |
| State Route Number                    | State Route  |
| Related Route Type                    | Related Route Type Code                                  |
| Related Route Qualifier               | Related Route Qualifier Code                             |
| Begin ARM                             | Beginning Accumulated Route Mileage                      |
| End ARM                               | Ending Accumulated Route Mileage                         |
| Begin SRMP                            | Beginning State Route Mile Post                          |
| Begin AB                              | Beginning Mile Post Ahead/Back                           |
| End SRMP                              | Ending State Route Mile Post                             |
| End AB                                | Ending Mile Post Ahead/Back                              |
| Begin SRMP2                           | Beginning State Route Mile Post (Ahead/Back)             |
| End SRMP2                             | Ending State Route Mile Post (Ahead/Back)                |
| Related Roadway Type<br>Description   | RRT Definition   |
| State Route Description               | State Route and Cross Street                             |
| RRT_RRQ                               | RRQ Definition   |
| Vertical Curve Bvc Arm                | Beginning Vertical Curve Accumulated Route Mileage       |
| Vertical Curve Vpi Arm                | Vertical Point of Intersection Accumulated Route Mileage |
| Vertical Curve Evc Arm                | Ending Vertical Curve Accumulated Route Mileage          |
| Vertical Curve Type                   | Crest or Sag Curve                                       |
| Vertical Curve Length                 | Length of Curve (ft)                                     |
| Vertical Curve Percent Grade<br>Ahead | Grade (%) ahead of Curve                                 |
| Vertical Curve Percent Grade<br>Back  | Grade (%) back of Curve                                  |

Although the recorded number of vertical curves increases by 226 from 2010 to 2011, there is no calculated difference among the average values of all observations for vertical curve length and vertical curve percent grade ahead or back between the two years (315 feet, 0, and 0 respectively). The maximum recorded value for vertical curve length is 6,700 feet located along SR 82 between ARM 106.24 and 107.51. The steepest vertical curve percent grade ahead is 16.13% along an Angle Point Curve at ARM 28.65 of SR 503; similarly, the steepest vertical curve percent grade back is located at ARM 28.66 of the same route. These maximum values are found at the same locations for the 2010 and 2011 datasets.

The WSDOT data for the number of lanes and roadway width information differentiates between the increasing and decreasing mile post directions for the State Routes. The 2010 dataset contains 8,519 observations while the 2011 dataset lists 8,549 rows, and increase of 30 observations over the period of two years. The WSDOT data captured in the 16 columns describing number of lanes and roadway information is listed in Table 2.5 on the next page.

| Number of Lanes and Roadway Width<br>Attribute | Definition                                 |
|--|--|
| LRS_Date                                       | Date input into Linear Referencing System  |
| SRID   | State Route ID                             |
| SR   | State Route                                |
| RRT  | Related Route Type                         |
| RRQ  | Related Route Qualifier                    |
| BegARM   | Beginning Accumulated Route Mileage        |
| EndARM   | Ending Accumulated Route Mileage           |
| BegMP  | Beginning Mile Post                        |
| BegAB  | Beginning Mile Post Ahead/Back             |
| EndMP  | Ending Mile Post                           |
| EndAB  | Ending Mile Post Ahead/Back                |
| RoadwayDirection                               | Increasing or Decreasing or Both ways      |
| NumberOfLanesIncreasing                        | Number of Lanes in Increasing Direction    |
| NumberOfLanesDecreasing                        | Number of Lanes in Decreasing Direction    |
| RoadwayWidthInc                                | Roadway Width (ft) in Increasing Direction |
| RoadwayWidthDec                                | Roadway Width (ft) in Decreasing Direction |

Table 2.5: WSDOT Number of Lanes and Roadway Width Data.

When examining the average values among all observations within the 2010 and 2011 lane and roadway datasets, the average number of lanes in the increasing and decreasing direction do not change with both remaining at 2 lanes over the two-year period. Moreover, the calculated average roadway width in the increasing direction does not incur any difference at 23 feet for the 2010 and 2011 datasets. However, in regard to the decreasing direction, the average roadway width increases from 22 feet in 2010 to 23 feet for 2011. The maximum recorded values are the same for the two year datasets with six lanes in the increasing direction, five lanes in the decreasing direction, a maximum of 99 feet for roadway width in the increasing direction and 96 feet in the decreasing direction, respectively.

Similar to the lane configuration data, the WSDOT shoulder width data also accounts for increasing and decreasing mile post directions for the State Routes. The shoulder locations are referenced as Left, Left Center, Right Center, and Right. For 2010, there were 9,042 recorded shoulder width observations while 2011 recorded 9,056 observations; an increase of 14 observations over the two-year span. The shoulder width descriptors and their associated definitions are listed on the next page in Table 2.6.

| Shoulder Widths Attribute | Definition   |  |
|---------------------------|--|--|
| LRS_Date                  | Date input into Linear Referencing System                    |  |
| SRID                      | State Route ID   |  |
| SR                        | State Route  |  |
| RRT                       | Related Route Type   |  |
| RRQ                       | Related Route Qualifier                                      |  |
| BegARM                    | Beginning Accumulated Route Mileage                          |  |
| EndARM                    | Ending Accumulated Route Mileage                             |  |
| BegMP                     | Beginning Mile Post  |  |
| BegAB                     | Beginning Mile Post Ahead/Back                               |  |
| EndMP                     | Ending Mile Post   |  |
| EndAB                     | Ending Mile Post Ahead/Back                                  |  |
| RoadwayDirection          | Increasing or Decreasing or Bothways                         |  |
| ShoulderWidthLeft         | Shoulder Width (ft) of outer portion of Decreasing Direction |  |
| ShoulderWidthLeftCenter   | Shoulder Width (ft) of median side of Decreasing Direction   |  |
| ShoulderWidthRightCenter  | Shoulder Width (ft) of median side of Increasing Direction   |  |
| ShoulderWidthRight        | Shoulder Width (ft) of outer portion of Increasing Direction |  |

Table 2.6: WSDOT Shoulder Width Data.

There exists no calculated difference between the average and maximum recorded shoulder widths values for the 2010 and 2011 datasets. The average shoulder width left and shoulder width right is calculated to be 5 feet, while the average shoulder width left center and right center remains at 1 foot. A maximum of 37 feet is the distance of the left shoulder width, while the right shoulder width maximum value is 40 feet. The greatest shoulder width for the left center and right center is 20 and 36 feet respectively.

#### 2.3 Source AADT Data

The WSDOT GeoData Distribution Catalog webpage offers publically available data for download organized by transportation features, political and administrative features, geographic reference data, and environmental features. This downloadable data is provided in the form of ESRI shapefiles, which also includes the metadata files that accompany the shapefile information. Under the transportation features category, the Traffic Count Data file was downloaded from the GeoData Catalog webpage. Since this study examines highway crashes on a segmentation basis, the TPT Traffic Sections data was selected for download as opposed to the TPT Traffic Counts file which provides count information at specific point locations. The files selected for download include the TPT Traffic Sections data for years 2010, 2011, and 2012. The metadata files were extracted via ArcGIS and report the following information shown in Table 2.7.

| AADT Attribute | Definition  |  |
|----------------|---|--|
| FID            | Internal Feature Number (sequential)                              |  |
| Shape *        | Feature Geometry  |  |
| OBJECTID       | Internal Feature Number (sequential)                              |  |
| SRID           | State Route Identifier  |  |
| Begin_ARM      | Beginning Accumulated Route Mileage                               |  |
| End_ARM        | Ending Accumulated Route Mileage                                  |  |
| Location       | Milepost Count Locations and Ahead/Back indicator                 |  |
| Year_20**      | WSDOT calculated AADT for specified year                          |  |
| LOC_ERROR      | Error (if any) produced in LRS at time of input                   |  |
| RteType        | Route Type: IS (Interstate), SR (State Route), US (United States) |  |
| Shape_Leng     | Shape Length (coordinate defining measure)                        |  |

Table 2.7: WSDOT TPT Traffic Sections Data.

The WSDOT TPT Traffic Sections data contains 5,388 counts for year 2010, 5,290 counts for year 2011, and 5,236 counts for year 2012. From this source data, the AADT counts will be input into the 2010-2012 crash database according to the segments defined by the mile post locations. The varying number of segments for each year does not impact the AADT inputs into the final crash database because the homogeneous segments are more finite in length. The homogeneous segments captured within the WSDOT TPT Traffic Sections data are input with the associated AADT values reported for those segment milepost limits.

#### 2.4 Source Functional Classification Data

Also from the WSDOT GeoData Distribution Catalog webpage, the Functional Class, State Routes file under the transportation features category was downloaded for inclusion into the final crash database. The functional class observations were input by WSDOT based on the procedures previously explained in Section 1.2 WSDOT Functional Classification Methodology. Following the same process as the AADT data, the Functional Class, State Routes metadata file was extracted through ArcGIS to report the following information displayed on the following page in Table 2.8:

| <b>Functional Class Attribute</b> | Definition                                      |
|-----------------------------------|---|
| OBJECTID *                        | Internal Feature Number (sequential)            |
| Shape *                           | Feature Geometry                                |
| LRS_Date                          | Date input into Linear Referencing System       |
| BegARM                            | Beginning Accumulated Route Mileage             |
| EndARM                            | Ending Accumulated Route Mileage                |
| BegMP                             | Beginning State Route Milepost                  |
| BegAB                             | Beginning State Route Milepost Ahead or Back    |
| EndMP                             | Ending State Route Milepost                     |
| EndAB                             | Ending State Route Milepost Ahead or Back       |
| Direction                         | Increasing or Decreasing Milepost direction     |
| FederalFunctionalClassCode        | Federal Highway Administration Numerical Code   |
| FederalFunctionalClassDesc        | Federal Highway Administration Code Definition  |
| StateFunctionalClassCode          | WSDOT Functional Class Code (Alphanumeric)      |
| StateFunctionalClassDesc          | WSDOT Functional Class Code Definition          |
| LOC_ERROR                         | Error (if any) produced in LRS at time of input |
| RouteID                           | WSDOT Route Identifier                          |
| StateRouteNumber                  | Washington State Route Number                   |
| RelRouteType                      | State Route Related Roadway Type                |
| RelRouteQual                      | State Route Related Roadway Qualifier           |
| Shape.STLength()                  | Shape Length (coordinate defining measure)      |
| Shape_Length                      | Shape Length (coordinate defining measure)      |

Table 2.8: WSDOT Functional Class State Routes Data.

The available WSDOT Functional Class State Routes downloadable data only presented the functional class information for 2012; the 2010 and 2011 was unavailable for download on the GeoData Distribution Catalog website. The assigned functional class categories are shown on a segment basis according to accumulate route mileage and state route milepost markers. The 2012 dataset has 3,956 observations that show both the federal functional class designation as well as the state functional class designation for each stretch of roadway. Like the AADT data, the homogeneous segments captured within the WSDOT Functional Class State Route segments are input with the associated functional classes reported for those segment milepost limits.

The federal and state functional class designations from this dataset have been assigned according to standards and procedures established by the Federal Highway Administration and WSDOT. The homogenous segments crash database will show how the functional class designations will differ segment to segment if the designations were based on AADT and population thresholds. When assigning functional class designations by AADT and population counts, few changes in functional class labels were observed across the three year period of 2010 to 2012 for any individual segment. This would indicate that the federal and state functional class designations did not considerably change across the milepost segments within the WSDOT Functional Class State Routes downloadable data from 2010 to 2012.

#### 2.5 Homogeneous Segments Crash Database 2010-2012

The development of the homogeneous segments crash database incorporates accident information, roadway geometrics, AADT counts, and functional class. The manner in which the final database was established began by first determining the segment lengths. The roadway segments were defined as segments that maintain consistency in roadway characteristics for the length of a particular stretch of roadway, with a new segment being defined when any of the roadway characteristics change. The roadway characteristics that determine the segmentation process are the roadway geometrics which include the WSDOT source roadway geometrics data described in Section 2.2: horizontal alignment, vertical alignment, number of lanes and roadway width, and shoulder width. The shortest segment length that maintains consistent roadway geometrics measures 0.009 miles in length. The total number of observations for the three year period of 2010 to 2012 is 323,085 segments of homogenous roadway, with 107,695 segments for each year.

A total of 97 parameters are captured in the database which covers roadway geometrics, crash type, accident severity, AADT counts, and functional class. The data and information was pulled from the sourced WSDOT data and integrated into the homogeneous roadway segment. The observations from the source data were input into the homogenous roadway segment format based on milepost markers recorded in the source WSDOT data. The WSDOT source accident data was input as counts or number of occurrences that occurred on any specific homogeneous roadway segment for any particular roadway segment was determined by the recorded milepost location from the crash observations. The reported crashes were assigned to its corresponding homogeneous segment if the milepost location fell within the homogeneous segment milepost limits. These counts were accumulated for total crash count, impact location, collision severity, number of vehicles involved, and collision type on a segment-by-segment basis.

As described earlier, the roadway geometric data served as the basis for segmentation when creating the homogeneous roadway segments crash database. Not all segments contain complete roadway geometric information; these cells with omitted geometric information within the dataset were populated with the value -99 to signify missing data. Additionally, roadway geometric information from 2011 was used as the basis for 2012. The segmentation process for homogeneous segments was standardized across the three year period; that is to say, the limits and attributes for the homogeneous segments from 2010 are the same for 2011 and 2012.

Section AADT information was used from the Annual Average Daily Traffic volumes along the state highway system in the WSDOT geospatial database, and matched to each segment according to milepost. Each homogenous segment was then classified based on one of five geographic classes: Rural, Small Urban, Small Urbanized, Large Urbanized, and Metropolitan. It was observed that areas designated as Rural did not always have low AADT levels and not all Metropolitan segments displayed high levels of AADT. In order to obtain finer resolution on the five geographical classes and to compare the definitions at the segment level, two sets of classifications were made based on section AADT and census population data.

Table 2.9 on the following pages lists the parameters in the homogenous roadway segments database with a brief description for each one.

| Parameter                              | Description   |
|--|---|
| SR                                     | State Route   |
| BegARM                                 | Beginning Accumulated Route Mileage                                     |
| EndARM                                 | Ending Accumulated Route Mileage  |
| Year                                   | Crash Year  |
| NumberOfLanesIncreasing                | Number of Lanes in Increasing Direction                                 |
| NumberOfLanesDecreasing                | Number of Lanes in Decreasing Direction                                 |
| RoadwayWidthInc                        | Roadway Width (ft) in Increasing Direction                              |
| RoadwayWidthDec                        | Roadway Width (ft) in Decreasing Direction                              |
| ShoulderWidthLeft                      | Shoulder Width (ft) of outer portion of<br>Decreasing Direction         |
| ShoulderWidthLeftCenter                | Shoulder Width (ft) of median side of Decreasing Direction              |
| ShoulderWidthRightCenter               | Shoulder Width (ft) of median side of<br>Increasing Direction           |
| ShoulderWidthRight                     | Shoulder Width (ft) of outer portion of<br>Increasing Direction         |
| HorizontalCurvePointOfTangencyArm      | Horizontal Curve PT Accumulated Route<br>Mileage                        |
| HorizontalCurvePointOfCurvatureArm     | Horizontal Curve PC Accumulated Route<br>Mileage                        |
| HorizontalCurveRadius                  | Radius of Curve (R)   |
| HorizontalCurveMaximum(Super)Elevation | Max Super Elevation (e)   |
| HorizontalCurveLength                  | Length of Curve (L) in feet   |
| HorizontalCurveCentralAngle            | Angle of Deflection ( $\Delta$ ) in degrees                             |
| Vertical Curve Bvc Arm                 | Beginning Vertical Curve Accumulated Route<br>Mileage                   |
| Vertical Curve Vpi Arm                 | Vertical Point of Intersection Accumulated<br>Route Mileage             |
| Vertical Curve Evc Arm                 | Ending Vertical Curve Accumulated Route<br>Mileage                      |
| Vertical Curve Length                  | Length of Curve (ft)  |
| Vertical Curve Percent Grade Ahead     | Grade (%) ahead of Curve  |
| Vertical Curve Percent Grade Back      | Grade (%) back of Curve   |
| totalacc                               | total count of roadside, roadway, and other location crashes in segment |
| rdside                                 | count of roadside crashes in segment                                    |
| rdway                                  | count of roadway crashes in segment                                     |
| othloc                                 | count of other location crashes in segment                              |
| pdo                                    | count of reported Property Damage Only from crashes in segment          |

Table 2.9: Homogeneous Roadway Segments Database Parameters.

| Parameter              | Description   |
|------------------------|---|
| pinj                   | count of reported Possible Injury from crashes in segment         |
| evi                    | count of reported Evident Injury from crashes in segment          |
| sinj                   | count of reported Serious Injury from crashes in segment          |
| fatal                  | count of reported Fatal from crashes in segment                   |
| unknown                | count of reported Unknown Injury from crashes in segment          |
| hiinj                  | count of crashes in segment reporting more than one injury        |
| justinj                | count of crashes in segment reporting one injury                  |
| loinj                  | count of crashes in segment reporting no injuries                 |
| veh1                   | count of crashes in segment involving 1 vehicle                   |
| veh2                   | count of crashes in segment involving 2 vehicles                  |
| veh3                   | count of crashes in segment involving 3 vehicles                  |
| veh4                   | count of crashes in segment involving 4 vehicles                  |
| veh5                   | count of crashes in segment involving 5 vehicles                  |
| othveh                 | count of crashes in segment involving more than 5 vehicles        |
| rend                   | count of Rear End type crashes in segment                         |
| trend                  | count of Turning Rear End type crashes in segment                 |
| sdirtsw                | count of Same Direction Turning Sideswipe type crashes in segment |
| sdirsw                 | count of Same Direction Sideswipe type crashes in segment         |
| sdirt                  | count of Same Direction Turning type crashes in segment           |
| sdiroth                | count of Same Direction Others type crashes in segment            |
| headon                 | count of Head On type crashes in segment                          |
| odirsw                 | count of Opposite Direction Sideswipe type crashes in segment     |
| odirt                  | count of Opposite Direction Turning type crashes in segment       |
| fobj                   | count of Fixed Object type crashes in segment                     |
| eang                   | count of Entering At Angle type crashes in segment                |
| oturn                  | count of Overturned type crashes in segment                       |
| animal                 | count of Animal type crashes in segment                           |
| bicycle                | count of Bicycle type crashes in segment                          |
| ped                    | count of Pedestrian type crashes in segment                       |
| oneparkonemoving       | count of One Parked, One Moving type crashes in segment           |
| entlvdr                | count of Entering/Leaving Driveway type crashes in segment        |
| other                  | count of crashes classified as Other in segment                   |
| nostate                | count of crashes classified as Not Stated in segment              |
| StateFunctionalClass   | Rural or Urban class indicator                                    |
| FederalFunctionalClass |   |
| Functional             | Federal Functional Class 'Other Principal Arterial' captured in   |
| class(4level)          | 'Principal Arterial'  |
| Interstate             | indicator for Interstate Functional Class type                    |
| Other (F               | indicator for Other Freeway/Expressway Functional Class type      |
| Freeway/Expressway     |   |

 Table 2.9 (continued): Homogeneous Roadway Segments Database Parameters.

| Parameter                            | Description   |
|--------------------------------------|---|
| Other Principal Arterial             | indicator for Other Principal Arterial Functional Class type                  |
| Minor Arterial                       | indicator for Minor Arterial Functional Class type                            |
| Major Collector                      | indicator for Major Collector Functional Class type                           |
| AADT                                 | WSDOT calculated AADT for specified year                                      |
| Functional Class_AADT based          | AADT based Geographic Classification  |
| Functional<br>Class_Population based | Population based Geographic Classification                                    |
| Rural Rural                          | indicator for Rural AADT class and Rural population class                     |
| Small Urban Rural                    | indicator for Small Urban AADT class and Rural population class               |
| Small Urbanized Rural                | indicator for Small Urbanized AADT class and Rural population class           |
| Large Urbanized Rural                | indicator for Large Urbanized AADT class and Rural population class           |
| Metropolitan Rural                   | indicator for Metropolitan AADT class and Rural population class              |
| Rural Small Urban                    | indicator for Rural AADT class and Small Urban population class               |
| Small Urban Small Urban              | indicator for Small Urban AADT class and Small Urban population class         |
| Small Urbanized Small<br>Urban       | indicator for Small Urbanized AADT class and Small Urban population class     |
| Large Urbanized Small<br>Urban       | indicator for Large Urbanized AADT class and Small Urban population class     |
| Metropolitan Small Urban             | indicator for Metropolitan AADT class and Small Urban population class        |
| Rural Small Urbanized                | indicator for Rural AADT class and Small Urbanized population class           |
| Small Urban Small<br>Urbanized       | indicator for Small Urban AADT class and Small Urbanized population class     |
| Small Urbanized Small<br>Urbanized   | indicator for Small Urbanized AADT class and Small Urbanized population class |
| Large Urbanized Small<br>Urbanized   | indicator for Large Urbanized AADT class and Small Urbanized population class |
| Metropolitan Small<br>Urbanized      | indicator for Metropolitan AADT class and Small Urbanized population class    |
| Rural Large Urbanized                | indicator for Rural AADT class and Large Urbanized population class           |

 Table 2.9 (continued): Homogeneous Roadway Segments Database Parameters.

| Parameter                          | Description   |
|------------------------------------|---|
| Small Urban Large<br>Urbanized     | indicator for Small Urban AADT class and Large Urbanized population class     |
| Small Urbanized Large<br>Urbanized | indicator for Small Urbanized AADT class and Large Urbanized population class |
| Large Urbanized Large<br>Urbanized | indicator for Large Urbanized AADT class and Large Urbanized population class |
| Metropolitan Large<br>Urbanized    | indicator for Metropolitan AADT class and Large Urbanized population class    |
| Rural Metropolitan                 | indicator for Rural AADT class and Metropolitan population class              |
| Small Urban Metropolitan           | indicator for Small Urban AADT class and Metropolitan population class        |
| Small Urbanized<br>Metropolitan    | indicator for Small Urbanized AADT class and Metropolitan population class    |
| Large Urbanized<br>Metropolitan    | indicator for Large Urbanized AADT class and Metropolitan population class    |
| Metropolitan Metropolitan          | indicator for Metropolitan AADT class and Metropolitan population class       |

Table 2.9 (continued): Homogeneous Roadway Segments Database Parameters.

The functional class related parameters are the focal point of the homogeneous roadway segments crash database. While most of the data was obtained from WSDOT sources and formatted for input into the final crash database, the functional class parameters are the ones that address the nature of this study. The assigned WSDOT classifications are described in the parameters State Functional Class, Federal Functional Class, and Functional Class (4level), in addition to the indicators for each individual functional class type. The column for Functional Class AADT Based lists the geographic class that is assigned to the segment based on AADT alone. Alternatively, the Functional Class Population Based column labels the geographic class that is assigned to the segment based on population alone. The subsequent columns serve as indicators for the various combinations of functional classification based on AADT and functional classification based on population; the columns indicate whether the two geographic classifications match or not. As the homogeneous roadway segments crash database shows, there exist many observations in which the geographic class assigned on the basis of AADT for not match the geographic class assigned on the basis of population. The difference in the classifications illustrate the discrepancy that exists between using AADT and population for assigning geographic class, thus influencing the way in which functional class is assigned. The functional classification procedure for assignment based on population and AADT will be explained in the next chapter.

## **3.0 Functional Classification (Centerline Miles)**

Section 1.2 discussed the procedure and protocol that WSDOT, in conjunction with the FHWA, follows in assigning functional classifications to roadway segments, and concludes by mentioning the process of assigning functional class by population and AADT. This chapter will introduce the process in which functional classifications were assigned by population and AADT counts. The two methods of assigning functional class are applied to the homogeneous segments crash database in which functional and geographic classifications are input into each observation. This chapter will begin by describing the procedures and conditions applying the geographical classifications of Rural, Small Urban, Small Urbanized, Large Urbanized, and Metropolitan, using the population and AADT criteria. The last section will discuss the validation process using the WSDOT Highway Logs, followed by comparisons between the population based and AADT based geographic and functional classifications in terms of centerline miles.

#### 3.1 Population Based Geographic Type Classification

The source crash data provided by WSDOT was found to contain information on segment location by city and county. Census data was obtained for years 2010 to 2012 from the United States Census Bureau – U.S. Department of Commerce. The census data was found to contain population information at both county and city levels. This data was matched to the location information in the source data to obtain the area populations for each segment's location. Area names for several sections of roadway, predominantly in rural areas were absent in the source data. In order to assign them with a population estimate, WSDOT SRweb, and Geoportal were utilized to ascertain their area type or physical boundary. Segments for which area names were available were assigned a population count based on the census information available. This information was then used to categorize the segments into one of the five geographic classes, based on the following population criteria:

- Rural: < 5,000
- Small Urban: 5,000 49,999
- Small Urbanized: 50,000 199,999
- Large Urbanized: 200,000 499,999
- Metropolitan: > 500,000

#### 3.2 AADT Based Geographic Type Classification

The source crash data obtained from WSDOT was found to classify the available routes within four functional classes: Principal Arterials, Minor Arterials, Collectors, and Interstates. The federal classifications for the same routes included an additional class with a distinction made between freeways/expressways and other principal arterials. To avoid repeated observations of freeway segments as Principal Arterials, the federal classifications were matched to the homogenous segments and all five federal classifications for functional class were included in this part of the study. Ranges were obtained from the FHWA guidelines to set the capacity levels for each functional class within each of the five geographical classes. The upper limits for Small Urban levels of AADT were also obtained from the FHWA guidelines and were used as a baseline to compute ranges of AADT for the higher order geographical classes, using volume to capacity ratios and the average number of lanes for each functional class. Table 3.1 shows the resulting ranges of AADT for each of the classes.

| Functional<br>Class/<br>Geographic<br>Class | Factors   | Interstate | Other<br>Freeways/<br>Expressways | Other<br>Principal<br>Arterials | Minor<br>Arterials | Major &<br>Minor<br>Collectors |
|---|-----------|------------|-----------------------------------|---------------------------------|--------------------|--------------------------------|
|   | Capacity  | 2,400      | 2,300                             | 1,900                           | 1,700              | 1,400                          |
| Matropoliton                                | V/C ratio | 0.8        | 0.8                               | 0.83                            | 0.8                | 0.7                            |
| Metropolitan                                | Lane      | 8          | 6                                 | 4                               | 2                  | 2                              |
|   | Boundary  | 153,600    | 110,400                           | 63,080                          | 27,200             | 19,600                         |
|   | Capacity  | 2,200      | 2,100                             | 1,700                           | 1,400              | 1,200                          |
| Large                                       | V/C ratio | 0.8        | 0.8                               | 0.83                            | 0.8                | 0.65                           |
| Urbanized                                   | Lane      | 6          | 6                                 | 4                               | 2                  | 2                              |
|   | Boundary  | 105,600    | 100,800                           | 56,440                          | 22,400             | 15,600                         |
|   | Capacity  | 2,000      | 1,800                             | 1,500                           | 1,200              | 1,000                          |
| Small                                       | V/C ratio | 0.6        | 0.6                               | 0.65                            | 0.65               | 0.6                            |
| Urbanized                                   | Lane      | 6          | 4                                 | 4                               | 2                  | 2                              |
|   | Boundary  | 72,000     | 43,200                            | 39,000                          | 15,600             | 12,000                         |
| Small Urban                                 | Boundary  | 12,000     | 4,000                             | 2,000                           | 1,500              | 1,100                          |

Table 3.1: AADT Ranges for Functional and Geographic Class.

The 'boundary' values form an upper limit for the AADT range for each functional class within each geographic class; the Rural classification (not listed in the table) would be considered as anything less than Small Urban. These ranges were then matched to the AADTs for each homogenous segment to obtain the AADT based geographic classifications.

#### **3.3 Highway Log Centerline Miles Validation**

In checking the length of each route using the ARMs for each homogenous segment in the dataset, it was found that the total ARM lengths resulted in a figure about 300 miles in excess of the WSDOT highway log lengths. It was observed that the highway log ARMs were consistent with the homogenous segment ARMs and further investigation showed that the differences in length were in specific segments of routes that overlapped each other. These differences between ARM lengths and highway log lengths were matched to the overlapping segments, as a means of avoiding double counting the lengths while testing data consistency. One example of such a location is State Route 12, where the ARM length totals at 430.779 miles, while the highway log length is 106.38 miles less at 324.51 miles. It was found that SR12 overlapped with I-5 and I-82. After accounting for these overlaps, the homogenous segment data resulted in a total system mileage of 6,867.683 miles, which was found to be within acceptable limits of the WSDOT highway log total system length of 6,951.34 miles. Thus, the homogenous segment data was

assembled based on specific criteria as a means of testing and ensuring its validity. A summary of the number of centerline mainline only miles based on 2010 ARM for principal arterial, minor arterial, and collector roadways is provided in Table 3.2, based on the homogeneous segments database.

| Number of Lanes    | 2-Lane   | Multi-Lane | One-way |
|--------------------|----------|------------|---------|
| Principal Arterial | 1,918.87 | 780.191    | 18.318  |
| Minor Arterial     | 1,783.85 | 99.374     | 1.49    |
| Collector          | 1,378.87 | 26.857     | 3.451   |
| Total              | 5,081.59 | 906.422    | 23.259  |

 Table 3.2: Functional Class Centerline Miles by Lane Configuration.

Together, these three functional classes account for 6,011.267 miles of the 6,867.683 miles available. Principal arterials were found to comprise a total of 2,717.377 miles, of which 1,918.868 miles were 2-lane roadways, 780.191 were multi-lane roadways, and 18.318 miles being one-way. Of the 1,884.716 minor arterial miles, 1,783.852 miles were found to be 2-lane roadways, 99.374 miles were found to be multi-lane roadways with the remaining being one-way. Similarly, collectors were found to be a total of 1,409.174 centerline miles, of which 1,378.866 miles were 2-lane roadways.

The functional classification of the homogenous segments using section AADT data and census population counts has been expressed in cumulative centerline miles. A segment wise comparison between the two classifications was made to show the similarities and differences in the resulting five geographical classifications from 2010 until 2012. Tables 3.3 and 3.4 show the summary of this comparison for 2010.

| Population Based   | Rural     | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |
|--------------------|-----------|----------------|--------------------|--------------------|--------------|
| Principal Arterial | 1,935.036 | 521.684        | 190.364            | 36.095             | 34.198       |
| Minor Arterial     | 1,701.500 | 131.176        | 49.616             | 2.424              | 0.000        |
| Collector          | 1,344.655 | 49.208         | 11.672             | 3.639              | 0.000        |
| Total              | 4,981.191 | 702.068        | 251.652            | 42.158             | 34.198       |

Table 3.3: Population Based Functional Class Centerline Miles by Geographic Classification.

| Table 3.4: AADT Based Function | onal Class Centerline I | e Miles by Geographic Classification. |
|--------------------------------|-------------------------|---------------------------------------|
|--------------------------------|-------------------------|---------------------------------------|

| AADT Based         | Rural     | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |
|--------------------|-----------|----------------|--------------------|--------------------|--------------|
| Principal Arterial | 453.379   | 2,112.08       | 138.105            | 7.543              | 6.270        |
| Minor Arterial     | 716.077   | 1,052.298      | 65.598             | 13.994             | 36.749       |
| Collector          | 652.946   | 685.351        | 7.989              | 26.742             | 36.146       |
| Total              | 1,822.402 | 3,849.729      | 211.692            | 48.279             | 79.165       |

The largest differences were observed in the total centerline miles that fell under the Rural and Small Urban definitions. The population based classification resulted in 4,981.191 Rural centerline miles of roadway, while based on AADT, only 1,822.402 miles would fall under a Rural definition.

Similarly, Small Urban areas had a total of 702.068 centerline miles of roadway when classified by population, but 3,849.729 miles when described by AADT. Thus, segments that were being classified as falling within Rural areas were observing traffic volumes that would be expected in higher order geographic areas, something that was observed for Principal Arterials, Minor Arterials, and Collectors alike. These observations taken together suggest that a classification based solely on the population of the area that a segment falls within does not necessarily hold true based on the traffic volumes being observed along the segments.

Table 3.5 displays the centerline miles of roadway for each of the five geographic classifications based on section AADT data and census population information for Principal Arterials, Minor Arterials, and Collectors. The rows contain the centerline miles based on AADT while the columns show the centerline miles based on population and each cell shows the intersection of the respective geographic types. Thus, the diagonal entries show the number of miles where the classifications based on AADT and population matched, while the off-diagonal cells show the number of miles where the AADT classifications did not match with the population based classifications.

|            |                    |           | Population Basis |                    |                    |              |  |
|------------|--------------------|-----------|------------------|--------------------|--------------------|--------------|--|
|            |                    | Rural     | Small<br>Urban   | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
|            | Rural              | 1,742.492 | 51.43            | 26.355             | 2.125              | 0.000        |  |
| is.        | Small Urban        | 3,104.596 | 546.797          | 147.378            | 114.694            | 15.468       |  |
| AADT Basis | Small<br>Urbanized | 70.864    | 66.299           | 54.256             | 4.562              | 15.672       |  |
|            | Large<br>Urbanized | 26.721    | 8.326            | 12.903             | 0.000              | 0.329        |  |
|            | Metropolitan       | 1,742.492 | 51.43            | 26.355             | 2.125              | 0.000        |  |

Table 3.5: Matrix of 2010 Population Based and AADT Based Functional Class Centerline Miles.

Of the 6,011.774 centerline miles of Principal Arterials, Minor Arterials and Collector roadways, the diagonal entries totaled to 2,343.545; only 38.983% of the geographic classifications by population corresponded to the classification based on observed AADT. The 3,108.709 miles that were classified as being within Rural areas based on population would fall under a Small Urban classification based on AADT. Similarly, 66.299 miles classified as being in Small Urban areas based on population would actually be considered as Small Urbanized based on AADT. These differences in geographical classification were less pronounced at the Large Urbanized and Metropolitan levels with the largest observed difference being 34.652 miles of roadway that were classified as being Large Urbanized based on population, but had small enough daily traffic volumes to be categorized as Small Urban by AADT.

Table 3.6 visualizes the percentage of the miles for each geographical definition type against the total system centerline miles of 6,011.267 for Principal Arterials, Minor Arterials and Collectors. The color scale employed in this table progresses in values from low to high with their corresponding color of green to red, with red signifying the highest percentage.

|            |                    | Population Basis |                |                    |                    |              |
|------------|--------------------|------------------|----------------|--------------------|--------------------|--------------|
|            |                    | Rural            | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |
|            | Rural              | 28.99%           | 0.86%          | 0.44%              | 0.04%              | 0.00%        |
| .s         | Small Urban        | 51.65%           | 9.10%          | 2.45%              | 1.91%              | 0.26%        |
| AADT Basis | Small<br>Urbanized | 1.18%            | 1.10%          | 0.90%              | 0.08%              | 0.26%        |
|            | Large<br>Urbanized | 0.44%            | 0.14%          | 0.21%              | 0.00%              | 0.01%        |
|            | Metropolitan       | 28.99%           | 0.86%          | 0.44%              | 0.04%              | 0.00%        |

Table 3.6: Matrix of 2010 Population Based and AADT Based Functional Class Centerline Miles by Percent.

As before, 90.65% of the total centerline miles fell within the Rural and Small Urban classifications. Approximately 80.69% of the total miles were classified as being Rural by population, only 28.98% of the centerline miles saw AADT classifications that correspond with a Rural area. The remaining 51.71% had annual daily traffic volumes that would be classified as being Small Urban. Another notable observation is that none of the Principal Arterial, Minor Arterial or Collector roadway miles that were classified as being Metropolitan or Large Urbanized by population actually fell within the corresponding categories based on AADT. This could be a result of either no corresponding segments, or perhaps an effect of low Metropolitan miles in comparison to Rural and Small Urban miles. This large difference in the total number of miles for each category could lead to a percentage of the total that is very close to zero. Additionally, 0.58% of Large Urbanized and 0.26% of Metropolitan areas by population were observed to have AADTs in the Small Urban ranges. Conversely, 0.61% of the Rural areas and 0.49% of the Small Urban areas by population were found to have Metropolitan levels of daily traffic volumes.

## 4.0 Functional Classification (Segments)

The centerline mileage matrices comparing population based and AADT based functional classes presented in Section 3.3, are presented in this chapter in counts of homogeneous segments. A total of 107,695 homogeneous roadway segments are account for each individual year of crash data. The functional classification matrices of AADT and population based measures will first be presented for all functional class segment types. The segment matrices will be further evaluated by presenting the comparison matrices for each specific WSDOT defined functional class: Interstate, Principal Arterial, Minor Arterial, Collector, and Non-Interstate segments.

All 107,695 homogeneous roadway segments for years 2010, 2011, and 2012 are shown in comparison matrices in Tables 4.1, 4.2, and 4.3. As with the centerline miles comparison tables, the rows represent the classifications based on AADT while the columns represent the classifications based on population, with each cell showing the intersection of the respective geographical classifications expressed in number of homogenous segments. The cells along the diagonal of the tables depict segments where the two types of classifications remained consistent with each other. The off-diagonal cells show segments that were classified as being of a certain geographical type by population but differences in AADTs resulted in differences in classification.

|             |                    | 2010 Population Basis |                |                    |                    |              |
|-------------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|
|             |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |
| S           | Rural              | 27,379                | 1,067          | 436                | 65                 | 4            |
| Basis       | Small Urban        | 54,586                | 9,757          | 4,498              | 887                | 408          |
| 2010 AADT B | Small<br>Urbanized | 1,471                 | 1,604          | 1,348              | 128                | 378          |
|             | Large<br>Urbanized | 462                   | 521            | 911                | 0                  | 32           |
| 7           | Metropolitan       | 443                   | 628            | 518                | 0                  | 164          |

Table 4.1: Matrix of 2010 Population Based and AADT Based Functional Class Homogeneous Roadway Segments.

Table 4.2: Matrix of 2011 Population Based and AADT Based Functional Class Homogeneous Roadway Segments.

|           |                    |        | 2011 Population Basis |                    |                    |              |
|-----------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|
|           |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |
| S         | Rural              | 28,718 | 1,381                 | 794                | 94                 | 18           |
| Basis     | Small Urban        | 51,991 | 9,655                 | 4,563              | 897                | 391          |
|           | Small<br>Urbanized | 2,026  | 1,298                 | 1,133              | 68                 | 271          |
| 2011 AADT | Large<br>Urbanized | 720    | 571                   | 710                | 0                  | 38           |
| 7         | Metropolitan       | 886    | 672                   | 511                | 21                 | 268          |

Table 4.3: Matrix of 2012 Population Based and AADT Based Functional Class Homogeneous Roadway Segments.

|                 |                    | 2012 Population Basis |                |                    |                    |              |  |
|-----------------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|                 |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| 2012 AADT Basis | Rural              | 29,054                | 1,695          | 1,123              | 104                | 50           |  |
|                 | Small Urban        | 50,466                | 9,455          | 4,798              | 855                | 424          |  |
|                 | Small<br>Urbanized | 2,615                 | 1,228          | 747                | 43                 | 174          |  |
|                 | Large<br>Urbanized | 896                   | 436            | 626                | 40                 | 76           |  |
| 7               | Metropolitan       | 1,310                 | 763            | 417                | 38                 | 262          |  |

It should be noted that while the total number of homogenous segments remain the same over the three-year period, the number of segments in each category change depending on the adjustments in area population and traffic section AADT levels.

As observed in the centerline miles evaluation, the number of segments classified as Rural and Small Urban by AADT and population account for 86.15% of the total number of segments. While the number of segments in each category remains relatively consistent over the three years, some

interesting observations could be made when aggregating some of the data. The number of segments classified as being Rural based on both population and AADT increased by 6% from 27,379 in 2010 to 29,054 in 2012. Conversely, the number of segments classified as being Rural based on population, but with Small Urban AADT levels, reduced by 7.55% from 54,586 in 2010 to 50,466 in 2012. The number of Rural segments by population that saw Metropolitan levels of traffic flow increased nearly threefold from 443 segments in 2010 to 1,310 segments in 2012. An increasing trend was also observed in the segments classified as Metropolitan by both measures wherein the number of homogenous segments increased from 164 in 2010 to 268 in 2011, and remained consistent through 2012. The largest changes were observed in the number of segments that fell within the Rural, Large Urbanized and Metropolitan classifications. The subsequent sections of this chapter will isolate the functional classifications of Interstates, Principal Arterials (Freeway/Expressway + Other Principal Arterial), Minor Arterials, and Collector roads to show the segment distribution among the geographic classifications.

#### **4.1 Interstate Segments**

The summary for all 7,459 homogenous Interstate segments is shown in Tables 4.4, 4.5, and 4.6. The greatest difference observed from 2010 to 2012 were in the number of segments classified as Small Urbanized by population and Rural by AADT levels, an increase from 51 homogenous segments in 2010 to 247 in 2012.

|          |                    | 2010 Population Basis |                |                    |                    |              |  |  |  |  |
|----------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|--|--|--|
|          |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |  |  |
| s        | Rural              | 211                   | 37             | 51                 | 0                  | 4            |  |  |  |  |
| Basis    | Small Urban        | 3,500                 | 803            | 307                | 187                | 66           |  |  |  |  |
| E        | Small<br>Urbanized | 255                   | 211            | 194                | 0                  | 0            |  |  |  |  |
| 2010 AAD | Large<br>Urbanized | 143                   | 337            | 604                | 0                  | 11           |  |  |  |  |
| 7        | Metropolitan       | 2                     | 235            | 208                | 0                  | 93           |  |  |  |  |

Table 4.4: Matrix of 2010 Population Based and AADT Based Functional Class Homogeneous Interstate Segments.

Table 4.5: Matrix of 2011 Population Based and AADT Based Functional Class Homogeneous Interstate Segments.

|             |                    | 2011 Population Basis |                |                    |                    |              |  |
|-------------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|             |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| ×           | Rural              | 243                   | 38             | 143                | 0                  | 18           |  |
| Basis       | Small Urban        | 3,322                 | 901            | 363                | 187                | 52           |  |
| 2011 AADT B | Small<br>Urbanized | 317                   | 139            | 110                | 0                  | 0            |  |
|             | Large<br>Urbanized | 192                   | 298            | 520                | 0                  | 6            |  |
| 7           | Metropolitan       | 37                    | 247            | 228                | 0                  | 98           |  |

|                 |                    | 2012 Population Basis |                |                    |                    |              |  |
|-----------------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|                 |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| 2012 AADT Basis | Rural              | 274                   | 40             | 247                | 10                 | 35           |  |
|                 | Small Urban        | 3,269                 | 962            | 380                | 177                | 35           |  |
|                 | Small<br>Urbanized | 201                   | 159            | 85                 | 0                  | 0            |  |
|                 | Large<br>Urbanized | 274                   | 224            | 487                | 0                  | 15           |  |
| 7               | Metropolitan       | 93                    | 238            | 165                | 0                  | 89           |  |

Table 4.6: Matrix of 2012 Population Based and AADT Based Functional Class Homogeneous Interstate Segments.

The total number of segments within each geographical classification by population remained the same over the three year span. Therefore, the differences observed in the number of corresponding segments by AADT are a result of the variations in AADT over the three year period. The number of homogenous segments that were classified as having Metropolitan, Small Urban and Large Urbanized levels of AADT showed the least amount of variation going from 2010 to 2012, while the number of segments with Rural levels of daily vehicular flow increased by 100% from 303 segments in 2010 to 606 segments in 2012. On the other hand, the number of segments with Small Urbanized levels of AADT reduced from 660 segments in 2010 by 14.24% from 2010 to 2011 and further reduced by 21.38% from 2011 to 2012, an overall reduction of 215 homogenous segments. The number of Interstate segments falling within areas of Rural definitions by population was unsurprisingly a significant portion of the total segments at 4,111. But under the AADT definition, this number was found to drop significantly to 442 segments in 2011, while the number of Small Urban Interstate segments increased from 1623 based on population, to 4825 segments in 2011 based on AADT. Similar increases were observed in the number of Large Urbanized and Metropolitan segments with an increase from 187 population based segments to 1,016 AADT based segments, and 174 population based segments to 610 AADT based segments respectively in 2011.

## 4.2 Principal Arterial (Freeway/Expressway + Other Principal Arterial) Segments

By definition, WSDOT characterizes the functional classification of Principal Arterials as a combination of Freeway/Expressway and Other Principal Arterials type functional classes. Tables 4.7, 4.8, and 4.9 depict the matrix comparisons of the 42,046 homogenous segments that fall within this category between the population based and AADT based classifications.

Similar to the Interstate segments, the total number of homogenous Principal Arterial segments remained the same over the three-year period at 42,046 segments. The number of segments with Rural levels of AADT increased by 1,688 segments from 6,091 in 2010 to 7,779 in 2012. The total number of Rural segments by the population definition of geographical area was found to be 27,735 while under the AADT classification this number was found to be significantly smaller at 6,967 segments in 2011.

|             |                    |        | 2010 Population Basis |                    |                    |              |  |  |
|-------------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|--|
|             |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| ×           | Rural              | 5,485  | 341                   | 200                | 65                 | 0            |  |  |
| Basis       | Small Urban        | 21,716 | 6,716                 | 3,407              | 531                | 342          |  |  |
| 2010 AADT B | Small<br>Urbanized | 531    | 968                   | 909                | 100                | 378          |  |  |
|             | Large<br>Urbanized | 3      | 27                    | 106                | 0                  | 21           |  |  |
| 7           | Metropolitan       | 0      | 26                    | 103                | 0                  | 71           |  |  |

 Table 4.7: Matrix of 2010 Population Based and AADT Based Functional Class Homogeneous Principal Arterial Segments.

 Table 4.8: Matrix of 2011 Population Based and AADT Based Functional Class Homogeneous Principal Arterial Segments.

|                 |                    |        | 2011 Population Basis |                    |                    |              |  |  |
|-----------------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|--|
|                 |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| 2011 AADT Basis | Rural              | 5,892  | 528                   | 453                | 94                 | 0            |  |  |
|                 | Small Urban        | 21,145 | 6,686                 | 3,388              | 543                | 339          |  |  |
|                 | Small<br>Urbanized | 692    | 786                   | 773                | 59                 | 271          |  |  |
|                 | Large<br>Urbanized | 4      | 35                    | 25                 | 0                  | 32           |  |  |
|                 | Metropolitan       | 2      | 43                    | 86                 | 0                  | 170          |  |  |

 Table 4.9: Matrix of 2012 Population Based and AADT Based Functional Class Homogeneous Principal Arterial Segments.

|                 |                    | 2012 Population Basis |                |                    |                    |              |  |
|-----------------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|                 |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| 2012 AADT Basis | Rural              | 6,183                 | 826            | 661                | 94                 | 15           |  |
|                 | Small Urban        | 20,557                | 6,422          | 3,554              | 586                | 389          |  |
|                 | Small<br>Urbanized | 964                   | 665            | 439                | 16                 | 174          |  |
|                 | Large<br>Urbanized | 13                    | 61             | 13                 | 0                  | 61           |  |
| 5               | Metropolitan       | 18                    | 104            | 58                 | 0                  | 173          |  |

The difference between the two classifications was also observed in the other geographic classifications, but the most significant difference was observed for the Small Urban classification whereas the population based definition resulted in 8,078 segments while the daily traffic volumes based definition had 32,101 segments in 2011. Approximately 76% of the segments in the Principal

Arterial functional classification were observed to have Small Urban levels of AADT over the three-year study period.

#### **4.3 Minor Arterial Segments**

A total of 32,024 segments comprise the number of homogeneous segments identified with the Minor Arterial classification. Tables 4.10, 4.11, and 4.12 represent the population based and AADT based comparison matrices of the Minor Arterial segments for 2010, 2011, and 2012.

Table 4.10: Matrix of 2010 Population Based and AADT Based Functional Class Homogeneous Minor Arterial Segments.

|             |                    |        | 2010 Population Basis |                    |                    |              |  |  |
|-------------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|--|
|             |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| ø           | Rural              | 9,556  | 149                   | 148                | 0                  | 0            |  |  |
| Basis       | Small Urban        | 17,146 | 1,966                 | 562                | 68                 | 0            |  |  |
| 2010 AADT B | Small<br>Urbanized | 617    | 422                   | 245                | 28                 | 0            |  |  |
|             | Large<br>Urbanized | 103    | 102                   | 201                | 0                  | 0            |  |  |
| 5           | Metropolitan       | 218    | 295                   | 198                | 0                  | 0            |  |  |

Table 4.11: Matrix of 2011 Population Based and AADT Based Functional Class Homogeneous Minor Arterial Segments.

|                 |                    |        | 2011 Population Basis |                    |                    |              |  |  |
|-----------------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|--|
|                 |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| 2011 AADT Basis | Rural              | 10,244 | 357                   | 161                | 0                  | 0            |  |  |
|                 | Small Urban        | 15,863 | 1,757                 | 616                | 66                 | 0            |  |  |
|                 | Small<br>Urbanized | 758    | 333                   | 249                | 9                  | 0            |  |  |
|                 | Large<br>Urbanized | 262    | 130                   | 140                | 0                  | 0            |  |  |
| 5               | Metropolitan       | 513    | 357                   | 188                | 21                 | 0            |  |  |

Consistent with the Interstate and Principal Arterials, the number of Rural segments based on population was found to reduce significantly from 27,640 compared to 10,762 segments based on AADT in 2011. The number of Small Urban segments by population showed an increase from 2,934 compared to the 18,302 AADT based segments in 2011. Another significant observation from the summary is that under the Minor Arterial functional class, there are zero segments that fall within a Metropolitan geographic definition based on population. On the contrary, the AADT based definition suggests that between 711 and 1,417 Minor Arterial segments demonstrated Metropolitan levels of daily traffic volumes over the three-year period.

|             |                    |        | 2012 Population Basis |                    |                    |              |  |  |
|-------------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|--|
|             |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| *           | Rural              | 10,451 | 465                   | 209                | 0                  | 0            |  |  |
| Basis       | Small Urban        | 14,923 | 1,651                 | 637                | 27                 | 0            |  |  |
| 2012 AADT B | Small<br>Urbanized | 1,116  | 361                   | 197                | 0                  | 0            |  |  |
|             | Large<br>Urbanized | 346    | 74                    | 119                | 31                 | 0            |  |  |
| 7           | Metropolitan       | 804    | 383                   | 192                | 38                 | 0            |  |  |

 Table 4.12: Matrix of 2012 Population Based and AADT Based Functional Class Homogeneous Minor Arterial Segments.

### **4.4 Collector Segments**

A total count of 26,166 homogeneous roadway segments has been identified as the Collector type functional class for years 2010, 2011, and 2012. Tables 4.13, 4.14, and 4.15 show the matrices for the population based and AADT based comparisons for the Collector functional class types from 2010 to 2012.

Table 4.13: Matrix of 2010 Population Based and AADT Based Functional Class Homogeneous Collector Segments.

|                 |                    | 2010 Population Basis |                |                    |                    |              |  |
|-----------------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|                 |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| 2010 AADT Basis | Rural              | 12,127                | 540            | 37                 | 0                  | 0            |  |
|                 | Small Urban        | 12,224                | 272            | 222                | 101                | 0            |  |
|                 | Small<br>Urbanized | 68                    | 3              | 0                  | 0                  | 0            |  |
|                 | Large<br>Urbanized | 213                   | 55             | 0                  | 0                  | 0            |  |
| 7               | Metropolitan       | 223                   | 72             | 9                  | 0                  | 0            |  |

Table 4.14: Matrix of 2011 Population Based and AADT Based Functional Class Homogeneous Collector Segments.

|             |                    |       | 2011 Population Basis |                    |                    |              |  |  |
|-------------|--------------------|-------|-----------------------|--------------------|--------------------|--------------|--|--|
|             |                    | Rural | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| S           | Rural              | 12339 | 458                   | 37                 | 0                  | 0            |  |  |
| Basis       | Small Urban        | 11661 | 311                   | 196                | 101                | 0            |  |  |
| 2011 AADT B | Small<br>Urbanized | 259   | 40                    | 1                  | 0                  | 0            |  |  |
|             | Large<br>Urbanized | 262   | 108                   | 25                 | 0                  | 0            |  |  |
| 7           | Metropolitan       | 334   | 25                    | 9                  | 0                  | 0            |  |  |

|           |                    | 2012 Population Basis |                |                    |                    |              |  |
|-----------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|           |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| S         | Rural              | 12146                 | 364            | 6                  | 0                  | 0            |  |
| Basis     | Small Urban        | 11717                 | 420            | 227                | 65                 | 0            |  |
|           | Small<br>Urbanized | 334                   | 43             | 26                 | 27                 | 0            |  |
| 2012 AADT | Large<br>Urbanized | 263                   | 77             | 7                  | 9                  | 0            |  |
| 7         | Metropolitan       | 395                   | 38             | 2                  | 0                  | 0            |  |

Table 4.15: Matrix of 2012 Population Based and AADT Based Functional Class Homogeneous Collector Segments.

Like the Minor Arterial segment analysis, 24,855 Collector segments classified by population were reduced to 12,834 segments when based on AADT criteria in 2011. Similarly, the number of Small Urban segments were found to increase from 942 population based segments to 12,269 AADT based segments in 2011. Based on population, the Collectors contain zero Metropolitan segments while the AADTs over the same three year span of this study indicate between 304 and 435 Metropolitan level segments.

# 4.5 Non-Interstate Segments (Collector + Minor Arterial + Principal Arterial)

When excluding Interstate segments, the total count of homogeneous roadway segments is 100,236 Non-Interstate segments for 2010, 2011, and 2012. The Non-Interstate segments classification includes Principal Arterial (Freeway/Expressway + Other Principal Arterial), Minor Arterial, and Collector segments. Tables 4.16, 4.17, and 4.18 represent the matrices for the population based and AADT based comparisons for the Non-Interstate functional classification for 2010, 2011, and 2012.

|           |                    |        | 2010 Population Basis |                    |                    |              |  |  |
|-----------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|--|
|           |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |  |
| S         | Rural              | 27,168 | 1,030                 | 385                | 65                 | 0            |  |  |
| Basis     | Small Urban        | 51,086 | 8,954                 | 4,191              | 700                | 342          |  |  |
|           | Small<br>Urbanized | 1,216  | 1,393                 | 1,154              | 128                | 378          |  |  |
| 2010 AADT | Large<br>Urbanized | 319    | 184                   | 307                | 0                  | 21           |  |  |
| 2         | Metropolitan       | 441    | 393                   | 310                | 0                  | 71           |  |  |

Table 4.16: Matrix of 2010 Population Based and AADT Based Functional Class Homogeneous Non-Interstate Segments.

|        |                    | 2011 Population Basis |                |                    |                    |              |  |
|--------|--------------------|-----------------------|----------------|--------------------|--------------------|--------------|--|
|        |                    | Rural                 | Small<br>Urban | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| S      | Rural              | 28,475                | 1,343          | 651                | 94                 | 0            |  |
| Basis  | Small Urban        | 48,669                | 8,754          | 4,200              | 710                | 339          |  |
| AADT F | Small<br>Urbanized | 1,709                 | 1,159          | 1,023              | 68                 | 271          |  |
| 2011 A | Large<br>Urbanized | 528                   | 273            | 190                | 0                  | 32           |  |
| 7      | Metropolitan       | 849                   | 425            | 283                | 21                 | 170          |  |

 Table 4.17: Matrix of 2011 Population Based and AADT Based Functional Class Homogeneous Non-Interstate Segments.

 Table 4.18: Matrix of 2012 Population Based and AADT Based Functional Class Homogeneous Non-Interstate Segments.

|        |                    |        | 2012 Population Basis |                    |                    |              |  |
|--------|--------------------|--------|-----------------------|--------------------|--------------------|--------------|--|
|        |                    | Rural  | Small<br>Urban        | Small<br>Urbanized | Large<br>Urbanized | Metropolitan |  |
| S      | Rural              | 28,780 | 1,655                 | 876                | 94                 | 15           |  |
| Basis  | Small Urban        | 47,197 | 8,493                 | 4,418              | 678                | 389          |  |
| AADT H | Small<br>Urbanized | 2,414  | 1,069                 | 662                | 43                 | 174          |  |
| 2012 A | Large<br>Urbanized | 622    | 212                   | 139                | 40                 | 61           |  |
| 7      | Metropolitan       | 1,217  | 525                   | 252                | 38                 | 173          |  |

It was observed that while 80,230 segments fell under a Rural definition based on population, only between 28,648 and 31,420 segments demonstrated AADTs within an actual Rural range. Additionally, 11,954 segments were classified as being Small Urban based on population, but over the three-year period it was observed that between 61,175 and 65,273 segments showed Small Urban levels of daily traffic volumes. Rural areas based on population with Metropolitan levels of AADT increased from 441 segments in 2010 to 1,217 segments in 2012. This trend was observed for all the other population classes except for Small Urbanized areas, whereas the number of segments with Metropolitan levels of daily traffic volumes decreased from 310 in 2010 to 252 in 2012. Small Urbanized population based segments also saw an increase from 385 to 876 Rural level AADT segments, and 4,191 to 4,418 Small Urban level AADT segments from 2011 to 2012. Inversely, areas designated as Small Urbanized based on both the population and AADT criteria were found to reduce from 1,154 to 662 segments over the three years of 2010 to 2012.

## **5.0 Crash Summary**

The crash counts in the homogeneous segments crash database were consolidated to ensure consistency with the WSDOT source crash data and Washington State collision data summary logs for the years 2010 to 2012. It should be noted that while the crash counts in the Washington State collision data summary logs include crashes on ramps, alternatives, spurs and couplets, only crashes occurring along the mainline of the roadway segments are examined in this study. The crash counts from the homogeneous segments crash database have been disaggregated to examine various mainline crash characteristics in tabular summaries. The summaries were prepared according to the total number of crashes, number of crashes by impact location, number of crashes by collision severity, and collision type for the three year time frame of 2010 to 2012. This chapter will present the crash summary tables by roadway functional classification in the first section, and by geographic classification in the second section. The functional classification tables are based on the results the WSDOT determined from their functional classification procedures. The geographic classification tables will present comparisons between the crash counts with the AADT based classification measure and the population based classification measure.

#### 5.1 Crash Summaries by Roadway Functional Class

Each of the roadway functional class summary tables includes Rural and Urban crashes within the major functional classes of: Interstate, Principal Arterials, Minor Arterials, and Major Collectors. The resulting segment functional classifications stem from WSDOT's functional class assignment process in which the functional class were determined on a roadway segment basis according to accumulate route mileage and state route milepost markers. Table 5.1 displays the total number of crashes along the 6,867.683 miles of mainline roadway represented in the homogeneous crash segments database, grouped by year and area type for the four major functional classifications used by WSDOT.

| Functional Class   | Rural/Urban  | Total Crashes |        |        |  |
|--------------------|--------------|---------------|--------|--------|--|
| Functional Class   | Kural/Orball | 2010          | 2011   | 2012   |  |
| Interstate         | Rural        | 2,188         | 2,180  | 2,346  |  |
| interstate         | Urban        | 9,419         | 9,169  | 9,604  |  |
| Dringing Artonial  | Rural        | 3,954         | 4,078  | 4,076  |  |
| Principal Arterial | Urban        | 15,214        | 15,267 | 15,445 |  |
| Minor Arterial     | Rural        | 2,089         | 2,066  | 2,085  |  |
| Millor Artenai     | Urban        | 2,286         | 2,209  | 2,314  |  |
| Maior Collector    | Rural        | 1,332         | 1,218  | 1,283  |  |
| Major Collector    | Urban        | 15            | 15     | 12     |  |
| Total              |              | 36,497        | 36,202 | 37,165 |  |

Table 5.1: Total Crash Count by Functional Class from 2010 to 2012.

The number of crashes in Urban areas were found to be consistently about 2.8 times higher than the number of Rural crashes during the three-year time frame. The total number of crashes along minor arterial roadways in Washington State was found to be around 4,300 per year with a 100 crash reduction between 2010 and 2011, but an increase from 4,275 crashes in 2011 to 4,399 in 2012. Similarly, Interstate crashes were found to reduce from 11,607 in 2010 to 11,349 crashes in 2011, but increase significantly to 11,950 in 2012. Total crashes along Principal Arterials were found to show an increasing trend over the three years with 19,168 crashes in 2010 up to 19,521

crashes in 2012. Overall, the total number of crashes decreased from 2010 to 2011, but increased significantly between 2011 and 2012. The total number of crashes from 2010 to 2012 is organized by major impact location as Roadside, Roadway, or Other location in Table 5.2 on the following page. The information is presented for each of the crash years and disaggregated according to functional class and Rural or Urban indicators.

| Functional Class     | Rural/Urban | 2010     | 2011    | 2012   |  |
|----------------------|-------------|----------|---------|--------|--|
| Functional Class     | Kural/Orban | Roadside |         |        |  |
| Interated            | Rural       | 800      | 772     | 891    |  |
| Interstate           | Urban       | 1,346    | 1,199   | 1,402  |  |
| Duin sin al Astanial | Rural       | 1,335    | 1,458   | 1,457  |  |
| Principal Arterial   | Urban       | 1,612    | 1,611   | 1,707  |  |
| Minor Arterial       | Rural       | 924      | 875     | 885    |  |
| WINOI AItenai        | Urban       | 357      | 336     | 317    |  |
| Maior Collector      | Rural       | 636      | 621     | 676    |  |
| Major Collector      | Urban       | 5        | 5       | 2      |  |
| Sub Total            |             | 7,015    | 6,877   | 7,337  |  |
| Functional Class     | Rural/Urban |          | Roadway |        |  |
| Interstate           | Rural       | 1,374    | 1,379   | 1,436  |  |
| Interstate           | Urban       | 8,066    | 7,959   | 8,195  |  |
| Duin ain al Autonial | Rural       | 2,609    | 2,606   | 2,612  |  |
| Principal Arterial   | Urban       | 13,565   | 13,613  | 13,697 |  |
| Min on Antonial      | Rural       | 1,163    | 1,187   | 1,194  |  |
| Minor Arterial       | Urban       | 1,918    | 1,867   | 1,991  |  |
| Maior Collector      | Rural       | 695      | 593     | 606    |  |
| Major Collector      | Urban       | 10       | 10      | 10     |  |
| Sub Total            |             | 29,400   | 29,214  | 29,741 |  |
| Functional Class     | Rural/Urban | Other    |         |        |  |
| Tutuntata            | Rural       | 14       | 29      | 19     |  |
| Interstate           | Urban       | 7        | 11      | 7      |  |
| Duin ain al Antanial | Rural       | 10       | 14      | 7      |  |
| Principal Arterial   | Urban       | 37       | 43      | 41     |  |
| Min en Antenial      | Rural       | 2        | 4       | 6      |  |
| Minor Arterial       | Urban       | 11       | 6       | 6      |  |
|                      | Rural       | 1        | 4       | 1      |  |
| Major Collector      | Urban       | 0        | 0       | 0      |  |
| Sub Total            |             | 82       | 111     | 87     |  |
| Total                |             | 36,497   | 36,202  | 37,165 |  |

 Table 5.2: Functional Class Crash Count by Impact Location from 2010 to 2012.

Crashes along the main Roadway section accounted for a significant portion of the total number of crashes. Crashes falling under the Other location category increased between 2010 and 2011 before reducing in 2012. The number of crashes on the Roadway or Roadside was found to show the opposite with 2012 having the highest number of total crashes for the three-year period. It was also

found that crashes along Rural Principal Arterial Roadsides, Rural Interstate Roadways, Urban Principal Arterial Roadways, and Rural Minor Arterial Roadways, demonstrated a steady increase in crashes while Roadside Minor Arterial crashes showed a steady decrease in crashes from 2010 to 2012. Functional class crash counts sorted by collision severities are displayed in Table 5.3 according to PDO, Possible Injury, Evident Injury, Serious Injury, Fatal, and Unknown Injury.

| Eurotional Class   | Rural/Urban | 2010           | 2011            | 2012   |  |
|--------------------|-------------|----------------|-----------------|--------|--|
| Functional Class   | Kurai/Orban | PDO            |                 |        |  |
| T                  | Rural       | 1,505          | 1,504           | 1,662  |  |
| Interstate         | Urban       | 6,474          | 6,250           | 6,607  |  |
| Dainainal Astarial | Rural       | 2,537          | 2,652           | 2,724  |  |
| Principal Arterial | Urban       | 9,961          | 9,931           | 10,046 |  |
|                    | Rural       | 1,235          | 1,205           | 1,253  |  |
| Minor Arterial     | Urban       | 1,503          | 1,447           | 1,494  |  |
| Maine Callester    | Rural       | 797            | 690             | 790    |  |
| Major Collector    | Urban       | 10             | 7               | 6      |  |
| Sub Total          |             | 24,022         | 23,686          | 24,582 |  |
| Functional Class   | Rural/Urban |                | Possible Injury |        |  |
| T                  | Rural       | 353            | 319             | 347    |  |
| Interstate         | Urban       | 2,239          | 2,231           | 2,328  |  |
| D''' 144''         | Rural       | 647            | 631             | 650    |  |
| Principal Arterial | Urban       | 3,786          | 3,843           | 3,853  |  |
|                    | Rural       | 390            | 397             | 382    |  |
| Minor Arterial     | Urban       | 507            | 498             | 535    |  |
|                    | Rural       | 230            | 217             | 213    |  |
| Major Collector    | Urban       | 1              | 5               | 4      |  |
| Sub Total          |             | 8,153          | 8,141           | 8,312  |  |
| Functional Class   | Rural/Urban | Evident Injury |                 |        |  |
| <b>T</b>           | Rural       | 266            | 276             | 255    |  |
| Interstate         | Urban       | 554            | 546             | 539    |  |
| D''' 147 '1        | Rural       | 537            | 556             | 505    |  |
| Principal Arterial | Urban       | 1,052          | 1,161           | 1,160  |  |
|                    | Rural       | 301            | 318             | 301    |  |
| Minor Arterial     | Urban       | 177            | 178             | 188    |  |
|                    | Rural       | 203            | 229             | 179    |  |
| Major Collector    | Urban       | 3              | 2               | 2      |  |
| Sub Total          |             | 3,093          | 3,266           | 3,129  |  |

Table 5.3: Functional Class Crash Count by Collision Severity from 2010 to 2012.

| Functional Class    | Rural/Urban | 2010           | 2011   | 2012   |  |
|---------------------|-------------|----------------|--------|--------|--|
| Functional Class    | Kural/Orban | Serious Injury |        |        |  |
| Interstate          | Rural       | 38             | 39     | 40     |  |
| Interstate          | Urban       | 87             | 79     | 73     |  |
| Principal Arterial  | Rural       | 138            | 136    | 95     |  |
| Finicipal Attental  | Urban       | 254            | 179    | 184    |  |
| Minor Arterial      | Rural       | 97             | 83     | 70     |  |
| WIIIOI AIteria      | Urban       | 40             | 50     | 53     |  |
| Major Collector     | Rural       | 54             | 47     | 54     |  |
| Wajor Conector      | Urban       | 1              | 0      | 0      |  |
| Sub Total           |             | 709            | 613    | 569    |  |
| Functional Class    | Rural/Urban |                | Fatal  |        |  |
| Interstate          | Rural       | 14             | 24     | 17     |  |
| Interstate          | Urban       | 19             | 25     | 18     |  |
| Dringing 1 Artonial | Rural       | 52             | 48     | 44     |  |
| Principal Arterial  | Urban       | 43             | 39     | 51     |  |
| Minor Arterial      | Rural       | 39             | 30     | 31     |  |
| Minor Arterial      | Urban       | 14             | 14     | 6      |  |
| Maion Calleston     | Rural       | 13             | 9      | 13     |  |
| Major Collector     | Urban       | 0              | 1      | 0      |  |
| Sub Total           |             | 194            | 190    | 180    |  |
| Functional Class    | Rural/Urban | Unknown        |        |        |  |
| Turta wata ta       | Rural       | 12             | 18     | 25     |  |
| Interstate          | Urban       | 46             | 38     | 39     |  |
| D 147.1             | Rural       | 43             | 55     | 58     |  |
| Principal Arterial  | Urban       | 118            | 114    | 151    |  |
|                     | Rural       | 27             | 33     | 48     |  |
| Minor Arterial      | Urban       | 45             | 22     | 38     |  |
|                     | Rural       | 35             | 26     | 34     |  |
| Major Collector     | Urban       | 0              | 0      | 0      |  |
| Sub Total           | ·           | 326            | 306    | 393    |  |
| Total               |             | 36,497         | 36,202 | 37,165 |  |

Table 5.3 (continued): Functional Class Crash Count by Collision Severity from 2010 to 2012.

PDO type crashes were found to be significantly higher in number than the other crash severity types with 2012 having the highest number of the three years. Fatalities were found to have the least number of overall crashes, displaying an apparent decreasing trend, with the exception of Urban Principal Arterial Fatalities which were found to be significantly higher in 2012 compared to 2010.

The functional class crash count by number of vehicles involved is presented on the next two pages in Table 5.4 ranging from one vehicle involved (Veh1) to more than six vehicles involved ( $\geq$ Veh6).

| Functional Class   | Rural/Urban | 2010   | 2011              | 2012   |
|--------------------|-------------|--------|-------------------|--------|
|                    |             |        | ber of vehicles - |        |
| Interstate         | Rural       | 1,404  | 1,385             | 1,527  |
|                    | Urban       | 1,647  | 1,501             | 1,721  |
| Principal Arterial | Rural       | 2,227  | 2,399             | 2,374  |
| 1                  | Urban       | 2,290  | 2,384             | 2,463  |
| Minor Arterial     | Rural       | 1,187  | 1,142             | 1,181  |
|                    | Urban       | 442    | 415               | 416    |
| Major Collector    | Rural       | 786    | 747               | 825    |
| Major Concetor     | Urban       | 5      | 5                 | 2      |
| Sub Total          |             | 9,988  | 9,978             | 10,511 |
| Functional Class   | Rural/Urban | Num    | ber of vehicles - | Veh2   |
| Tutoustoto         | Rural       | 692    | 682               | 690    |
| Interstate         | Urban       | 5,937  | 5,857             | 5,987  |
| D' ' 144 '1        | Rural       | 1,541  | 1,481             | 1,525  |
| Principal Arterial | Urban       | 11,045 | 11,025            | 11,05: |
|                    | Rural       | 798    | 832               | 79     |
| Minor Arterial     | Urban       | 1,637  | 1,559             | 1,65   |
|                    | Rural       | 509    | 424               | 42     |
| Major Collector    | Urban       | 10     | 9                 |        |
| Sub Total          |             | 22,169 | 21,869            | 22,13  |
| Functional Class   | Rural/Urban |        | ber of vehicles - |        |
|                    | Rural       | 69     | 84                | 9.     |
| Interstate         | Urban       | 1,396  | 1,400             | 1,45   |
|                    | Rural       | 164    | 172               | 15     |
| Principal Arterial | Urban       | 1,533  | 1,518             | 1,57   |
|                    | Rural       | 95     | 83                | 9      |
| Minor Arterial     | Urban       | 182    | 208               | 20     |
|                    | Rural       | 30     | 39                | 3      |
| Major Collector    | Urban       | 0      | 1                 | 5      |
| Sub Total          | Orban       | 3,469  | 3,505             | 3,60   |
| Functional Class   | Rural/Urban | ,      | ber of vehicles - |        |
|                    | Rural       | 17     | 15                | 22     |
| Interstate         | Urban       | 348    | 312               | 36     |
|                    | Rural       | 17     | 20                | 2      |
| Principal Arterial | Urban       | 285    | 283               | 29     |
|                    |             |        | _                 |        |
| Minor Arterial     | Rural       | 7      | 7                 | 1      |
|                    | Urban       | 23     | 21                | 3      |
| Major Collector    | Rural       | 6      | 7                 |        |
|                    | Urban       | 0      | 0                 | 7.5    |
| Sub Total          |             | 703    | 665               | 75:    |

Table 5.4: Functional Class Crash Count by Number of Vehicles Involved from 2010 to 2012.

| Functional Class   | Rural/Urban | 2010                      | 2011             | 2012   |  |
|--------------------|-------------|---------------------------|------------------|--------|--|
| Functional Class   | Kural/Orban | Number of vehicles - Veh5 |                  |        |  |
| Interstate         | Rural       | 3                         | 9                | 7      |  |
| Interstate         | Urban       | 64                        | 73               | 70     |  |
| Dringing Artorial  | Rural       | 5                         | 5                | 3      |  |
| Principal Arterial | Urban       | 39                        | 44               | 45     |  |
| Minor Arterial     | Rural       | 1                         | 1                | 1      |  |
| WIIIOI AIteriai    | Urban       | 2                         | 5                | 4      |  |
| Major Collector    | Rural       | 0                         | 0                | 0      |  |
| Major Collector    | Urban       | 0                         | 0                | 0      |  |
| Sub Total          | ·           | 114                       | 137              | 130    |  |
| Functional Class   | Rural/Urban | Numb                      | er of vehicles - | ≥Veh6  |  |
| Interstate         | Rural       | 3                         | 5                | 6      |  |
| Interstate         | Urban       | 27                        | 26               | 14     |  |
| Duinsingl Antonial | Rural       | 0                         | 1                | 2      |  |
| Principal Arterial | Urban       | 22                        | 13               | 12     |  |
| Minor Arterial     | Rural       | 1                         | 1                | 0      |  |
| Minor Arteria      | Urban       | 0                         | 1                | 0      |  |
| Maior Collector    | Rural       | 1                         | 1                | 2      |  |
| Major Collector    | Urban       | 0                         | 0                | 0      |  |
| Sub Total          |             | 54                        | 48               | 36     |  |
| Total              |             | 36,497                    | 36,202           | 37,165 |  |

Table 5.4 (continued): Functional Class Crash Count by Number of Vehicles Involved from 2010 to 2012.

The number of crashes involving one vehicle and two vehicles were found to be significantly higher than the other vehicle involvement types across all roadway functional classes. In crashes involving four vehicles or more, it was found that Urban Interstate and Urban Principal Arterial regions had significantly higher numbers of crashes than the other functional classes. Moreover, with the exception of crashes involving two vehicles, all the other categories show higher total accidents in 2012 than in 2010. One instance of a crash involving six vehicles or more on a Rural Major Collector was found for 2010 and 2011, and two such events were found to have occurred in 2012 despite the lower expected AADTs on such segments.

The crash counts for the 19 different collision types are arranged by functional class from 2010 to 2012 in Table 5.5. It was observed that the largest number of occurrences were Rear End, Fixed Object, Same Direction Sideswipe, Same Direction Others, and Entering at an Angle type crashes. As one would expect, Interstates were found to have had the least number of crashes related to Turning Traffic and Head-On collisions because of the divided directional lanes and reduced access points. It was observed that 43 crashes involving pedestrians occurred on the Interstate system over the three years. The total number of Rear End crashes for all functional types was found to remain fairly steady over the three year crash analysis period with more occurrences in Urban areas than in Rural areas, particularly in Urban Interstates and Principal Arterials.

| Functional Class         | Rural/Urban | 2010                             | 2011              | 2012     |  |
|--------------------------|-------------|----------------------------------|-------------------|----------|--|
|                          |             | Rear End                         |                   |          |  |
| Interstate               | Rural       | 328                              | 315               | 28       |  |
|                          | Urban       | 5,537                            | 5,501             | 5,56     |  |
| Principal Arterial       | Rural       | 738                              | 735               | 74       |  |
| Timeipai Aiteriai        | Urban       | 6,839                            | 6,917             | 6,83     |  |
| Minor Arterial           | Rural       | 380                              | 367               | 39       |  |
| WIIIOI AIteria           | Urban       | 858                              | 900               | 88       |  |
| Major Collector          | Rural       | 203                              | 165               | 16       |  |
| Major Collector          | Urban       | 3                                | 1                 |          |  |
| Sub Total                |             | 14,886                           | 14,901            | 14,87    |  |
| Functional Class         | Rural/Urban | -                                | Furning Rear End  | d        |  |
| Tutoustoto               | Rural       | 0                                | 0                 |          |  |
| Interstate               | Urban       | 0                                | 0                 |          |  |
| D: : 1 4 / : 1           | Rural       | 7                                | 9                 |          |  |
| Principal Arterial       | Urban       | 208                              | 225               | 16       |  |
|                          | Rural       | 10                               | 3                 |          |  |
| Minor Arterial           | Urban       | 20                               | 9                 | 2        |  |
|                          | Rural       | 2                                | 0                 |          |  |
| Major Collector          | Urban       | 0                                | 0                 |          |  |
| Sub Total                |             | 247                              | 246               | 20       |  |
| Functional Class         | Rural/Urban | Same Direction Turning Sideswipe |                   |          |  |
| _                        | Rural       | 0                                | 0                 | <b>^</b> |  |
| Interstate               | Urban       | 0                                | 0                 |          |  |
| <b>D</b> · · · · · · · · | Rural       | 7                                | 6                 |          |  |
| Principal Arterial       | Urban       | 135                              | 127               | 14       |  |
|                          | Rural       | 3                                | 5                 |          |  |
| Minor Arterial           | Urban       | 24                               | 17                | 2        |  |
|                          | Rural       | 0                                | 1                 |          |  |
| Major Collector          | Urban       | 0                                | 0                 |          |  |
| Sub Total                |             | 169                              | 156               | 17       |  |
| Functional Class         | Rural/Urban |                                  | e Direction Sides |          |  |
|                          | Rural       | 205                              | 202               | 24       |  |
| Interstate               | Urban       | 1,581                            | 1,592             | 1,68     |  |
|                          | Rural       | 124                              | 117               | 11       |  |
| Principal Arterial       | Urban       | 1,482                            | 1,510             | 1,59     |  |
|                          | Rural       | 39                               | 47                |          |  |
| Minor Arterial           | Urban       | 132                              | 110               | 13       |  |
|                          | Rural       | 19                               | 110               | 1.       |  |
| Major Collector          | Urban       | 1                                | 1                 |          |  |
| Sub Total                | Orban       | 3,583                            | 3,596             | 3,81     |  |

Table 5.5: Functional Class Crash Count by Collision Type from 2010 to 2012.

| Functional Class   | Rural/Urban | 2010       | 2011                               | 2012    |
|--------------------|-------------|------------|------------------------------------|---------|
|                    |             |            | ne Direction Tur                   |         |
| Interstate         | Rural       | 2          | 1                                  | 2       |
|                    | Urban       | 0          | 0                                  | ]       |
| Principal Arterial | Rural       | 104        | 88                                 | 91      |
|                    | Urban       | 289        | 295                                | 342     |
| Minor Arterial     | Rural       | 59         | 59                                 | 66      |
| Willion / Miterial | Urban       | 72         | 80                                 | 67      |
| Major Collector    | Rural       | 35         | 30                                 | 4       |
| Major Concetor     | Urban       | 1          | 1                                  |         |
| Sub Total          |             | 562        | 554                                | 61      |
| Functional Class   | Rural/Urban | Sa         | me Direction Otl                   | ners    |
| Internetete        | Rural       | 136        | 156                                | 154     |
| Interstate         | Urban       | 398        | 349                                | 41      |
| D                  | Rural       | 80         | 71                                 | 8       |
| Principal Arterial | Urban       | 372        | 360                                | 37-     |
|                    | Rural       | 25         | 37                                 | 3       |
| Minor Arterial     | Urban       | 37         | 48                                 | 5       |
|                    | Rural       | 16         | 14                                 | 1       |
| Major Collector    | Urban       | 0          | 0                                  |         |
| Sub Total          |             | 1,064      | 1,035                              | 1,13    |
| Functional Class   | Rural/Urban | Head On    |                                    |         |
|                    | Rural       | 3          | 2                                  |         |
| Interstate         | Urban       | 2          | 7                                  |         |
|                    | Rural       | 36         | 41                                 | 3       |
| Principal Arterial | Urban       | 50         | 43                                 | 6       |
|                    | Rural       | 23         | 19                                 | 2       |
| Minor Arterial     | Urban       | 14         | 19                                 | 1       |
|                    | Rural       | 14         | 14                                 | 1       |
| Major Collector    | Urban       | 10         | 2                                  | 1       |
| Sub Total          | Orban       |            |                                    | 17      |
| Functional Class   | Rural/Urban |            | 139141Opposite Direction Sideswipe |         |
| Functional Class   | Rural       | Oppos<br>1 | 3                                  | leswipe |
| Interstate         | Urban       | 4          | 4                                  |         |
|                    | Rural       | 51         | 58                                 |         |
| Principal Arterial |             |            |                                    | 4       |
|                    | Urban       | 71         | 56                                 | 6       |
| Minor Arterial     | Rural       | 34         | 48                                 | 2       |
|                    | Urban       | 26         | 22                                 | 2       |
| Major Collector    | Rural       | 28         | 25                                 | 2       |
| -                  | Urban       | 0          | 1                                  |         |
| Sub Total          |             | 215        | 217                                | 18      |

Table 5.5 (continued): Functional Class Crash Count by Collision Type from 2010 to 2012.

| Functional Class           | Rural/Urban | 2010              | 2011         | 2012  |  |
|----------------------------|-------------|-------------------|--------------|-------|--|
|                            |             | Oppo              | urning       |       |  |
| Interstate                 | Rural       | 0                 | 0            | 0     |  |
| Interstute                 | Urban       | 1                 | 0            | 0     |  |
| Principal Arterial         | Rural       | 78                | 84           | 106   |  |
| Timelpar Arteriar          | Urban       | 1,047             | 1,047        | 1,008 |  |
| Minor Arterial             | Rural       | 60                | 62           | 52    |  |
| WIIIOI AIteria             | Urban       | 186               | 145          | 163   |  |
| Major Collector            | Rural       | 38                | 34           | 25    |  |
| Major Conector             | Urban       | 0                 | 1            | (     |  |
| Sub Total                  |             | 1,410             | 1,373        | 1,354 |  |
| Functional Class           | Rural/Urban |                   | Fixed Object |       |  |
| Interstate                 | Rural       | 874               | 864          | 968   |  |
| Interstate                 | Urban       | 1,433             | 1,240        | 1,46  |  |
| D 1 1                      | Rural       | 1,179             | 1,334        | 1,31  |  |
| Principal Arterial         | Urban       | 1,652             | 1,656        | 1,732 |  |
|                            | Rural       | 751               | 723          | 73    |  |
| Minor Arterial             | Urban       | 320               | 297          | 28    |  |
|                            | Rural       | 546               | 529          | 56    |  |
| Major Collector            | Urban       | 5                 | 4            |       |  |
| Sub Total                  | - 1         | 6,760             | 6,647        | 7,06  |  |
| Functional Class           | Rural/Urban | Entering At Angle |              |       |  |
| -                          | Rural       | 0                 | 0            |       |  |
| Interstate                 | Urban       | 0                 | 2            |       |  |
| <b>D</b> · · · · · · · · · | Rural       | 341               | 287          | 29    |  |
| Principal Arterial         | Urban       | 2,080             | 1,970        | 2,02  |  |
|                            | Rural       | 194               | 185          | 19    |  |
| Minor Arterial             | Urban       | 412               | 392          | 46    |  |
|                            | Rural       | 139               | 112          | 10    |  |
| Major Collector            | Urban       | 4                 | 2            |       |  |
| Sub Total                  | - 1         | 3,170             | 2,950        | 3,074 |  |
| Functional Class           | Rural/Urban | ,                 | Overturned   | ,     |  |
|                            | Rural       | 275               | 233          | 25    |  |
| Interstate                 | Urban       | 174               | 139          | 13    |  |
|                            | Rural       | 257               | 269          | 26    |  |
| Principal Arterial         | Urban       | 180               | 192          | 17    |  |
|                            | Rural       | 190               | 173          | 16    |  |
| Minor Arterial             | Urban       | 34                | 34           | 3     |  |
|                            | Rural       | 102               | 98           | 12    |  |
| Major Collector            | Urban       | 0                 | 1            |       |  |
| Sub Total                  |             | 1,212             | 1,139        | 1,15  |  |

Table 5.5 (continued): Functional Class Crash Count by Collision Type from 2010 to 2012.

| Functional Class   | Rural/Urban  | 2010   | 2011           | 2012  |  |
|--------------------|--------------|--------|----------------|-------|--|
| Functional Class   | Kulai/Olbaii | Animal |                |       |  |
| Interstate         | Rural        | 184    | 198            | 226   |  |
| Interstate         | Urban        | 67     | 86             | 77    |  |
| Dringing Arterial  | Rural        | 655    | 703            | 708   |  |
| Principal Arterial | Urban        | 110    | 136            | 145   |  |
| Minor Arterial     | Rural        | 186    | 200            | 228   |  |
| Minor Arterial     | Urban        | 37     | 22             | 26    |  |
| Maian Callastan    | Rural        | 110    | 83             | 111   |  |
| Major Collector    | Urban        | 0      | 0              |       |  |
| Sub Total          |              | 1,349  | 1,428          | 1,522 |  |
| Functional Class   | Rural/Urban  |        | Bicycle        |       |  |
| In the methods     | Rural        | 20     | 2              | (     |  |
| Interstate         | Urban        | 4      | 1              |       |  |
| Principal Arterial | Rural        | 39     | 8              | 1.    |  |
|                    | Urban        | 16     | 140            | 13    |  |
| Minor Arterial     | Rural        | 32     | 14             | 1     |  |
|                    | Urban        | 4      | 26             | 2     |  |
| Major Collector    | Rural        | 19     | 6              |       |  |
|                    | Urban        | 0      | 0              |       |  |
| Sub Total          |              | 134    | 197            | 17    |  |
| Functional Class   | Rural/Urban  |        | Pedestrian     |       |  |
|                    | Rural        | 2      | 2              |       |  |
| Interstate         | Urban        | 10     | 16             | 1     |  |
|                    | Rural        | 25     | 21             | 1     |  |
| Principal Arterial | Urban        | 237    | 247            | 27    |  |
|                    | Rural        | 12     | 10             | 1     |  |
| Minor Arterial     | Urban        | 28     | 35             | 4     |  |
|                    | Rural        | 3      | 11             | 1     |  |
| Major Collector    | Urban        | 0      | 0              | -     |  |
| Sub Total          |              | 317    | 342            | 36    |  |
| Functional Class   | Rural/Urban  |        | Parked, One Mc |       |  |
|                    | Rural        | 33     | 35             | 3     |  |
| Interstate         | Urban        | 33     | 39             | 3     |  |
|                    | Rural        | 34     | 31             | 2     |  |
| Principal Arterial | Urban        | 87     | 80             | 9     |  |
|                    | Rural        | 19     | 19             | 2     |  |
| Minor Arterial     | Urban        | 25     | 20             | 2     |  |
|                    | Rural        | 13     | 20             | 1     |  |
| Major Collector    | Urban        | 0      | 0              |       |  |
| Sub Total          | Orban        | 244    | 244            | 24:   |  |

Table 5.5 (continued): Functional Class Crash Count by Collision Type from 2010 to 2012.

| Functional Class     | Rural/Urban  | 2010                      | 2011       | 2012   |  |  |
|----------------------|--------------|---------------------------|------------|--------|--|--|
| Functional Class     | Kurai/Orbaii | Entering/Leaving Driveway |            |        |  |  |
| Interstate           | Rural        | 5                         | 2          | 3      |  |  |
| Interstate           | Urban        | 3                         | 3          | 4      |  |  |
| Driveirel Arteriel   | Rural        | 10                        | 8          | 10     |  |  |
| Principal Arterial   | Urban        | 20                        | 23         | 25     |  |  |
| Minor Arterial       | Rural        | 6                         | 5          | 2      |  |  |
| WINOI AItenai        | Urban        | 6                         | 6          | 3      |  |  |
| Major Collector      | Rural        | 6                         | 8          | 10     |  |  |
| Major Collector      | Urban        | 0                         | 0          | 0      |  |  |
| Sub Total            |              | 56                        | 55         | 57     |  |  |
| Functional Class     | Rural/Urban  |                           | Other      |        |  |  |
| Intenstate           | Rural        | 120                       | 164        | 160    |  |  |
| Interstate           | Urban        | 171                       | 188        | 193    |  |  |
| Driveirel Arteriel   | Rural        | 189                       | 208        | 204    |  |  |
| Principal Arterial   | Urban        | 338                       | 243        | 253    |  |  |
| Minor Arterial       | Rural        | 66                        | 90         | 84     |  |  |
| Minor Arterial       | Urban        | 51                        | 32         | 37     |  |  |
| Maior Collector      | Rural        | 42                        | 51         | 42     |  |  |
| Major Collector      | Urban        | 0                         | 1          | 1      |  |  |
| Sub Total            |              | 977                       | 977        | 974    |  |  |
| Functional Class     | Rural/Urban  |                           | Not Stated |        |  |  |
| Interatoto           | Rural        | 0                         | 1          | 1      |  |  |
| Interstate           | Urban        | 1                         | 2          | 1      |  |  |
| Duin ain al Antonial | Rural        | 0                         | 0          | 0      |  |  |
| Principal Arterial   | Urban        | 1                         | 0          | 2      |  |  |
| Minor Arterial       | Rural        | 0                         | 0          | 1      |  |  |
| Minor Arteria        | Urban        | 0                         | 0          | 0      |  |  |
| Major Callester      | Rural        | 1                         | 1          | 0      |  |  |
| Major Collector      | Urban        | 0                         | 0          | 0      |  |  |
| Sub Total            |              | 3                         | 4          | 5      |  |  |
| Total                |              |                           |            | 37,165 |  |  |

Table 5.5 (continued): Functional Class Crash Count by Collision Type from 2010 to 2012.

Reduced access to interstate facilities led to nearly zero Turning Rear End and Same Direction Turning Sideswipe type crashes, the only exceptions being one incident each on an Urban Interstate reported in 2012. Urban Principal Arterials accounted for a significant number of the Turning Rear End type collisions on the network with 208, 225, and 169 crashes in 2010, 2011, and 2012. Same Direction Sideswipe crashes were found to follow an increasing trend going from 3,583 crashes in 2010 to 3,596 crashes in 2011 to 219 crashes in 2012. This trend was consistent within the Urban Interstate and Principal Arterial functional classes, while Rural Principal Arterials demonstrated a reduction from 124 crashes in 2010 to 114 in 2012.

Same Direction Turning type crashes decreased from 562 in 2010 to 554 in 2011, but increased to 611 in 2012. While Rural Principal Arterials decreased over the three year span, Urban Principal Arterial Same Direction Turning type crashes increased from 289 in 2010 to 342 in 2012. The number of Head-On crashes was also found to increase from 139 in 2010 to 170 in 2012, while the number of Opposite Direction Sideswipes was found to be 215 in 2010 lowering to 187 in 2012. Opposite Direction Turning type collisions were observed to decrease with 1,410 crashes in 2010 to 1,354 crashes in 2012, with over a third of the incidents occurring on Urban Principal Arterials. Collisions involving Fixed Objects were found to decrease from 2010 to 2011, but increase to 7,065 incidents in 2012, with Principal Arterials accounting for nearly half of the yearly total.

Another consideration in this analysis was the impact pedestrians and bicyclists had on crashes within the major roadway functional classes. It was found that over the three year period, 27 collisions involving bicyclists occurred on the interstate system, 22 of which occurred on Rural Interstates. Of these bicyclist collisions, 24 occurred in 2010 with zero incidents in 2012. Principal Arterials were found to have the highest number of bicyclist related crashes, with Rural regions decreasing from 39 crashes in 2010 to 13 in 2012. Conversely, Urban Arterials increased from 16 bicycle related crashes in 2010 to 140 in 2011 and 130 in 2012. Rural Minor Arterials and Major Collectors showed a decrease over the three year period, while Urban Minor Arterials increased by nearly five times from 2010 to 2012. Overall, bicycle related crashes were found to increase from 134 in 2010, to 197 in 2011, before reducing by 18 crashes reported in 2012.

Collisions involving pedestrians was found to exhibit an increasing trend over the three years with 317, 342, and 367 crashes respectively from 2010 to 2012. A total of 43 crashes over the three year period involved pedestrians on Interstates, of which 37 were found to have occurred in Urban areas. Crashes involving pedestrians on Rural Principal Arterials were found to decrease from 25 in 2010 to 14 in 2012. Urban Principal Arterials in contrast, while not only accounting for about 70% of the total pedestrian related crashes, also increased from 237 in 2010 to 271 in 2012. To a lesser extent, a similar trend was also observed in Urban Minor Arterials with 28 crashes in 2010 increasing to 41 in 2012.

#### 5.2 Crash Summaries by Geographic Class

The next series of tables arranges the crash counts according to geographic class beginning with the total counts for all 6,867.683 miles of mainline roadway in Washington State. The crash counts were arranged based on geographic regions classified by segment AADT and regional census population data. The crash count tables are presented by impact location, collision severities, number of vehicles involved, and collision types. The tables aggregated by geographic class compare the measures of both the section AADT based classification results and the population based results. A large number of segments on the system fall within Small Urbanized, Small Urban or Rural definition when based on population. These segments are not isolated on the network and areas with low population levels could contain segments with very high AADT levels. Incident geographical area type was found to vary depending on the population and AADT of the respective segments on the system.

Table 5.6 shows the comparison of the total crash counts for the AADT and population based geographic class according to: Metropolitan, Large Urbanized, Small Urbanized, Small Urban, and Rural. The population based geographic classification shows that the number of accidents in

Metropolitan areas increased from 3,121 in 2010 to 3,181 in 2012. The highest number of crashes according to this measure occur in Small Urbanized and Small Urban areas, with the former showing a decreasing trend going from 2010 to 2012 and the latter showing and increasing trend

|                  | AADT Based |             |        | Population Based |        |        |  |
|------------------|------------|-------------|--------|------------------|--------|--------|--|
| Geographic Class | Т          | otal Crashe | s      | Total Crashes    |        |        |  |
|                  | 2010       | 2011        | 2012   | 2010             | 2011   | 2012   |  |
| Metropolitan     | 5,018      | 5,148       | 5,194  | 3,121            | 3,134  | 3,181  |  |
| Large Urbanized  | 3,619      | 3,321       | 3,689  | 922              | 941    | 794    |  |
| Small Urbanized  | 4,874      | 3,487       | 2,519  | 11,026           | 10,749 | 10,885 |  |
| Small Urban      | 21,008     | 21,626      | 21,893 | 10,460           | 10,422 | 11,019 |  |
| Rural            | 1,978      | 2,620       | 3,870  | 10,968           | 10,956 | 11,286 |  |
| Total            | 36,497     | 36,202      | 37,165 | 36,497           | 36,202 | 37,165 |  |

Table 5.6: Total Crash Count by Geographic Class from 2010 to 2012.

Between 2010 and 2012, crashes in Large Urbanized areas decreased by 128 crashes. Compared to the AADT based measure, while the total number of accidents for the years remains the same, the number within each geographic class varies due to the disparity between the two methods of classification. Population based Rural crashes total at 109,864 for the three years, whereas only 8,468 crashes based on AADT occur in areas that can be classified as Rural. Small Urban areas inversely show nearly double the number of crashes using AADT as the basis for classification compared to using the population based assessment. Similarly, AADT based Small Urbanized areas have about a third of the number of crashes in contrast to using population as a basis; Large Urbanized areas also show a significantly higher number of crashes when using AADT as a basis.

Table 5.7 on the following page displays the total number of crashes sorted by impact location for the AADT based and population based geographic classes. The impact locations are identified as Roadside, Roadway, or Other location and presented for crash years 2010, 2011, and 2012 disaggregated to five geographic classes.

As with the total crash counts discussion, Small Urban areas were found to have had between 4,603 and 4,668 Roadside crashes when consolidated by AADT. In contrast, population based Rural Roadside crashes were depicted as being the highest at about 3,970 crashes per year. In spite of the reduced totals, AADT based rural Roadside crashes were found to have an increasing trend over the three years. AADT based Metropolitan, Small Urbanized and Small Urban Roadside crashes saw a reduction from 2010 to 2011, before increasing in 2012. The general distribution of Roadway type crashes follows similar pattern as the Roadside type crashes when AADT is used as to classify geographic area. In addition to being the highest in number of crashes, Small Urban Roadway type crashes were observed to increase from 16,352 in 2010 to 17,159 in 2012.

|                  | А      | ADT Base | d      | Population Based |        |        |
|------------------|--------|----------|--------|------------------|--------|--------|
| Geographic Class | 2010   | 2011     | 2012   | 2010             | 2011   | 2012   |
|                  |        |          | Road   | lside            |        |        |
| Metropolitan     | 573    | 625      | 661    | 364              | 343    | 405    |
| Large Urbanized  | 444    | 394      | 517    | 124              | 128    | 110    |
| Small Urbanized  | 719    | 600      | 516    | 1,260            | 1,223  | 1,275  |
| Small Urban      | 4,603  | 4,469    | 4,668  | 1,354            | 1,308  | 1,427  |
| Rural            | 676    | 789      | 975    | 3,913            | 3,875  | 4,120  |
| Sub Total        | 7,015  | 6,877    | 7,337  | 7,015            | 6,877  | 7,337  |
| Geographic Class |        |          | Road   | lway             |        |        |
| Metropolitan     | 4,437  | 4,516    | 4,523  | 2,751            | 2,787  | 2,775  |
| Large Urbanized  | 3,169  | 2,922    | 3,168  | 792              | 805    | 680    |
| Small Urbanized  | 4,143  | 2,871    | 2,000  | 9,750            | 9,506  | 9,595  |
| Small Urban      | 16,352 | 17,086   | 17,159 | 9,080            | 9,093  | 9,565  |
| Rural            | 1,299  | 1,819    | 2,891  | 7,027            | 7,023  | 7,126  |
| Sub Total        | 29,400 | 29,214   | 29,741 | 29,400           | 29,214 | 29,741 |
| Geographic Class |        |          | Otl    | her              |        |        |
| Metropolitan     | 8      | 7        | 10     | 6                | 4      | 1      |
| Large Urbanized  | 6      | 5        | 4      | 6                | 8      | 4      |
| Small Urbanized  | 12     | 16       | 3      | 16               | 20     | 15     |
| Small Urban      | 53     | 71       | 66     | 26               | 21     | 27     |
| Rural            | 3      | 12       | 4      | 28               | 58     | 40     |
| Sub Total        | 82     | 111      | 87     | 82               | 111    | 87     |
| Total            | 36,497 | 36,202   | 37,165 | 36,497           | 36,202 | 37,165 |

Table 5.7: Geographic Class Crash Count by Impact Location from 2010 to 2012.

Crash counts by geographic class are grouped by collision severities in Table 5.8 presented in the next page. The collision severity categories are listed as: PDO, Possible Injury, Evident Injury, Serious Injury, Fatal, and Unknown Injury. In regard to crash severities, PDO crashes were found to vary between 2,051 and 2,064 crashes over the 3-year period when classified on the population base, a range that increases to 3,417 to 3,563 crashes based on AADT. Similarly, AADT based Large Urbanized and Small Urban PDO crashes were found to be significantly higher than the corresponding population based counts. PDO crash locations that were classified as Small Urbanized and Rural based on population reduced greatly when examined on the AADT basis. Possible Injury crashes followed a similar relationship as demonstrated by the PDOs, with AADT based Small Urban crashes increasing over the 3-year period. AADT based Evident Injury crashes in Metropolitan areas were found to increase from 241 in 2010 to 307 in 2012, while in Small Urbanized areas they were found to decrease over the same period. AADT based Serious Injury crashes in Small Urbanized and Small Urban areas were exhibited a decreasing trend and Rural areas, while being fewer in number compared to the population based classification, showed an increase in number of crashes in 2012 over 2010. Consolidating crashes based on population would suggest that crashes in Rural areas result in the most fatalities on the system, but when classified based on AADT this number was found to indicate Small Urban areas as being more susceptible.

| 81               |        | ADT Base | ę      | Population Based |        |        |  |
|------------------|--------|----------|--------|------------------|--------|--------|--|
| Geographic Class | 2010   | 2011     | 2012   | 2010             | 2011   | 2012   |  |
| Geographic Class | 2010   | 2011     | PE     |                  | 2011   | 2012   |  |
| Metropolitan     | 3,417  | 3,432    | 3,563  | 2,051            | 2,069  | 2,064  |  |
| Large Urbanized  | 2,440  | 2,230    | 2,412  | 550              | 565    | 470    |  |
| Small Urbanized  | 3,208  | 2,265    | 1,646  | 7,366            | 7,091  | 7,210  |  |
| Small Urban      | 13,657 | 14,102   | 14,398 | 7,064            | 7,013  | 7,443  |  |
| Rural            | 1,300  | 1,657    | 2,563  | 6,991            | 6,948  | 7,395  |  |
| Sub Total        | 24,022 | 23,686   | 24,582 | 24,022           | 23,686 | 24,582 |  |
| Geographic Class | )-     | - )      | ,      | e Injury         | - )    | )      |  |
| Metropolitan     | 1,271  | 1,316    | 1,238  | 834              | 827    | 863    |  |
| Large Urbanized  | 899    | 798      | 993    | 262              | 248    | 204    |  |
| Small Urbanized  | 1,181  | 866      | 598    | 2,708            | 2,751  | 2,802  |  |
| Small Urban      | 4,471  | 4,659    | 4,715  | 2,367            | 2,369  | 2,480  |  |
| Rural            | 331    | 502      | 768    | 1,982            | 1,946  | 1,963  |  |
| Sub Total        | 8,153  | 8,141    | 8,312  | 8,153            | 8,141  | 8,312  |  |
| Geographic Class | 0,200  | 0,212    | ,      | t Injury         | 0,212  | -,     |  |
| Metropolitan     | 241    | 309      | 307    | 167              | 196    | 205    |  |
| Large Urbanized  | 220    | 222      | 228    | 85               | 104    | 92     |  |
| Small Urbanized  | 360    | 272      | 189    | 699              | 700    | 682    |  |
| Small Urban      | 2,034  | 2,135    | 2,038  | 745              | 782    | 791    |  |
| Rural            | 238    | 328      | 367    | 1,397            | 1,484  | 1,359  |  |
| Sub Total        | 3,093  | 3,266    | 3,129  | 3,093            | 3,266  | 3,129  |  |
| Geographic Class | - )    | -)       | ,      | s Injury         | -)     | -) -   |  |
| Metropolitan     | 58     | 47       | 52     | 52               | 22     | 34     |  |
| Large Urbanized  | 32     | 39       | 34     | 13               | 10     | 12     |  |
| Small Urbanized  | 79     | 51       | 45     | 141              | 119    | 91     |  |
| Small Urban      | 478    | 400      | 347    | 148              | 140    | 157    |  |
| Rural            | 62     | 76       | 91     | 355              | 322    | 275    |  |
| Sub Total        | 709    | 613      | 569    | 709              | 613    | 569    |  |
| Geographic Class |        |          |        | ıtal             |        |        |  |
| Metropolitan     | 10     | 18       | 8      | 6                | 7      | 5      |  |
| Large Urbanized  | 10     | 12       | 7      | 3                | 3      | 3      |  |
| Small Urbanized  | 18     | 11       | 12     | 29               | 29     | 25     |  |
| Small Urban      | 137    | 130      | 129    | 40               | 26     | 36     |  |
| Rural            | 19     | 19       | 24     | 116              | 125    | 111    |  |
| Sub Total        | 194    | 190      | 180    | 194              | 190    | 180    |  |
| Geographic Class |        |          |        | nown             |        |        |  |
| Metropolitan     | 21     | 26       | 26     | 11               | 13     | 10     |  |
| Large Urbanized  | 18     | 20       | 15     | 9                | 11     | 13     |  |
| Small Urbanized  | 28     | 22       | 29     | 83               | 59     | 75     |  |
| Small Urban      | 231    | 200      | 266    | 96               | 92     | 112    |  |
| Rural            | 28     | 38       | 57     | 127              | 131    | 183    |  |
| Sub Total        | 326    | 306      | 393    | 326              | 306    | 393    |  |
| Total            | 36,497 | 36,202   | 37,165 | 36,497           | 36,202 | 37,165 |  |

Table 5.8: Geographic Class Crash Count by Collision Severity from 2010 to 2012.

Geographic class crash counts disaggregated by number of vehicles involved is shown on the following page in Table 5.9. The categories for number of vehicles ranges from one vehicle involved (Veh1) to more than six vehicles involved ( $\geq$ Veh6).

|                  | AADT Based |        |              | Population Based |        |        |  |
|------------------|------------|--------|--------------|------------------|--------|--------|--|
| Geographic Class | 2010       | 2011   | 2012         | 2010             | 2011   | 2012   |  |
|                  |            | N      | lumber of ve | ehicles - Veh    | 1      |        |  |
| Metropolitan     | 633        | 744    | 823          | 401              | 400    | 451    |  |
| Large Urbanized  | 531        | 522    | 630          | 203              | 189    | 182    |  |
| Small Urbanized  | 1,003      | 817    | 700          | 1,592            | 1,563  | 1,616  |  |
| Small Urban      | 6,840      | 6,744  | 6,924        | 1,928            | 1,948  | 2,086  |  |
| Rural            | 981        | 1,151  | 1,434        | 5,864            | 5,878  | 6,176  |  |
| Sub Total        | 9,988      | 9,978  | 10,511       | 9,988            | 9,978  | 10,511 |  |
| Geographic Class |            | N      | lumber of ve | ehicles - Veh    | 12     |        |  |
| Metropolitan     | 3,414      | 3,406  | 3,382        | 2,072            | 2,094  | 2,115  |  |
| Large Urbanized  | 2,361      | 2,174  | 2,319        | 596              | 617    | 509    |  |
| Small Urbanized  | 3,180      | 2,186  | 1,487        | 7,743            | 7,542  | 7,543  |  |
| Small Urban      | 12,324     | 12,839 | 12,878       | 7,285            | 7,197  | 7,540  |  |
| Rural            | 890        | 1,264  | 2,066        | 4,473            | 4,419  | 4,425  |  |
| Sub Total        | 22,169     | 21,869 | 22,132       | 22,169           | 21,869 | 22,132 |  |
| Geographic Class |            | N      | lumber of ve | ehicles - Veh    | 13     |        |  |
| Metropolitan     | 751        | 763    | 744          | 502              | 484    | 470    |  |
| Large Urbanized  | 563        | 496    | 576          | 100              | 104    | 83     |  |
| Small Urbanized  | 526        | 387    | 256          | 1,311            | 1,315  | 1,375  |  |
| Small Urban      | 1,538      | 1,696  | 1,734        | 1,021            | 1,049  | 1,111  |  |
| Rural            | 91         | 163    | 291          | 535              | 553    | 562    |  |
| Sub Total        | 3,469      | 3,505  | 3,601        | 3,469            | 3,505  | 3,601  |  |
| Geographic Class |            | N      | lumber of ve | ehicles - Veh    | 4      |        |  |
| Metropolitan     | 171        | 184    | 200          | 112              | 123    | 117    |  |
| Large Urbanized  | 139        | 93     | 132          | 21               | 26     | 19     |  |
| Small Urbanized  | 126        | 71     | 68           | 304              | 252    | 291    |  |
| Small Urban      | 253        | 280    | 289          | 192              | 189    | 233    |  |
| Rural            | 14         | 37     | 66           | 74               | 75     | 95     |  |
| Sub Total        | 703        | 665    | 755          | 703              | 665    | 755    |  |
| Geographic Class |            | Ν      | lumber of ve | ehicles - Veh    | 15     |        |  |
| Metropolitan     | 34         | 39     | 41           | 25               | 27     | 23     |  |
| Large Urbanized  | 19         | 24     | 25           | 2                | 2      | 1      |  |
| Small Urbanized  | 22         | 21     | 4            | 50               | 58     | 48     |  |
| Small Urban      | 38         | 49     | 49           | 23               | 28     | 41     |  |
| Rural            | 1          | 4      | 11           | 14               | 22     | 17     |  |
| Sub Total        | 114        | 137    | 130          | 114              | 137    | 130    |  |
| Geographic Class | ļ          |        | umber of ve  | hicles - ≥Ve     |        |        |  |
| Metropolitan     | 15         | 12     | 4            | 9                | 6      | 5      |  |
| Large Urbanized  | 6          | 12     | 7            | 0                | 3      | 0      |  |
| Small Urbanized  | 17         | 5      | 4            | 26               | 19     | 12     |  |
| Small Urban      | 15         | 18     | 19           | 11               | 11     | 8      |  |
| Rural            | 1          | 1      | 2            | 8                | 9      | 11     |  |
| Sub Total        | 54         | 48     | 36           | 54               | 48     | 36     |  |
| Total            | 36,497     | 36,202 | 37,165       | 36,497           | 36,202 | 37,165 |  |

Table 5.9: Geographic Class Crash Count by Number of Vehicles Involved from 2010 to 2012.

For crashes involving one or two vehicles, the population based definition suggests Rural areas having the most occurrences; when based on AADT, the counts shift towards Small Urban areas. The number of single vehicle crashes in Small Urban areas dips from 2010 to 2011, and increases in 2012, while the number of two vehicle crashes shows an increasing trend. The number of Rural two vehicle crashes increases when based on AADT, but the total crash counts are much lower when compared to the population based classification. Three vehicle crashes in areas with Small Urban levels of AADT were found to be much higher than those in areas of Rural AADT. Crashes involving four vehicles were observed to increase in areas with Metropolitan, Small Urban, and Rural levels of AADT, whereas Small Urbanized levels of AADT decreased over the three-year period. Population based measures would indicate that there were 28 crashes in Rural areas involving six vehicles or more, but when AADT is taken into account this number dropped to four crashes over the three-year span.

It was found that while many of the crashes were recorded as having occurred in Rural areas based on segment area population, these numbers changed because of the AADT based geographical classifications reported on the segments. Table 5.10 on the following pages will present the crash counts for the 19 different collision types arranged by geographic class from 2010 to 2012 for the AADT and population based measures.

Rear End crashes were counted at their highest numbers in segments with Small Urban levels of AADT, with an increase in counts from 2010 to 2012 for both AADT levels with Small Urban and Rural levels. The number of Rear End crashes in areas with Large Urbanized levels of AADT was found to be in the range of 2,108 to 2,229 crashes, substantially higher than the numbers within Large Urbanized populated areas. Similarly, Turning Rear End, Same Direction Turning Sideswipe, and Same Direction Sideswipe type crashes were found to occur more frequently in areas with Small Urban levels of AADT, the latter two demonstrating an increase over the three year period. Same Direction Sideswipe crashes were observed to decrease for segments with Small Urbanized levels of AADT.

Head-On collisions were at their highest counts in Small Urban levels of AADT while Rural and Small Urbanized levels of AADT showed an increase from 2010 to 2012. Opposite Direction Sideswipe crashes have the greatest counts at Small Urbanized AADT levels or lower with Small Urban and Small Urbanized levels of AADT indicating a decrease in crash counts over the three years. Opposite Direction Turning type crashes were significantly higher in areas with Small Urban levels of AADT, but Rural and Large Urbanized appeared to increase. As with the previous crash types, Small Urban levels of AADT accounted for more Fixed Object, Overturned, Entering/Leaving Driveway, and Entering at an Angle crashes than the other geographic class.

The population based classification would suggest that Rural areas experienced the highest number of bicycle related crashes. Based on AADT, Rural bicycle crashes reduced to 45 crashes over the three-year period. Alternatively, areas with Small Urban levels of AADT were found to have had 386 crashes with an increase in crash counts over the same period. A similar observation was made with respect to crashes involving pedestrians, with increasing crash counts for all geographic classes with the exception of areas with the Small Urbanized class.

|                  | А      | ADT Base | d           | Population Based   |        |        |  |
|------------------|--------|----------|-------------|--------------------|--------|--------|--|
| Geographic Class | 2010   | 2011     | 2012        | 2010               | 2011   | 2012   |  |
|                  |        |          | Rear        | End                |        |        |  |
| Metropolitan     | 2,982  | 2,974    | 2,951       | 1,774              | 1,815  | 1,771  |  |
| Large Urbanized  | 2,229  | 2,003    | 2,108       | 380                | 417    | 324    |  |
| Small Urbanized  | 2,343  | 1,636    | 1,013       | 5,710              | 5,588  | 5,602  |  |
| Small Urban      | 6,881  | 7,515    | 7,548       | 4,669              | 4,718  | 4,829  |  |
| Rural            | 451    | 773      | 1,259       | 2,353              | 2,363  | 2,353  |  |
| Sub Total        | 14,886 | 14,901   | 14,879      | 14,886             | 14,901 | 14,879 |  |
| Geographic Class |        |          | Turning     | Rear End           |        |        |  |
| Metropolitan     | 9      | 9        | 2           | 10                 | 2      | 4      |  |
| Large Urbanized  | 1      | 5        | 5           | 2                  | 3      | 1      |  |
| Small Urbanized  | 60     | 16       | 21          | 95                 | 106    | 74     |  |
| Small Urban      | 168    | 206      | 155         | 113                | 107    | 99     |  |
| Rural            | 9      | 10       | 20          | 27                 | 28     | 25     |  |
| Sub Total        | 247    | 246      | 203         | 247                | 246    | 203    |  |
| Geographic Class |        | Same     | Direction T | <b>Turning Sid</b> | eswipe |        |  |
| Metropolitan     | 9      | 7        | 9           | 13                 | 11     | 10     |  |
| Large Urbanized  | 3      | 3        | 6           | 12                 | 4      | 4      |  |
| Small Urbanized  | 22     | 7        | 10          | 49                 | 53     | 58     |  |
| Small Urban      | 122    | 132      | 135         | 75                 | 70     | 85     |  |
| Rural            | 13     | 7        | 14          | 20                 | 18     | 17     |  |
| Sub Total        | 169    | 156      | 174         | 169                | 156    | 174    |  |
| Geographic Class |        | Sa       | ame Directi | on Sideswi         | pe     |        |  |
| Metropolitan     | 865    | 817      | 842         | 484                | 474    | 533    |  |
| Large Urbanized  | 507    | 492      | 563         | 75                 | 99     | 75     |  |
| Small Urbanized  | 563    | 377      | 269         | 1,457              | 1,415  | 1,518  |  |
| Small Urban      | 1,506  | 1,733    | 1,762       | 1,031              | 1,076  | 1,152  |  |
| Rural            | 142    | 177      | 379         | 536                | 532    | 537    |  |
| Sub Total        | 3,583  | 3,596    | 3,815       | 3,583              | 3,596  | 3,815  |  |
| Geographic Class |        | S        | Same Direc  | tion Turnin        | g      |        |  |
| Metropolitan     | 17     | 43       | 37          | 24                 | 39     | 25     |  |
| Large Urbanized  | 20     | 9        | 16          | 21                 | 18     | 15     |  |
| Small Urbanized  | 49     | 42       | 40          | 117                | 125    | 128    |  |
| Small Urban      | 436    | 419      | 444         | 207                | 189    | 226    |  |
| Rural            | 40     | 41       | 74          | 193                | 183    | 217    |  |
| Sub Total        | 562    | 554      | 611         | 562                | 554    | 611    |  |

Table 5.10: Geographic Class Crash Count by Collision Type from 2010 to 2012.

|                  | AADT Based |                       |              | Population Based |       |       |  |
|------------------|------------|-----------------------|--------------|------------------|-------|-------|--|
| Geographic Class | 2010       | 2011                  | 2012         | 2010             | 2011  | 2012  |  |
|                  |            | Same Direction Others |              |                  |       |       |  |
| Metropolitan     | 204        | 204                   | 179          | 89               | 99    | 89    |  |
| Large Urbanized  | 118        | 92                    | 152          | 29               | 20    | 17    |  |
| Small Urbanized  | 141        | 111                   | 79           | 356              | 309   | 345   |  |
| Small Urban      | 569        | 561                   | 622          | 292              | 288   | 345   |  |
| Rural            | 32         | 67                    | 101          | 298              | 319   | 337   |  |
| Sub Total        | 1,064      | 1,035                 | 1,133        | 1,064            | 1,035 | 1,133 |  |
| Geographic Class |            |                       | Hea          | d On             |       |       |  |
| Metropolitan     | 3          | 6                     | 13           | 2                | 1     | 9     |  |
| Large Urbanized  | 2          | 5                     | 4            | 1                | 3     | 5     |  |
| Small Urbanized  | 11         | 12                    | 18           | 22               | 20    | 25    |  |
| Small Urban      | 114        | 101                   | 117          | 40               | 37    | 44    |  |
| Rural            | 9          | 17                    | 18           | 74               | 80    | 87    |  |
| Sub Total        | 139        | 141                   | 170          | 139              | 141   | 170   |  |
| Geographic Class |            | Opj                   | posite Direc | ction Sidesv     | wipe  |       |  |
| Metropolitan     | 11         | 6                     | 6            | 7                | 6     | 3     |  |
| Large Urbanized  | 3          | 10                    | 3            | 0                | 0     | 1     |  |
| Small Urbanized  | 22         | 15                    | 12           | 32               | 27    | 27    |  |
| Small Urban      | 161        | 148                   | 132          | 51               | 48    | 47    |  |
| Rural            | 18         | 38                    | 34           | 125              | 136   | 109   |  |
| Sub Total        | 215        | 217                   | 187          | 215              | 217   | 187   |  |
| Geographic Class |            | Орј                   | posite Direc | ction Sidesv     | wipe  |       |  |
| Metropolitan     | 68         | 75                    | 61           | 118              | 119   | 103   |  |
| Large Urbanized  | 37         | 41                    | 48           | 52               | 46    | 52    |  |
| Small Urbanized  | 180        | 106                   | 87           | 442              | 435   | 386   |  |
| Small Urban      | 1,071      | 1,094                 | 1,056        | 556              | 538   | 579   |  |
| Rural            | 54         | 57                    | 102          | 242              | 235   | 234   |  |
| Sub Total        | 1,410      | 1,373                 | 1,354        | 1,410            | 1,373 | 1,354 |  |
| Geographic Class |            |                       | Fixed        | Object           |       |       |  |
| Metropolitan     | 578        | 609                   | 688          | 356              | 320   | 388   |  |
| Large Urbanized  | 466        | 427                   | 507          | 147              | 143   | 124   |  |
| Small Urbanized  | 762        | 646                   | 529          | 1,272            | 1,222 | 1,273 |  |
| Small Urban      | 4,350      | 4,278                 | 4,474        | 1,396            | 1,343 | 1,466 |  |
| Rural            | 604        | 687                   | 867          | 3,589            | 3,619 | 3,814 |  |
| Sub Total        | 6,760      | 6,647                 | 7,065        | 6,760            | 6,647 | 7,065 |  |

Table 5.10 (continued): Geographic Class Crash Count by Collision Type from 2010 to 2012.

|                  | AADT Based        |       |       | Population Based |       |       |  |
|------------------|-------------------|-------|-------|------------------|-------|-------|--|
| Geographic Class | 2010              | 2011  | 2012  | 2010             | 2011  | 2012  |  |
|                  | Entering At Angle |       |       |                  |       |       |  |
| Metropolitan     | 111               | 144   | 169   | 120              | 108   | 113   |  |
| Large Urbanized  | 74                | 69    | 70    | 118              | 119   | 100   |  |
| Small Urbanized  | 346               | 242   | 184   | 946              | 877   | 893   |  |
| Small Urban      | 2,465             | 2,299 | 2,320 | 1,183            | 1,132 | 1,239 |  |
| Rural            | 174               | 196   | 331   | 803              | 714   | 729   |  |
| Sub Total        | 3,170             | 2,950 | 3,074 | 3,170            | 2,950 | 3,074 |  |
| Geographic Class |                   |       | Over  | turned           |       |       |  |
| Metropolitan     | 51                | 67    | 61    | 25               | 26    | 21    |  |
| Large Urbanized  | 51                | 47    | 60    | 11               | 9     | 7     |  |
| Small Urbanized  | 89                | 62    | 51    | 141              | 138   | 132   |  |
| Small Urban      | 858               | 795   | 783   | 182              | 169   | 151   |  |
| Rural            | 163               | 168   | 196   | 853              | 797   | 840   |  |
| Sub Total        | 1,212             | 1,139 | 1,151 | 1,212            | 1,139 | 1,151 |  |
| Geographic Class |                   |       | An    | imal             |       |       |  |
| Metropolitan     | 8                 | 16    | 33    | 2                | 2     | 0     |  |
| Large Urbanized  | 25                | 34    | 28    | 14               | 13    | 5     |  |
| Small Urbanized  | 52                | 57    | 74    | 33               | 53    | 48    |  |
| Small Urban      | 1,093             | 1,095 | 1,097 | 161              | 194   | 220   |  |
| Rural            | 171               | 226   | 290   | 1,139            | 1,166 | 1,249 |  |
| Sub Total        | 1,349             | 1,428 | 1,522 | 1,349            | 1,428 | 1,522 |  |
| Geographic Class |                   |       | Bic   | ycle             |       |       |  |
| Metropolitan     | 1                 | 14    | 12    | 0                | 19    | 15    |  |
| Large Urbanized  | 2                 | 2     | 6     | 2                | 9     | 13    |  |
| Small Urbanized  | 6                 | 23    | 13    | 2                | 62    | 53    |  |
| Small Urban      | 105               | 141   | 140   | 9                | 74    | 67    |  |
| Rural            | 20                | 17    | 8     | 121              | 33    | 31    |  |
| Sub Total        | 134               | 197   | 179   | 134              | 197   | 179   |  |
| Geographic Class |                   |       | Pede  | strian           |       |       |  |
| Metropolitan     | 11                | 35    | 25    | 40               | 39    | 43    |  |
| Large Urbanized  | 7                 | 6     | 25    | 17               | 11    | 31    |  |
| Small Urbanized  | 66                | 35    | 27    | 102              | 112   | 103   |  |
| Small Urban      | 221               | 250   | 264   | 106              | 122   | 133   |  |
| Rural            | 12                | 16    | 26    | 52               | 58    | 57    |  |
| Sub Total        | 317               | 342   | 367   | 317              | 342   | 367   |  |

Table 5.10 (continued): Geographic Class Crash Count by Collision Type from 2010 to 2012.

|                  | A      | ADT Base | d           | Pop         | oulation Ba | sed    |
|------------------|--------|----------|-------------|-------------|-------------|--------|
| Geographic Class | 2010   | 2011     | 2012        | 2010        | 2011        | 2012   |
|                  |        | С        | ne Parked,  | One Movin   | ng          |        |
| Metropolitan     | 20     | 31       | 23          | 15          | 20          | 24     |
| Large Urbanized  | 13     | 8        | 23          | 4           | 2           | 3      |
| Small Urbanized  | 31     | 32       | 29          | 37          | 35          | 40     |
| Small Urban      | 168    | 144      | 144         | 88          | 78          | 83     |
| Rural            | 12     | 29       | 26          | 100         | 109         | 95     |
| Sub Total        | 244    | 244      | 245         | 244         | 244         | 245    |
| Geographic Class |        | En       | tering/Leav | ving Drivev | vay         |        |
| Metropolitan     | 2      | 3        | 8           | 6           | 2           | 4      |
| Large Urbanized  | 1      | 1        | 2           | 1           | 1           | 0      |
| Small Urbanized  | 5      | 4        | 1           | 4           | 8           | 5      |
| Small Urban      | 40     | 42       | 42          | 22          | 24          | 24     |
| Rural            | 8      | 5        | 4           | 23          | 20          | 24     |
| Sub Total        | 56     | 55       | 57          | 56          | 55          | 57     |
| Geographic Class |        |          | Ot          | her         |             |        |
| Metropolitan     | 67     | 88       | 74          | 35          | 32          | 26     |
| Large Urbanized  | 60     | 66       | 62          | 36          | 24          | 17     |
| Small Urbanized  | 126    | 64       | 62          | 208         | 164         | 173    |
| Small Urban      | 678    | 671      | 655         | 279         | 214         | 229    |
| Rural            | 46     | 88       | 121         | 419         | 543         | 529    |
| Sub Total        | 977    | 977      | 974         | 977         | 977         | 974    |
| Geographic Class |        |          | Not S       | Stated      |             |        |
| Metropolitan     | 1      | 0        | 1           | 1           | 0           | 0      |
| Large Urbanized  | 0      | 1        | 1           | 0           | 0           | 0      |
| Small Urbanized  | 0      | 0        | 0           | 1           | 0           | 2      |
| Small Urban      | 2      | 2        | 3           | 0           | 1           | 1      |
| Rural            | 0      | 1        | 0           | 1           | 3           | 2      |
| Sub Total        | 3      | 4        | 5           | 3           | 4           | 5      |
| Total            | 36,497 | 36,202   | 37,165      | 36,497      | 36,202      | 37,165 |

Table 5.10 (continued): Geographic Class Crash Count by Collision Type from 2010 to 2012.

### **6.0 Model Findings**

We begin with the discussion of results from the population-ADT classification models. This discussion provides a rational basis for evaluating the conventional urban-suburban modeling typology that typically includes three-lane, four-lane, five-lane and six-plus lane SPFs. The reasoning is that the population-ADT classifications are subsumed within the conventional urban-suburban architecture, but not in a neat nested manner. For example, a five-lane urban SPF can contain variables that belong in part to the urban-urban classification, and in part to an urban-rural

classification. Due to this potential crossover effect, the heterogeneities extracted from the population-ADT classification are more micro-level than those that will be uncovered in the traditional urban-suburban SPF architecture. The implications are that the random parameter mean and standard deviation in the traditional urban-suburban architecture may not reflect the mean shifts due to the population-ADT effects that drive the underlying sub categories of urban-suburban arterials. Hence, inferences can be too aggregate – and one can miss the opportunity to target locations of safety interest at a more micro level consistent with the population-ADT classifications.

Global findings from the population-ADT classification models are based on the following geometric characteristics:

Lanes (number of lanes increasing, number of lanes decreasing, roadway width increasing, roadway width decreasing);

Shoulders (shoulder width left, shoulder width left center, shoulder width right center, shoulder width right);

Vertical alignment (vertical curve BVC arm, vertical curve VPI arm, vertical curve EVC arm, vertical curve length, vertical curve percent grade ahead, vertical curve percent grade back); and Horizontal alignment (horizontal curve point of tangency arm, horizontal curve point of curvature arm, horizontal curve radius, horizontal curve maximum (super) elevation, horizontal curve length, horizontal curve central angle)

Out of the above mentioned 20 significant features, number of lanes, roadway width, shoulder width, point of vertical tangent grade (PVT), vertical curve point of vertical curve grade (PVC) horizontal curve maximum superelevation (e), curve central angle (delta), horizontal curve radius (R) were found to be random parameters. In addition, derived measures such as degree of curve, absolute vertical grade difference (A), and rate of vertical curvature (K) were also found to be random. The majority of the statistically significant effects were geometric. In addition, functional class indicators such as minor arterial indicator were also found to be random. Roadside information was not fully evaluated due to inconsistencies in matching roadside inventories for all homogeneous segments. Nevertheless, the finding of randomness in a substantial number of geometric features merits attention.

First, it demonstrates the significant amount of unobserved heterogeneity that is present in the urban-suburban context. There is no particular pattern in the nature of the randomness of parameters across the population-ADT spectrum. In other words, we do not observe a greater degree of randomness (as in numerous random parameters) in the urban-urban context, which one would typically expect due to traffic flow heterogeneities and functional class variations.

The heterogeneity of horizontal curvature variables such as degree of curve and radius reflects the fact that driver response to sharpness of curve effects is variable across segments, and that it is not reasonable to constrain the effect of curve degree or radius to a fixed parameter across segments. Likewise, the effect of superelevation is also not expected to be fixed across segments due to the inherent variations in superelevation design and driver reaction with respect to lane position on a superelevated curve. Randomness of superelevation effects in this study turns out to be motivated

by the maximum value in a segment. This effect appears to capture the sensitivity of superelevation variation within the curve and associated driver expectations.

The randomness of vertical curvature parameters such as rate of vertical curvature and absolute grade difference reflects the variations from segment to segment due to design speed effects. The rate of vertical curvature in particular is a direct measure of design speed application, and it is not reasonable to constrain this effect to be fixed across segments. The absolute grade difference is a parameter that is influenced by the design speed and the length of curve. For the same A value, one can expect a longer curve with a higher design speed, versus a shorter curve with a lower design speed. It is not reasonable to expect the same effect size across these two segment types.

The randomness of vertical curve grades (PVC and PVT) is an interesting finding. It appears that the effect of a 3% forward tangent in a segment A would have a different effect size compared to the same magnitude forward tangent in segment B. While this is expected, the context in which this occurs requires further attention. For example, it is not possible to discern with the given data organization whether this is due to within-segment design features alone, or also motivated by prior segment and following segment features. The same reasoning is applied to the interpretation of randomness of the backward tangent as well. The heterogeneity effect, i.e., the random parameter means are smaller compared to the effect of the absolute grade difference by an order of magnitude, but still statistically significant.

The discussion above summarizes the findings from the population-ADT classification models. Out of the 24 major categories that were developed, 16 categories yielded sufficient sample sizes so as to enable the estimation of random parameter models. The six categories that did not yield estimable models included with sample size in parentheses: Rural-metropolitan (0);

Large urban-large urbanized (0); Large urbanized-small urban (200); Metropolitan-large urbanized (0); Small urbanized-large urbanized (16); Large urbanized-metropolitan (8); Small urbanized-metropolitan (198); and Rural-large urbanized (188)

As result, a total of 87 models were estimated for the population-ADT classification SPFs.

### **6.1 Conclusions and Recommendations**

Several conclusions arise from the development of the 87 models developed in this study. First and foremost is the treatment of heterogeneity in the form of random parameters in SPF development in the urban-suburban context. Since the majority of parameters that are random are geometric in nature, context appears to play a role that in that the roadside environment is unaccounted for. The treatment of roadside data on a consistent basis and its inclusion in the model database will potentially alleviate some of the ambiguities in the random parameter effects currently attributed to horizontal and vertical curvature.

Second, the presence of transition zones in the urban-suburban border areas can also play a role in the generation of unobserved heterogeneity. Land use information is usually a reasonable proxy for capturing this transition effect, in addition to design features such as speed limit change zones, cross sectional change areas and signage control. The addition of such data can provide added resolution to the nature of unobserved heterogeneity and the role it plays in the significance of geometric random parameters.

Third, the effect of roadside environment variables such as lighting, curb and sidewalk presence can also play a role in generating unobserved heterogeneities in the geometric parameter effect. Lighting is most likely a factor in segments containing horizontal curves, as well as vertical curves with climbing lanes, transition zones and segments where pedestrian and nonmotorized activity is significant. The addition of lighting data can provide for a richer set of random parameter identifications with more accurate effect sizes attributed to urban-suburban roadway geometry.

Roadside geometry is also potentially random if it were included. In the case of roadside geometry an added computational burden arises. Roadside geometry due to its correlation with roadway geometry will motivate the need for random parameter models where parameter correlation cannot be ignored. The correlated parameter models pose the burden of larger parameter dimensionalities and difficulties in interpretation. For example, if a roadside parameter represents a roadside variable that is an indicator, and its correlation with a roadway geometry parameter such as degree of curve is found to be significant, then, we have a potential mix of parameter distributions. This mix of parameter distributions makes the interpretations of parameter effects and their standard deviations difficult. In random parameter models, it is often useful to consider the simpler of mixing distributions, such as normal only distributions. However, given the complexity of the urban-suburban context, this aforementioned simplicity may not be suitable, motivating instead a much more complex modeling typology. The urban-suburban context is therefore a challenging area to gain insights from with respect to targeted geometric treatment; however, this challenge can be mitigated with the addition of consistent roadside geometry data, roadside environment data, and land use data.

With respect to modeling architectures, it is worthwhile to consider the mapping of the population-ADT classification SPFs with the conventional urban-suburban architecture in an embedded manner. For example, one can use population-ADT classification data indicators as additional variables in five-lane urban arterial SPF to see if the indicator is random or fixed across segments. Any randomness in the indicator will suggest that the heterogeneity due to multiple population-ADT class effects is significant. As a result, it may be worthwhile to consider further deepening of the five-lane SPF into stratifications along the population-ADT subsets provided that adequate sample sizes allow that differentiation.

Another aspect that has not been evaluated in this study is the effect of heterogeneity in means in random parameter models. Heterogeneity in the mean of a geometric parameter can result in mean

shifts within stratified subgroups. For example, if it is determined that roadside variables are significant sources of heterogeneity in means, then, one can examine the nature of random parameter means by roadside stratification. This type of analysis also has its computational limitations due to parameter dimensionality. However, careful choice of the roadside stratifications, as well as potential land use and roadside environment stratifications can provide additional insights that can enrich the process of safety location prioritization.

### A.1 Appendix on Population-ADT Classification SPFs

Random Parameter Negative Binomial Model of Total Crashes on Rural-Rural SPF Class
Roadway Segments
Deplied coveriance matrix of center parameters

| Dependent<br>Log likel:<br>Restricter<br>Chi squar<br>Dignificer<br>Hofedden I<br>Farimation<br>Inf.Cr.AJ<br>Hodel est:<br>Ample is | efficients Heg<br>variable<br>incod function<br>s log likelinoon<br>d ( C.d.f.)<br>Freiho E-squarte<br>n based on H =<br>C = 12105.1 A.<br>Instedr Roy TJ.<br>2 pla on 20<br>hinomial regres | T0741<br>+6079,83<br>9 -7158,87<br>2152,04<br>5 -1508<br>5 -1 | 199<br>742<br>171<br>10<br>234<br>15T |                 |          |                   |
|---|--|---|---------------------------------------|-----------------|----------|-------------------|
| TOTALADÓ  | Coefficient  | Standard<br>Extor   | 1                                     | Fram.<br>(21>2* |          | nflüthce<br>erval |
| 1   | linreddm perati  | there.  |                                       |                 |          |                   |
| Constant)   | -7.20097444  | .20035  | -36.30                                | .0000           | -7.68345 | -6.69520          |
| DEGIL   |  | 00241   |                                       |                 | +, D0065 |                   |
| VCK21   |  | .36198  | -2.84                                 |                 | -2.62979 | 21498             |
| NCULINT!  | -1.139925+++   |   | -6.15                                 | .0000           | -1.50220 |                   |
| HCVCRAS)  |  |   |                                       |                 | .00009   | .00012            |
| SHVDCRI   |  | .35755  | -2.66                                 | .0078           | -1.68288 | -,28128           |
| HARLI   |  | .06323  | -9.50                                 | -0.024          | -1.68288 | 04352             |
| NOFLINC)  | 35357***   | .12347  | -2.57                                 | .0042           | -,60550  |                   |
|   | leans for render   |   |                                       |                 |          |                   |
| LIMPLE  | .9995****  | .02889  | 50.42                                 | .0000           | 101053   | 1.05232           |
| 15118191  | -96962***  | -01877  | \$2.72                                |                 | ,95279   |                   |
| ENMOSTI   | 05446***   | .00903  | -8.81                                 | .0001           | -,08217  | 01478             |
| 11  | Disgonal element   | a of Choles   | by matrix                             | 174344          | 10.000   |                   |
| LINADE  | .04005***  | .00720  | 5.50                                  | _0000           | .01579   | .05432            |
| 1/1.2211  | 000056***  |   |                                       |                 | .00064   | 111000            |
|   | .01224***  |   |                                       |                 | ,00488   | .02010            |
|   | Below diagonal +   |   |                                       |                 |          |                   |
| itst imai   | 114472++   | 12001   | 2.23                                  | .0259           | .00534   | .08388            |
| 1559 1341   |  | .00385  |                                       | .0000           | -,08322  | +.04460           |
| LINE LHL  | 102171+++  | .00108  |                                       |                 | -01095   | .04199            |
|   | Dispersion perm  |   |                                       |                 |          |                   |
|   |  | .24707  |                                       | .0000           |          | 1.00510           |

| Conweigno                | e metuia                           |           |                 |  |
|--------------------------|------------------------------------|-----------|-----------------|--|
| CHADE                    | LHLED                              | 898047    | 011911010000000 |  |
| LHADT<br>LNLEN<br>SHNDLT | .1004E-02<br>.1787E-02<br>2560E-02 | -5934E-02 | .1006E-03       |  |

Inglied standard deviations of random parameters S.D\_Deta) L

| t.a.] |      |   |   |   |   |   |   | ĩ |
|-------|------|---|---|---|---|---|---|---|
|       |      | - | 4 | - | - | + | - | - |
| 11    | 1.24 | 2 |   | D | 2 | 2 | 2 | a |
| 21    | - 64 | ø | 9 | è |   | ė | 8 | ŝ |
| 31    | - 23 | ē | ñ | ò | 5 | ŝ | 1 | 3 |

Inglied correlation matrix of random parameters

| Cor.Mat.1 | LIGADE  | THTAN   | SHWELT  |
|-----------|---------|---------|---------|
| LINADTI   | 1.00000 | .44032  | 90320   |
|           |         | 1,00000 |         |
| SHADLTI   |         | +,08888 | 1,00000 |

#### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Rural-Rural SPF Class Roadway Segments

| arre  | lass Roduwa   | iy begine   | ms   |                         |   |   |                                     |  |                                   |                              | perenators                             |         |  |
|---|---|---|--|-------------------------|---|---|-------------------------------------|--|-----------------------------------|------------------------------|--|---------|--|
|   | efficients Negli<br>Variable  | inAeg Mindel  | 100  |                         |   |   | Coverienc                           |  |                                   |                              | · paradaters                           |         |  |
|   | Thood function  |   |  |                         |   |   |                                     |  |                                   |                              |  |         |  |
| Restricte   | nd log likelihood<br>red [ 10 d.f.]   | -1133.022   | 17.9   |                         |   |   |                                     | 2,00                                   | DT                                | LHLEN                        | SHVOLT .                               | YOTLANE |  |
| Significe<br>NoFadden<br>Estimatio<br>Inf.Cr.AJ<br>Nodel est<br>Secole is | not level<br>Freudo S-squared<br>in based on N +<br>11 = 8452.0 AT<br>timered: Aug 31,<br>, I pis and 260<br>binomial regress | .000<br>.1153<br>52040, E =<br>2/R =<br>2018, 17:17         | 200<br>252<br>21<br>162<br>155                   |                         |   |   | LHADT<br>LHLEN<br>SKHDLT<br>TOTLANS | .70802-<br>23902-<br>.07968-<br>82145- | 03<br>02 .18<br>02 ~.85<br>02 .25 | 29E-01<br>40E-02<br>03E-01 - | .2269E-01<br>.9729E-01<br>tom garamete | .3114   |  |
|   |   | Standard  |  | Prob.                   | 954 04  | oficience   | D.D Sets:                           |  | 3                                 |                              |  |         |  |
|   | Coefficient   | RENDE   |  | 18192*                  |   | e2783   |                                     |  | 88708                             |                              |  |         |  |
| Conseance<br>DEO1<br>HCVCRAN<br>MAPS<br>NCVMMSEL<br>VCMJ (                | .304002-04***<br>22782***<br>30287***<br>-1.17918**<br>Heane for sandom<br>1.02317***   | .24082<br>.00367<br>.14050-04<br>.04925<br>.00086<br>.40366 | 2,71<br>6,21<br>-3,29<br>-3,45<br>-3,45<br>-3,43 | .0068<br>.0000<br>.0010 | -0.87648<br>.00216<br>.00210-04<br>36342<br>20465<br>-2.13103<br>.95821<br>.94888 | -7,33131<br>.0171#<br>.11600D-09<br>09222<br>01328<br>22728<br>1.09713<br>1.09028 | 11001007                            | ii<br>ii<br>nrrslatii                  |                                   |                              | 0.10000000                             |         |  |
| SWMDLT  |   | .01139  |  | 10000                   | →.09522   | +.05558   | Cor.Hat.                            |  |                                   |                              | TOTLAHE                                |         |  |
|   | -,16089***  | .06718  |  | ,0048                   | 82087   | 08732   |                                     | 1.00000                                |                                   |                              |  |         |  |
|   | Disponal element  |   |  |                         |   |   |                                     | 72894                                  |                                   |                              |  |         |  |
| 1113.07   | 1003584   | ,00318  | 1.91   | 10403                   | 0002e   | .DI224  |                                     |  |                                   |                              | 98881                                  |         |  |
| LICEN   |   | .01080  | 4,00   |                         | .04791  | .12100  |                                     |  |                                   |                              | 1,09000                                |         |  |
| SHMDLT  |   | .01030  | 2.26   | ,0235                   | ,00314  | .04382  | 1011405                             |  | 100031                            |                              |  |         |  |
| TUTLANE   |   | 701182  |  |                         | -91971  | ,08742  |                                     |  |                                   |                              |  |         |  |
|   | Salor diagonal e  |   |  |                         |   | 6.225.0175  |                                     |  |                                   |                              |  |         |  |
| TIUT TURY   |   | .00164  |  | +0000                   | 10220   | 04768   |                                     |  |                                   |                              |  |         |  |
| LINE LIGH   |   | ,01221  |  | +0000                   | -11572  | .16699  |                                     |  |                                   |                              |  |         |  |
| 1.0100_1.011.1  |   | .00977  | 4.28   |                         | .02241  | -04049  |                                     |  |                                   |                              |  |         |  |
| LTOT_LNAS   |   | +07326  |  | ,0000                   | ~   |   |                                     |  |                                   |                              |  |         |  |
| ITOT LML  |   | .0301#  |  | +0410                   | 11342   | .00260  |                                     |  |                                   |                              |  |         |  |
| 1101_3801   |   | +02441  |  | -0218                   |   | +51001  |                                     |  |                                   |                              |  |         |  |
|   | Dispersion paras  | wher for Neg  |  | .0000                   | 1.05623   | 2.00***   |                                     |  |                                   |                              |  |         |  |
| boal Farai  | 1.855394++  |   |  |                         |   |   |                                     |  |                                   |                              |  |         |  |

## Random Parameter Negative Binomial Model of Possible Injury Crashes on Rural-Rural SPF Class Roadway Segments

| Dependent  | efficients Hegh<br>veriable<br>chood function |   |                                       | 0.000000                         |  |  | Covariano   | e matria                                 |                                      |           | parameters           |
|--|---|---|---------------------------------------|----------------------------------|--|--|---|--|--------------------------------------|-----------|----------------------|
|  | t log likelihood                              |   |                                       |                                  |  |  |   | 1.85                                     |                                      | TLASE     |                      |
| Significat<br>McFadden &<br>Estimation<br>Inf.Cr.AD<br>Hodel est:<br>Sample is<br>Regative W | <pre>ed (</pre>                               | .00<br>.02290<br>52060, X +<br>C/N + .1<br>2015, 13:14<br>20 individus<br>100 model | 000<br>543<br>16<br>100<br>147<br>118 |                                  |  |  | INLEH<br>TOTLARE<br>NGARL<br>Emplied s<br>S.D_Bata) | .2010E-<br>2986E-<br>2601E-<br>tenderd 0 | 01 .621<br>01 .933<br>evistions<br>1 | 16E-112   | .1816<br>N permetere |
| F2357  |   | Standard<br>Errer   |                                       | Stub.<br>(s)>Z*                  | 954 Co<br>Int                            | mfidence<br>erval                      | 21  | 1  | 49587<br>49574                       |           |                      |
| - 18   | Sunnandom payane                              | CHEW  |                                       |                                  |  |  | 21  |  | 04171                                |           |                      |
| Constant:<br>SHNDCR:<br>HCVLINI:<br>SKYNDDEC:  | -8.82278***<br>10963**<br>.70095*<br>.03880** | .05468<br>.05443<br>.35740<br>.01473  | -11.00<br>-2.16<br>1.95<br>2.20       | .0000<br>.0206<br>.0704<br>.0278 | -4,62188<br>-,20797<br>-,05034<br>,00402 | -8.22970<br>01018<br>1.66024<br>.06988 | Implied c   | orreletio                                | n matrix                             | of raddom | parameters           |
| MODER1   |   | -54098  | -9-90                                 | -0000                            |  | 65978                                  |   |  |                                      |           |                      |
| BC/BCBLS   | 8.44183*                                      |   | 1.96                                  | .0670                            | -2.02128                                 | 12.30401                               | Cor.Nat.  | INLER                                    | TOTLANE                              | HARD.     |                      |
| CHLER)<br>TOTLARE:<br>HARL   | -1.41640+++                                   | 104222<br>.17676<br>.19210  | +7,37                                 | -0001                            | ,84097<br>.33128<br>-1,79305             | 1.02846<br>1.02428<br>-1.03871         | TOTLARET  | 1.00000<br>83688<br>46575                | 53685                                | 46575     |                      |
|  | Magonal element                               |   |                                       |                                  |  |  |   |  |                                      | Sectors.  |                      |
| TOTLANE:<br>HARL   | .14319***<br>.19880***<br>.28356**            | -03653  | 3,31                                  | 1000s                            | .06297<br>.06576<br>.02265               | .22340<br>.20401<br>.54250             | Cog.Mat.(   | THEFT                                    | TOTLARS.                             | MARL.     |                      |
|  | slow diagonal a                               | Sements of 4  | Tholesley.                            | matrix                           | -1.000                                   | 1111111111                             |   | 1.00000                                  |                                      |           |                      |
| EHAR LHLI  | 20852***<br>18824<br>21895                    | .22064  | -1.82                                 | .0148                            | -,29760<br>-,66068<br>-,68063            | 11345<br>.26420<br>.14589              | TOTLAME   | -,84404<br>-,98990                       | 2,00000                              | .12793    |                      |
|  | Superaton peran                               |   |                                       |                                  |  |  |   |  |                                      |           |                      |
| SoulPart!  | -70711+++                                     | .24218  | 2.92                                  | .0035.                           | .23263                                   | 1,18180                                |   |  |                                      |           |                      |

## Random Parameter Negative Binomial Model of Evident Injury crashes on rural-rural SPF class roadway segments

| ependent<br>og likel:<br>kestrioter<br>hi spist<br>ignificer<br>fofedden<br>fof.Cr.Al<br>odel est:<br>angle is | nfluienis Hegl<br>Variable<br>Liood function<br>1 log liethicooc<br>d [ 2 d.f.]<br>Terdo H-equared<br>1 based on W =<br>C = 0012.7 AJ<br>mated: Sep 01,<br>2 pie and 201 | -2020.815<br>-2228.746<br>406.240<br>.000<br>.00184<br>52040. K =<br>C/H = .0<br>2018.15425<br>2019.15425<br>20 individua | (172<br>568<br>587<br>542<br>500<br>560<br>560<br>550<br>550<br>550<br>550<br>550<br>550<br>550 |                                   |                           |                   |
|--|--|---|---|-----------------------------------|---------------------------|-------------------|
| 21018  | Coefficient  | Standard  | 1   | fron-<br>(zi>2*                   |                           | ofidence<br>erval |
|  | fonrandum parama   | ters  |   |                                   |                           |                   |
| innatant1  | -10.00000+++   | :50100  | -12.81  | 10000                             | -12.3842                  | -10.2166          |
| 135620103  | +++00000+++  | :00183  | -6.58   |                                   | 01186                     | +:00030           |
| NYN02001   | 00900***<br>09042*<br>.00859***  | 、自己要求的工   | -1.99   | 10499                             | 10728                     | .20604            |
| CUPTCVA!   | -**92200.  | .00045  | 9.55  |                                   | .05631                    | .00687            |
| DEGI (   | -+01976**  | 100993  | -1-189  | 10469                             | 03917                     | -200031           |
| 13   | itens for candles  | parameters.   |   |                                   |                           |                   |
|  | *******  | .07798  | 12104   | +0000                             |                           | 1,19137           |
| LHLOTI   |  |   |   |                                   |                           |                   |
| LHLOTI   | 11418**  | 100042  | -2.27   | .0231                             | -121340                   | 01075             |
|  | .89966***<br>11418**<br>itegonal element   | s of Cholesk  | or materia  |                                   |                           |                   |
|  | ltachnal alement   | s of Cholesk  | or materia  |                                   |                           |                   |
| LIGOT  | .59328**<br>.10371***  | # of Choles)<br>.37003<br>.02916  | cy matrix<br>2,41<br>3,52   | -0158                             | -10503<br>-04856          |                   |
| 100.07   | 10271***<br>10271***<br>Helow diagonal e   | # of Choles)<br>.37003<br>.02916<br>lements.of 0  | cy matrix<br>2.41<br>3.52<br>Dolesky  | ,9158<br>,0004                    | .16503<br>.04356          | 1,81882           |
| LNADTI<br>TOTLANT  | itegonal element<br>.59528**<br>.10271***<br>Helow diagonal e<br>.17251  | # of Choles)<br>.02916<br>lements of 0<br>.13046  | cy matrix<br>2.41<br>3.52<br>Cholesky<br>1.84   | .0158<br>.0004<br>matrix<br>.0152 | .16503<br>.04956<br>10050 | 1,81852           |
| LNGADTI<br>TOTLANT<br>TOTLANT  | 10271***<br>10271***<br>Helow diagonal e   | # of Choles)<br>.02916<br>lements of 0<br>.13046  | cy matrix<br>2.41<br>3.52<br>Cholesky<br>1.84   | .0158<br>.0004<br>matrix<br>.0152 | .16503<br>.04956<br>10050 | 1,81852           |

Implied noverlance matrix of random parameters

| COVATIANOS       | C RWILLIN              |                             |
|------------------|------------------------|-----------------------------|
|                  | LIGADT                 | TOTLAME                     |
| LHAOT<br>TOTLAHE | -8020E-04<br>.1234E-02 | -4041E-01                   |
| Implied at       | andetd devi            | ations of random parameters |
| H.D_Retai        |                        | 1                           |
| 11               | .007085<br>.2010       | 63<br>28                    |

Implied correlation matrix of random parameters

|  | -   | -   | -  | +- | - | ÷ | -  | - | - | - | ÷ | + | - | - | - | - | 4 | - |
|--|-----|-----|----|----|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
| Cor  | 18  | z:  | ١. | 3. |   | 1 | 3  | Ģ | İ | τ |   | à | Ċ | π | ź | A | 3 | E |
| the second s |     |     | -  | ÷  | + |   |    | ÷ | - | ÷ | - | - | • | - | ÷ | - | - | ÷ |
|  | 111 | ħ.  | 'n | 1  | 1 |   | 10 | ģ | t | à |   |   | 4 | 1 | 5 | ż | ė | z |
| 100  | TE. | 2.5 | Ġ# | 1  |   |   | 1É | á | 4 | 6 |   |   | Ľ | 1 |   | 6 |   | ė |

### Random Parameter Negative Binomial Model of Serious Injury Crashes on Rural-Rural SPF Class Roadway Segments

| Random Coe<br>Dependent<br>Log likels<br>Entretiste<br>Significan<br>Hofaiden S<br>Estimation<br>Inf.dr.AIG<br>Hodel asto<br>Semple is<br>Repaire b | Verido R-square<br>besed on S =<br>1 = 1926.0 A<br>mared: Sep 00,<br>2 pds end 20<br>1008181 regres   | EnReg Nodel<br>-452,405<br>2 -452,405<br>11,800<br>.00194<br>82080,8 =<br>2018, 17188<br>000 individue<br>000 individue                         | 92<br>94<br>70<br>76<br>10<br>21<br>11<br>29<br>21<br>18                                      |   |  |  | Deples conversance matrix of immon parameters<br>Greatinge matrix<br>LADDE VORADAA<br>LADDE VORADAA<br>LADDE .12408-00<br>VORADAE -46988-00 .44008-00<br>Deples standard deristions of immon payameters<br>5.0_Dets( |
|---|---|---|---|---|--|--|--|
| 22371   | Coefficient   | Scandard<br>Error   |   | Freb.<br>12/30*   | Dit Co<br>Int  | nfidence<br>erval  | 11 ,0554283<br>31 .209750  |
| CONSTANTS<br>NARL<br>VOTPVCA<br>HOVCSASS<br>START<br>VCFASOA<br>VCFASOA<br>VCFASOA<br>STARTS<br>STARTS  | Inrandom param<br>-13.5623***<br>.66517**<br>.0046***<br>.96020D-04**<br>.96020D-04**<br>.99024***<br>.99024***<br>.00565***<br>.00565***<br>.00565***<br>.00565***<br>.00565***<br>.00565***<br>.00565***<br>.00565*** | 1.19857<br>.34272<br>.31703<br>.00119<br>.39180-04<br>.39180-04<br>.00501<br>.00501<br>.00120<br>.00787<br>.01120<br>.00787<br>.01200<br>.00787 | 2.53<br>2.17<br>3.10<br>2.48<br>6.86<br>-4.00<br>T NATTIN<br>2.32<br>2.43<br>tolesty<br>-1.98 | .0115<br>.0359<br>.0019<br>.9141<br>.0020<br>.9001<br>.0025<br>.0149<br>FATUIN<br>.0479 | -58.0018<br>.18466<br>.08386<br>.00138<br>.183580-04<br>.88422<br>-,58438<br>.01251<br>.03209<br>-,25017 | -13.2038<br>1.33810<br>1.23847<br>.00603<br>.172740-03<br>1.24975<br>2010<br>.05275<br>.22695<br>00115 | Implied correlation matrix of sandom parameters<br>Chr.Nat.) IJADE VCFAENA<br>IMADE 1.0000062062<br>VCFAENAL62062 1.00000  |
| insifern!   | .06832***   | .02355  | 2.81  | 10049   | ,92027   | -1128#   |  |

### Random Parameter Negative Binomial model of High Injury Crashes on Rural-Rural SPF Class Roadway Segments

| Log likel:<br>Destincte<br>Chi agako<br>Significes<br>MoFedden 1<br>Estimatio<br>Inf.Cy.AJ<br>Hodel est<br>Seple is<br>Hegative 1 | <pre>#fficients Hed<br/>variable<br/>thood function<br/>f Sog likelihood<br/>ed [ 2 d.f.]<br/>in level<br/>heddon X - equate<br/>to based on X =<br/>0 = 4443.0 A.<br/>marcel: Sep CW,<br/>2 pds and 260<br/>(incedial copyed)</pre> | 111<br>-J361.637<br>1 -J366.137<br>1 -J360.40<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J301<br>-J3 | 255<br>760<br>900<br>249<br>10<br>987<br>220<br>41# |                          |                 |                   | Covariance matrix<br>INTER NOFLINE<br>INTER 2039E-01<br>WOFLINE1824E-02 .1477E-01<br>Emplied standard deviations of random paramet<br>S.O_Deta( : |
|---|--|--|---|--------------------------|-----------------|-------------------|---|
| HIDN'   | Coefficient  | Standard<br>Errid  |   | Frob.                    | 954 Co<br>201   | nfidence<br>erval | 1) .142787<br>2) .137015  |
|   | Sonrandoz parade   |  |   |                          |                 |                   | Implied correlation matrix of random paramete   |
| Constant)   | -2,13665+++  | .13666   | +15,50  | +0000                    | +3,20052        | +2127254          |   |
| 15450.0   | 61745***   | 122897   | -8.68   | .0000.                   | -,55617         | ×.43157           |   |
| 1820181   |  | 182693   | -8.86   | -0000                    | ~,888.02        |                   |   |
| HCWCRAH   | .00145D-D4***  | .17490-04  | 4.50  | .dobd                    | 4383333+04      | 1114430-08        | Cor.Mac.; LHLEN HOFLING   |
| 1   | leans for catdos   | n persmetets   |   |                          |                 |                   |   |
| LICENCE I   | _95870***  | 102705   | 24.27   | :0000                    | .00015          | 1:00020           | ININU 1.00000 37447   |
| income to be in the local of the  | .90211***  | .10366   | 8.22  | .0000                    | -54275          | 2.26267           | MOFLINC: =,37647 1,00000  |
| 001119C1  | itaconial element  | te of Cholesi  |   |                          |                 |                   |   |
| 1100 C 11   |  |  |   |                          |                 |                   |   |
| 1122 C 11   | -14279***  | .03.890  | 7156  | 0000                     | -10678          | -17982            |   |
| LITERS)   | .14279***  |  |   |                          | -105794         |                   |   |
| LILEN)<br>DOFLINC   | .14279***<br>.12704***   | 104036   | 3.15  | .0014                    |                 |                   |   |
| LILEN)<br>DOFLINC   | 122704***  | 00030.<br>S to stormals  | 3.15  | .0014<br>matrix          |                 | ,20415            |   |
| LUILDU)<br>SOFLINC<br>JUICF_UIL   | .12704***<br>Melow disponal o  | 04036<br>demetra of 0<br>Lenets of 0<br>Letes.   | 3.15<br>Cholerky<br>-1.97                           | .0014<br>matrix<br>.0088 | 13078           | ,20415            |   |
| LICER<br>ROFLER<br>JUNCF_LICE   | .12704+++<br>Melow diagonal e<br>+:03131<br>Diagenator peres   | 04036<br>demetra of 0<br>Lenets of 0<br>Letes.   | 3.15<br>Cholerky<br>-1.97<br>flin dist              | .0014<br>matrix<br>.0088 | _04794<br>18078 | ,20415            |   |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Rural-Rural SPF Class Roadway Segments

| Dependent                          | efficients Nepl<br>variable<br>thood function                    | 00511                   |                  |                   |             |                   | 동생한동문            | e satrik              | Netrix of rend        |                 |
|------------------------------------|--|-------------------------|------------------|-------------------|-------------|-------------------|------------------|-----------------------|-----------------------|-----------------|
|                                    | f Log likelihood   |                         |                  |                   |             |                   |                  | LUCE                  | BEVERAR               |                 |
| Significe<br>Hofedden              | ed [ 3 sl.f.]<br>toe level<br>Feeddo K-squaren<br>t based on H = | .002                    | 66<br>60         |                   |             |                   | LULEN<br>HCVCRAS | -88122-00<br>-66158-0 |                       |                 |
| Ist.Cr.All                         | C = 1761.0 Ål  | 10/N = +3               | 34               |                   |             |                   | Implied #        | tandard de            | viations of re        | tdom parameters |
|                                    | Instadi Sep 04,<br>I pds and 260                                 |                         |                  |                   |             |                   |                  |                       | 1993년의 비가가 199<br>199 |                 |
|                                    | inomial regress  |                         |                  |                   |             |                   | D.D_Betai        |                       | *                     |                 |
|                                    |  | Standard                |                  | Frup.             |             | ofidence          | 11               | .092                  |                       |                 |
|                                    | Confficient  | Error                   | . F              | 12/22*            |             | laves             |                  |                       |                       |                 |
|                                    | foorandos parate   |                         |                  |                   |             |                   | Walk Carlo       |                       |                       | dom parameters  |
|                                    | -4.26107++4  | .30324                  | +13212           | 0.00000           | -5001311    | -3.51083          | autorease a      | SEASERCAND.           | 2003048-06-480        | non parameters  |
| HASS                               | +.92981+++   | -21749                  |                  | .0000             | -1,38209    | 62053             |                  |                       |                       |                 |
| HOOLR                              | 78402***   | .20488                  | -5.88            | .0001             | -1.10572    | 38281             |                  |                       |                       |                 |
| DELCHYPER                          | .04597*  | .03528                  | 1,95             | .0680             | +.00340     | .09535            | Cor.Nat.1        | LOLPH                 | BARDING BARD          |                 |
| TOTLASE                            | . 45224**  | -22272                  | 2.17             | .0304             | .04574      | -91875            |                  |                       |                       |                 |
| NCVLINI (                          | -2.13206*  |                         | -1.96            | 10046             | -2.54813    | .14291            | THERM            | 1.00000               | .30186                |                 |
| 11                                 | Ceans for sendor   | t parameters.           |                  |                   |             |                   |                  | 000000                |                       |                 |
| LILEN                              | 191961***  | . 08884                 | 15.29            | .0000             | 10001287870 | 1.08465           |                  |                       |                       |                 |
| RCVCRED)                           | .82198D-04**   |                         | 2.11             | 10052             | .\$12130-05 | +15994D-04        |                  |                       |                       |                 |
|                                    | Disgonal element   | ts of Chilese           | ty matrix        |                   |             |                   |                  |                       |                       |                 |
| STATISTICS NO.                     | .05224+++  | .02948                  | 3.13             | 3100.             | .03667      | .18008            |                  |                       |                       |                 |
| LULEN                              |  | .21080-04               | 2,25             | 10346             | 1382830-05  | .10219D-08        |                  |                       |                       |                 |
| LULEN                              | 1938125-5444   |                         |                  |                   |             |                   |                  |                       |                       |                 |
| LULEN<br>ROVCRAM                   | Maloy disponal #   |                         |                  |                   |             |                   |                  |                       |                       |                 |
| LHLEN<br>ROVCRAN<br>1<br>1807 LHL  | <pre># Langersh wolw<br/>+00000;</pre>                           | .03522                  | 1.08             | ,0738             | 01001       | .12007            |                  |                       |                       |                 |
| LHLEN<br>RÖVGRAN<br>1<br>1977_LINE | Maloy disponal #   | .03522<br>meter for Neg | 1.98<br>Sta dist | .0758<br>ribution |             | .12007<br>8.00741 |                  |                       |                       |                 |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Rural-Rural SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Nestriote:<br>Dil sglarv<br>Significar<br>Nofedden 1<br>Kstimation<br>Inf.Cr.A20<br>Nodel est:<br>Sample is | <pre>fficience Hegi<br/>veriable<br/>thread function<br/>a log limiting<br/>is a star<br/>is a star<br/>is a star a star<br/>is a star a<br/>incoming the star<br/>is a star a<br/>incoming regression<br/>incoming regression<br/>incoming regression<br/>incoming regression<br/>incoming regression</pre> | 20<br>-4019.09<br>-5196.89<br>1043.99<br>-00<br>4 .1170<br>82040, K =<br>12/W =<br>2015, 16:47<br>2015, 16:47 | 989<br>204<br>200<br>813<br>8<br>178<br>178<br>178 |                         |                  |                   |
|--|--|---|--|-------------------------|------------------|-------------------|
| LOISJ  | Coefficient  | Standard<br>Scrot   | . e  | Prob.<br>Lt∣>Z*         |                  | nfidance<br>ecval |
| /1   | loorandon param  | atieza  |  |                         |                  |                   |
|  | -7.02040***  |   |  |                         |                  |                   |
|  | 100000-04***   |   |  |                         |                  | ,12130D-03        |
| 20761  | 00023+++   | .40450-04   | -2.58  | .0000                   | 00031            | 00018             |
|  | leans for rando  |   |  |                         |                  |                   |
|  | .54732***  | .02634  | 35.97  | .0000                   |                  |                   |
|  |  |   |  |                         |                  |                   |
|  | 1.00323***   | .02150  | 66.65  | .0000                   | .96105           | 1.04558           |
| LHLEN  | Disposal element   | te of Chules  | BY MATELN  | É.                      |                  |                   |
| LHLEN  |  | is of Choles<br>100477  | ty matrix<br>5.25                                  | :0000                   |                  |                   |
| LHLEN  | Disposal element   | 10 of Choles<br>100477  | ty matrix<br>5.25                                  | :0000                   |                  |                   |
| LHLDI<br>LHLDI<br>LHLDI<br>LHLDI   | 02804***<br>.02804***<br>.02471**  | 10 of Chules<br>100477<br>101133  | 87 matiite<br>8.25<br>2.56                         | .0000<br>.0292          | 201249           | 103440            |
| LHLDI<br>LHLDI<br>LHLDI<br>LHLDI   | Diagonal element<br>.02054***<br>.02471**<br>Helow diagonal :  | is of Chules<br>.00477<br>.01132<br>elements of (   | ty maters<br>5.25<br>2.55<br>Choleaky              | .0000<br>.0293          | .01849<br>.00290 | .03440<br>.04692  |
| LULIN<br>LULIN<br>LULIN<br>LULIN   | 02804***<br>.02804***<br>.02471**  | is of Dules<br>.00477<br>.01133<br>riments of .<br>.01590   | Ry matrix<br>8.25<br>1.55<br>Choleaky<br>-5.45     | 0000.<br>1020.<br>NIIIM | -11178           | .03440<br>.04692  |

|           | LSADT                 | LILLEN .                   |
|-----------|-----------------------|----------------------------|
| LHADT     | .42722-03<br>21602-02 | .75468-03                  |
| Deplied a | tandard devi          | ations of random parameter |
|           |                       |                            |
| 3.5_Beta  |                       | 1                          |

Implied orvariance matrix of random parameters

| Cor.Nat.      | 110407 110281 |
|---------------|---------------|
|               |               |
| LINADT        | 1.0000009650  |
| E-mit where a |               |

### Random Parameter Negative Binomial Model of Total Crashes on Small-Urban-Rural SPF Class Roadway Segments

| ********  |  |  |   |                 |            |                   |
|---|--|--|---|-----------------|------------|-------------------|
| Dependent<br>Sog 1120<br>Destricts<br>Chi squar<br>Dignifics<br>Nofadden<br>Estimati<br>Inf.Cy.Al<br>Nodel est<br>Pasple is | pefficience Hep<br>t variable<br>lineod function<br>of log inkelshoo<br>red [ 6 d.f.]<br>nope Level<br>Freedu F-square<br>on based and H -<br>25 - 63200.3 A<br>timated: Rep 86.<br>5 Z pds and 470<br>himmal repres | TOTAL<br>-81100.14<br>1 -41097.14<br>1 0099.95<br>000<br>1 .1432<br>94114, K =<br>1018, 20:60<br>57 Induvida | ADC<br>961<br>718<br>554<br>000<br>820<br>10<br>661<br>21 |                 |            |                   |
| TOTALACC  | Coefficient  | Stendard.<br>Ertur   |   | Pro0-<br>11:32* |            | nfidence<br>arval |
|   | Storandoe peram  |  |   |                 |            |                   |
|   | -7,88568+++  |  | 100 100   |                 | -0.00450   | CONTRACTOR OF A   |
| TNLTT   | 00848444   | ,01350   | 22.48   |                 |            |                   |
| mention of some   |  | 01876  | -4.75   |                 | .97143     | 0.04328           |
| SHIDUT  | 01099+++   | .00223   | -10.66  | .0000           | 13.003     | -,02544           |
| UNIT ONT  | - 50130+++   | 111000   | -6.61   |                 |            |                   |
| annon an an an an   |  | .50210-05  | 10.15   |                 |            |                   |
| 10000   | 110070-04***   | 11100.00   | -1.54   | name -          | 1003000-00 |                   |
| TEMPS TOD   | 08532***   | 0.0418   | 17.07   | 0000            | 09871      | 07243             |
| MCD1R   | .20954***  | 108723   | 5.64  |                 |            | .29290            |
|   | Nearly for candle  |  |   |                 |            | 167677            |
| 0551  | nossa  | .00120   | 1   | 10047           | - 1000 PT  | 200368            |
| THERN   |  | 0.044.00   | 1111-21   | 0000            | .88925     | .92423            |
| ENVYPOINT:  | .01188***  | .00168   | 1.58  | .0000           | .00867     |                   |
|   | Discoul element  |  |   |                 | 10020-     | +01013            |
| DEGL  |  |  |   |                 | _00071     | .00324            |
| LNLEH   |  | 00727  | 9.25  | .0505           | .04593     |                   |
| BWYWEZISC   | 0008844  | ,00048   | 2.21  |                 | .00011     | .00179            |
| 10100000  | Selow dispotal +   |  |   |                 |            | 1114414           |
| STHE DEG  | .04437+++  | .00070   |   |                 |            | 100342            |
| 1000 020  | - 00214  | 100126   | -1.98   |                 |            | ,00228            |
| 1 mary rist   | -,00219<br>-,00488***  | 00109  | -4.75   |                 | 00890      | 00287             |
|   | Dispersion pares   | meter for Har  |   |                 |            |                   |
| ScalFace  |  |  |   |                 |            | .94923            |
|   |  |  |   |                 |            |                   |

| COVERSIANO                | e ##233N                           | 000000000000          |                 |
|---------------------------|------------------------------------|-----------------------|-----------------|
|                           | 1031                               | LOLEN                 | SHINDINC        |
| DES1<br>LNLEW<br>AVVXDIDC | .38418-04<br>.31363-04<br>11145-04 | .79778-00<br>30478-03 | .24198-04       |
| Inglied a                 | tandazd devi                       | ations of re-         | idim peresevers |
| I.D Setal                 |                                    | 1                     |                 |

| <br> | +  | <br>- | + | - | +  | - | - | + | • | - | - | - |   |
|------|----|-------|---|---|----|---|---|---|---|---|---|---|---|
| 1    | x  |       | ŝ | ż | 'n | 7 | 2 | Ż | ż | ε | ÷ | ģ | 3 |
| 2    | ł. |       |   |   |    | ŝ | ģ | ń | ģ | ģ | à | â |   |
| - 3  | i. |       |   |   | ż  | ż |   | ÷ | à | đ | ŝ | 2 | 4 |

Deplied correlation matrix of vandom parameters

| Cor.Nat.      | DESS    | 18148  | REVENDED |
|---------------|---------|--------|----------|
|               |         |        |          |
| 2803.1        | 2.00000 | .70910 | +.00872  |
| CHERICO.      | .74310  |        | 48521    |
| POPULATION C. | 02072   | 65525  | 1.00000  |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small-Urban-Rural SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi egiare<br>Significer<br>MoFadden 4<br>Estomation<br>Inf Cr All<br>Model esti<br>Sample 10 | efficients Hegi<br>variable<br>hood function<br>d leg likelihoo<br>ef [ 6 8.6.]<br>reclor 3-equate<br>record 3-equate<br>1 bared on N =<br>2 = 44201.5 Å<br>matodi Sep 07,<br>12 pdm and 47<br>incomial regress | -23122.64<br>-25142.35<br>10038.90<br>.00<br>4 .1789<br>54124. E =<br>10/E =<br>-2015.00:45<br>.01<br>2015.00:45 | 113<br>089<br>100<br>18<br>492<br>492 |         |             |                    |
|--|---|--|---------------------------------------|---------|-------------|--------------------|
| PDO1   | Coefficient   | Standard<br>Erste  |                                       | Padb.   |             | infidence<br>erval |
|  | fourgridow permi-   | at arra  |                                       | ****    |             |                    |
|  | -8.36073***   | 07862  | 244233                                | 10000   | -8,40704    | -8.11497           |
|  | 1,00836***  |  | 64.63                                 |         |             | 1.03894            |
| DEG11  | .01992**  | ,00693   | 2.00                                  |         | .00090      | .02807             |
| SERDET   | 02335***  | .00939   | -9.53                                 | .0005   | 04000       | 02870              |
| WOWE 2NOT  | -,15529***  | 113549   | -5.75                                 | .0000   | +1.04001    | -,81768            |
| INCOCRAME.   | +454085-04***   | .41552-05  | 7.37                                  | .0000   | .33337D-04  | .374785-04         |
| HCTR:-   | .454085-04***<br>.978012-05***  | .21980-05  |                                       | .0005   | -,15265D-04 | 429560-05          |
| SEMINITICS)  | 07056***  | .00756   | -10.29                                | .0000   | 09335       | -,04374            |
|  | leans for rando   | I DEFENSION .  |                                       |         |             |                    |
| TOTLANE  | -,07143   | ,02122   | -5.31                                 | .0008   | 11506       | 02990              |
| THERE  | .90668***   | 101046   | 86.78                                 | .0000   | .88418      | 1.82718            |
| NAXABILING (   | 100910***   |  |                                       |         | .00438      | ,01369             |
|  | hagonal element   | ts of Cholesi  | by matrix                             | 0.00000 |             |                    |
| TOTLASE  | .00940+++   | 201首79   | 1.14.74                               |         | .115244     | 112431             |
| LNLEN)   | .06003***   | .00883   | 6.95                                  | .0000   | .04111      | .07695             |
| SPYRE DRUCK  | .06003****  | .00051   | 1,18                                  | -0285   | .00001      | .00210             |
| 1.2.2.2.2.1.1.1  | slow disconal a   | Latents of 4   | Tholeskir:                            | matrix  |             |                    |
| ILNL TOT   | .06185***<br>01219***<br>00412***   | ,01540   | 3,95                                  | .0000   | -08197      | .08225             |
| 18NY_2031  | -100219444  | 100289   | -4,63                                 | .0000   | -,01849     | +,00718            |
| 18MY LIST:   | +100472***  | 100154   | -4,29                                 | .0000   | 00809       | 00244              |
| 11   | isspermion parks  | reter for He   | gBin dist                             | 2100510 | 10.         |                    |
| ScalFarm(  | .94282***   | 103367   | 28.00                                 | .0000   | .57664      | 1.00841            |
|  |   |  |                                       |         |             |                    |

implied covariance matrix of random parameters

 Covariance
 matrix

 TOTLANE
 INTER SNTWDINC

 TOTLANE
 INTER SNTWDINC

 TOTLANE
 -0.2

 INTER -0.2
 -1074202

 NATURE -0.2
 -1074202

Implied standard deviations of random parameters

| D Betal |   |   |   |   |   |   |   | 1 |
|---------|---|---|---|---|---|---|---|---|
|         |   | ÷ | - | - | - | - | - | - |
| 1)      |   | d |   |   |   |   |   | ÷ |
| 2.1     |   |   |   |   |   |   |   | 3 |
| 21      | ż | ð | à | à | ł | ÷ | ź | ź |

Implied correlation matrix of random parameters

| Cos.Hat.)      | TOTLASE | 111101 | NAMPTHO |
|----------------|---------|--------|---------|
|                | 1,00000 |        | 93196   |
| SHEARING SHEEP | 92494   |        | 1.00000 |

## Random Parameter Negative Binomial Model of Possible Injury Crashes on Small-Urban-Rural SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restlikter<br>Significer<br>Hofdder, T<br>Hofdder, T<br>Hofdder, T<br>Hofdder, T<br>Hofdder, T<br>Hofdder, T<br>Hofdder, T<br>Hofdler, S<br>Hogel is<br>Hegeliter | fficients Neg<br>Variable<br>hood fucction<br>log likelihood<br>d [ 3 d.f.]<br>Seudo N-square<br>Negedo N-square<br>Negedo N =<br>1 = 10735.8 Al<br>nated Sep 07,<br>2 pds not 17<br>linosial regress | 5:<br>-0581.907<br>8 -10078.04<br>1442.240<br>442.240<br>8 .07155<br>8 4114. K =<br>10/K =<br>2015.15:57<br>057 induviou  | 923<br>229<br>984<br>900<br>900<br>189<br>900<br>189<br>901<br>813                                    |  |  |   | Toplied unvariance matrix of random parameters           Doverlance matrix           Toplied standard           Toplied standard deviations of random parameters           5.0_Beta)         1 |
|--|---|---|---|--|--|---|--|
| #2N71  | Coefficient   | Standard<br>Error   | 1   | Prob.  | 958 Co<br>INS  | nfidence<br>erval   | 1) .0383541<br>2) .0895231   |
| 13<br>COLSTANT<br>LINES<br>SHADAT<br>BOVES<br>SHADAT<br>BOVES<br>SHADAT<br>REVENSE<br>NOTARE<br>LINAT<br>JOTLANE<br>JOTLANE  | Inrendom parama<br>-10.7487***<br>-00402***<br>-04402***<br>-21487***<br>-00418***<br>-00418***<br>-02568*<br>-22502***<br>-22502***<br>-22502***<br>-22502***  | 41829<br>.26784<br>.00475<br>.73880-08<br>.01502<br>.00502<br>.00566<br>.01502<br>.00566<br>.01505<br>.00565<br>.27300<br>r peisenetrs<br>.00825<br>.008257<br>rs of Choise<br>.71419 | -40.12<br>40.55<br>+4.00<br>-5.36<br>2.13<br>3.00<br>1.39<br>2.62<br>-6.77<br>+3.71<br>55.50<br>61.15 | 10000<br>10000<br>10000<br>10000<br>10000<br>10000<br>10007<br>10007<br>10007<br>10000<br>10000<br>10000<br>10000<br>10000 | -11.3757<br>.76988<br>-,05718<br>-,48440-04<br>-,14945<br>.00517<br>.00587<br>-,00087<br>.05726<br>-1.16728<br>5.09472 | -10.2208<br>.85711<br>+.00066<br>14576D-04<br>00908<br>.00828<br>.00828 | Implied correlation matrix of random parameters<br>Ger.Mast.) TOTLANS LAADT<br>TOTLANS, 1.0000094240<br>IMLDT:94240 1.00000  |
| ILNA TOT   | Helow diagonal (<br>03805***<br>Laperation param<br>.63623***   | .00496<br>metes fos Sey<br>.08890   | -7,67<br>pbin dist<br>13,79   | .0000<br>dibutio<br>.0000  |  | 02812   |  |

## Random Parameter Negative Binomial Model of Evident Injury Crashes on Small-Urban-Rural SPF class Roadway Segments

| Dependent<br>Log likel<br>Restricter<br>Chi equari<br>Significer<br>NoFedden 1<br>Estimation<br>Inf.Cr.Al<br>Nodel est<br>Nample 1s | efficients Heg<br>variable<br>unood function<br>d log likelihoo<br>ef ( 3 3.f.)<br>ope Level<br>heado fraguare<br>o based on H =<br>C = 10345.1 A<br>instel Sep 07.<br>J pH and 47<br>instel regres | 1<br>-7669.077<br>3 -7862.677<br>477.000<br>.000<br>9 .00311<br>94114, 2 =<br>12/H =<br>.2015, 19:52<br>3015, 19:52<br>3015, 19:52 | 284<br>100<br>000<br>45<br>165<br>165<br>127 |         |               |              |
|---|---|--|--|---------|---------------|--------------|
| xv5   | Coefficient   | Standard<br>Error  | 2  |         | 30% Co<br>Int |              |
| 11  | Conrendom perem   | stars  |  |         |               |              |
| Constant  | -7.52152***   | .28400   | -26.42                                       | .0000   | -8.08288      | -4.34715     |
| 1 125 110 1   | . TRACEWAR  | 02420  | 11.96  | 10000   |               | .79730       |
| INVERT  | 02097**   | ,00829   | -2.55  | .0109   | -108110       |              |
| MOVR -  |   | -64192-05  | -2.90  | -000T   | 91107D-04     | -, 605£50-06 |
| SHHELTCR  | 02097**<br>19437D-04***<br>04753***   | .01656   | -2,92  | .0255   | 07990         | 01577        |
| SCUMMEEL  | .00165***   | ,00068   | 2.63   | .0081   | .000588       | .00318       |
| NYNDERCI  | .00165<br>.01187<br>.26178  | +01655   | 8.00   | -0481   | ,00029        | ,42990       |
| HCOCR!  | .26178***   | .00219   | 0.28   | +100.   | .10069        | .42205       |
| HOVERAR!  | .3788ZD-08***   | +54075-04  | 2.00   | ,0077   | .900750-05    | .65057E-04   |
| 12  | Seens for rendo   | a parameters   |  |         |               |              |
| TOTLAMET  | 10370**   | .04805   | -7.18  | .0308   | 19789.        | 00952        |
| LICERT  | .88189***   | .01892   | 46.55  | .0000   | .84380        | .91798       |
|   | Nickeysell allowers   | to of Philaden   | inter state of state                         |         |               |              |
| TOTLANE   | .02530***   |  | 3,75   | .0000   | .00726        | .04332       |
| LRLEN   | :02978Y44   | .00930   | 3.22   | 10014   | .01104        | .04735       |
| 11  | Below diagonal -  | elements of (  | Cholesky.                                    | BATTIN  |               |              |
|   | +.05197***  | .01122   | -4.63  | 20000   | 07895         | 02999        |
| ILMI TOTI   |   |  |  |         |               |              |
| ins rori  | Dispersion perm   | mater for Net  | gEin dist                                    | ributio | fi.           |              |

#### Deplied covatiance matrix of random parameters

|           | TOTLARS                 | THIEN                       |
|-----------|-------------------------|-----------------------------|
| TOTLAHE   | -68898-08<br>+.1314E-02 | .1184E-02                   |
| Implied # | tantard devi            | ations of rendom perameters |
| S.D_Setel |                         | 1                           |

Deplied correlation matrix of random parameters

|          |    | - | - | - | - | - | - | - | - |   | - | -  | - | - | - | - |
|----------|----|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|
| Cor.Mat. | Ľ. | Ţ | Q | Ť | 1 | à | 1 | r |   |   |   | I  | 2 | Ĺ | ź | ú |
|          | +  | - | - | - | - | + | - | ÷ | - |   | - | +  | - | - | - | ÷ |
| TOTLANE  |    |   |   |   |   |   |   |   |   |   | į | 1  | ż | ź | 7 | 1 |
| 210.01   | ŧ÷ | + | ÷ | ł | 6 | 3 | 7 | ş |   | 1 |   | \$ | ð | ō | 4 | ò |

### Random Parameter Negative Binomial Model of Serious Injury Crashes on Small-Urban-Rural SPF Class Roadway Segments

|  |  | *****   | ********  |  | ***********   |   |
|--|--|---|---|--|---|---|
| Dependent<br>Log 11Mel:<br>Restricte:  | officients Hegi<br>Variable<br>incod function<br>I log likelthood<br>ed ( 3 d.f.)  | 81<br>-2352.25<br>-2501.88  | 183<br>183<br>652   |  |   |   |
| Significat   | ice level  | 2000  | 000   |  |   |   |
|  | feeudo Bregueres   |   |   |  |   |   |
|  | t based on N =<br>2 = #802.5 A3  |   |   |  |   |   |
|  | insted: Sep 05.  |   |   |  |   |   |
|  | 2 pas and 470  |   |   |  |   |   |
|  | irogrami regram  |   |   |  |   |   |
|  |  | Tiscdard.   |   | Free.  | 95% Cc  |   |
| (\$1147)   | Coefflosest  | Rewor.  |   | 12152*   | Int   | rexvel.   |
|  | forcardim parama   |   | ********  |  |   |   |
|  |  |   |   |  |   |   |
| []<br>Cotatient  | -9.01075+++  | .46824  | -19.55  | .0000  | -0.92442  | -8.0969T  |
| SIVURAN)   | -9.01075***<br>.00122D-04**  | .46624<br>.20TTD-04   | 2.22  | ,0196  | \$4170D-D8  | -8.09697<br>.110630-09                                      |
| SCVCRAR)<br>HCVCRAR)   | -9:01079***<br>.00122D-04**<br>.00221***   | 2971D-06<br>-00064  | 2,22  | +0194<br>+001#   | .94179D-D5  | .110630-09  |
| SCVCRAR)<br>HCVCRAR)   | -9:01079***<br>.00122D-04**<br>.00221***   | 2971D-06<br>-00064  | 2,22  | +0194<br>+001#   | .94179D-D5  | .110630-09  |
| Constant)<br>HEVERAN<br>HEVERAN<br>HEVEREVAL<br>LIGADT)  | -9.01075***<br>001220-04**<br>.00221***<br>Weans for random<br>.41027***   | .46624<br>,25TTD-06<br>,00064<br>parameters<br>,05135   | 2,55<br>8,19<br>7,59  | ,0194<br>,0018<br>,0000  | .94179D-05<br>.00097  | .110630-09<br>.00346<br>.51098                              |
| COLUCEAN)<br>SCYCEAN<br>SCYCEAN<br>SCYFTCVA(<br>13<br>LIGADT)<br>DEG1(   | -9.01075***<br>001220-04**<br>.00221***<br>Heans for random<br>.41027***<br>02645***   | .46624<br>.2977D-04<br>.00064<br>parameters<br>.05135<br>.00585   | 2.55<br>3.49<br>7.59<br>-3.05   | .0194<br>.0018<br>.0000<br>.0021   | .50957<br>01351   | .11063D-09<br>.00346<br>.51098<br>00966                     |
| COLUCEAN)<br>SCYCEAN<br>SCYCEAN<br>SCYFTCVA(<br>13<br>LIGADT)<br>DEG1(   | -9.01075***<br>001220-04**<br>.00221***<br>Heans for random<br>.41027***<br>02645***   | .46624<br>.2977D-04<br>.00064<br>parameters<br>.05135<br>.00585   | 2.55<br>3.49<br>7.59<br>-3.05   | .0194<br>.0018<br>.0000<br>.0021   | .50957<br>01351   | .11063D-09<br>.00346<br>.51098<br>00966                     |
| Cotations)<br>HEVERAN<br>HEVERAN<br>HEVERAN<br>ISONFTOVAL<br>ISON<br>ISONFTOVAL<br>ISON<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISONFTOVAL<br>ISO | -9.01078***<br>.00122D-04**<br>.00221***<br>Wears for random<br>.41027***<br>.02645***<br>Niegonal element<br>.22624***              | .46624<br>.2977D-06<br>.00044<br>.05135<br>.05535<br>a of Choles<br>.0005                                       | 2.53<br>8.19<br>7.59<br>-0.05<br>ky matrix<br>5.18                              | .0000<br>.0000<br>.0021  | .94179D-05<br>.00097<br>.50957<br>04351<br>.01824             | .11063D-03<br>.00346<br>.51098<br>00566<br>.03812           |
| Cotations)<br>HEVERAN<br>HEVERAN<br>SEVERAN<br>SECONDEN<br>SECONDEN<br>DESI<br>DESI  | -9.01078***<br>.001225-04**<br>.00221***<br>iteams for random<br>.41027***<br>.02652***<br>0140051 *!ement<br>.22624***<br>.01662*** | .46624<br>.2977D-06<br>.00064<br>parameters<br>.05135<br>.00555<br>s of Choles<br>.00501                        | 2.55<br>8.49<br>7.59<br>-3.08<br>ky matrix<br>5.18<br>5.32                      | .0000<br>.0000<br>.0021<br>.0000<br>.0000                                      | .94179D-05<br>.00097<br>.50957<br>04351<br>.01824<br>.00675   | .110030-02<br>.00346<br>.51095<br>00955<br>.03812<br>.02846 |
| Cotations)<br>HEVERAN<br>HEVERAN<br>SEVERAN<br>SECONDEN<br>SECONDEN<br>DESI<br>DESI  | -9.01078***<br>.001225-04**<br>.00221***<br>iteams for random<br>.41027***<br>.02652***<br>0140051 *!ement<br>.22624***<br>.01662*** | .46624<br>.2977D-06<br>.00064<br>parameters<br>.05135<br>.00555<br>s of Choles<br>.00501                        | 2.55<br>8.49<br>7.59<br>-3.08<br>ky matrix<br>5.18<br>5.32                      | .0000<br>.0000<br>.0021<br>.0000<br>.0000                                      | .94179D-05<br>.00097<br>.50957<br>04351<br>.01824<br>.00675   | .110030-02<br>.00346<br>.51095<br>00955<br>.03812<br>.02846 |
| Constant)<br>MCVCRAH<br>HCVFTCVA<br>13<br>13GADT)<br>DEGI<br>13GADT)<br>DEGI<br>10EG 166   | -9.01078***<br>.00122D-04**<br>.00221***<br>Wears for random<br>.41027***<br>.02645***<br>Niegonal element<br>.22624***              | .46624<br>,2577D-04<br>.00044<br>; parametera<br>.05535<br>a of Choleal<br>.00505<br>.00501<br>.00501<br>.00521 | 2.23<br>8.49<br>7.59<br>-3.05<br>ky abt71.8<br>5.18<br>5.32<br>Cholesky<br>2.24 | .0194<br>.0036<br>.0021<br>.0000<br>.0021<br>.0000<br>.0003<br>matrix<br>.0249 | .54179D-05<br>.00097<br>.004351<br>.01824<br>.00675<br>.50147 | .110030-02<br>.00346<br>.51095<br>00955<br>.03812<br>.02846 |

| Teriscot     |                        |           |  |
|--------------|------------------------|-----------|--|
|              | LHADT                  | DEGI      |  |
| 64.DT<br>101 | .79788-98<br>.33025-02 | .41202-03 |  |

Ingliad standard deviations of random parameters

| esei  |   |
|-------|---|
|       | +++++++++++++++++++++++++++++++++++++++ |
| - I I | .0282370                                |
| 31    | ,0205178                                |

inglied correlation matrix of random parameters

| +>==>=== | +  | - | -  | ÷ | ÷  | + | - | ÷ | + | - | - | + | - | + | ÷ | - | -  |
|----------|----|---|----|---|----|---|---|---|---|---|---|---|---|---|---|---|----|
| Cor.Man. | Ę. |   | 1  | Ľ | 15 | 2 | Ż | ¢ |   |   |   |   |   | t | ε | d | d, |
|          | ÷  | - | ÷  | ÷ | -  | ÷ | ÷ | - | - | - | - | + | + | - | ÷ | ÷ | ÷  |
| LNADT    | £. | Ľ | J. | ģ | ò  | t | 0 | ò |   |   |   | ì | 5 | ð | 5 | 5 | ž. |
| 1030     | i. |   |    | k | Ż  | 6 | 5 | ì |   |   | É | ì | ŝ | q | p | 9 | Q, |

## Random Parameter Negative Binomial Model of Fatal Injury Crashes on Small-Urban-Rural SPF class Roadway Segments

| Dependent<br>Log ligel<br>Restricte<br>Rightfine<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifed<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden<br>Stifedden | <pre>bood function i log likelihood td [ 3.6.f.]</pre>   | 760<br>-1171.40<br>-2177.75<br>12.70<br>.0055<br>.0055<br>94114, E =<br>.0/H =<br>.0055, 18104<br>\$7 individu | 103<br>525<br>532<br>530<br>5<br>50<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5<br>5 |   |  |   |
|--|--|--|--|---|--|---|
| FATAL  | Coefficient  | Standard<br>Error  |  | Frib.<br>(g)>2*   | 024 Col<br>2nt                                   | ofidenze<br>ervel                             |
|  | Sonyandok payane   | ters   |  |   |  |   |
| (constant)   | -10.0719***  | .76548   | -18:17   | .0000   |  | +8.8777                                       |
|  | and a state of the   | .00078   | 8.40   |   |  | .005.68                                       |
| ICVPTCVL:  | .50426***  |  |  | _0000   | .00292   |   |
| SEMDRT   | .042634  | .07510   |  | _0000   | -,00282  | 09725   |
| SMORT  |  | .02510   |  |   |  |   |
| SMORT  | .04203+<br>teens for candim  | .02510   | 1.97   | ,0557   |  |   |
| SHMDRT)  | ,042034  | .02510<br>parameters   | 1.97   | .0557   | -,00117  |   |
| SHMDRT)<br>13<br>13(ADT)<br>DEG1   | .04203*<br>Seens for candim<br>.41509***   | .02310<br>perameters<br>.01408   | 1.97   | .0557<br>.0500  | -,00117  | .09725<br>.88438                              |
| SHMDRT)<br>13<br>13(ADT)<br>DEG1   | .04203*<br>Mens for candim<br>.41509***<br>03552**   | .02510<br>parameters<br>.01458<br>.01403<br>c of Choles  | 1.97<br>4.61<br>-2.52<br>ky matria   | .0557<br>.0500<br>.0117                                     | -,00117  | .09725<br>.88438                              |
| SEMDET)<br>DEG1<br>DEG1<br>II  | .04803*<br>Means for candim<br>.41909***<br>03812**<br>Dispiral elements   | .02510<br>papameters<br>.01408<br>.01408<br>s of Choles<br>.00766  | 1.97   | ,0557<br>.0500<br>.9157<br>.0500                            | -,00117<br>,34582<br>-,04013                     | .69725<br>.58438<br>00795                     |
| SHMDRT)<br>(3<br>138402)<br>(1002)<br>(10<br>19407)<br>(10<br>19407)<br>(10<br>19407)<br>(10<br>19407)<br>(10<br>19407)  | .04803*<br>Stor: for candim<br>.41509***<br>03552**<br>Clapinal elements<br>.03736***<br>.02224**                    | .02510<br>psiameters<br>.01408<br>cd Choless<br>.00766<br>.00940   | 1.97<br>4.61<br>-2.52<br>ky natzia<br>5.67<br>2.97   | .0557<br>.0100<br>.0117<br>.0000<br>.0180                   | -,00117<br>,24582<br>-,06013<br>,02233           | .58438<br>00791<br>.05236                     |
| SEMDRY<br>()<br>LULARY<br>DEG2<br>()<br>LULARY<br>()<br>LULARY<br>()<br>LULARY<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()   | .04803*<br>Seens for sandim<br>.41603***<br>03552**<br>Diagrasi element<br>.03735***<br>.02224**<br>Delry diagonal e | .02510<br>psingeturs<br>.01408<br>cd Choless<br>.00768<br>.009940<br>intents of                                | 1.97<br>4.61<br>-2.52<br>ky matrix<br>8.67<br>2.37<br>Cholesky   | .0557<br>.0100<br>.0117<br>.0000<br>.0180                   | -,00117<br>,24582<br>-,06013<br>,02233           | .58438<br>00791<br>.05236                     |
| SEMDRY   | .04803*<br>Stor: for candim<br>.41509***<br>03552**<br>Clapinal elements<br>.03736***<br>.02224**                    | .02510<br>pdiameters<br>.01408<br>c of Chples<br>.00766<br>.00940<br>lements of .<br>.00754                    | 1.97<br>4.61<br>-2.52<br>ky matrix<br>8.67<br>2.97<br>Cholesky<br>-1.91  | .0557<br>.0000<br>.0117<br>.0000<br>.0180<br>.0180<br>.0415 | -,00117<br>,24582<br>-,04815<br>,02238<br>,00381 | .09723<br>.88438<br>00796<br>.05238<br>.04066 |

| Crysriano     | e matrix              |                             |
|---------------|-----------------------|-----------------------------|
|               | LHADT                 | 08:51                       |
| LNADT<br>DEG1 | .13955-02<br>38215-03 | .89912-03                   |
| implied e     | tandard devia         | stions of rankow parameters |
| 3.5_Setal     | .03734<br>.02447      | 1<br>68<br>11               |

Implied occrelation matrix of sandom parameters

DER.NAT.| INLET 2001 LUMADT| 1.00000 -.41796 DESI| -.41798 1.00000

| Random Parameter Negative Binomial Model of Unknown | Injury Crashes on Small-Urban-Rural            |
|---|--|
| SPF Class Roadway Segments                          | N 8  |
| · · · · · · · · · · · · · · · · · · ·               | Implied covariance satrix of random parameters |

| Dependent<br>Log likels<br>Restricted<br>Chi square<br>Significar<br>MoTedden t<br>Estimation<br>Inf.Cr.AD<br>Nodel esti<br>Sample is  | fficients (Feg)<br>Verianie<br>Anod function<br>(1 log likelahoo)<br>dd [ 2 d.d.)<br>ise level<br>(2 de seguera<br>(2 de seguera)<br>anted: Seg OD,<br>2 pds and 47<br>innenial regres | UNNM<br>-1250.87<br>1 -1267.095<br>30.31<br>001<br>6 -01271<br>94114. % =<br>10/W = .1<br>2015.10151<br>007 10017100 | 224<br>000<br>111<br>11<br>027<br>136   |  |                                      |                                      |
|--|--|--|---|--|--------------------------------------|--------------------------------------|
| บหรอเฉพา   | Coefficient  | Standard<br>Retoy  | r   | 9708-<br>12(12)  | 919 C:<br>Int                        | dEldence<br>estal                    |
| 12   | fonrandum parame   | et a rai   |   |  |                                      |                                      |
| Coristant  | -10:0530***  | .78480   | -12.01  | .0000  | -01.5912                             | -0.5148                              |
| 9072.1H2   | 89742**  | + 8100E  | -2.28   | 0224   | -1,78210                             | 13278                                |
| HOVCRAS!   | ·R04012-04**   | .8824D-04  | 2.21  | .0108  | 1284850-04                           | 1163350-03                           |
| MODIA  | .63066***  | .23772   | 2.65  | .0040  | ,23474                               | 1.08638                              |
| (DRIGRYNA  | 01599  | 111050   | -1.31   | .0312  | -102676                              | .00477                               |
|  | isans for candor   | a manamatana a   |   |  |                                      |                                      |
|  |  |  |   |  |                                      |                                      |
| LHLEN!   | 192935***  | 105061   | 18.30   | .0000  | 162643                               | 1,02467                              |
| LNLEN:<br>LNA27  | 192935***<br>174654***   | .08061<br>.00141   | 18.30   | .0000  | 162643                               | 1,02+61<br>.95780                    |
| LHLEN<br>LHADT   | .92555***<br>.74654***<br>Heginal element  | .06061<br>.00141<br>te of Choles)  | 18.30<br>7.41<br>ty natris  | .0000<br>.0000   | .07514                               | .95780                               |
| LHLEN<br>LHLEN<br>LHLET  | .92555***<br>.74654***<br>Heginal element  | .06061<br>.00141<br>te of Choles)  | 18.30<br>7.41<br>ty natris  | .0000<br>.0000   | .07516                               | .05780                               |
| LHLEN<br>LHAZT)<br>LHAZT)<br>LHLEN<br>LHLEN  | .92835***<br>.74614***<br>Negonal element<br>.19600***<br>.01892**   | .08061<br>.00741<br>tr of Choles)<br>.05559<br>.00778  | 18.30<br>7.41<br>ty natria<br>2.99<br>2.05                                      | .0000<br>.0000<br>.0028<br>.0409                               | 103645<br>103645                     | .05780                               |
| LHLEH<br>LHLEH<br>LHLEH<br>LHLEH<br>LHLEH<br>LHLEH   | .02005***<br>.74614***<br>Magonal element<br>.10600***<br>.01002**<br>Malow diagonal *   | .08067<br>.00741<br>ts of Choles)<br>.05555<br>.00778<br>Generots of (   | 18.30<br>7.41<br>ty matrix<br>2.95<br>2.05<br>Choleaky                          | .0000<br>.0000<br>.0028<br>.0438                               | .57516<br>.53649<br>.53067           | .05790<br>.17586<br>.00117           |
| 5<br>101,014<br>109,27<br>109,27<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,0000000000  | .92835***<br>.74654***<br>Negonal element<br>.10600***<br>.01882**<br>Helov diagonal *<br>.03239***  | .08087<br>.00748<br>tr of Choles<br>.00778<br>.00778<br>elements of (<br>.00961                                      | 18.30<br>7.48<br>ty netrix<br>2.35<br>2.05<br>Doleaky<br>5.43                   | .0000<br>.0000<br>.0028<br>.0400<br>matrix<br>.0504            | .07514<br>.03645<br>.01067<br>.01615 | .05790<br>.17586<br>.00117           |
| 15<br>101,011<br>103,27<br>103,27<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>101,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,07<br>10,070 | .02005***<br>.74614***<br>Magonal element<br>.10600***<br>.01002**<br>Malow diagonal *   | .08067<br>.00748<br>.00549<br>.00549<br>.00778<br>41emetts 05 0<br>.00941<br>metes for Per                           | 18.30<br>7.48<br>ty netrie<br>2.05<br>2:05<br>2:05<br>2:43<br>5:43<br>ftih dirt | .0000<br>.0000<br>.0028<br>.0460<br>matrix<br>.0006<br>ributio | .07514<br>.03649<br>.00067<br>.01425 | .05780<br>.17586<br>.00117<br>.00107 |

| Coversance |                        |           |  |
|------------|------------------------|-----------|--|
|            | LILEI                  | LEADT     |  |
| LHERN      | .11248-01<br>.3497E-02 | .12042-02 |  |

Implied standard deviations of random parameters

1,0\_bets) 1 1, .104000 2, .7341148

inglied correlation matrix of random parameters

| - | - | - |    | - | - | - | -  | - | - | - | - | - | - | - | - | - | - | - | - | -  | - |   | - |    |
|---|---|---|----|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|----|
| 0 | 2 | ¢ | .1 | 1 | 4 | ŝ | i  |   |   |   | t | h | t | 2 | 1 |   |   |   |   | ī, | 3 | h | b | ġ  |
| - | ÷ | - |    | ÷ | - | - | +  | • | - | - | ÷ | ÷ | ÷ |   | - | - | - | - |   | -  | - | 4 | - | •  |
|   |   |   | L1 | t | ż | 1 | ĺ. |   | 1 | 5 | D | à | o | ł | ð |   |   |   | ŝ | ż  | 5 | 0 | e | ð  |
|   |   |   | L) | ù | ä | ġ | i  |   |   |   | 9 | ş | ò | A | ø |   |   | à | 4 | 0  |   | ò | 0 | i, |

## Random Parameter Negative Binomial Model of High Injury Crashes on Small-Urban-Rural SPF Class Roadway Segments

| Restricte<br>Chi squar<br>Significa<br>Nofedden<br>Estimatic<br>Inf.Cr.AI<br>Nodel est<br>Yeuple le<br>Depative | Variable<br>incod function<br>d log likelthos<br>ed [ 3 d.f.]<br>n=m level<br>Seculo B-epunced<br>n based on N =<br>C = 19502.5 A2<br>insted: Sep 03,<br>2 pds and 470<br>knomial segress | 1 -10040.17<br>403.27<br>.001<br>.300<br>.3900<br>.4114, 3 =<br>C/N =<br>2019, 15:31<br>87 indivious<br>int model | 820<br>973<br>731<br>83<br>297<br>151 |                 |               |                    |
|---|---|---|---------------------------------------|-----------------|---------------|--------------------|
|   | Coefficient   |   |                                       | 1200-<br>(1)57* | 95% Do<br>Int | nfldenve<br>leyval |
|   | Honrendim parama<br>-8.35672***   |   |                                       |                 |               |                    |
| Constant!   | +8:00672***   | .21515  | -29,34                                | 10000           | +8,77\$47     | -5.00495           |
| 100021  | 0.006374  | .00937  | 0.1.00                                | .0030           | + 012TE       | .00005             |
| MODERI  | .18282**<br>70419***<br>.71336D-04***   | .06512  | 2.22                                  | +9210           | -01798        | .28830             |
| NUVLINI   | 70610***  |   | -5.49                                 | +0000           | 98423         | -145215            |
| HEVERAN   | -713360-04***   | .1252D-04   | 5.79                                  | 10000           | 47191D-D4     | .354810-08         |
| STREET  | -,02021+++  | .00886  | -3.05                                 | .0024           |               | 00717              |
| ACTINUESEL)   |   | 100064  | 9,67                                  | .0011           | .00099        | -00306             |
|   |   |   |                                       |                 |               |                    |
| SHIEN)  | 186075***   | :01515  | 55.80                                 | .0000           | .81105        | 587046             |
| LNADT)  | .62101***   | ,02994  | 28.94                                 | 10000           |               | .68724             |
| 0.000   | .56075***<br>.62101***<br>Dispotal element<br>.06815***<br>.00885***  | a of Cholesi  | TV metris                             |                 |               |                    |
| (INLER)   | .06815***   | .01088  | 8.16                                  | .0000.          |               | .18888             |
| LHAPT   | .00555***   | .00232  | 3.62                                  | 1000.           | .00431        | .01340             |
|   | Below disdonal e  | Lements of  | これは日本市体のの                             | matrix -        |               |                    |
| LINE LINE   | .01138***   | 100305  | 3,70                                  | .0002           | -01552        | COST4T-            |
| _   | Dispersion parws  | ster for He   | sein diet                             | winiti at       |               |                    |
|   | 1.0445D***  | 12426   | 8.45                                  | .0000           | 90094         | 1.20803            |
| Enal Darmi  |   |   |                                       |                 |               |                    |

#### Implied ocvariance matrix of random parameters

|                | 2312.815               | 11402                       |
|----------------|------------------------|-----------------------------|
| LHLEN<br>LHAPT | -4244E-02<br>.7415E-02 | .20755-03                   |
| Implied st     | andard devi            | ations of random parameters |
| A.D Betal      |                        | 1                           |

11 10451470 21 1044154

Impliant correlation matrix of random parameters

| - | - | - | - |     | + | - | +- | - | - | - | - | - | - | -  |     | - | - | - | - | - | ٠ | - |
|---|---|---|---|-----|---|---|----|---|---|---|---|---|---|----|-----|---|---|---|---|---|---|---|
| ¢ | 2 | z | 1 | Ne. | t | ÷ | ť. |   |   | 1 | ú | t | r | ņ, |     |   |   | t | 1 | Ŕ | İ | Ţ |
| - | - | - | + |     | - | - | ÷  |   | - | + | - |   | - | ÷  | • • | - | - | + | - | ÷ | - | - |
|   |   |   |   |     |   |   |    |   |   |   |   |   |   |    |     | 1 | ł | 1 | 5 | 3 | 2 | 1 |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Small-Urban-Rural SPF class Roadway Segments

|                                    |   | renered and                    |                  |        |                           |                    |                |                                |                |   |                |
|------------------------------------|---|--------------------------------|------------------|--------|---------------------------|--------------------|----------------|--------------------------------|----------------|---|----------------|
| 1202022                            |   | 21252-01252                    |                  |        |                           |                    | Inglisd :      | covariance.                    |                |   | parameters     |
| Dependent                          | officients Negl<br>Voclable   | 2082                           | 1117             |        |                           |                    | COVALLAND      | wittes w                       |                |   |                |
| Restricte                          | incod function<br>4 log likelihoo   | -1986.86<br>+ -9166.21         | 102              |        |                           |                    |                | LILL                           |                | LINADT                                  | DEGL           |
| Significa<br>NoFedden<br>Ewtinatio | ed [ 0 d.f.]<br>note level<br>Patido N-agiare<br>n Daged on N =<br>C = 0960.7 A | .20<br>8 .0408;<br>94118, X =  | 100<br>231<br>12 |        |                           |                    | LNLEN<br>LNADT | .09918-0<br>10692-0<br>1097E-0 | 2 .101         | 42-01                                   | .12118-03      |
| Nodel est<br>Sample is             | ineted: Sep 05,<br>2 pds 400 47   | 1015, 10:09<br>097 10:01/10:00 | 1.8              |        |                           |                    |                |                                | Miétissi       | net lo r                                | ton parameters |
| Nupative :                         | tinomial regree   | sich model                     |                  |        |                           |                    | S.D_Seta       |                                | ÷:             |   |                |
|                                    | Coefficient   | Standard                       |                  | Prob.  | 309 Co                    | nfidence<br>segval | 1              | .09<br>.33                     | 18088<br>18429 |   |                |
|                                    | Schrandon pecan   |                                |                  |        |                           |                    |                |                                | 36.1           |   |                |
| Constant {                         | -12.2003***   | .39917                         | 3306730          | .0000  | ~13.0427                  | -11:0780           |                |                                |                |   |                |
|                                    | -1.02011***   |                                |                  |        |                           | -1.26557           | Implied :      | terrelation                    | MATTIN .       | of rands                                | in parameters  |
| HCVCRAB!                           | _86400D-04***   | _2169D-04                      | 8,98             | .0001  | .438990-04                | -12591D-08         |                |                                |                |   |                |
| 7000000                            | - 14474+++  | 01041                          | -4.45            | 0.0400 | 06711                     | 02434              |                |                                |                |   |                |
| HC-30(SEL)                         | .00361+++   | 100052                         | 3.81             | .0001  | .00180                    | 00542              |                | *********                      | + + + + +      | +++++++++++++++++++++++++++++++++++++++ |                |
| TOTLANE                            | .00341+++   | 00154                          | -1.22            | +0000  | 42761                     |                    | Cor.Mat.       | 1301,000                       | 1333.27        | 2003                                    | 2              |
| SHEDCR!                            |   | .01178                         | -4.50            | .0000  | 07638                     |                    |                |                                |                | ******                                  | 4              |
| SHYNDDEC)                          | .02540***   | .00754                         | 2.27             | +0007  | +01047                    | .04031             | LNLEN          | 1.00000                        | +.55656        | +.61008                                 | 6              |
| 14333030                           | leans for candor  |                                |                  |        |                           |                    | LNADT          |                                | 1.00000        | 198788                                  |                |
|                                    | 132675***   |                                |                  | +0000  |                           | .87501             | DEGI           | 41005                          | .09735         | 1.00000                                 | Ê.             |
| LHADT                              | 1.26303***  |                                |                  | .0000  | 1.17574                   | 1.05592            |                |                                |                |   |                |
| D02[31]                            | 0D142+  | 200441                         | -1.96            | .0203  | 01726                     | 000003             |                |                                |                |   |                |
|                                    | Dispinal elevent  | ts of Chiler                   | ty materia       | 1.5    |                           |                    |                |                                |                |   |                |
| INCES:                             | .09461***   | ,02988                         | \$.95            | .0505  | .84766                    | 124248             |                |                                |                |   |                |
| LNADT                              | .02650+++   | .00443                         | \$198            | .0000  | 101702                    | .03518             |                |                                |                |   |                |
| 08.911                             | .01425***   |                                | 3.07             |        | .00514                    | .02936             |                |                                |                |   |                |
|                                    | Below disgonal (  | alements of 0                  |                  |        |                           |                    |                |                                |                |   |                |
| 115% 1NL                           | 0176644   | .00011                         | -2.12            | .0295  | 03306                     | 0017e              |                |                                |                |   |                |
| ADES INL                           | 01768++   | 100940                         | -2,88            | +0422  | -,22188                   | 10039              |                |                                |                |   |                |
| IDEG LMA.)                         | _164#T++  | ,06757                         | 2.43             | .0140  | .00105                    | .29690             |                |                                |                |   |                |
|                                    | Dispersion para   |                                |                  |        | <ul> <li>Solar</li> </ul> |                    |                |                                |                |   |                |
| ScalParm)                          |   | ,05743                         |                  |        |                           |                    |                |                                |                |   |                |
|                                    |   |                                |                  |        |                           |                    |                |                                |                |   |                |

|                        | THEF.                             | LINADT                 | DEGI          |
|------------------------|-----------------------------------|------------------------|---------------|
| LNLEN<br>LNADT<br>DEG1 | .0991E-02<br>1069E-02<br>1097E-02 | .1014E-01<br>.0112E-03 | .32338-03     |
| Deplied :              | standard davia                    | stight of the          | utos paramete |
| S.D Seta               |                                   | ¥ ::                   |               |

| - XC 4 |  | 2 | a | э | 4 | 7 | 4 | ŝ |  |
|--------|--|---|---|---|---|---|---|---|--|
|        |  | - | ÷ | - |   | 4 | - | 1 |  |
|        |  |   |   |   | 2 |   |   |   |  |

| Cor.Mat. | 230,800 | THEFT  | 20032   |
|----------|---------|--------|---------|
|          | 1.00000 |        | 61008   |
| DEGL     | +.41005 | .09735 | 1.00050 |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Small-Urban-Rural SPF

### **Class Roadway Segments**

| Dependent<br>Log likel<br>Bestricte<br>Chi squar<br>Significe<br>Nofeddan<br>Estimatio<br>Inf.Cr.AJ<br>Model est<br>Bample 1# | efficients Teg<br>variable<br>shood function<br>ad [ 6 d.f.]<br>nos level<br>freudd 3-squaret<br>n based on N =<br>C = 51024.6 A;<br>imatod: Sep 53,<br>2 pds shot 371 | L0<br>-26499.30<br>4 -82097.49<br>-13206.57<br>-000<br>5 -2057.<br>94114. H =<br>-10/H =<br>9615.56.21<br>9615.56.21<br>9615.56.21 | 430<br>101<br>200<br>128<br>18<br>542 |                      |            |            |
|---|--|--|---------------------------------------|----------------------|------------|------------|
| ······  |  | Statigated.  |                                       | Prop.                |            | wfidence   |
| 1,02947   | Coefficient  | Resor  |                                       | 121>2*               | Int        | eyval .    |
|   | Sourender perem  | 11427  |                                       | 10.00 at 10.00 ke he |            |            |
| Constant?   | -0.23882***<br>-0.23882***   | .52428   | -86.11                                |                      | -0.40010   | -7,97294   |
| BOVLINT (   | C. 78755444  | 100012   | -9.22                                 | -0000                | +.00475    | 62029      |
| BOVORANI  | ,66488D-04***  | -72472-55  | 8-87                                  | -0000                | .602440-04 | .737320-04 |
| SINDRY  | ,64488D-04***<br>03250***  | .00028   | -9,04                                 | .0000                | 03854      | 02594      |
| 50000553  | .00209***  | .00042   | -9.04<br>5.01                         | .D000                | .00127     | .00291     |
| SHNDCH  | 04400***   | .00373   | -11.00                                | 0000                 | -,06181    | 03869      |
|   | .01678***  |  |                                       |                      | +03384     |            |
| HOUPTEYA I  | 00063+++   | 00004  | 148-010                               | _DD01                | -:00109    | 00014      |
|   | Deans for randor<br>.90487***<br>1.02101***  | n perapeters   |                                       |                      |            |            |
| LICENT  | .90457###  | 101004   | 50.05.                                | -9000                |            | .92429:    |
| LNADT   | 3.02193***   | .01912   | 87.58                                 | 0000                 | 199217     | 1.05144    |
| TOTLANE   | 12610+++   | C02091   | -6.03                                 |                      | +,14708    | 08512      |
|   | Disgonal element   | ts of Children   | by matrix                             |                      |            |            |
| 1.01.201  | .12804***  | 100044   | 18,22                                 | -0000                | +10492     |            |
| LNADT   | +01600+++  | .05453   | 2.74                                  |                      | 100801     |            |
| T071AiW   | .00482**   | ,00841   | 2.03                                  | 0428                 | ,00024     | .01860     |
| 111000000000000000000000000000000000000   | Ealmy diamonal a   | Tanante's internet   | The Castleri                          | 10000                |            |            |
| IING LSE  | -,02817***<br>-,02720+   | .00613   | -8.60                                 | ,0000                | 04018      | +.81817    |
| ITCT_LNL  | +.02720+   | 102867   | +1,91                                 | .0827                | +,08791    | ,00852     |
| 1705 2841   | ~.03436*   | 201309   | +1,94                                 | 10626                | -,05005    | 100120 ·   |
| 1   | Disperation pares  | natar for Ba   | gütin ittart                          | ribucies             | ц.:        |            |
| Scalfarm  | .560II+++  | 102742   | 35.47:                                | 0000                 | 102400     | 192196     |
|   |  |  |                                       |                      |            |            |

Ingiled opvariance matrix of random parameters

|                           | 1011210                           | LIGADT                 | TOTLANE         |
|---------------------------|-----------------------------------|------------------------|-----------------|
| LHLEN<br>LHADT<br>TOTLAHE | .1864E-01<br>8523E-02<br>8021E-02 | -1080E-01<br>-3538E-03 | .13912-02       |
| Implies a                 | tandard devi                      | ations of rai          | uion parameters |
| S.T_Sets                  |                                   | 1                      |                 |
| 1<br>2<br>3               | .1210<br>.05288<br>.05718         | 62<br>50<br>16         |                 |
|                           |                                   |                        |                 |

Implied occuelation matrix of random parameters

| Cor.Mat.) | 101203  | LULDT  | TOTLAH  |
|-----------|---------|--------|---------|
| Lat.en    | 1,00000 |        | *.73191 |
|           |         |        | 1222964 |
| TOTLASE   | 78181   | .20064 | 1.00000 |

#### Random Parameter Negative Binomial Model of Total Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments

| Random Coe                             | fficients Hegh   | ndag Model                 |                  |                 |               |          | Implied covariance matrix of random para |                    |          |            |             |
|--|--|----------------------------|------------------|-----------------|---------------|----------|--|--------------------|----------|------------|-------------|
|  | verieple   |                            |                  |                 |               |          | COVARIAND                                | e matrix           |          |            |             |
| Restricted                             | hood function<br>log likelshood  | -98529-52                  | 022              |                 |               |          |  | 1104               | 20       | VCE        | movia sint  |
| Significen<br>NoFedden 9<br>Estimation | d [ 6 d.f.]<br>ce level<br>seudo %-squared<br>hased on N =<br>= 19757.5 AD | .00<br>.4145<br>17072, H = | 000<br>813<br>17 |                 |               |          | LHAOT<br>VCE<br>BCVLIHT                  | 127218-<br>.0361E- | 01<br>01 | 2,948      | 1.121       |
| Model esti                             | asted: Sep 00,<br>2 pds eid - 00   | 2015, 17:08                | 108              |                 |               |          | Implied at                               | tendend d          | evietion | e uf sand: | m parameter |
| Bedative 2                             | 1 pos silo fi  | ion model                  |                  |                 |               |          | D.D_Beta                                 |                    | I.       |            |             |
| TOTALACC                               |  | Standard<br>Error          |                  | ProD:<br>(21>2* | 36% Co<br>Tur | ejval    | 11                                       | .05                | 21405    |            |             |
|  | curandon parate  |                            |                  |                 |               |          |  |                    |          |            |             |
|  | -4.70471***  |                            | -11.78           | .0000           | -5.22327      | -4.15415 |  |                    |          |            |             |
| LULEN:                                 |  | .01553                     | 32.00            |                 |               |          | Implied of                               | orrelatio          | o matrix | of subder  | parabecers. |
| 90821                                  | .52368***<br>.58314***   | .06617                     | 8.56             | 2005            | .42544        | 169288   |  |                    |          |            |             |
| NCVMMRII)                              | -4.95035+++  | 1,21975                    | -0.04            | .0005           | -7.45621      | -2.43049 |  |                    |          |            |             |
| TOTLANE                                | .09795***  | .01542                     | 6.32             | .0000           | .06759        | .22531   |  |                    | *******  |            |             |
| SERDCE                                 |  | 100668                     | -2,85            | .0000           | 05556         | 05629    | Cot.Mat.                                 | LEADY              | . VC8    | REALINE    |             |
| VCVPT5RB:                              | ,00349++=  | ,00084                     | 4,88             | ,2000           | .00008        | 200212   |  |                    |          |            |             |
| 11                                     | sans for random  | parameters                 |                  |                 |               |          | LEADT                                    | 1,00000            | 193355   | .91850     |             |
| LINADT                                 | .70115+++  | ,02941                     | 23184            | :0000;          | 104353        | 175878   |  |                    |          | 172395     |             |
| VCR                                    | +8.07867***  | 127576                     | -11-17           | .0000           | +3.41911      | -2,53823 | HCVL1M3                                  | .,05050            | .72685   | 1.00000    |             |
| SCOLUNT:                               | -1.05436***  | .13735                     | -12.04           | .0000           | -7.20274      | -1.55594 |  |                    |          |            |             |
| 3539.04                                | sagonal element  | a of Choles                | my matrix        | 1.1.1.1         |               |          |  |                    |          |            |             |
| LIGATE                                 | .05216***  | .00218                     | 23.40            | .0000           | .04768        | · 02644  |  |                    |          |            |             |
| VCIU                                   | .61566***  | .14081                     | 0.76             | :0002           | .29450        | .93673   |  |                    |          |            |             |
|  | .32205**   |                            |                  | 0219            | .04870        | .89928   |  |                    |          |            |             |
| 1.1                                    | elov disconsi e  | lements of 1               | Cholesky.        | BATELS          |               |          |  |                    |          |            |             |
| TACK TRAT                              | 3.60204***   | .29966                     | 5.55             | .0000.          | 2.01851       | 2.19017  |  |                    |          |            |             |
| INCV LUE                               | 1.17309***   | .21618                     | 8.20             | .0000           | 1.34332       | 2:19650  |  |                    |          |            |             |
| THEA ACK                               | +,09168***   |                            |                  |                 | -1.0655+      | 32580    |  |                    |          |            |             |
|  | Lepersion payas  |                            |                  |                 |               |          |  |                    |          |            |             |
|  |  |                            |                  |                 |               |          |  |                    |          |            |             |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small-Urban-Small-Urban SPF class roadway segments

| Small*Croan Sr1 Ci                                    | das Todaw    |
|---|--------------|
| Random Coefficients NegDo                             | Neg Model    |
| Dependent watiable                                    | 000          |
| Log ligwlihood function                               | -11892.14537 |
| Restricted log likelihood                             |              |
| Chi aguared [ 6 d.f.]                                 |              |
| Signification level                                   | ,00000       |
| Mafeddan Faelds R-aguared                             |              |
| Estimation based on H = 1                             |              |
| Inf.Cr.AIC = 20740.3 AIC                              |              |
| Migel estimated: Rep 10. 2                            |              |
| Sample is 2 pds and 655<br>Repative minimial represen |              |

Implied covariance matrix of random parameters

| Constanto                  | e notzia                            |                    |         |      |
|----------------------------|-------------------------------------|--------------------|---------|------|
|                            | SHADT                               | LITLEN             | RCVLINE |      |
| LIGADT<br>LNLEH<br>MCVLUHT | .3025E-03<br>.2464E-02<br>.1504E-01 | .20125-01<br>.2202 | 1.975   | 1189 |

Implied standard deviations of random parameters

| \$001      | Confficient      | Standarii<br>Errov |        | Prob-<br>(#)>2* |            | ntidence<br>artal |
|------------|------------------|--------------------|--------|-----------------|------------|-------------------|
|            | fonrandum peram  |                    |        |                 |            |                   |
| lenetant!  | +5.38582***      |                    | -18-58 | .0008           | -4.65224   | -6.109931         |
| VCE:       | 47101+++         | .00124             | -1.01  |                 | 65900      | 36298             |
| CVNXEL11   | -6.20625***      |                    | -5,98  |                 | -8.25925   | -9.16991          |
| TOTLANE    | 08122***         | .02758             |        | 10032           |            | 02722             |
| SWNDCR:    | +,03996***       | :00536             |        | +0000           |            | 02948             |
| CVITODS:   | .00391+++        |                    | 6.00   | .0000           | .00265     |                   |
| DE131 (    | 05371++          | 100148             | -2.54  | 10110           | 00##7      | +,10060           |
| IDMONTONCI | .03146***        |                    | 10,12  |                 |            | 203756            |
| CVFTCVA .  | ,00146***        | ,00091             | 4.65   | -0000           | .00034     | ,00207            |
|            | .822740-04***    |                    | 0.21   | .0000           | .047720-04 |                   |
| VOVVELAT   | +.20192***       | .00041             | -6.04  | .0000           | 00362      | +.00100           |
| 13         | leans fur random | t parameters       |        |                 |            |                   |
| 110.07)    | .70091***        | .03787             | 123128 |                 | -72566     | .87215            |
| THERM.     | .02210***        | .01836             | 50.23  | .0000           | .55420     | 195516            |
| HOWLINE    | -3.13350***      | 120142             | -15,60 | 10000           | -5.54030   | -3.75561          |
|            | itegonal element |                    |        |                 |            |                   |
| LIGDT      |                  | 100623             | 8,00   |                 | .0067£     | .00151            |
| INTERN     | .325554++        | .00706             | 26.67  | 10020           | .1020€     | .12966            |
| NCYLART (  | .44235****       |                    | 2.00   |                 | .13642     | ,74836            |
|            | Helow diagonal ( |                    |        |                 |            |                   |
|            | 122657844        |                    | 7.52   |                 | _08687     | 114127            |
| HEV LEAD   | 1768784++        | .20141             | 2.75   |                 |            | 1,32772           |
| MEY LHL:   | 1.09000***       | 122031             |        | 12000           |            | 0.59747           |
| 1.1        | Laperston Dank   |                    |        |                 |            |                   |
| IcalPars:  | .39547***        | .01105             | 185.87 | .0000           |            | .41278            |

| 21 |           |  |
|----|-----------|--|
|    |           |  |
|    | 2753.54.8 |  |

|    | 1.3.9 (3.4.4.8.9) |
|----|-------------------|
| 3) | 1.40521           |
|    |                   |

S.D\_Beta) 1

Implied correlation matrix of random parameters

| CoriNet. | INKOT   | 19110  | 80/2383 |
|----------|---------|--------|---------|
| LHADT    | 1.00000 | .78632 | -55704  |
| HCVLING  | .34704  | .02764 | 1,00000 |

#### Random Parameter Negative Binomial Model of Possible Injury Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments m parameters

|                                    | efficients Negl   |                             |                  |       |               |                     | Implied co     | TYATLADDA            | matrix :       | f pendos | parameters.  |
|------------------------------------|---|-----------------------------|------------------|-------|---------------|---------------------|----------------|----------------------|----------------|----------|--------------|
| Dependent                          | Veriable  |                             | 14.2             |       |               |                     | Coverlance     | astrik.              |                |          |              |
| Restricte                          | Shood function<br>0 log likelihood  | z -0908.823                 | 191              |       |               |                     |                | LINA                 | nr.            | LHLEN    | DEGI         |
| Significe<br>Sofedden<br>Fatimatio | nd [ 6 d.C.]<br>nom level<br>Freudo R-squared<br>h based on N =<br>C = 12001.4 AU | .00:<br>2504'<br>11012, W = | 100<br>185<br>19 |       |               |                     | LHLDT          | -66678-0<br>.15952-0 | 18             | 10-X0    | . 30468-04   |
|                                    | insted: Sep 10,   |                             |                  |       |               |                     | Implied st     | enderd De            | eviations      | of sand  | on parameter |
| Degazive :                         | 2 pus and di<br>binomial regress  | Labox no.es                 |                  |       |               |                     | 0.0_Deta:      |                      | -1             |          |              |
| FIND                               | Coefficient   | Stenderd                    |                  | F10D+ | 35% Co<br>Int | infldence<br>retval | 11<br>21<br>31 | -025                 | 9520e<br>79587 |          |              |
|                                    | Nonratidom perate   |                             |                  |       |               |                     |                |                      |                |          |              |
| Constant)                          | -1.03102***   | 147528                      | -11.11           | .0000 | -6.77557      | -6.32428            |                |                      |                |          |              |
|                                    | 36770++   |                             |                  |       | 70785         |                     | Implied or     | CORLATION            | a postria      | of saids | n parameters |
| NOVHKSL11                          | +8.03714*   | 2.67755                     | -1.85            | +2807 | -10.008841    |                     |                |                      |                |          |              |
|                                    |   | .00697                      | -6.92            | .0000 | 07708         |                     |                |                      |                |          |              |
| TUYECGED                           | .00495***   | 100104                      | 4,70             | +0000 | .00290        | 100705              |                |                      |                |          |              |
| HOVE INT (                         | -2.34319***   | 21509                       | -5.56            | .0000 | -2.88736      |                     | Cor.Mat.)      | LIEADT               | 1111110        | DEGI     |              |
| RHYNDINCI                          | .02748***   | 100900                      | 2156             | +0100 | 1222187       |                     |                |                      |                |          |              |
|                                    | .757188-04+++   |                             |                  | 10000 |               | 1012200-03          |                | I.00000              | .*0007         |          |              |
| VEVVELA                            | 00463+++  | 100070                      |                  | +0000 | 00581         | -,102,94            |                | 1,80807              |                |          |              |
|                                    | Henne for random  |                             |                  |       |               |                     |                | .61176               |                | 1.00000  |              |
| SHADT                              |   | .04950                      |                  |       | -153974       |                     |                |                      |                |          |              |
| 13153                              | .07743+++   | .02766                      |                  |       | .42328        | .93161              |                |                      |                |          |              |
| 00011                              |   |                             |                  | ,0087 | 01223         | 00209               |                |                      |                |          |              |
|                                    | Dispinal elevent  |                             |                  |       |               |                     |                |                      |                |          |              |
|                                    | .02582+++   |                             |                  |       |               |                     |                |                      |                |          |              |
| LMLERI                             |   |                             |                  |       | .08385        |                     |                |                      |                |          |              |
| DEGI                               |   |                             | 2.16             |       | .111196       | -81040              |                |                      |                |          |              |
|                                    | Selow diagonal e  |                             |                  |       |               |                     |                |                      |                |          |              |
| 12.00_1NA1                         | 1.55524+++  | ,02567                      | 5,68             | .0000 | .00031        |                     |                |                      |                |          |              |
|                                    | -08122***   |                             |                  |       | 102896        |                     |                |                      |                |          |              |
| A PARTY - DIRECT                   | 00273   |                             |                  |       | +:00911       | 000145              |                |                      |                |          |              |
|                                    |   |                             |                  |       |               |                     |                |                      |                |          |              |
|                                    | Dispension parm   |                             |                  |       | .29945        |                     |                |                      |                |          |              |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments

| Sepundent<br>Log likel<br>Setricte<br>Thi equal<br>Significa<br>Erfadden<br>Erfinetic<br>Inf.Cr.Al<br>Lodel eat<br>Sample 10 | efficients Hegi<br>variable<br>ihood function<br>d log Likelihoo<br>rdd ( 8 9.5.)<br>Tasuid R-squares<br>m Based on N =<br>C = 615.4 Al<br>insted: Sep 10.<br>V J pds end 5 <sup>3</sup> | 2<br>-1063.766<br>-2664.233<br>761.039<br>.000<br>10072, K =<br>(2/N = .0<br>2015.19705<br>36 individue | 10<br>80<br>81<br>60<br>11<br>80<br>98                                |  |                                     |                                      |
|--|--|---|---|--|-------------------------------------|--------------------------------------|
| EVI.   | Confficient  | Standard<br>Error   |   | Frob.  |                                     | mfidence<br>ervel                    |
|  | Sonrandon parase   | CATE  |   |  |                                     |                                      |
|  | -5.42044***  |   |   | .0000  | -6.58500                            | -4.26887                             |
|  | .05755***  |   | 3.25  |  |                                     |                                      |
|  | -2.11184***  |   | -8-22   | .0000.   |                                     | -1.35879                             |
| INTERVE  | .01307+++  | .02993  | 1.32  | .0000  | .00536                              | .02077                               |
| SCYCRAM  | .33928D-04*  | 2075D-04  |   |  | 122640-06                           | .805555D-04                          |
| SHUDLT   | ~_06004***   | .02897  | +6.65   | 10000  | 07768                               | 04285                                |
|  | Heans for rendor   | Contraction of the second   |   |  |                                     |                                      |
|  |  |   |   |  |                                     |                                      |
| UNADT  | .523444444   | .06385  | 0.55  | .0000  | 141027                              |                                      |
| LINADT   | .53346***<br>.64361***   | .06383<br>.03204  | 8-95<br>26-95   | .0000  | ,41027<br>,78582                    |                                      |
| LHADT  | .98848***<br>.84861***<br>Disgonal element   | .06383<br>.03204<br># of Choleak  | 8-95<br>26-99<br>V matrix   | -0000  | .78582                              | 191140                               |
| LINADT<br>LINLEI<br>LINADT   | .98848***<br>.84861***<br>Disgonal slamart<br>.01066**   | .06383<br>.03204<br># of Chaleak<br>.00499  | 0-95<br>26-99<br>y marris<br>1-95                                     | .0000  | ,78582                              | .91140<br>.02757                     |
| LWADT<br>LWADT<br>LWADT<br>LWADT   | .95848***<br>.84861***<br>Disgonal element<br>.01006**<br>.02268**   | .06085<br>.03204<br># of Chplesk<br>.00409<br>.01068  | 9-55<br>26-55<br>y metris<br>1:55<br>2-12                             | .0000<br>.0475<br>.0337                              | ,00015<br>,00175                    | .91140<br>.02757                     |
| LINADT<br>LINLEI<br>LINADT<br>LINADT<br>LINLEI   | .958+6***<br>.84861***<br>Disgonal element<br>.01066**<br>.02268**<br>Below disgonal 4   | .06383<br>.03206<br># of Chplask<br>.00409<br>.01068  | 8-95<br>16-98<br>ty metris<br>1-98<br>2-12<br>holesky                 | .0000<br>.0475<br>.0137                              | ,78582<br>,00015<br>100175          | .91140<br>.02757<br>.04361           |
| LINADT<br>LINLEI<br>LINADT<br>LINADT   | .055+6***<br>.04361***<br>Disgonal slaman<br>.01266**<br>.02269**<br>Below disgonal +<br>.05292**  | .06365<br>.03204<br>s of Chilesk<br>.00695<br>.01069<br>.01069<br>.02307                                | 8.91<br>26.98<br>27.98<br>2.12<br>2.12<br>holesky<br>2.29             | .0000<br>.0475<br>.0837<br>.0837<br>.0215            | .78883<br>.00015<br>.00175          | .91140<br>.02757<br>.04361           |
| LUNADT<br>DICEU<br>LUNADT<br>LUNADT<br>LUNADT<br>LUNA  | .958+6***<br>.84861***<br>Disgonal element<br>.01066**<br>.02268**<br>Below disgonal 4   | .00385<br>.03204<br>.03204<br>.00005<br>.01065<br>.01065<br>.02307<br>.02307<br>.02307                  | 8.91<br>26.98<br>37.98<br>1.99<br>2.12<br>holesky<br>2.29<br>Bin dist | .0000<br>.0475<br>.0937<br>.0337<br>.0215<br>ribidio | .78583<br>.0015<br>.00175<br>.00775 | .81140<br>.02757<br>.01361<br>.05913 |

Implied dovariance matrix of vacuum parameters

LALEN Covariance matrix LINADT

.19222-03 .78372-03 .98168-62 LINADT LINADT

Inglies standard deviations of random parameters

S.D. Setal 1 

Deplied correlation matrix of random parameters

| Cost | Max.   | £  |   |   | I | 1 | Δ | ₽ | Ξ |       |   | Ļ | 21 | L | z | 2 |
|------|--------|----|---|---|---|---|---|---|---|-------|---|---|----|---|---|---|
|      |        | ÷  | - | ÷ | - | - | - | 4 | 4 | <br>- | 4 | - | -  | - | 4 | - |
|      | LISADT | Ê. | 1 | 2 | ά | ø | ċ | ò | ä |       | 2 | ż | à  | 2 | L | 4 |
|      | LOCEN  | 8  |   | 2 | 5 | 1 | 5 | i | × | 1     | 2 | a | d  | Ď | ά | ò |

### Random Parameter Negative Binomial Model of Serious Injury Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments

| +++++++++++++++++++++++++++++++++++++++   | *************   | **********  |   |   |         |              | inglied cove        | riant          |
|---|---|---|---|---|---------|--------------|---------------------|----------------|
| Dependent<br>Sog likel<br>Restricter<br>Chi square<br>Signifinar<br>Rofadden (<br>Estimatio<br>Inf.Cr.AI)<br>Nodel esti | efficients Teg5<br>Variable<br>Uncof Function<br>at [ 6 d.f.]<br>net livel<br>Instal for the second<br>to based on H =<br>C = 1610.8 AI<br>Instal Teg 10,<br>2 pds and 55 | 81<br>-793.423<br>-814.747<br>81.467<br>-000<br>-05295<br>17072, K =<br>17072, K =<br>17075, 191920 | 00<br>69<br>36<br>18<br>94<br>35        |   |         |              | COVACIANDE<br>LSADT | 21475<br>37808 |
| Segurive 1  | ticonial regress  | ion model   |   |   |         |              | 3.0_Beta)           |                |
|   |   | Standard  |   | Frob.                                   | 954 Di  | infidence    | 11                  | .0             |
| 510(1)  | Coefficient   | Srtor -   |   | \$32*                                   | Int     | Lavis        | 21                  | - 22           |
|   |   |   | +++++++++++++++++++++++++++++++++++++++ | +++++++++++++++++++++++++++++++++++++++ |         | ************ | - 11                | +9             |
|   | Tonxandist parame   |   | 0,000                                   | 100.00                                  | Stocker |              |                     |                |
| COLATADT  | -5.95448***   |   |   |   |         |              |                     |                |
| BCVLINZ   | -1.80751**  |   |   |   |         | 29531        | Implied cost        | 41415          |
| VCPARESA:   |   | 103527  |   | 10099                                   | -02179  | ×16008       |                     |                |
|   | Heans for random  |   |   |   |         |              |                     |                |
| LISADT)   | .42303***   |   |   |   | +16310  |              | *********           |                |
| 101,211   |   | ,05014  |   |   | 176405  |              |                     | LNADT          |
|   | 04308**   |   |   |   | 04490   | 00116        |                     |                |
|   | Disgonal element  |   |   |   | 02/2411 | 1 11220265   | LSADT 1.            |                |
|   | .04833***   |   |   |   | .01287  |              |                     | 17991          |
| LISCENT   |   |   |   |   | .01655  |              | INVESTION           | 20590          |
| SHORT)  | .03257444   | :05187  |   | -0056                                   | .00960  | .05424       |                     |                |
|   | Below disponal e  |   |   |   |         |              |                     |                |
| THE THE   |   | 102437  |   | -9047                                   |         |              |                     |                |
| SHN_LINA  | ~_02778**   | 192235  |   |   | 05188   |              |                     |                |
|   | ,01944  |   |   |   |         | +25944       |                     |                |
|   | Dispersion parak  |   |   |   |         |              |                     |                |
| CALFAIRS  | .00210**  | .03297  | 2,43                                    | -0195                                   | 101291  | 114014       |                     |                |
|   |   |   |   |   |         |              |                     |                |

|                          | LIGOT                              | LHLEN                  | NUMBER          |
|--------------------------|------------------------------------|------------------------|-----------------|
| LSADT<br>LNLER<br>JHEDRT | .21475-02<br>.89465-03<br>97808-68 | .1192E-01<br>.1095E-02 | .15258-02       |
| Implied st               | andard days                        | etions of is           | ndom parameters |
| S.D_Beta)                |                                    | 1                      |                 |

ion matrix of random parameters

| Cor.500.1 | LNADT   | LULEN     | SEVERS  |
|-----------|---------|-----------|---------|
|           |         | ********* |         |
| LEADT     | 1.00000 |           |         |
| 10128081  | .17991  | 2,000000  | . 65215 |
| THUDRY    | 20890   | 148218    | 1.00000 |

### Random Parameter Negative Binomial Model of Fatal Injury Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments

| Log likel:<br>Restricted<br>Dri sgiary<br>Significan<br>Nofedden H<br>Estimation<br>Inf.Cr.Al0<br>Nodel est:<br>Hample 15 | <pre>fflictents HegB<br/>veriable<br/>hood function<br/>t log limblich<br/>d [ 1 d.f.]<br/>tot level<br/>becade d- Bust<br/>becade d- Bust</pre> | 817<br>-218.753<br>-218.481<br>1.387<br>.227<br>.00318<br>17072, H =<br>C/H = .0<br>2015, I0:321<br>34 Individua | 12<br>72<br>20<br>19<br>57<br>5<br>26<br>86   |   |                                       |                              |
|---|---|--|---|---|---------------------------------------|------------------------------|
|   | Coefficient   | Stendard<br>Error  |   | Prob.   |                                       | eriebile                     |
| PASAGE  |   |  |   |   |                                       |                              |
|   | lobrandom parama  | ters   |   |   |                                       |                              |
|   | lobrendom person<br>-3.51663***   | ters<br>2.24011  | -4,56   | .0000   | -14.20725                             | -5.42615                     |
| []<br>Constant]   | lonzendom persne<br>-3.51663***   | 2,24011  |   |   |                                       |                              |
| Congrant  <br>LRLEN   | -3.51668+++   | 2.24011  | 10.73   |   |                                       |                              |
| LINADY  | -3.51663***<br>.55622***<br>(ean= for isnou<br>.66762***  | 2.24011<br>.09100<br>permesers<br>.20510   | 10.73   | ,0000   | .20630                                | 1.10003                      |
| LINADY  | -3.51663+++<br>.55652+++<br>(eany for xandom  | 2.24011<br>.09100<br>permesers<br>.20510   | 10.73   | ,0000   | .20630                                | 1.10003                      |
| U<br>Constant<br>Litifi<br>Litifi<br>Litifi<br>Litifi<br>1  | -3.51663***<br>.55622***<br>(ean= for isnou<br>.66762***  | 2.24011<br>.09110<br>permeters<br>.22512<br>for digts.   | 10.73<br>2.96<br>of rands                     | ,0000,<br>.0000<br>m pacama                     | .30630<br>.22601                      | 1.10003                      |
| (I<br>Constant)<br>LRLEH<br>()<br>LRADT<br>()   | -3.51663***<br>.55652***<br>teane for xandum<br>.66762***<br>Itale paremeters   | 2.34011<br>.00180<br>persectors<br>.20132<br>for dists.<br>.19911<br>etes for Neg                                | 10.73<br>2.96<br>of rands<br>1.90<br>Bin 01st | .0000<br>.9030<br>m parame<br>.0574<br>ributkor | -2000.<br>-2000.<br>*10302.<br>96210. | 1.10003<br>1.10923<br>.76559 |

Random Parameter Negative Binomial Model of Unknown Injury Crashes Small-Urban-Small-Urban SPF Class Roadway Segments

| Sependant<br>Log likel<br>Restricte<br>Thi Aquar<br>Significa<br>Sofaddan<br>Estimatio<br>Estimatio | efficiente Hegi<br>veriable<br>ihood function<br>d log likelinood<br>ed ( 1 d.f.)<br>noe level<br>Fields R-squared<br>n based on S =<br>C = 1212.5 Ad<br>instel Sep H. | CHD28<br>-593,85<br>-411,48<br>34.04<br>.00<br>.0196<br>17072, M =<br>C/W =                    | 761<br>636<br>806<br>000<br>778<br>7<br>071         |   |   |  |
|---|--|--|---|---|---|--|
| lample is   | 3 pds and 53<br>binomial regress   | 36 individu  |   | *******   |   |  |
| instances)  | Confficient  | Atandarii<br>Errar   |   | Prob.   |   | ofidence<br>wrwal                        |
|   |  | Errar  | r   |   |   |  |
|   | Normandon person   | Errar  |   | 12/52*  | Int   | sryal                                    |
| instant)  | Nonimidon perman   | frrar<br>Sers<br>.26293  |   | 12132*  | Int<br>-3,1480.0  | -2.1104)                                 |
| l<br>Lingtant  <br>Lintet)  | Ninimidon persae<br>-2.41375+**<br>.01165***   | Errar<br>Seas<br>.26293<br>.04602  | 17,72   | 12(52*  | Int<br>-3.14808<br>.72544   | -2.11041<br>.90554                       |
| Linatant<br>Linten<br>VCR   | Norisidan persat<br>-2.41175***<br>.81165***<br>-3.52764***  | Errar<br>.26293<br>.04603<br>2.81797   | 17,72   | 12152*  | Int<br>-3.14808<br>.72544<br>-15.57688                                      | -2.11841<br>.9554<br>-4.29547            |
| DISSTANT<br>LIGITIN<br>VCAI<br>TOTLANE  | Ninimidon persae<br>-2.41375+**<br>.01165***   | Errar<br>.26298<br>.04602<br>2.81707<br>.07562   | 17.72<br>-3.99<br>9.04                              | 12152*  | Int<br>-3.14808<br>.72544   | -2.11841<br>.9554<br>-4.29547            |
| DISSTANT<br>LIGITIN<br>VCAI<br>TOTLANE  | Nonimodom perman<br>-2.41375***<br>.81265***<br>-3.82744***<br>.23953***   | Errar<br>.26293<br>.04603<br>2.87557<br>.07563<br>parateters                                   | 17.72<br>-3.95<br>9.04                              | .0000<br>.0000<br>.0000<br>.0004<br>.0024                   | Int<br>-3.14000<br>.72544<br>-15.57638<br>.04192                            | +2.11941<br>.90554<br>-4.22569<br>.37778 |
| Constant<br>Listen<br>VCRI<br>TOTLANE<br>SHVOLT   | Nunimodom persam<br>-4.41375***<br>-3.5155***<br>-3.53744***<br>.21955***<br>Deats for random<br>10135***  | Errar<br>.26393<br>.04003<br>2.87707<br>.07563<br>paraketers<br>.02487                         | 17,75<br>-3,65<br>9,04<br>-4,05                     | .0000<br>.0000<br>.0004<br>.0024                            | 3nt<br>-1.14808<br>-12544<br>-15.57638<br>-06182<br>15013                   | +2.11941<br>.90554<br>-4.22569<br>.37778 |
| Instant<br>Listen<br>VCRI<br>TOTLANE<br>SHWOLT  | Norraddan persae<br>-2.43375***<br>-3.1365***<br>-3.33744***<br>.23953***<br>Nears for random<br>1013***<br>State perseeters   | Errar<br>.26988<br>.06803<br>2.87707<br>.07563<br>parameters<br>.02457<br>for drate,           | 17.75<br>-3.95<br>9.04<br>-4.05<br>of rands         | .0000<br>.0000<br>.0004<br>.0024                            | 3nt<br>-3.14809<br>.72544<br>-15.57638<br>.04132<br>15013<br>tecs           | +2.11941<br>.90554<br>-4.22569<br>.37778 |
| LINGTANT<br>LINET<br>VCRI<br>TOTLANE<br>SINOLT  | Norraddan persae<br>-2.43375***<br>-3.1365***<br>-3.33744***<br>.23953***<br>Nears for random<br>1013***<br>State perseeters   | Errar<br>.26991<br>.06603<br>2.87707<br>.07563<br>parameters<br>.02497<br>for dists.<br>.01704 | 17,75<br>-3,45<br>9,04<br>-4,05<br>of rands<br>8,05 | .0000<br>.0000<br>.0004<br>.0024<br>.0024<br>.0020<br>.0025 | 3nt<br>-3.14808<br>.72544<br>415,57658<br>.09132<br>15013<br>term<br>.01013 | +2.11941<br>.90554<br>-4.22569<br>.37778 |

## Random Parameter Negative Binomial Model of High Injury Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments

| Dependent<br>Log likelt<br>Neptrioter<br>Significar<br>Nefection<br>Collection<br>Inf.Co.All<br>Kodel esti<br>Sample 19  | fficients Hagi<br>veriable<br>hood function<br>flog likelihood<br>d [ & d.f.]<br>is level<br>iseado B-squares<br>based on S *<br>. & 6645.4 A<br>natedi Sep 11,<br>2 pis and 2<br>thoughal regrets | H1<br>-3311.62<br>-3564.04<br>1144.73<br>.000<br>1.1473.8<br>1.7172.8<br>1.7172.8<br>2013.14:54<br>3013.14:54 | 121<br>096<br>000<br>025<br>11<br>159<br>152                   |   |  |  |
|--|--|---|--|---|--|--|
| HIIMI  | Coefficient  | Standard<br>Error   | 1  | Frob.<br>(#)52*                           |  | nfidence<br>er%l                               |
| 13   | ionrandon parane   | tere  |  |   |  |  |
| and the second s | -#.95564***<br>.02542***<br>.00125**<br>00090***<br>30014**  | and the second second   | 100 C  |   | -7.30056<br>.77873<br>.00028<br>00058<br>00058 | -6.32370<br>.86001<br>.00228<br>00016<br>03671 |
| MARL   |  |   |  |   |  |  |
| MARL   | leans for random   | parameters:   |  |   |  |  |
| LIADTI<br>BHNDAT!  |  | .05475<br>.00048  | 12,32  | 0000                                      | .58703<br>00051                                | .75185<br>06644                                |
| LIGOT  <br>SHADNES   | .07920***<br>07947***  | .05475<br>.00048  | 12:31<br>-0.45<br>ty matrix                                    | 0000                                      | .58703<br>00051                                | -,06644  |
| IJADI<br>(TADAU<br>)<br>(TADI<br>)<br>(TADI<br>)   | .67436***<br>07947***<br>Maganal elemen:<br>.02157***<br>.00128**  | .00068<br>.00068<br>.00391<br>.00391<br>.00061  | 12:32<br>-0,45<br>ky matrix<br>5.59<br>2,85                    | .0000<br>.0000<br>.0006<br>.0115          | 158703   | 06649  |
| LNADT<br>BHUDAT<br>LNADT<br>CHADT<br>SHACATI   | .67436***<br>07947***<br>Leganal element<br>.02187***  | .05475<br>.00945<br>.00945<br>.00941<br>.00941<br>.00041<br>.00041<br>.00042                                  | 12:32<br>-0,45<br>ky matrim<br>5:59<br>2:53<br>Doleeky<br>9:11 | .0000<br>.0000<br>.0000<br>.0115<br>.0115 | .58703<br>00061<br>.01621                      | 066444<br>.02953<br>.00227                     |

|                  | LIDADT                 | B10429-7                    |
|------------------|------------------------|-----------------------------|
| LISADT<br>SANDRS | .07855-08<br>.13068-02 | .35828-32                   |
| inglied at       | andazi devi            | ations of random parameters |
| D.D.Beta         |                        | I                           |
|                  | 0.0147                 | 11                          |

| Cor.Nat. | LUADI   | SWHERE  |
|----------|---------|---------|
| LIBDT    | 1.00000 | .99521  |
| SHADAL   | .99925  | 1.00000 |

| Random Parameter Negative Binomial Model of Just Injury Crashes on Small-Urban-Small-Urban |
|--|
| SPF class roadway segments   |

| Bandon Co<br>Dependent<br>Don 11ke1                          | efficients HegB<br>veriable<br>ibcod function<br>d log likelibood                                     | InReg Nodel<br>JUSII                                       | 347<br>7.5                 |                 |               |                   | Coveriant              | · natile                           |                       |                | parameters   |
|--|---|--|----------------------------|-----------------|---------------|-------------------|------------------------|------------------------------------|-----------------------|----------------|--------------|
| Restricts  | d ing likelihood  | +4929.554  | 9.2                        |                 |               |                   |                        |                                    |                       |                | DEGI         |
| Bignifios<br>NcFedden<br>Estimatio<br>Iof.Cr.al<br>Nodel est | ent ( .6 n.f.)<br>noe level<br>Treudo R-squared<br>n based on N =<br>C = Bill.6 AJ<br>Lasted) deg 11, | ,000<br>1.16081<br>17872, R =<br>10/0 = .4<br>2016, 16/270 | 00<br>25<br>20<br>47<br>11 |                 |               |                   | LHEAN<br>LHEAT<br>DEAL | ,34848-0<br>-,42038-0<br>-,74248-0 | 1<br>2 .215<br>0 .101 | 38-05<br>48-03 |              |
| Hard & Com   | I pds and 61<br>Bindmini regress  | Calcing mobility in  |                            |                 |               |                   | 0.0 Bets               |                                    | 1                     | C-117          |              |
| JUNTINI  | Coefficient   | Standard<br>Excor  | :                          | Foob.<br> # >2* | 93% Co<br>Int | mfidence<br>mrval | 1                      | ,18                                | 2292                  |                |              |
|  | Nonzandos garase  |  |                            |                 |               |                   | 3                      | ,5074                              | 2441                  |                |              |
| Constant   | -5.05105***<br>.05670***<br>-7.25125**<br>05035***<br>.00817**  | .88375   | 10.00                      | - Anan          | 100 10 10     | 10474             | 11000000               |                                    |                       |                | n paraketers |
| VCVPTERA)  | -50317**  | .001.90  | 15.99                      | +0141           | 100063        | -00872            |                        |                                    |                       |                | S            |
|  | -35514.0**  |  |                            |                 |               |                   |                        | LITER                              |                       | 0001           |              |
|  | .845800-04***   |  |                            |                 |               |                   |                        |                                    |                       |                |              |
|  | 00084***  |  |                            |                 |               |                   | INTER                  | I.00000                            | 123435                | +:89824        | 6            |
| 8271   |   |  | 2.27                       | 10177           | 1.24600       | 12.02142          | 10.01                  |                                    | 1.00000               | 180971         | 5            |
|  | Neans for subdom  | pereneters.  |                            | 1000            |               | .92314            | 100.01                 | 58024                              |                       | 1.00000        |              |
| LINLEY   |   |  |                            |                 |               |                   |                        |                                    |                       |                |              |
| IEBL   |   | 00000  | 7.04                       | 10000           | .84589        | - 000209          |                        |                                    |                       |                |              |
|  | Disgonal alement  | a of Cholesk   |                            |                 |               |                   |                        |                                    |                       |                |              |
| LITER  | .16275***   | .02850   | 3.02                       | 10000           | 10536         | .21674            |                        |                                    |                       |                |              |
| LISADT   | .02558+++   |  | 3,39                       | 10000           | .01721        | .03394            |                        |                                    |                       |                |              |
| 1031   | .DD#17**  | 100271   | 2.27                       | .0250           | 100085-       | .01149            |                        |                                    |                       |                |              |
|  | Selce diagonal e  | ilements of C  | Nolesky                    | matrix          |               |                   |                        |                                    |                       |                |              |
|  | +-03872+**  |  |                            |                 |               |                   |                        |                                    |                       |                |              |
|  | 00497   |  |                            |                 |               |                   |                        |                                    |                       |                |              |
|  | 00017   |  |                            |                 | -,00534       | 00565             |                        |                                    |                       |                |              |
|  | Disperain pares   |  |                            |                 |               | 11010             |                        |                                    |                       |                |              |
|  |   |  |                            |                 |               | . 42026           |                        |                                    |                       |                |              |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Small-Urban-Small-Urban SPF Class Roadway Segments

Implied onvariance matrix of random parameters Coveriance matrix 
 Liter
 Liter
 Liter

 Liter
 -54328-01
 Liter

 Liter
 -54328-01
 5537E-02

 HCULINI
 -24482-01
 -39688-03
 HIVLINE Deplied standard deviations of random parameters 4 J.D\_Detai .237110 .0743460 1.29394 11 21 31 Implied occupition matrix of random parameters 
 Corr.Mat.
 INTEN
 INTEN
 INTEN

 INTEN
 1.00000
 -.94058
 .23429

 INTEN
 -.94054
 .20000
 .83071

 HEVLINI
 .23429
 .81071
 1.00000

| Dependent<br>Log likel:<br>Restricted<br>Chi egiatr<br>Nifedden<br>Mifedden<br>Estimation<br>Inf.Cr.AT<br>Nodel est:<br>Resple is | officients Heg<br>variable<br>(hosd functions<br>d log likelihoo<br>d ( & d.f.)<br>(hose level<br>(hosed on H =<br>c = 20701.2 a)<br>imated: Sep 11,<br>2 pGs end 8<br>innomal regres | L0<br>-12665.04<br>-12665.04<br>-29903.785<br>-39903.785<br>-3905<br>-3905<br>-3905<br>-10072. K =<br>10075 = 1.1<br>-2015, 15:42<br>-2015, 15:42<br>-20 | 271<br>017<br>000<br>142<br>12<br>010<br>010 |                 |            |                    |
|---|---|--|--|-----------------|------------|--------------------|
| 10187   | Coefficient   | Standard<br>Error  |  | Trok-<br>isi>2* |            | nfidence<br>VerV61 |
| . 11  | Corrandom param   |  |  | ******          |            |                    |
| Constant)   | -5.53639+++   | .30775   | -17.22                                       | 10000           | H8.23058   | -6,93321           |
| VCR)  | 43660***  | .20581   | -8.55  | ,0005           | 64389      | 32921              |
| (CVHX38L)   | -3.41776***   | 1,44548  | -8.75  | 10005           | +8.28078   | -2,88437           |
| BHHDCR)   |   | .05041   | -2.42  | .0204           | -104027    | 00949              |
| CVETSRA!  |   | .00068   |  | ,0000           | .00181     |                    |
| NYNDINC   | .01428***   | .00195   | 7,40   | .0000.          | 02010.     | .01805             |
| BOVORAN   | .863650-04***   | .01990-05  | 8.03   | , 2020 .        | .50236D-04 | 1224340-04         |
| VEVVEZA)  | +.00240***  | 100045   | -2.27  | .0000           | 00336      | -1001#1            |
| MCV2.)  | 5,42099***  | 1.44544  | 8178   | .0002           |            | 4.20386            |
| 102.51  | 00610***  | .00614   | -4.22  | .0000           | 00090      |                    |
| SWWDLT:   | 00190+++  | .00614   | -6.59  | .0000           | 04990      | 02540              |
| STROTT:   | *.04570***  | .00645   |  | ,0000           | -105424    |                    |
| MARLO   | 20639***  | -05697   | -5.62  | .0008           |            | -,09443            |
| 11  | launs fut candor  | parameters.  |  |                 |            |                    |
| LHLEW)  | .90957***   | .01761   | 51.66  | .8008           | .07346     | . 54445            |
| LHADT   | .02011***   | -63276   | 28.35  | .0000           | 126900     | 149222             |
| HCVLSKI   | +30621.1+++   | 7432.856   | -3.75  | 20002           | -43024.I.  | -12697.6           |
| 1   | lingunal element  |  | VV MACELA                                    |                 |            |                    |
| LHLEN   | .22752***   | .01700   | 10.86  | .8008           | .20379     | .27048             |
| 1344071   | .04023***   | ,00297   |  | .0000           | -05918     | 104827             |
| HEVELINE  | .31142++  |  | 2,12   | .0340           |            | .10935             |
|   | lainy disgonal .  |  |  |                 |            |                    |
| LNA LUL   | 06252***  | ,00642   |  | .0000           | 07549      | -,04955            |
| ACV LRL   | .90871  | .45150   |  | .0351           | 19090      | .01039             |
| NUV_LIK   | 0.21010+++  |  |  | .0000           | .70130     |                    |
|   | Dispersion para   |  |  |                 |            |                    |
|   |   | .01141   | 38,45  |                 | .72564     | .45418             |
|   | 1.441.44  | 104444   | FX192  | 1.111/14        |            | 143420             |

88

1.674

### Random Parameter Negative Binomial Model of Total Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

|   |  | *********  |   |         | *********** |            |
|---|--|--|---|---------|-------------|------------|
| Dependent<br>Log likel<br>Hastricts<br>Chi squax<br>Hignifics<br>Hofadden<br>Estimatio<br>Inf.Cr.Al<br>Hodel est<br>Semple is | efficients Hegi<br>Veriable<br>inhood functions<br>ed [] & difficient<br>ed [] & difficient<br>paeudo H-squares<br>in tased on H =<br>0 = 17505.9 R<br>interest Sep [].<br>; 2 pds and 4<br>Discutal regress | TOTAL<br>-6731.88<br>-24417.30<br>31870.90<br>.00<br>5 .6423<br>6320. X -<br>10/X + 2.<br>5015.18:00 | ACC<br>525<br>927<br>927<br>928<br>927<br>928<br>927<br>927<br>927<br>927<br>927<br>927<br>927<br>927<br>927<br>927 |         |             |            |
|   |  | Standard   |   | Frich.  | 614 00      | nfisence   |
| TOTALADCI   | Doefficient:   | farer  | =   | 18152*  |             | ervel      |
|   |  |  |   |         |             | 20213      |
|   | Hinrandon param  | SCHTS.   |   |         |             |            |
| Constant!   | -5.00398+++  | .47424   | -10.88  | .0000   | +6.93548    | -4.07448   |
| WCVL (  | 00035***   |  | -1.17   | .0000   |             | e.d0019    |
| HOUCEASI  | _32207D-04***  | 11102D-04  | 2.72  | .00%5   |             | .055030-04 |
|   | 100165+++  | .00500.  |   | .0001   | .00186      | .00540     |
| HCV5.1  | .16955D-08**   | .7065D-05  | 2,92  | .0168   | 1010070-08  |            |
| SHARE   | +:000-68***  | .00103   | -12:01  | .0000   | 10055       | - 00047    |
| 1002221   | .005045+++   | .00604   |   |         | .02174      | .04295     |
| HOVEL ME  | -2.38455***<br>29057**   |  | -8.24   | 0660    | -2.88571    | -1.81795   |
| VERI  |  | .14309   | +2.03   | .0425   | 57102       |            |
| NCCCS.  | -1.20074***  | .28124   | -9.10   | .0000   |             |            |
| WORKSON,  | +:00328**  | .00043   | 1.1.10  | 1414    | -,00249     | .00000     |
|   | Maans for random   | TRUSTALATE   |   |         |             |            |
| 1911,812  | .8054T***<br>.75265***   | .02474   | 34.41   | .0000.  | -85718      | 85415      |
| LIADT   | 75263444   | .05349   | 54,82   | .0000   | .65781      | .85165     |
| TOTLANT   | .12454   | .02917   | 4.27  | .0000   | -06747      | .10101     |
|   | Disgonal element   |  |   |         |             |            |
| 101100  | 22800***   | 02458  | 4.76  | .0000   | -19175      | .28857     |
| 1,002,007.0   |  | .01383   | 1.85  | .onnn   | 103533      | .05815     |
| TOTLANE   | :01965+**  | .00406   | 4.05  | .0001   | .01013      | .02050     |
|   | .01968+**<br>Below diagonal (  | lunsers of ;   | malesiry.   | matrix. |             |            |
| 11114 (110)   |  | 01787  | -8.85   | .0000   | 11092       | 04308      |
| LTOT LML  |  | .03936   | 10.47   | .0025   | 04278       | .11168     |
|   | 05137  | 109402   | -1.47   | .0705   | +,12105     | .91281     |
|   | Dispersion pares   | ater for De-   | die dies  |         |             |            |
| Beal Parm   |  | .01273   |   |         | . 57415     | .42605     |
|   |  |  |   |         |             |            |

|          |            |           | w peroneters |
|----------|------------|-----------|--------------|
| Coverian | xiziem so  |           |              |
|          | ********** |           | TOTLAJE      |
|          | DICEN      | LISADT    | TOTLAHE      |
| LICERT   | .57855-01  |           |              |
| LIGADT   | 1847E+01   | _0100E-02 |              |
| TOTLANT  | .12162-02  | 55995-02. | 145252-02    |

Inglied standard deviations of random parameters

| <br>    |     |   | - | -   | - | - | -   |   |
|---------|-----|---|---|-----|---|---|-----|---|
| 0.02110 |     |   | 1 |     |   |   | 2   |   |
|         |     |   |   | . # |   |   |     |   |
| 21      | - 2 | d | 9 | 2   | 4 | 4 | 1   | 1 |
| 31      |     | ъ | æ | 17  | ż | в | is. | r |

Implied correlation matrix of random parameters

| Cos.Nat. | LIGHT   | THIPDL             | TOTIMIE |
|----------|---------|--------------------|---------|
|          |         | ~.79045<br>L.20500 |         |
|          | -\$1099 |                    | 1,00000 |

#### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

SIMULI-UFDEMIZED SFT Class K Bandom Coefficients Segmente Model Dependent waixable 800 Log Likelihoon Finotian -7010.00395 Hertanited log Likelihoo -15600.25401 Chi squared ( 6 n.f.) 16000.25401 Dignificance Lavel 0.0000 McFaddem Facudo Araguardi .00000 McFaddem Facudo Implied covariance matrix of random parameters Covariance matrix INTER LNAST TOTIANT INTER + 16168-01 INTER + 16168-01 INTER - 1.5608-02 INTER - 55018-02 INTER - 55018-02

Implied standard deviations of random parameters

| S.D_Beta) |   |   |   |   |   |   |   | ł |
|-----------|---|---|---|---|---|---|---|---|
|           | 7 | 1 | 1 | 1 | 5 | ī | 1 | 1 |
| 2         | i |   | i | i | 3 |   |   |   |
| 3)        | ÷ | 0 | 6 | ą | 1 | ġ | 1 | 1 |

| 8001        | Cosfficient      | Standard<br>Error | (8)        | Fron.<br> z >Z* |            | ofidende<br>ermi |
|-------------|------------------|-------------------|------------|-----------------|------------|------------------|
| 1           | Monrandom param  | state             |            | 10.00           | 1.151.251  |                  |
| Constanti   | -5.05663***      | .94800            | -10.67     | .0000           | -6,03271   | +8.T2065         |
| VCVL1       | 00080+++         | .4781D-04         | +4-40      | .0000           | -,00068    | 00017            |
| HCVCbAIL    | .,40834D-04***   | .11123D-04        |            |                 | 1140070-04 | .66761D-04       |
| VEVUTGER !! | .00237***        |                   |            | .0000           | .00124     | .00350           |
| 30778.1     | .22560D-04***    | _8029D-08         | 2.91       |                 |            |                  |
| SHFERTI     | +:08901***       | 100354            | +15.25     | .0008           | -,20045    | 01757            |
| 369/DCR     | .03268***        | 00787             | 4.18       |                 | 101728     |                  |
| HOVLINT)    | +2,42517***      | 135788            | -7.58      | .0000           | -8.08794   | -1.74901         |
| 820281      | -1.14310+++      | 101070            | +4.30      | .0000           | -1.00043   | -175056          |
| VCE)        | +127627+         | 111362            | -2.97      | _045T           | -155668    | .00475           |
|             | means for render | n parameters      |            |                 |            |                  |
| 101.811     | .85125***        | .02856            | 33,05      | .0000           |            | 193823           |
| LSADT       | .6301744#        | 06185             | 13.42      | -0000           | ,70838     | .95159           |
| TOTIANE     | .10256***        | 100270            | 3.12       |                 | ,09808     | -16628           |
|             | Disgonal slaman  | ts of Chiles      | ky maniris |                 |            |                  |
| COLUMN)     | .22161***        | 02828             | 8.05       | .0000           | 117217     | 125336           |
| CRADT       | .06095***        | .01478            | 4.14       | .0000           | 108208     | .08980           |
| TUTLANS     | .01095***        |                   | 3.79       |                 | 102343     | 03024            |
| 10000       | Selow disponel . | elements of a     | Chickesky  | MACOLE.         |            |                  |
|             |                  |                   |            |                 | 10690      | 02083            |
|             | 02417            |                   | 1.75       |                 | 06033      | .10864           |
|             | -,05862          |                   | -1.99      | .0076           | +,21665    | 01744            |
|             | Disperation pays |                   |            |                 | n          |                  |
|             | .36396***        |                   |            |                 |            | .39058           |
|             |                  |                   |            |                 |            | ,3905            |

Seplied correlation matrix of random parameters

| Cor.Met. | LITTER  | LHADT   | TOTLAH  |
|----------|---------|---------|---------|
| LILENI   | 1,00000 | 7171859 | .38377  |
| 110401   | -,78889 | 2.00000 | 46223   |
| TOTLANE  | 120317  | 06222   | 1,00000 |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restricter<br>Chi eguar<br>McFadden i<br>Estimatico<br>Inf.Cr.A20<br>Nodel est<br>Sespie is | efficients Hey<br>variable<br>three function<br>d log livelthood<br>d [ § 2.f.]<br>Freedo R-square<br>t based on N =<br>C = 0475.1 &<br>unscalt Sep 12.<br>2 pds and t<br>rinsmial repres | 51<br>+8228.06<br>4 +6878.323<br>4 200.51<br>-00<br>4 .5575-<br>4 320, K =<br>10/H = 1.0<br>2015, 13:66<br>100 Lnd video | 116<br>605<br>900<br>13<br>13<br>13<br>129<br>107 |        |           |            |
|--|---|--|---|--------|-----------|------------|
|  |   | Standern   |   | Frob.  | 958.04    | inflidence |
| 8183   | Coefficient   | Error  | ÷   | 1z1>2* |           | Lavia      |
|  | Tobo anifoli parami   | stars  |   |        |           |            |
| Constant!  | -5.76036***   | .76027   | -7.12   | .0000  | +6.72021  | -3,51816   |
| LIGADT   |   | ,08179   | 7.84  | .0000  | -48087    | .00169     |
| VEVLI  | -,00039***  | .94510-04  | -1110   |        | 00257     | 00028      |
| 29NDRT:  | -,09710***  | ,00841   |   | 10000  | 11081     | 08066      |
| 38NDCH   | .03370+++   | .01083   | 1,21  | .0018  | 101217    | ,05428     |
| MCVLINI (  | -2.74365+++   | 134955   | -7,90   | .0000  | -3.44933  | -2.07798   |
| NOOLE  | -2,07558+++   | .49894   | -2.54   | .0004  | -2.75309  | 79730      |
| RWYWDINC   | .01646***   | .00563   | 2.92  |        | 00542     | .02750     |
| HEVR.  | .810810-044   | .10840-04  | 1,91  | .0523  | 21233D-06 | 420742-04  |
| 13   | teans for random  | t parameters   |   |        |           |            |
| 13(18)   | 101070+++   | .05230   | 25.29   | .0000  | .75365    | .88008     |
| VCVFTSRAI.   | .00218+**   | .00081   | 12170   | 10049  | .05540    | .05374     |
| TOTLATET   | ,0774£  | .00113   | 1.05  | .0198  | ⇒.02275   | .11766     |
| 10000000   | liaponal element  | ts of Chales)  | ey matrix   | 10000  |           |            |
| LHLEN (  | .06030++<br>.00407+++   | .02849   | 3.33  | .0174  | .01051    | .11035     |
| VCVPTORA!  | .00407+4+   | ,00078   | 3.15  | 10000  | .00252    | .00561     |
| TOTLARE  | .10051***   | .00048   | 0.61  | .0001  | .05270    | .14033     |
|  | alre distinal .   |  |   | matris |           |            |
| IVEV LNL   | .00519+++   | .00024   | 5,52  | .0000  | .00334    | .00703     |
| ITUT LNLS  |   | .02651   |   |        | 05926     | .04356     |
| ITOT VCV:  | 03265***  |  | 12,89   | .0097  | 05794     | +,0079Z    |
|  | Dispersion para   |  |   |        |           |            |
| DoalFarm!  | .24664+++   |  | 10.51   |        | .30994    | 100004     |
|  |   |  |   |        |           | .10114     |

Implied coverience matrix of rendom peremeteds Covariance matrix LULEN VEVPIORA TOTLAME LUCLEU .5444E-02 VCVFTERA .5151E-05 .4543E-04 TOTLAHE +.4440E-08 -.1738E-09 111148-02 Implied standard deviations of random parameters S.D\_Bete ÷

| 21   |  |   | d | ė | ò | 3 | 8 | 8 | 1 |
|------|--|---|---|---|---|---|---|---|---|
| 21   |  |   | ä | ŝ | ĩ | ġ | ş | 4 | 5 |
| 3.   |  | 9 |   |   | 4 | ö | ō | ù | 1 |
| C. 1 |  |   |   |   |   |   |   |   |   |

implied correlation matrix of random parameters

|           | ******** |          |         |
|-----------|----------|----------|---------|
| Cor.Nat.  | LINLEY   | TOTPICAL | TOTLNIE |
|           |          |          |         |
| 上的工作时     | 1,00000  | .76695   | -,22610 |
| VCVPT0RA: | .78499   | 1.00000  | 17114   |
| TOTLANE   | +.22640  | 77514    | 1.00000 |

### Random parameter Negative Binomial Model of Evident Injury Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

| andem Coefficients HegEnFer Model<br>spechemen variable EV:<br>up likelinhood function -1983.68523<br>estimated backlinhood -4814.40400<br>ht spussed ( 3 4.6.) 353.08314<br>ipinficatore Laval 002000<br>dedites frequent 4 303, H = 12<br>nf.Dr.AEC = 3640.7 A2C/H = .475<br>odel estimated Sp 16, 7015. 56:17:12<br>maple is 2 pds and e160 inforvideals<br>egative kinemial represention model<br>Honrindom parameters<br>matant( -4.3281*** .6112) -4.81 .0005 -4.63748 -2.62227<br>TOTLAND - 4.32847*** .61129 -4.81 .0005 -4.63748 -2.62227<br>TOTLAND - 1.5281*** .61129 -4.81 .0005 -4.63748 -2.62227<br>TOTLAND - 1.5281*** .61129 -4.81 .0005 -4.63748 -2.62227<br>TOTLAND - 1.5281*** .61129 -4.81 .0005 -4.63748 -2.62227<br>TOTLAND5281*** .61129 -4.81 .0005 -4.63748 -2.62227<br>TOTLAND5281*** .00968 2.20 .0078 .24829 .24829<br>IMLON00394*** .0019 3.20 .014 .00300 .00482<br>IMLON00394*** .0019 3.20 .014 .00300 .00482<br>IMLON0034*** .0019 3.20 .014 .00300 .0482<br>IMLON0034*** .0019 4.48 .0000 .2412 .46224<br>IMLON0034*** .0019 2.87 .0000 -1.46224<br>IMLON00190019 1.2000000 .2412 .00507<br>IMLON00194*** .00194 .100 .0000 .24127 .04320<br>IMLON00194*** .00194 .1000 .0000 .24127 .04320<br>IMLON00194*** .00194 .1000 .0277 .04320<br>IMLON00194*** .00194 .1000 .0277 .04320<br>IMLON0100 .0070 .1000 .0311 .25097<br>IMLON0100 .0070 .1000 .0311 .25097<br>IMLON0100 .0070 .1000 .0311 .25097<br>IMLON0100 .0070 .0070 .0077<br>IMLON0100 .0070 .0070 .0077<br>IMLON .0104*** .0000 .2412 .0070 .0077<br>IMLON .0104*** .0004 .0107 .0070 .0071<br>IMLON .0104*** .0004* .0107 .0070 .0071   |   |  |   |                            | ~         |          |          |
|--|---|--|---|----------------------------|-----------|----------|----------|
| odel estimated: Sep 14, 7015, 14:12/12<br>mple 24 2 pdf son 4 146 Instructionals<br>spative Einzels requestion model<br>NUL Coefficient Estors 2 18:52* Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal<br>Internal | Dependent<br>Log likeli<br>Restricted<br>Chi aquara<br>Significat<br>NoFedden H<br>Larimation | Variable<br>hood function<br>i log likelihoot<br>of ( 3 d.f.)<br>ore level<br>result 8 s-squared<br>based on N = | E1<br>-1963,6663<br>-2141.4090<br>205.0833<br>.0000<br>1 .052505<br>4930, H = | 23<br>90<br>14<br>00<br>61 | -ŏ        |          |          |
| matanı3202**** .412337 .0000 -4.3748 -2.6227<br>OTTAINI 15120** .0990 1.37 .0077 .3423 .4452<br>TMOMAL 0035*** .0010 3.80 .0014 .00130 .0042<br>TMOMAL 0055*** .5428400 .0000 .4074 .86626<br>TMILDI -3.5216*** .5428400 .0000 .35507 -1.40296<br>INMER 05 random garameter<br>LMADT -3.51*** .0046058 .0000 .24121 .46216<br>INMER 00534*** .0046058 .0000 .2577 .04578<br>INMER 00534*** .00461 .584 .0000 .2577 .04578<br>INMER 00534*** .0054* .17 .0098 .0321 .36807<br>INMER 001201 .0070 .18 .0037 .0020 .0027<br>INMER 001201 .0070 .0070 .0000 .0000 .0000   | Nodel esti<br>Imple is<br>Impative i  | mated: Sep 14,<br>5 pds and 41<br>rinoxial regress   | 2015, 14-12rt<br>40 individual<br>mich model<br>Stangard                      | 12                         |           |          |          |
| matanı3202**** .412337 .0000 -4.3748 -2.6227<br>OTTAINI 15120** .0990 1.37 .0077 .3423 .4452<br>TMOMAL 0035*** .0010 3.80 .0014 .00130 .0042<br>TMOMAL 0055*** .5428400 .0000 .4074 .86626<br>TMILDI -3.5216*** .5428400 .0000 .35507 -1.40296<br>INMER 05 random garameter<br>LMADT -3.51*** .0046058 .0000 .24121 .46216<br>INMER 00534*** .0046058 .0000 .2577 .04578<br>INMER 00534*** .00461 .584 .0000 .2577 .04578<br>INMER 00534*** .0054* .17 .0098 .0321 .36807<br>INMER 001201 .0070 .18 .0037 .0020 .0027<br>INMER 001201 .0070 .0070 .0000 .0000 .0000   | 11  | lonrandon catana   | 1828  |                            |           |          |          |
| TOTLANT:         .15110**         .09969         1.20         .02429         .20429         .20429           TOTMSHEL         .00559***         .00109         5.20         .0014         .00130         .0014           TMEMBEL         .00538***         .04044         1.06         .0000         .4057*         .86444           TMEMBEL         .70038***         .04044         1.06         .0000         .4057*         .86444           TMEMBEL         .70038***         .04044         1.060         .4057*         .86444           TMEMBEL         .70038***         .04044         1.060         .4057*         .8647*           TMEMDEL         .4011***         .04494         4.45         .0000         .4125         .4214           TMEMDEL         .0034***         .0012         5.27         .00447*         .04247         .04247         .04247         .04247         .04247         .04247         .04247         .04343         .26897         .03311         .26897         .03311         .26897         .03311         .26897         .03214         .26897         .03247         .04374         .02697         .00247         .00247         .00247         .00247         .002491         .00241         .00241<   | in an an a  |  | 0.012.00  | -4.91                      | .0000     | +4.03748 | -2.62227 |
| CHORAGL         COULDE         COULDE <thcoulde< th=""> <thcoulde< th=""> <thcoulde< t<="" td=""><td>TOTLAMEL</td><td>.15120**</td><td>00000</td><td>1.21</td><td>10278</td><td>.01429</td><td>124822</td></thcoulde<></thcoulde<></thcoulde<>  | TOTLAMEL  | .15120**   | 00000   | 1.21                       | 10278     | .01429   | 124822   |
| LHEBN . 70030*** .04940 17.06 .0000 .40574 .86626<br>HTLBN .70030*** .04940 17.06 .0000 .40574 .86626<br>HEBRS for random parameters<br>LHADT  | C-RASEL!  | .00336***  |   | 2122                       |           | ,00130   |          |
| Ideads for random parameters         IAADT         -0445         +.45         -0000         -24125         +2116           IMDER2         -06347***         01042         -5.57         0000         -20447         -104200           IDEQUES1         -06347***         01012         -5.57         0000         -20447         -104200           IDEQUES1         -06444         -0001         7.54         0000         -25.57         00077           INADT         -05474***         00041         7.54         00001         -25.57         00375           INADT         -05474***         00441         7.54         00001         -25.57         00375           INADT         12564**         05141         7.17         0298         00311         25087           IDE         -01040         -01040         10010         10010         -00001         00277           IDE         -01020         00700         -02         0027         -02093         0027           IDE         -01000         -010000         -02093         -00293         -00293         -00293  | LHLEN   | .78095***  | .04940  | 11,96                      | .0000     | .69574   |          |
| LIAD71 .4501*** .04452 4.46 .0000 .24121 .421<br>BURGE2  | HEVELNE   | -2.52182***  | .52,524   | -4.00                      | 10000     | -3.55027 | -1.49294 |
| LIAD71 .4501*** .04452 4.46 .0000 .24121 .421<br>BURGE2  | 10.11   | leats for random   | : parameters  |                            |           |          |          |
| Disgunal elements of Cholesky matrix<br>IMADT , 06979*** , 00461 1.94 .0000 .02872 .04978<br>HHDDD1 13164** , 06144 3.17 .0498 .01811 .35687<br>[Bicon disgunal elements of Cholesky matrix<br>SMM_JMA,01001 .00760 .1.95 .013700803 .00287<br>  | Lith001   | ,43111+++  | 109452  | 1.15                       | 10008     |          | 142114   |
| BHUDRI .1354** .06144 J.17 .0298 .01811 .26997<br>[Below diagonal elements of Cholesky matrix<br>SNM LINA1102 .00760 .1.98 .012702693 .00287<br>[Dispersion parameter for Numbin discription]  | 1000282   | 06347+++   | .01082  | -5.87                      | 10000     | -100447  | 06326    |
| BHUDRI .1354** .06144 J.17 .0298 .01811 .26997<br>[Below diagonal elements of Cholesky matrix<br>SNM LINA1102 .00760 .1.98 .012702693 .00287<br>[Dispersion parameter for Numbin discription]  | )1  | lagunal alemant  | a of Cholesky   | / matrix                   | 0         |          |          |
| BHUDRI .1354** .06144 J.17 .0298 .01811 .26997<br>[Below diagonal elements of Cholesky matrix<br>SNM LINA1102 .00760 .1.98 .012702693 .00287<br>[Dispersion parameter for Numbin discription]  | LIM071  | .03478***  |   | 15.84                      | ,0000     | x02872   | 104378   |
| SEM LNA)01202 .00760 -1.95 .013702683 .00267<br>)Dispersion parameter for MedMin distribution  | INVERTI-  | 1.   | .06144  | 0.024270                   | 10298     | 2013131  | .25997   |
| Discersion paymenter for Neglin distribution   | 5.757.14  | below diagonal a   | lements of Ch   | holesky                    | matrix    |          |          |
| Dispersion parameter for SepHin distribution<br>salFarm: .5014E*** .030446 6.50 .0000 .40830 .75506  |   |  |   |                            |           |          | .00281   |
| ualpann; .seiss*** .D2046 6.53 .D200 .40330 .76306   | 11  | imperation pares   | eter for Negl   | tin dist                   | 111045108 | 11       |          |
|  | PERLERING   | 126185444  |   | 6.10                       | +0990     | .40830   | 175506   |

Teplish opvariance matrix of random parameters

|                  | 110420                | SENDET                       |
|------------------|-----------------------|------------------------------|
| LJUAOT<br>JINORT | 112078-03<br>41778-03 | .34635-03                    |
| Implied a        | tandazd derta         | stinne of rendsm perspectate |
| B.D_Bets)        |                       | 1                            |
| 1                | .034746               |                              |

Suplici correlation matrix of random parameters

| Cos | Mat. 1    |   |   | t | 11 | Ŕ | ¢ | Ť. | i.    | (STATE | (R) |
|-----|-----------|---|---|---|----|---|---|----|-------|--------|-----|
|     |           | - | - | - | +  | ÷ | - | -  | <br>- | -      | i.  |
|     | LNADT     | 1 |   | ż | à  | t | à | 0  | έ,    | 760    | it: |
|     | duribri - |   |   |   |    |   |   |    |       | 24.5.0 |     |

Random Parameter Negative Binomial Model of Serious Injury crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

| Dependent<br>Log limei<br>Dei aguer<br>Significe<br>Miffedden<br>Estimatio<br>Ist.cr.A2<br>Rodel est<br>Dample 18  | ine level<br>Freudic X-Squared   | 91<br>-495.452<br>-491.495<br>8.207<br>.042<br>.01427<br>8020, K =<br>2/N = .1<br>2018.10141<br>40 100141004              | 01<br>24<br>89<br>8<br>20<br>82  |  |  |   |
|--|--|---|--|--|--|---|
|  |  | Standard<br>Erxtr   |  | Prob.  |  | nfidence<br>erval   |
| AINJ:  | Coefficient  | 8.54.94   |  | TRUCK.   | #04/   |   |
|  | Coefficient<br>fonrandom parame  |   |  | TRUPP!   | +0-0   |   |
| Sonwtent)  | Jonzandom parame   | ters<br>1,42226   |  | .0063  | -6.67078   | +1,09559  |
| Sonatest)<br>SENDET  | Jonrandom parame<br>-3.88517***<br>*.05706*  | ters<br>1,42228<br>,02651   | -1.98  | .0589  | -4.47075   | -1.09039  |
| Sonwtent)  | Jonzandom parame   | ters<br>1,42226   | -1,98<br>2,10  | .0589  | -6.67078   | +1,09559  |
| Sonatant<br>SENDET<br>HCVHXSEL   | fonrahdom parette<br>-3.88517***<br>*.05734*<br>.09681**   | ters<br>1,42226<br>,02651<br>,00249   | -1,98<br>2,10  | 6880.<br>8880.<br>6000.  | -6.61018<br>09908<br>.00036  | -1.05559<br>.00650<br>.01066<br>.02947                    |
| SOLFLADI<br>SENDAT<br>SENDAT<br>HIVHX985<br>LNLEH<br>BCVLIN1   | foorandre parame<br>-3.85517***<br>*.05704*<br>.09581**<br>.74618***   | ters<br>1,42226<br>,02651<br>,00263<br>,00251<br>1,36611  | +1,98<br>2,10<br>7,98  | 6880.<br>8880.<br>6000.  | -4.47078<br>09928<br>.00036<br>.54292  | -1.05559<br>.00650<br>.01066<br>.02947                    |
| SONSTANT<br>SENDAT<br>SENDAT<br>UNLEN<br>BCVLINI<br>LHEDT  | Jourandum parates<br>-3.85517**<br>0.05551**<br>.05551**<br>.74618***<br>-2.73553**<br>teams for random<br>.25215*                     | ters<br>1,42226<br>,02651<br>.00263<br>.09351<br>1,56611<br>primeters<br>.14610   | -1,98<br>3,10<br>7,98<br>-2,05<br>1,95                                 | .0389<br>.0368<br>.0000<br>.0400   | -6.61018<br>*.09903<br>.00036<br>.84392<br>*3.61266<br>01425                 | -1.05559<br>.00650<br>.01066<br>.02947                    |
| SONSTANT<br>SENDAT<br>SENDAT<br>UNLEN<br>BCVLINI<br>LHEDT  | fonrandim parathe<br>-3,82517***<br>*,05704*<br>.0581**<br>.74618***<br>-2,78513**<br>feans for random                                 | ters<br>1,42226<br>,02651<br>.00263<br>.09351<br>1,56611<br>primeters<br>.14610   | -1,98<br>3,10<br>7,98<br>-2,05<br>1,95                                 | .0389<br>.0368<br>.0000<br>.0400   | -4.47078<br>*.09903<br>.00034<br>.84392<br>*3.47264<br>01425                 | -1,09559<br>,00690<br>,01066<br>,02947<br>-,12760         |
| SONATAON<br>SENIORI<br>MUVINSEL<br>LNLEN<br>RUVINSEL<br>LNLEN<br>LNLEN<br>LNLEN  | Sonrahdim parata<br>-3.85517***<br>-0.9551**<br>.74628**<br>-2.78553**<br>Ceans for random<br>.85235*<br>Stale parameters<br>.03300*** | ters<br>1,42226<br>,02651<br>.0285<br>.09351<br>1,56611<br>primeters<br>.14610<br>fbr dista.<br>.01012                    | -1,98<br>3,10<br>7,98<br>-2,05<br>1,95<br>of rando<br>3,26             | .0389<br>.0368<br>.0000<br>.0405<br>.0405<br>.0723w<br>m parame<br>.0011 | -4.47078<br>09903<br>.00096<br>.34392<br>-3.47266<br>05425<br>tars<br>.01317 | -1,09559<br>,00690<br>,01066<br>,02947<br>-,12760         |
| Sonatani<br>Senatani<br>Senati<br>Senati<br>Likiti<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV120<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201<br>SCV1201 | Jonrahdim parate<br>-3.85517***<br>.055304*<br>.0553**<br>.74618***<br>-1.78513**<br>teans for random<br>.28218*<br>Scale paratetrs    | ters<br>1,42226<br>,02651<br>,02651<br>1,56511<br>1,56511<br>parameters<br>,14610<br>for dista<br>,01012<br>miter for Neg | -1.98<br>3.10<br>7.98<br>-2.05<br>1.98<br>of rando<br>3.26<br>Bin dist | .0389<br>.0368<br>.0000<br>.0405<br>.0405<br>.0723w<br>m parame<br>.0011 | -4.47078<br>09203<br>.00038<br>.34352<br>-3.47266<br>08421<br>tars<br>.01317 | -1,09559<br>.00450<br>.01066<br>.02947<br>11760<br>.38851 |

Random Parameter Negative Binomial Model of Unknown Injury Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi aquare<br>Significer<br>Nofsduen J<br>Estimation<br>Inf.Cr.A20<br>Nodel esti<br>Semple is  | <pre>fficients Head<br/>Verianie<br/>brood function<br/>( log likelyhood<br/>en [ 1.6.f.]<br/>ins level<br/>hased on H =<br/>. = 750.9 AF<br/>mated: Sep 14,<br/>. 2 pds and 41<br/>instal representation<br/>( 1.100 and 1.</pre> | (2015)<br>-571.425<br>-576.705<br>10.848<br>.000<br>.01000<br>8220, H =<br>2/H = .0<br>2015, 10:047<br>60 Individual | 15<br>92<br>16<br>16<br>8<br>92<br>13                      |  |   |   |
|---|--|--|--|--|---|---|
|   | ************   | Standard   |  | Frob.  | 35% Confidence<br>Interval  |   |
| CHRONOMI  | Coeffloiens  | REFOR  | <b>R</b>   | 18125*   | Int   | ex.Asy  |
| CHRIGHN   | Coefficient  |  |  |  | Int   | ervel.  |
|   |  | tere   | -2.06  |  | -11.46766   | exvel   |
|   | ionrandon parama   | tere<br>2.90005  |  | .5391  | -11.46766   | 29969   |
| Constant)<br>LEADT  | Ionrandob parana   | ter#<br>3.90005<br>.02701  | 2.24   | .0391  | -11.46766   | 20960   |
| Constant)<br>LEADT  | lonzandob pazane<br>-1.00567**<br>.00000***  | tete<br>2.90005<br>.02703<br>2.91912   | 2.24   | .0091<br>.0013<br>.0461  | -11.46766<br>.05514<br>.7.35937   | 20000<br>.14102<br>04866                              |
| LINATI<br>LINATI<br>SCVLINI<br>BANDIT   | 007201000 perente<br>-5,00567**<br>.00006***<br>-9,01402**   | ters<br>2.90005<br>.03703<br>2.01912<br>.09022   | 2.24<br>-1,99<br>-2,98                                     | .0391<br>.0013<br>.0461<br>.0029                                     | -11.46766<br>.05514<br>.7.35937   | 20000<br>.14102<br>04866                              |
| Congnant)<br>LIADI<br>BOVGIMI<br>BANDIT<br>SENDCR:  | 000740000 parate<br>-5.00567**<br>.00000***<br>-9.01412**<br>11213***<br>.09014***   | ters<br>2.90005<br>.03703<br>2.01912<br>.09022<br>.02715   | 2,24<br>-1,99<br>-2,88<br>3,33                             | .0391<br>.0013<br>.0461<br>.0029                                     | -11,46766<br>(0514<br>-7,35557<br>-,10044                                       | 20000<br>.14102<br>-,04868<br>-,03003                 |
| Constant)<br>LBADI)<br>SCVLIMI<br>BARDIT<br>SENDCR)<br>(3   | Contrandos parano<br>-5,00567**<br>,00055**<br>-4,01402**<br>-,11073***<br>.09046***<br>Nens for rendos  | ter#<br>2.50005<br>.63703<br>2.01512<br>.09022<br>.02715<br>parameter#   | 1,14<br>-1,99<br>-2,98<br>3,39                             | .0391<br>.0015<br>.0461<br>.0029<br>.0009                            | -11.46766<br>(0514<br>-7,35357<br>10044<br>.00724                               | 20960<br>.14102<br>06866<br>03083<br>.14365           |
| Congrant)<br>LINATT<br>SCVLIMI<br>DANDIT<br>SENDER<br>JALEN   | 000740000 parate<br>-5.00567**<br>.00000***<br>-9.01412**<br>11213***<br>.09014***   | tets<br>2.90005<br>2.01701<br>2.01912<br>.03022<br>.02715<br>perameters<br>.11207                                    | 2,24<br>-1,99<br>-3,98<br>3,39<br>6,94                     | .5391<br>.0015<br>.0461<br>.0029<br>.0009                            | -11.46766<br>.03514<br>.7.30557<br>.10064<br>.00724<br>.49468                   | 20960<br>.14102<br>06866<br>03083<br>.14365           |
| Congrant)<br>LINATT<br>SCVLIMI<br>DANDIT<br>SENDER<br>JALEN   | Tonzandom parama<br>-b.00007**<br>.00005***<br>-t.01402**<br>11030***<br>.00044***<br>tmans for random<br>.71888***  | tets<br>2.90005<br>2.01701<br>2.01912<br>.03022<br>.02715<br>perameters<br>.11207                                    | 2.14<br><1.99<br>-3.88<br>3.33<br>6.84<br>of rands         | .5391<br>.0015<br>.0461<br>.0029<br>.0009                            | -11.46766<br>.03514<br>.7.30557<br>.10064<br>.00724<br>.49468                   | 20060<br>.14102<br>08068<br>03083<br>.14385<br>.89710 |
| Congrant<br>LNAIT<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI<br>SCVLINI | ionrandoh perama<br>-5.00507**<br>.00005***<br>-1.01412**<br>.100142**<br>.00044***<br>Imans for random<br>.71888***<br>Imale perumetera   | ters<br>2.90008<br>  | 2.14<br><1.99<br>-3.84<br>3.33<br>6.94<br>of rands<br>2.55 | .0191<br>.0011<br>.0441<br>.0020<br>.0000<br>.0000<br>.0000<br>.0000 | -11.44768<br>.03524<br>.7.8557<br>.10044<br>.05724<br>.79468<br>ctars<br>.02438 | 20960<br>.14102<br>06066<br>03083<br>.14385<br>.89710 |

## Random Parameter Negative Binomial Model of High Injury Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi squar)<br>Significes<br>Mofedden 1<br>Fatimation<br>Inf.Cr.All<br>Model est:<br>Rangle is | efficients Hegt<br>Variable<br>(hood function<br>a log likelihood<br>d [ 6 d.f.]<br>(seado f-sparet<br>(based on N =<br>C = 4102.9 Al<br>mated: Sep 14,<br>2 pos end 4<br>minutial regress | HII<br>-1175,425<br>-2499,046<br>E -2499,046<br>E 127,247<br>2000<br>- 10508<br>E 120, H =<br>-<br>2015, 15(55)<br>40 1601V100A | 94<br>27<br>00<br>98<br>14<br>27<br>84 |                 |          |                   |
|--|--|---|--|-----------------|----------|-------------------|
| нттиз  | Coefficient  | Stendard<br>Eyyoy   | 1                                      | frob.<br>igi>2* |          | nfidence<br>erval |
| 11   | Conratidom param   | 11010   |  |                 |          |                   |
| Constant)  | -1,77501+++  | .71200  | -4.22                                  | :0000           | -5.29100 | -2.26572          |
| BUVLINTI   | -2.15578448  | . 12010   | -8.26                                  | .0000           | ~9.2224Z |                   |
| TOTLANS  | 00003***   | .05446  | 8.05                                   | .0022           | .06031   | .27878            |
| VCVL)  | 00053***   | .9563D-04   | -9,20                                  | .0014           | 000eB    |                   |
| SHKDLTI  | 08511***   | .011119   | -8.09                                  | .0000           | 09003    |                   |
| Strathes (   | .03237***  | .01100  | 2.84                                   | .0045           |          | .05472            |
|  | taning For manager   | A REPORT AND A REPORT OF  |  |                 |          |                   |
| CHIERON  | .006ET+++<br>.40013+++   | 004003  | 12.14                                  | .0000           | 100014   | .96100            |
| LNADT  | -405134++  | 055547  | 4.42                                   | .0000           | .23472   |                   |
| HCHNESEL .   | -00255**   | .00105  | 2.46                                   | 11188           | .00053   |                   |
| C  | Disponal element   | ts of Cholesk   | w metris                               |                 |          |                   |
|  | .14188***  | .08717  | 5.82                                   | .0001           | .06897   | .21469            |
| 130400   | .01910***  | .50696  | 2,75                                   | .0040           | .005550  |                   |
| HC-NKSEL!  | .15919+  | 0081172   |  |                 | 00096    |                   |
|  | Selow disconsi e   |   | Noiseky:                               | metris          |          |                   |
|  |  |   |  |                 | 07891    |                   |
| LIANS THE  | 00446***   | .00133  | -0.55                                  | .0000           | 00707    | 00185             |
|  | 00178  | 80100;  | 1.12                                   | .0238           | 00037    |                   |
| THEY INK!  |  |   |  |                 |          |                   |
| ARCV SIGN  | Dispersion para  |   |  | ribution        |          |                   |

Implied covariance matrix of random parameters

| Coverienc                  |                                   |                        |           |  |
|----------------------------|-----------------------------------|------------------------|-----------|--|
|                            | LNLEW                             | LIMUT                  | SCVSOXSEL |  |
| LHLHH<br>LHANT<br>HCTNCSEL | .2011E-01<br>7283E-02<br>6027E-08 | .2003E-02<br>.2626E-03 | .21148-04 |  |

Implied standard deviations of random parameters

| ******* | +   |    | - | - | - | - | - | • |
|---------|-----|----|---|---|---|---|---|---|
| 1       | 1.1 |    | à | à | à | z | 2 | 1 |
| 1.12    | 1.  | 11 | 4 | 4 | ė | ó | ō | à |
| 1.3     | 10  |    | 4 | d | 6 | ź | ŝ | ł |

Implied convelation matrix of random parameters.

| Cor.Mat.  | THEFT   | LUADT   | REARIEST 1 |
|-----------|---------|---------|------------|
|           | 1,00000 | +,33707 | 91855      |
| LUADT     | -,98707 | 1.00000 | 91237      |
| HCYNDLAFL | +191559 |         | 1.00000    |

## Random Parameter Negative Binomial Model of Just Injury Crashes on Small-Urban-Small-Urbanized SPF Class Roadway Segments

| estyldte<br>hi squarv<br>Ugnificer<br>Dfadden H<br>stimation<br>nf.Gr.A20<br>Dodel est:<br>emple is | <pre>variable hpod Eutotion log Likelihoo d [ 3 d.f.] ts leval verid: R-square l = 5414.4 A verid: Sep 14, 2 pis and 4 incelal regres</pre> | -2793.205<br>-3892.011<br>1479.215<br>.010<br>1 .20935<br>8380, H =<br>12/H = .6<br>2015, 16:45:<br>160 individua | 36<br>92<br>92<br>00<br>34<br>14<br>75<br>39         |                                   |                           |                           |
|---|---|---|--|-----------------------------------|---------------------------|---------------------------|
| THINK   | Coefficient   | Standard<br>Error   |  | 181524                            |                           | nfidence<br>erval         |
|   | Instandon payan   |   |  |                                   |                           |                           |
| Innatanti   | -5.50239***   |   | -1.62  | .0000                             | -7.35157                  | -9.45327                  |
|   | .75335***   | .04051  |  |                                   | .87997                    |                           |
| NHMERT  | ~.02655*  | 101940  |  |                                   | -,09706                   | .00400                    |
| TOTLASE   | -18422***   | 105573  | 2,95   | -0006                             | .07498                    | 128848                    |
| VCE)  | -: 06420++  | 39576   | -2.22  | .0170                             | -1.71997                  | 10040                     |
| 1000081   | 06420**<br>-1.70262***  | .60013  | -2.00  | .0291                             | -2.12450                  |                           |
| BCVL  | 00164***  |   | -1.21  | .0005                             | 00581                     | -,00547                   |
|   | .00494***   | 00100.  | 4.88   | .0000                             | .00208                    | .00690                    |
| CURRENT!  |   | 111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   |  |                                   |                           |                           |
| C'HRAELI  | Gents for rendor  | DECADECADE:   |  |                                   |                           |                           |
| LINADE  | .53500***   | .10491  | 5.70   | -0000                             | .39065                    | .30051                    |
| LINADE  <br>1940E  <br>2040EE   | .33540***<br>07696***   | .10091<br>.01539  | 5.70   | .0000                             | .39065                    | .30051                    |
| SCHERT  | 076964++  | .01539<br>te uf Cholerk   | -5.00<br>y metrix                                    | ,0000                             | .99065<br>10712           | 04600                     |
| SCHEDEL   | 076964++  | .01539<br>te uf Cholerk   | -5.00<br>y metrix                                    | ,0000                             | .99065<br>10712           |                           |
| LIGDE   | 076964++  | .01539<br>te uf Choleek<br>.00887   | -2.00<br>y matrix<br>7.88                            | .0000                             | 10712                     |                           |
| LIGADE)<br>ITRIBUL<br>ITRIBUL   | 07696***<br>lingunal clemen<br>.00190***<br>.13264***<br>Melow diagonal :   | .01539<br>te uf Cholerk<br>.00087<br>.04452<br>diements of C  | -5.00<br>y matrix<br>1.88<br>2.95<br>holesky         | ,0000<br>,0005<br>.0029           | .10712                    | 04600                     |
| (TADAGE<br>LIGADE)<br>LIGADE)<br>LIGADEL<br>LIGADEL   | 07696***<br>lingunal clemen<br>.00190***<br>.13264***<br>Melow diagonal :   | .01539<br>te uf Cholerk<br>.00087<br>.04452<br>diements of C  | -5.00<br>y matrix<br>1.88<br>2.95<br>holesky         | ,0000<br>,0005<br>.0029           | .10712                    | 04600<br>.09808<br>.21990 |
| ISADEI<br>ISADEI<br>INNIRII<br>INNIRII<br>ISA   | 07696***<br>Nagonal clemen<br>.08190***<br>.13264***  | .01939<br>te of Cholerk<br>.00097<br>.04412<br>flements of C<br>.00712  | -5.00<br>y matrix<br>7.08<br>2.98<br>holesky<br>8.35 | .0000<br>.0029<br>metrim<br>.0007 | 10713<br>.04981<br>.04119 | 04600<br>.09808<br>.21990 |

| Implied moveriance | natrus of | sandos: | parameters |
|--------------------|-----------|---------|------------|
|--------------------|-----------|---------|------------|

| 00HA21801       | 821188 5               |           |
|-----------------|------------------------|-----------|
|                 | LIADT                  | SHIDDET   |
| LUADT<br>SEMDET | .9794E-03<br>.7948E-03 | .51212-13 |

Implied standard deviations of random parameters

S.D\_Setel 1

1) .0513941 2) .0241298

Implied posselation matrix of random parameters

| Coy.Mat.) | LMADT               | 8 | 8 | 11 | þ  | k; | i |
|-----------|---------------------|---|---|----|----|----|---|
|           | *********           | - | - | -  | -  | -  |   |
| LEADT     | 1.00000             | į | 2 | ġ  | 2  | 11 | i |
| REMORTI   | 1.00000<br>.98949 1 | i | đ | ò  | ¢. | j; |   |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Small-Urban-Small-

254 Confidence Interval

-6.83090 .74396 -.04056

-,04056 (01013 -1,68788 -,00057 ,00726 -,09368 -,00041 .02956

104048

.18024

.03653

.38757

-8,80191 .97141 -.00897 .98359 -.82034 -.00038 .00458 -.06298 -.06298

.08852

.95200

.14151

29071

.40.942

Frida.

-

Urbanized SPF Class Roadway Segments

Standard Ercor

 Destflorent
 Error
 a
 atroc

 Hoorandum parameters:
 -54.8581.\*\*
 52761
 -11.24
 0000

 --54.8581.\*\*
 52761
 -11.24
 0000

 --104470.\*\*
 50000
 -20.7
 0020

 --104470.\*\*
 00000
 -20.7
 0020

 --104480.\*\*
 00000
 -20.7
 0020

 --104480.\*\*
 00000
 -20.87
 00000

 --104040.\*\*
 .50200-04
 -52.30
 0000

 --00040.\*\*
 .50200-04
 -52.30
 0000

 --00040.\*\*
 .50200-04
 -52.30
 0000

 --00040.\*\*
 .50200-04
 -52.30
 0000

 --00040.\*\*
 .50200
 -0.88
 0000

 --00040.\*\*
 .00000
 2.42
 .00000

 -00000.\*\*
 .00000
 2.30
 .0000

 -13100\*\*\*
 .00000
 2.30
 .0000

 -10110\*\*\*
 .00000
 2.75
 .0000

 11.110\*\*\*
 .00000
 2.75
 .0000

(Below Hisquna) elements of Cholesky service ITOT LHL: .04255-\*\* .01362 8.40 .0030 (Dispersion parameter for Perglan distribution BostParm: .50329\*\*\* .01303 25.76 .0020

| Creditated or a cred  | ou recursions |
|---|---------------|
| Random Coefficients Hagin   | Reg Rodel     |
| Dependent wariable  | TOIN2         |
| log ligelibood function   | +7602.16314   |
| Restricted log likelihood   | -15615.09695  |
| CLL squares [ 3 d.f.]   |               |
| Significance level  | .00000        |
| NoFadden Faeudo R-squated   |               |
| Estimation based on D =   |               |
| inf_Cr_AIC = 15417.1 AD   |               |
| Nodel estimated: Sep 14, 2  |               |
| Sample is 2 pds and 410   |               |
| Sepacive bidomial regressi  | 00, model     |
| the factor factor for an excellent as factor and and as the factor factor for the factor of a |               |

Coefficient

10117

CODSTANT INSUI

SENDET VCFABBA NOOLEI HCVL: HCVL: SINDEL SINDER VUVL: SINDER

LULEII TOTLAJE

LILEI TOTLANE

Seplies covariance matrix of familos parameters Covatiance metrix

INTER TOTLASS

LHLES TOTSANE .48665-01 .13955-01 .41125-02

Implies standard deviations of random parameters

| 5.I | Set | a. |          |
|-----|-----|----|----------|
|     |     | 11 | .211384  |
|     |     | 21 | 10641218 |

Emplied correlation matrix of random parameters

| Cup.Mar. | LHLEN   | TOTLAR |
|----------|---------|--------|
| 1012001  | 1.00000 | .9926  |
| TOTLAHE  | 1.00000 | 3,0000 |

| Random Parameter Negative Binomial Model of Total Crash | hes on Rural-Small-Urban SPF Class |
|---|------------------------------------|
| Roadway Segments  |                                    |

| Restricted<br>Dri equard<br>Significan<br>Nofedden 1<br>Estimation<br>Inf.Ct.All<br>Nodel est:<br>Semple 19 | Variable<br>Incod function<br>1 log likelihoot<br>ad [ 6.5.5.]<br>isa level<br>freudo 3-square<br>t a level<br>freudo 3-square<br>C = 2014.2 AU<br>Incodial Sep 15.<br>2 pds and 10<br>Incodial regreat | 1 -2693.22<br>3082.28<br>(0)<br>1 (5722)<br>22002 H 1<br>2018, 25160<br>(0) Lhdlyldo | 991<br>110<br>200<br>286<br>19<br>080<br>123 |          |           |                   |
|---|---|--|--|----------|-----------|-------------------|
| TOTALACC  | Coefficient   | Standard<br>Ercor  |  | Prob.    |           | nfidenne<br>esvel |
|   | ioursudde parade  | CAVE.  |  | 1000     | 1000      |                   |
| Constant  | -0.17056***   | .80230   | -11.44                                       | .0000    | -10.75133 | -7.60430          |
| INART   | 2.32452***  | 110567   | 12.04  | 20000    | 1.11778   | 1.53100           |
| CVINEEL   | :00269*<br>-:11040***   | ,00188   | 1,97   | 0166     | 00007     | ,00633            |
| BINDLT  |   | ,05020   | -6.42  | 00000    | 55451     | 03266             |
| VENE (  | D0050***  | 10001#   | -2,00  | 20005    | -: CD004  | 00015             |
| 10  | teans for random  | . parameters   |  |          |           |                   |
| TMPSH1  | +++320***   | 104084   | 14,98  | 10000    | 129828    | 3,09242           |
| MCVR.   | -+00020***  | 181710-04  | -2,87  | .0005    | 00044     | -+00012           |
| TOTIANE   | +,18809**   | 107006   | -2.21  | 10269    | -129241   | -,01777           |
| 51  | liegonel element<br>.12821***   | te of Choles   | Ry matrix                                    |          |           |                   |
| 101201  | .11821***<br>.00048***  | ,04082   | 5.16   | 0010     | .04570    | +20763            |
| 80180   | +++800018   | .75822-04  | 8.98   | .0000    | .00530    | .00065            |
| TOTLINE:  | +040.46***  | -201605  | 4,77   | .0002    | .02901    | -09191            |
|   | Salov diagonal +  | Capacito of 1  | Cholasky:                                    |          |           |                   |
| NOV LNL :   | ,00015  | , 93030-04   | 2.90   | 10156    | 00003     | ,00055            |
| ITOT LAL  | .10726**  | ,06290   | 2.08   | .0426    | .00357    | .21096            |
| ITOT BCV  | .12717***   | .02411   | 5.25   | 20000    | .07905    | .17443            |
|   | Dispersion pares  | meter for Ne   | gBin dist                                    | ribution | 1         |                   |
| colfers)  | .00022***   | ,07688   | 8.00   | :0000    | .51354    | .82450            |
|   |   |  |  |          |           |                   |

Implied covariance matrix of random parameters

Coverience metrix INDES **RCVB** TOTLAHE 101.00 .14445-03 ,22822-08 ,70442-04 HOVE TOTLANE .1914E-04 .1375E-05 12298-01

Depiced standard deviations of random parameters

| 5.5 | Data | ł. |      |   |   |    |   |   |   |   | 1 |
|-----|------|----|------|---|---|----|---|---|---|---|---|
|     |      | +- | <br> | - | - | 4  |   | - | - |   | - |
|     |      | ε. |      |   |   | ÷  | - |   | - | × |   |
|     |      | 9  |      |   |   |    | ٠ | - | * | × |   |
|     | - 2  | 1  | 17   | ĥ | 6 |    | 7 | £ | ÷ |   | 8 |
|     |      |    |      |   |   | ۰. | ÷ | - | ~ | a |   |
|     |      |    |      |   |   |    |   |   |   |   |   |

Implied correlation matrix of random parameters

| Coriblet | LNLEN     | HILVE. | TOTLANE |
|----------|-----------|--------|---------|
|          |           |        |         |
| THIER!   | 1.00000.2 | 101008 | ,60580  |
| SCVR!    | .31389    |        | .87232  |
| TOTLASE  | .65595    | .87282 | 5,00000 |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Rural-Small-Urban SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Bastricter<br>Chi signar<br>NoFedden H<br>Estimation<br>Inf.Ct.AU<br>Hodel esti<br>Bangle is | Uncod function<br>d log likelihoo<br>ed ( | 1<br>-918.68<br>2 -0047.000<br>1000.733<br>.000<br>2102. K =<br>2102. K =<br>1015 = .0<br>.0010.1000<br>.0010.10000 | 195<br>195<br>100<br>107<br>15<br>185 |                 |                              |                                | Divertance matrix<br>INLER NOVE TOTLASE<br>SOLUTION SOLUTION OF A SOLUTION<br>NOVE SOLUTION OF A SOLUTION OF A SOLUTION<br>TOTLARE SAMADASI Gevicilate of annous parameters<br>S.C. Secs 1 1 |  |
|---|---|---|---------------------------------------|-----------------|------------------------------|--------------------------------|--|--|
| PEO   | Coefficient                               | Standard<br>Error   | 4                                     | Frob.<br>12122* | 95% Co<br>200                | nfidence<br>ervel              | 1.1 .174484<br>21 .4653502-03<br>31 .100237  |  |
|   | Ronrandom parab-                          |   |                                       |                 |                              | ***********                    | 3  |  |
| LNADCI<br>SINGCT  | -9.09155+**<br>1.24294***<br>11072***     | .97109<br>.10907<br>.02000  | -9.38<br>9.59<br>-5.30                | 0000<br>0000    | +10.00000<br>.98890<br>15164 | -7,10000<br>1,49600<br>-,96870 | implied correlation matrix of random parameters  |  |
| LULEN   | leans for candor                          | 07122   | 19.00                                 | .0000           | ,78608                       | 1.06526                        |  |  |
| 90778   | 00021+++                                  | .8485D-04   | -2.85                                 | -0086           | 00041                        | 00009                          | Coz.Mat.   LHLEN HCVR TOTLAN   |  |
| TOTLAHE   | 00521++                                   | -9744D-04   | -2.55                                 | 10107           | 00064                        | 00008                          |  |  |
| 10  | Disgonal element                          | he of Cholesk   | ty matzis                             | E               |                              |                                | LNLEN: 1.00000 .29063 .75122   |  |
| 13(1.57)  | .17850***                                 | 104919  | 3.55                                  | .0006           | 17000                        | -27090                         | BCVB1 .26063 1.00000 .77079  |  |
| SCVR.   | .00047+**                                 | .8114D-D4   | 3,78                                  | .0000           | .00031                       | .00063                         | TOTIANE: .75122 .77079 1.00000   |  |
| TOTLAME   | ,05166***                                 | .01796  | 2.88                                  | -0040           | 101646                       | 一位于希尔尔                         |  |  |
|   | Below disgonal                            |   |                                       |                 |                              |                                |  |  |
| THEA THE  | .10012                                    | .04010  |                                       |                 | 00005                        | .00032                         |  |  |
| THT TOLE  | .14191+4                                  | 0,00075   | 2.25                                  | 0290            | 01797                        | -26755                         |  |  |
|   | -11445***                                 | 1024年63   | 8.47                                  | .0000           | 104187                       | -5,4702                        |  |  |
| 1101_807)   |   |   |                                       |                 |                              |                                |  |  |
|   | Dispersion para<br>                       | .07410  | 7.54                                  | .0000           | \$2832                       | .72255                         |  |  |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Rural-Small-Urban SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restricted<br>Chi squar<br>Significae<br>Nofedden I<br>Estimation<br>Inf.Cr.A20<br>Nofel esti<br>Nofel esti | <pre>ffloinnts Hegt<br/>wariable<br/>isood function<br/>d log likelthood<br/>af [ f.d.f.]<br/>for level<br/>Found S-squared<br/>n based on 3 =<br/>C = 571.7 AJ<br/>instead: Sep 15,<br/>3 pde shot 11<br/>ninumial regress</pre> | FT<br>-473,840<br>-448,460<br>307,439<br>.000<br>1 ,27528<br>2202, X =<br>2202, X =<br>2018, 147217<br>0 LINUVIDUS | 43<br>97<br>15<br>45<br>41<br>28 |                 |          |                   |
|--|---|--|----------------------------------|-----------------|----------|-------------------|
| 8283   | Coefficient   | Standard<br>Error  | 2                                | From.<br> x:>2* |          | efidence<br>erval |
| 3  | Sungarifich parami  | tare   |                                  |                 |          |                   |
| Constant   | -12.4490***   | 1.46110  | -8.48                            | .0000           | -15,3270 | -015711           |
| 101-111  | . STORIGANA   | .05270   | 10.51                            | .0000           | 70544    | 1.03201           |
| SHUDLT   | 13916+**  | .02004   | -4.61                            | 10000           | ►.15411  | 07419             |
| OVIDERE  | .00296*   | .00200   | 1.87                             | .0523           | 00004    | .00784            |
| VEVLINI  | -,13916***<br>.00298*<br>-3.82600**   | 1,04535  | -2.07                            | 10381           | -7.44229 | 20911             |
|  |   |  |                                  |                 |          |                   |
| LHADT  | 1+81+41***  | 117819   | 8,68                             | +0000           | 1.17107  | 11,88214          |
| 0.020.002  | +.000.12***   | 4.000.000.00   | 121.08                           | 144918-0        |          | 1.1.4.309.0009    |
| TOTLAGE  | +,103655++  | ,00178   | -2.00                            | + 0454          | +.56304  | 00376             |
|  | brannel element   | s of Chilesa   | V MATEL                          |                 |          |                   |
| LHADT  | .05005*<br>.00032***  | ,02822   | 1.97                             | .0560           | P.00523  | .10538            |
| HOVE   | ;00092***   | .00011   | 2.99                             | .0028           | .00011   | .00084            |
| TOTLAKE  | .05432+++   | .02068   | 2.62                             | 10006           | 1011178  | .59485            |
|  | slow distonal a   | laments of C   | belenky                          | matris.         |          |                   |
| LHCV LHAS  | 100020  | .00013   | 1.01                             | .0478           | 0,00004  | .00045            |
| ATOT LINA)   | 122444  | .00543   | 31.94                            | 10456           |          | .29207            |
| TOT BCV  | .16321***   |  | 6.22                             | ,0000           | .07670   | .10972            |
| 15   | Dispersion paras  | meter for Heg  | Sin dist                         | ribution        |          |                   |
| (alfarm)   | 1,02058***  | ,26829   | 5.88                             | ,0001           | -50041   | 1.84034           |
|  |   |  |                                  |                 |          |                   |

Implied covariance matrix of random parameters

|                           | CIGOT                               | BCAR                   | TOTLAHE        |
|---------------------------|-------------------------------------|------------------------|----------------|
| LINADE<br>BOVN<br>TOTLANE | .19092-02<br>.10142-04<br>.42925-02 | 114648-54<br>.71708-04 | -30862-01      |
| Implied of                |                                     | etions of re-          | dom parameters |
| J.D Betal                 |                                     | 1                      |                |

|    |     |     | - |   | - | -  | - | -  |   |
|----|-----|-----|---|---|---|----|---|----|---|
| -  |     | . 1 |   | 5 |   |    |   |    | 1 |
| 11 | 1.1 | 42  | ĥ | 1 | ŝ | 8  | H | ţ, | ł |
| 31 |     |     |   | 1 | 9 | 'n | 3 | 5  | 4 |

Deplied correlation matrix of random parameters

| Cot.Mat. | 110.77  | 10745    | TOTLAS   |
|----------|---------|----------|----------|
| +        |         | +        |          |
| LNADCI   | 1,00000 | . \$2023 | . 600.63 |
| 20778.1  | 153023  | 5.00000  | . 94982  |
| TOTLASE  | 160082  | -194962  | 1,00000  |
|          |         |          |          |

| Random Parameter Negative Binomial Model of Evident Injury Crashes on Rural-Small-Urban |  |
|---|--|
| SPF class Roadway Segments  |  |

|  | effluieurs NegR   |   | *******  | *******   |  |  | implied covariance matrix of random parameters    |
|--|---|---|--|---|--|--|---|
| Depandant  |   |   | 1/2  |   |  |  | Covariance matrix                                 |
|  | thood function  |   |  |   |  |  |   |
|  | d log libelihood  |   |  |   |  |  | LIBROT COTLANE                                    |
|  | ed ( 3 d.f.)  | 32.222  |  |   |  |  |   |
|  | the level   | .000  |  |   |  |  | 18ADT .5556E-02                                   |
| HuFadden 4   | Paeutto R-aquarett  | .04893  | 43   |   |  |  | TOTLANE .2292E+01 .1012                           |
| Estimation   | n based on H =  | 2202, # =   |  |   |  |  |   |
| Inf. Cr.AIC  | C =   | C/H = 12  | 0.01   |   |  |  | Inglied standard deviations of random parameters  |
|  | smared: Sep 13,   |   |  |   |  |  |   |
|  | 2 pds and 11  |   | 18   |   |  |  | S.D_Beta: 1                                       |
|  | binomial represe  |   |  |   |  |  |   |
|  |   | Standard  |  | Prob.   |  | nflöence   | 11 .0730165                                       |
| EVE  | Coefficient   | Error   | - 27   | 101224  |  | mridence   | 41 1244324  |
|  |   |   |  | 18144   |  | .82.78+  |   |
|  |   |   |  |   |  |  |   |
|  | NULLEAD GOD DULLADS   | C#2#  |  |   |  |  | Inplied correlation matrix of random payameters   |
| Cimatant1  | Ronrandom parame  | 2.90849   | -4.28  | .0000   | -21.99637  | -4.36108   | Inglied correlation matrix of racdom payameters   |
|  |   |   |  | .0000   | -21-89637  | -4.36108   | Indited onligition matrix of iscome barameters    |
| Cutotaut1  | -8.11779***   | 2.90849   | 6.16   |   |  |  |   |
| Constant)<br>LUCEU<br>SHUCET   | -8.11773***<br>.75083***<br>07895<br>Heats for candim   | 2.90848<br>.10944<br>.03009<br>peramaters   | 6.06<br>-1.06  | .0000   | .83433<br>17814                                      | .96831<br>.02018   | Cox.Net.1 LHADT TOTLAH                            |
| CIMPTOLI<br>LINERI<br>SINGLT<br>LINET  | -8.11773***<br>.75082***<br>07595<br>Beans for cendum<br>.86811***  | 1.90849<br>.10944<br>.03000<br>pacamatain<br>.24107   | 6.06<br>-1.96<br>9.01  | .0000<br>.0185  | .83433<br>17814<br>-49589                            | .96531<br>.02018<br>1.45568                              | Cor.Her.; ERADT TOTLAHE                           |
| CUNSTANT<br>LUNCEN<br>SHUGLT<br>LUNCT<br>TOTLAND                             | -8.11773***<br>.75082***<br>07595<br>Heats for candom<br>.86811***<br>68811***  | 2.90849<br>.10944<br>.03000<br>perameters<br>.24107<br>.00748   | 6.96<br>-1.98<br>-2.88   | .0000<br>.0185<br>.0001<br>.0046                                      | .83433<br>17814                                      | .96831<br>.02018   | Cog Marty EBADT TOTLAME<br>LARATY 1.00000 (\$6001 |
| CUNSTATI)<br>LUCER<br>SHUCT<br>LUADT<br>TOTLAIG                              | -8.12773***<br>.75062***<br>07595<br>Baats Soc randum<br>.86818***<br>58814***<br>Disgoral element.                                 | 1.90848<br>.10944<br>.03009<br>.9474844<br>.24107<br>.24107<br>.00748<br># of Cholesk                                       | 6.06<br>-1.06<br>4.01<br>-2.00<br>V matcia                                     | .0000<br>.0185<br>.0001<br>.0046                                      | .83633<br>17814<br>.49569<br>99474                   | .96831<br>.02018<br>1.49968<br>10154                     | Cox.Her.; ENADT TOTLAHE                           |
| CIMPTANI<br>LINOLT<br>I<br>LINOT<br>TOTLAIG<br>LINAT                         | -2.11773***<br>.75063***<br>07505<br>Nears Bot candim<br>.86812***<br>58814***<br>Disporal element.<br>.073054                      | 2.90848<br>.10944<br>.03009<br>pacamaters<br>.24107<br>.00741<br>s of Chilese<br>.03793                                     | 6.06<br>-1.96<br>4.01<br>-2.04<br>V matcia<br>1.95                             | .0000<br>.0195<br>.0001<br>.0046                                      | .83633<br>17814<br>.45589<br>99474<br>00150          | .96831<br>.02018<br>1.43968<br>18184<br>.14733           | Cog Marty EBADT TOTLAME<br>LARATY 1.00000 (\$6001 |
| CIMPTANII<br>CICRII<br>ZHVCLT<br>I<br>LINOT<br>TOTLAIG<br>TOTLAIG<br>TOTLAIG | -8.11773***<br>.75082***<br>.07508<br>Bans Box candum<br>.86018***<br>58814***<br>Disporal element.<br>.07305*<br>.06851*           | 2.90448<br>.10944<br>.03009<br>perameters<br>.24107<br>.00748<br>s of Chilask<br>.03793<br>.03448                           | 6.06<br>-1.96<br>4.01<br>-2.04<br>V matrim<br>1.95<br>1.97                     | .0000<br>.0185<br>.0001<br>.0046<br>.0541<br>.0477                    | .83633<br>17814<br>.49569<br>99474                   | .96831<br>.02018<br>1.49968<br>10154                     | Cor.Mat.; LBADT TOTLAHE<br>LHADT 1.00000 .8001    |
| CINETANI<br>LINATI<br>LINATI<br>TOTLAIG<br>TOTLAIG<br>(1                     | -2.12773***<br>-5062***<br>-07105<br>Bants Soc candim<br>-50621***<br>-50814***<br>Diagonal element.<br>.07305*<br>Delow diagonal # | 1.90848<br>.10948<br>.03009<br>.940888418<br>.24107<br>.20748<br>s of Chilase<br>.03792<br>.03488<br>lapents of C           | 6.06<br>-1.06<br>4.01<br>-2.04<br>ty matrix<br>1.95<br>1.97<br>Nolesky         | .0000<br>.0185<br>.0001<br>.0046<br>.0541<br>.0497                    | .83633<br>17814<br>99474<br>00150<br>00654           | .96830<br>.02018<br>1.45568<br>15154<br>.14739<br>.18341 | Cog Marty EBADT TOTLAME<br>LARATY 1.00000 (\$6001 |
| CIMPTANI<br>LINAT<br>TOTLANE<br>TOTLANE<br>IITOT_LINA                        | -2.11779***<br>.20162<br>-07105<br>Bans Box tendem<br>.20014***<br>.010054<br>.00551*<br>Below diagonal #<br>.20024**               | 1.90848<br>.10944<br>.03009<br>.940888888<br>.34107<br>.00748<br>s of Cholask<br>.03793<br>.03448<br>lanents of C<br>.12412 | 6.06<br>-1.08<br>4.01<br>-2.04<br>ty matrix<br>1.95<br>1.97<br>Dilesky<br>2.66 | .0000<br>.0185<br>.0001<br>.0046<br>.0044<br>.0497<br>matrix<br>.0138 | .83633<br>17814<br>99474<br>00150<br>006150<br>00615 | .96831<br>.02018<br>1.43968<br>18184<br>.14733           | Cor.Mat.; LBADT TOTLAHE<br>LHADT 1.00000 .8001    |
| CIMPTANI<br>LINAT<br>TOTLANE<br>TOTLANE<br>IITOT_LINA                        | -2.12773***<br>-5062***<br>-07105<br>Bants Soc candim<br>-50621***<br>-50814***<br>Diagonal element.<br>.07305*<br>Delow diagonal # | 1.90848<br>.10944<br>.03009<br>.940888888<br>.34107<br>.00748<br>s of Cholask<br>.03793<br>.03448<br>lanents of C<br>.12412 | 6.06<br>-1.08<br>4.01<br>-2.04<br>ty matrix<br>1.95<br>1.97<br>Dilesky<br>2.66 | .0000<br>.0185<br>.0001<br>.0046<br>.0044<br>.0497<br>matrix<br>.0138 | .83633<br>17814<br>99474<br>00150<br>006150<br>00615 | .96830<br>.02018<br>1.45568<br>15154<br>.14739<br>.18341 | Cog Marty EBADT TOTLAME<br>LARATY 1.00000 (\$6001 |

## Random Parameter Negative Binomial Model of Serious Injury Crashes on Rural-Small-Urban SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi eguery<br>Significer<br>Nofedden I<br>fstimation<br>Inf.Cr.AD<br>Nodel est<br>Sample is | efficients HegB<br>variable<br>thood function<br>& log likelihood<br>ed [ 1 d.f.]<br>toe level<br>product R-squared<br>t based on H =<br>2 = 170.7 År<br>imateau dep 15,<br>2 pds and 11 | 25<br>-01.001<br>-03.007<br>007<br>007<br>007<br>2202, K =<br>0/W = .11<br>2015, 15:08:<br>01 individua | 13<br>94<br>94<br>19<br>8<br>19<br>18<br>18        |   |  |                                     |
|--|--|---|--|---|--|-------------------------------------|
| Repative b   | binchisl repress   | son sodel   |  |   | -11.521  | 17/11227                            |
|  |  | Dismilard   |  | People  | 124 000  | science                             |
| AING:  | Coefficient  | Diwidarii<br>Errer  |  | Prob.<br>(#1>2*   | 85% Co<br>Int  | nfidecce<br>erval                   |
| 8183   | SOLTADORE CATADA   | Ereer   |  | (a)>2+  | Int  | erval                               |
| SINC)  | fonrandom parame<br>-20.7749***  | Eroor<br>1428<br>4.11254  | -2.62  | (±1>2+  | -10.8354   | erval<br>-2.714                     |
| SINJ<br>Instant<br>LNAT  | Sonrandom parame<br>-10.7749***<br>1.15459**   | Ercor<br>1006<br>4.11358<br>.49603  | -1.62  | 121>2+<br>.0005   | -10.0354<br>-17047   | -2.714<br>4.1307                    |
| SINJ<br>Instant<br>LNAT  | Sonrandom parame<br>-10.7749***<br>1.15459**   | Ercor<br>1000<br>4.11358<br>.49603  | -1.62  | 121>2+<br>.0005   | -10.0354<br>-17047   | -2.714<br>4.1307                    |
| SING<br>SING<br>LINADT<br>LINADT<br>LINADT   | funrandum parame<br>-20.7749***<br>1.15959**<br>.00029***  | Erter<br>1000<br>4.113354<br>.49003<br>.26709   | -2.62<br>2.32<br>1.65                              | 121>2+<br>.0005   | -10.0354<br>-17047   | -2.714<br>4.1307                    |
| SING<br>SING<br>Innetent<br>LNADT<br>LNADT<br>LNLEN  | Sonrandom parame<br>-10.7749***<br>1.15459**   | Erter<br>4.11354<br>.49503<br>.28789<br>.parameters   | -1.62<br>1.32<br>1.65                              | +24 2 <br>#800.<br>#800.  | 1n5<br>-18.8354<br>.17847<br>.46312                          | -2.714<br>3.1307<br>1.6155          |
| SING<br>SING<br>Instant<br>LNADT<br>LNLEN<br>DILEN<br>TOTLANE  | iniandos parame<br>-20.7749***<br>1.15450**<br>.05624***<br>leans for randos<br>54162*   | Ercer<br>4.1135e<br>4.9503<br>(28759<br>) parameters<br>(20097  | -2.62<br>1.32<br>1.65<br>-1.96                     | +24 12 <br>8000<br>9000<br>2000                                 | 1n5<br>-18.8359<br>.17947<br>.46319<br>-1.12907              | -2.714<br>3.1307<br>1.6155          |
| SING<br>SING<br>INATT<br>LUADT<br>LUADT<br>DILEN<br>S<br>TOTLANE   | Intendie perme<br>-10.7749***<br>1.15459**<br>.9563***<br>isane for randou<br>56162*<br>Icale permeters  | Ercor<br>4.11354<br>49503<br>.28709<br>parameters<br>.20097<br>for dists.                               | -2.62<br>1.32<br>1.65<br>-1.96<br>of sands         | +24(12)<br>+24(0)<br>+0204<br>+0202<br>+0203<br>+0203<br>=04088 | 105.0354<br>-10.0354<br>.17947<br>.40319<br>-1.12007<br>tecs | -2.714<br>3.1307<br>1.6133<br>.0008 |
| I SING<br>SING<br>LIADT<br>LIADT<br>LIADT<br>IJLEN<br>TOTLASE<br>TOTLASE   | iniandos parame<br>-20.7749***<br>1.15450**<br>.05624***<br>leans for randos<br>54162*   | Error<br>0498<br>4.11334<br>.49603<br>.28709<br>parametess<br>.2007<br>for dista.<br>.09120             | -2.62<br>2.32<br>2.65<br>-1.96<br>of sando<br>1.94 | .0005<br>.0004<br>.0004<br>.0005<br>.0503<br>.0503<br>.0527     | -18.8354<br>.17847<br>.40918<br>-1.12007<br>tecs<br>00206    | -2.714<br>3.1307<br>1.6133<br>.0008 |

## Random Parameter Negative Binomial Model of High Injury Crashes on Rural-Small-Urban SPF Class Roadway Segments

| Handlin Coe<br>Depaident               | ffiolents NegB<br>Variable<br>Nood finition   | iBeg Nodel<br>NII                         | 162                       |                       |                               |                            | Inglied coveriance matrix of rendem parameters<br>Coveriance matrix   |
|--|---|---|---------------------------|-----------------------|-------------------------------|----------------------------|---|
| Bestrinter                             | i log likelihood  | -311.042                                  |                           |                       |                               |                            | LMADT TOTLAME   |
| Bignificer<br>McFaddet 1<br>Estimation | Aseudo R-squared<br>based on N =  | .000<br>.06727<br>2202, X -               | 00<br>11<br>8             |                       |                               |                            | 10ADT .3690E-03<br>TOTLAHE .1429E-01 .0722E-01  |
| Nodel esti<br>Sample is<br>Negative 1  | <pre>C = 000,7 AD<br/>MATES: deg 14. 1<br/>2 pds and 111<br/>Minomial regress</pre> | 1018. 16:01)<br>01 Individua<br>105 model | 26<br>Le                  | 3180011               |                               |                            | Implied statidard deviations of random parameters<br>3.0_Setai 1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 |
| HITH7                                  | Coefficient   | Standard<br>Error                         |                           | Fx:00.<br>1 = 1 > Z.* | 0.64 Con<br>Inco              | nfidense<br>ervel          | 2 (284244)<br>2 (284244)  |
| 11                                     | fonzasdon paramet   |   | 1000                      |                       |                               |                            | implied socrelation watnix of random parameters   |
| Constant  <br>VCVFTGRB                 |   | .00267                                    | -4.73<br>-12.55<br>-12.66 | .0209                 | -15,4002<br>01099<br>-25,9671 | -9.7525<br>00090<br>2.6514 |   |
|  | leans for random  |   |                           |                       |                               |                            | CHIF, HEG.   LNADT TOTLASE  |
| TOTLARE                                | 1.00795***<br>+.39707***<br>Diagonal elements                                       |   | 2,80                      |                       | 67966                         | 1.44024<br>11948           | LUNADT  1.00000 .40765<br>TOTLANT  .80765 1.00000   |
| LOGDT<br>TOTLASE                       | .06015**  | .09356                                    |                           | 10117                 | .02424                        | .13560                     |   |
| ITOT LSA                               | elou diegonal el  | Lesenta of 0<br>100548                    |                           | .0078                 | .06190                        | 40174                      |   |
|  | Supersich param   | star for Heg                              | Din dist                  | ribution              |                               |                            |   |
|  |   |   |                           |                       |                               |                            |   |

## Random Parameter Negative Binomial Model of Just Injury Crashes on Rural-Small-Urban SPF class Roadway Segments

| Dependent<br>Log livel:<br>Restricte<br>Di spist<br>Significe<br>HoTedien i<br>Estimatic<br>Inf.Cr.A2<br>Bogel est<br>Dample is | efficients HegB<br>variable<br>Accord function<br>d log likelihood<br>d [ 3 d.f.]<br>Feedo R-squares<br>t based on S =<br>T = 0.5.5 Al<br>Lanted: Heg 15,<br>3 pde and 15,<br>3 pde and 15, | 20011<br>-291.956<br>-253.406<br>120.697<br>.000<br>.16065<br>1202, R =<br>C/N = .2<br>2018, 10(21)<br>01 individua<br>107 model | 89<br>93<br>70<br>91<br>10<br>85<br>28<br>18         |                                   |                                    |                           |
|---|---|--|--|-----------------------------------|------------------------------------|---------------------------|
|   |   | Standard<br>Error  |  |                                   | Inte                               |                           |
|   |   |  |  | *****                             | ********                           | ********                  |
|   | foissandom parame   |  |  |                                   |                                    |                           |
| Constants   | -10,7550+++   | 2,73042  | -0.00  | .0000                             | -14,2055                           | -7-2302                   |
| KINYWODEC I   | .00540**<br>.84666***   | 121944   | (二)夏天清景。   | 10014                             | -20299                             | ,04398                    |
| THEFT   | · \$ 66666***   | .10##D   | 2,27   | +00.00                            | -66125                             | 2.97207                   |
|   | .62990**  | 127820 (   | 2228   | + 6217                            |                                    | 16136753                  |
| SLACE L   |   |  |  |                                   |                                    |                           |
| SLACE L   | teans for rannos  | parameters   |  |                                   |                                    |                           |
| LHADT:  | teans tos sension<br>5.03544***   | parameters,<br>20862   | 4.97   | ,0000                             | -62611                             | 1.44414                   |
| LHANT:<br>TOTLANE   | +.00070++   | 100242   | -3.21  |                                   | ~101088                            | +.00088                   |
| LHANT:<br>TOTLANE   | +.00070++   | 100242   | -3.21  |                                   | ~101088                            | +.00088                   |
| LHANT:<br>TOTLANE   | +.00070++   | 100242   | -3.21  |                                   | ~101088                            | +.00088                   |
| LHARL)<br>LHART:<br>TOTLAHE<br>LHART:<br>TOTLAHE<br>TOTLAHE   | 00178**<br>Disgonal sistent<br>.13256***<br>.03756*   | :00262<br># of Choles%<br>:09260<br>:01244   | -3.21<br>y manerix<br>9.22<br>1.97                   | .0272                             | 01008<br>.07119<br>00602           | +.00088                   |
| LHARL)<br>LHART:<br>TOTLAHE<br>LHART:<br>TOTLAHE<br>TOTLAHE   | 00178**<br>Disgonal sistent<br>.13256***<br>.03756*   | :00262<br># of Choles%<br>:09260<br>:01244   | -3.21<br>y manerix<br>9.22<br>1.97                   | .0272                             | 01008<br>.07119<br>00602           | 00088                     |
| LHARL)<br>LHART:<br>TOTLAHE<br>LHART:<br>TOTLAHE<br>TOTLAHE   | 00178**<br>Disgonal sistent<br>.13256***<br>.03756*   | :00262<br># of Choles%<br>:09260<br>:01244   | -3.21<br>y manerix<br>9.22<br>1.97                   | .0272                             | 01008<br>.07119<br>00602           | 00088                     |
| UARL<br>URAN<br>TOTLANE<br>TOTLANE<br>URAN<br>TOTLANE<br>ST<br>TOTLANE  | 00578**<br>Disgonal slement<br>.13250***  | 100142<br># of Cholesk<br>.09180<br>.09144<br>Lesents of G<br>.00404   | -3.21<br>y manris<br>1,22<br>1,97<br>holesky<br>4.66 | .0272<br>.0760<br>natrix<br>.0000 | 01000<br>.07119<br>00600<br>.22633 | 00068<br>.19987<br>.12113 |

| lovaziapos       | BATILS                 |                           |
|------------------|------------------------|---------------------------|
|                  | INADI                  | TOTLANE                   |
| INADT<br>TOTLAME | +1767E-01<br>-5206E-01 | .1567                     |
| implied at       | andard devie           | tions of pandom parameter |
| .D_Deta)         |                        |                           |
| 21<br>21         | .19290                 | P                         |

| 1018 | MAT.      |   | Ĺ | N | 4 | þ | Ť. | ð | 5 | ò | τ | t | 2 | B | ł |
|------|-----------|---|---|---|---|---|----|---|---|---|---|---|---|---|---|
|      |           | - | - | - | ÷ | - |    | - |   | - | ÷ | - | - | - |   |
|      | LHART   1 | ÷ | b | ģ | ø | ò | ġ. |   |   |   | 9 | ė | è | a | 0 |
| TO   | TLAILET   | 0 | 6 | ė | à | 2 | τ. |   | 1 | 2 | b | D | a | Ó | I |

## Random Parameter Negative Binomial Model of Low Injury Crashes on Rural-Small-Urban SPF Class Roadway Segments

| Austricter<br>Chi squari<br>Significer<br>NoTedden W<br>Estimation<br>Inf.Cr.AI<br>Nodel esti<br>Iangle is | Unood function<br>d log likwlihood<br>ed ( - 0 d.f.)                       | 2017.62<br>.000<br>1 .52104<br>2202, H =<br>10/8 = .1<br>2018, 14448<br>01 indemides | 48<br>10<br>00<br>98<br>12<br>20                   |  |  |  | LHKOT<br>AHNOLT - | 110,00<br>(26122-03<br>(65132-03<br>mdard devis | SEMDLY<br>.1017E-01<br>stime of random paramet<br>1 |    |
|--|--|--|--|--|--|--|-------------------|---|---|----|
| LOINT  | Coefficient  | Itandard<br>Error  | 4  | Frob.<br>12122*                                    | 95% Confidence<br>Intervel                                       |  | 21                | .053030   |   |    |
|  | Ronrandom parate   |  |  |  |  |  | Implied ons       | relation ma                                     | strix of random paramete                            | 28 |
| Constanti<br>TOTLANE:<br>LNLEW:<br>HCVID(3L1)<br>SCVN:<br>VCN:   | -3.94824+**<br>16403**<br>.98215***<br>-11.0187***<br>.00017***<br>65023** | .97010<br>.01671<br>.06839<br>5.53346<br>.8177D-06<br>.20964                         | -10.25<br>-2.01<br>19.40<br>-5.11<br>5.58<br>-2.08 | 0000.<br>7490.<br>0000.<br>0000.<br>0000.<br>1000. | -11.84972<br>-,80458<br>.79610<br>-17.8520<br>.00008<br>-1.14655 | -0.06676<br>00568<br>1.06620<br>-4.0815<br>.00025<br>05393 | Cor.Mat.          | LULAT SP  | TIIW  |    |
|  | leans for ranking  |  |  |  |  |  |                   | .91112 1.0                                      |   |    |
| LHADT)<br>SIBISCT)   | 1.96693***   | -12402   | 10.00  | 0000   | 1.11894  | 1.61400  |                   |   |   |    |
| TIMAT  | 06303***<br>.05356***  | .00739<br>.01589   | 7.18   | .0000  | 03655  | .06781   |                   |   |   |    |
|  | Selow disgonal 4   |  |  |  |  |  |                   |   |   |    |
|  | 12282+**   | 02/006   |  | 10000  | 15214  | ~,00242  |                   |   |   |    |
| 152N 154   | Dispersion parks   |  |  |  |  |  |                   |   |   |    |

## Random Parameter Negative Binomial Model of Total Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

| Restricts<br>Chi squar<br>Signifide<br>McFadden<br>Estimatio<br>Inf.Cc.A3 | <pre>ibood function d log likelihoo red { 6 d.f.] moe level Faculo R-square in based on H = C = IITO.5 A</pre> | d -1106.010<br>333.543<br>.000<br>d .19410<br>3020, K =<br>2020, K = | 162<br>260<br>200<br>200<br>218<br>18 |                         |                                  |                           | LMADT TOTLAME SEMECT<br>LMADT   |
|---|--|--|---------------------------------------|-------------------------|----------------------------------|---------------------------|---|
| Sample is<br>Regative   | imated: Hep 14,<br>2 pds and 3<br>binomial cagres  | 510 individue<br>sion model  | 47.8                                  |                         |                                  |                           | Implies standard deviations of random parameters 3.0_Data) 1                      |
|   | Confficient  | Standard<br>Errus  | *                                     | Fp.ok.<br>(±)>Z*        | Int                              | 4ITV67                    | 11 0783947<br>21 0429605<br>21 0629605  |
|   | Wonrandon param  |  |                                       |                         |                                  |                           | 11 142114613  |
| Constant  <br>LNCEN  <br>BCVB   | -7.84202***<br>.84354***<br>75276D-04***   | .92621<br>.06099<br>.27000-04  | 16.55                                 | ,0000<br>,0000<br>,0005 | -9.65736<br>.74405<br>.13079D-03 | .94887<br>21764D-04       | Implied correlation satrix of random parameters                                   |
| DEGI I<br>SHPOCKI<br>VEVLIMI  |  | 111129   |                                       | ,0005<br>,0088<br>,0088 | -2.74921                         | 01856<br>01856            | Gor.Mat., 1 DOLT FOTLAS SHADLT  |
|   | Maans for randh  |  |                                       |                         |                                  |                           |   |
| TOTLARE   | 1.00718***<br>-/14884**<br>-1.14362***   | .06389   | 9,45<br>-2,50<br>-2,68                | ,0218                   | .79897<br>27208<br>-1.98294      | 1.21535<br>02165<br>30890 | LDADT 1.0000005205 .93310<br>TOTLAME:05208 1.00000 .10018<br>SHMULT .00000 .10010 |
|   | Disgonal element   |  |                                       |                         |                                  |                           |   |
|   |  | .03576   | 8,44<br>3,95                          | ,0424                   | 03173<br>00818                   | .13198                    |   |
| TOTLASE   |  | ,00828   |                                       | 10002                   | 103244                           | .0335#                    |   |
| TOTLASE<br>SHVDLT   |  |  |                                       | and the second state    |                                  |                           |   |
| SHWDLT  | Selov diagonal   | elements of t  | those expr                            |                         | - Onten                          | 00000                     |   |
| TOTLASE<br>SHVDLT   |  | elements of 1<br>.00012  | those expr                            | 10412                   | 00049                            | .00000                    |   |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

| Aandon Goe<br>Dependent<br>Log likel:<br>Restricted<br>Chi sylare<br>Bightfloen<br>NiTaiden 7<br>Estimation<br>Tif.Gr.ACS<br>Hodel esti<br>Model esti<br>Sample is<br>Negative b | hood function<br>( log likelihood<br>of [ 3 d.f.]<br>or level<br>sends R-spinred<br>Lased of S =<br>= 1700.0 AT<br>match Sep 16,<br>3 pds and 10<br>insmil represe | nReg Nodel<br>F<br>-842,000<br>-1042,000<br>400,173<br>.000<br>.18176<br>2010, E =<br>C/H = .54<br>2015, 140281<br>10 individual<br>ion model | 00<br>11<br>15<br>19<br>10<br>10<br>11<br>11<br>19<br>18               |                         |  |   | Implied coverience matrix of rendem parameters<br>Coverience matrix<br>IMADE COMPOSE<br>IMADE COMPOSE |
|--|--|---|--|-------------------------|--|---|---|
| PDO  | Coefficient  | Standarii<br>Ercor  | =  | Prop.<br>jz/pZ+         | BDB Co<br>Dat  | ofidence<br>ermal                                       | 1, .029999<br>21, .0833828  |
| Dinstant)<br>LHUEN<br>TOTLARE<br>HNDCR:<br>UNADT<br>DIADT<br>BHNDCR:<br>(D<br>DIADT)<br>BHNDCR)<br>(D  | .83066***<br>D4308**<br>Mans for random<br>.90575***<br>D4525***<br>.02555***<br>.02555***<br>.02555***  | 1,01491<br>.09100<br>.01000<br>parmeters<br>.1140<br>.01649<br>s of Chilasky<br>.00966<br>lements of Ch                                       | 16.29<br>-3.17<br>0.13<br>-2.75<br>y matrix<br>0.87<br>1.10<br>bolesky | .0000<br>.0000<br>.0000 | -9.81863<br>.73071<br>08184<br>.69739<br>07899<br>.02941 | .93061<br>02425<br>1.12406<br>01248<br>.04061<br>.04097 | Emplied correlation matrix of rendom parameters<br>Cor.Mat.1 LHART SHADE<br>LHART SHADE<br>LHART 1.00000 .41214<br>ZHARCK1 .61216 1.00000   |
| BOALBACHI  | .03266***<br>Lapersint param<br>1.12809***   | 122982  | 5an daat<br>4.55   | ,0000                   | -97766   | ,04217<br>1.97882                                       |   |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi squar<br>Significer<br>Hofedden J<br>Fatimation<br>Inf.Cr.Al<br>Hodel est:<br>Rample is | efficients Heg3<br>Wariable<br>(hood function<br>s log liketinood<br>ed [ 6 d.f.]<br>Stando R-squared<br>t based on H =<br>C = \$23.5 A2<br>Imated: Sep 16.<br>2 pps end 11<br>incetti regress | 81<br>+452.657<br>- 600.675<br>- 840.041<br>- 00051<br>- 00551<br>- 0055 | 20<br>101<br>30<br>30<br>14<br>42<br>07 |         |           |          |
|--|--|---|---|---------|-----------|----------|
|  |  | Stendard  |   | Frob.   |           | nEldence |
| FIN2)  | Coefficient  | REEDE   |   | 121254  | Int       | erval    |
| 11   | Conrandom parama   | tere  |   |         |           |          |
|  | +8.93822***  |   | -0.65                                   | .0000   | -12.00631 | -5.81014 |
| LALES  | .74858+++  | +08180  |   | .0000   | .60622    | -32493   |
| TOTLAME  |  | 1.1471年   | -2.00                                   | .0217   | 49171     | +,03942  |
| (CYDTCVA)  | .004TT+  | 100248  | 2.06                                    | .0852   | 00012     | .00265   |
|  | teans for random   |   |   |         |           |          |
| LNADT (  | 1,047864**   | ,17652  | 5.91                                    | .0000   | .70185    | 1.333333 |
| HOVE SNEED   | +8,72798***  | 1+67054   | -3,65                                   | .0109   |           |          |
|  | -,11201+++   |   |   |         | 21127     | 00440    |
|  | Disputal alement   |   |   |         |           |          |
| LUADTI   | ,08237***<br>8.23970***  | 103359  | 2,75                                    | +2042   | +02655    | 115527   |
| HOVLING  | 8-23270+++   | 3,12915   | 2.92                                    | .0340   | 5,093359  |          |
| 2019/DCR-1   | .06789***  | .02008  |   | .0001   | .02883    | .\$0725  |
|  | Selev diagonal e   |   |   |         |           |          |
| CARD TANK 1  | .00458*  | 100250  | 2.22                                    | +0897   | 00032     | -00848   |
|  | .08366***  | .01018  | 2104                                    | .0557   |           | .15830   |
| URN LHE  |  |   |   |         | 20948     | 00047    |
| 1000_13GA  | +_05846**  |   |   |         |           |          |
| URN_URA<br>URN_HCVI<br>11  | 05345**<br>Dispersion param<br>1.82676**   | ming for Neg  | Ban dast                                | ributim |           |          |

Implied covariance matrix of rendom parameters

|                           | LHADT                               | 201101       | SHWDCR         |  |
|---------------------------|-------------------------------------|--------------|----------------|--|
| LHADT<br>SCVLIMI<br>MRDCR | .11168-03<br>.11605-02<br>.97085-03 | 10.47        | -16708-01      |  |
| Implied st                | anderd Devis                        | tions of re- | idim garaveter |  |
| 0.D_Seta)                 |                                     | ŧ.           |                |  |
| 11<br>31<br>31            | .010962<br>9.2956<br>.12920         | 6            |                |  |

Seplied correlation matrix of random parameters

| Cor.Nat.) | LNBDT   | REALINE | BUNDER  |
|-----------|---------|---------|---------|
| LHADE:    | 1,00000 | .03393  | ,71653  |
| DIDIDCR)  | .71433  | 43520   | 1.00000 |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

| Dependent va<br>Log limitino<br>Pestroited 1<br>Chi squared<br>Dofadden For<br>Estimation b<br>Inf.Cr.AIC<br>Nodel estima<br>Sample 1s 2<br>Regative bin | od Function<br>og likelihond<br>[ 3 d.f.]<br>lærel<br>udn R-squated<br>ased on S =<br>= 583.5 AI<br>ted: Dep 17,<br>gds and 10<br>conial regrass | 2<br>-172,732<br>-276,807<br>0,220<br>.041<br>.02332<br>0030, W =<br>C/W = .1<br>2015,19740:<br>10 individua<br>ion nodel | 49<br>15<br>17<br>9<br>80<br>47<br>1e |                         |                               |                               | Implied covariance matrix of random parameters Covariance matrix Sentors LNADT Familion .54778-02 LNADT .21478-02 .30578-02 LNADT .21478-02 .30578-02 LNADT .21478-03 .30578-02 |
|--|--|---|---------------------------------------|-------------------------|-------------------------------|-------------------------------|---|
| svzi e   | oeffioiest   | Standard<br>Revol   |                                       | Frob.<br>(21)g*         | 914 Co<br>Int                 | ofidence<br>ervel             | 5.0_Bets 3<br>10759496<br>30455003  |
|  | random parana  |   |                                       |                         |                               |                               |   |
| Constant  <br>LRLEH<br>VCVVFLA   | -8.43115***<br>1.03365***<br>.00717**  | 2.35442<br>.11314<br>.00318   |                                       | -0543<br>-0500<br>-9220 | -11.04573<br>.00737<br>.00108 | -1.81657<br>1.25878<br>.01881 | Implied correlation matrix of random parameters   |
| SENDCR)<br>LINADT  | 00305*   | .04521  | -1.95                                 | .0536                   | 17245                         | ,00418<br>1,06645             | Cor.Mat.; SHUDCE LHADT  |
|  | ptosl element  |   |                                       |                         |                               |                               |   |
| DONDCR:<br>LNUEDT  | .03024**   | .01590  | 2.41<br>2.82                          | .0049                   | 00092                         | .12704                        | SENDEN 1.0000074520<br>18820174524 1.00000  |
| 18eL   | ov illagonal e   | lements of C  | holesky                               | metrie:                 |                               |                               |   |
| SIMA_HHRI<br>(Dist   | 03980**<br>persion param   | .01418<br>ster for Sed  |                                       | +0171<br>ribution       | 04140                         | 00401                         |   |
| ScalFarm(  | .02818*  | .01553  |                                       |                         | 00225                         | 19961.                        |   |

The second second

### Random Parameter Negative Binomial Model of Serious Injury Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

| Appendent<br>og likej:<br>setrioter<br>hi squer:<br>ignificen<br>foradsen<br>stimetice<br>nf.Cr.AL<br>mdel est:<br>ample is  | efficients NegB<br>variable<br>theod function<br>1 log likelihood<br>di [ 3 d.f.]<br>Variable<br>Seudo R-squared<br>h based on N =<br>7 = 201.5 AI<br>Variable Jep 16,<br>2 puis and 12<br>Variable Tegress  | 22<br>-81.752<br>-101.020<br>22.8<br>.000<br>.09209<br>2020, X =<br>7/N = .1<br>2028, 18138<br>101 individue   | 83<br>47<br>42<br>91<br>93<br>99<br>90<br>94                                    |  | *****  |  |
|--|--|--|---|--|--|--|
| +  |  | Atencezá   |   | Prop.  | 624 0-   | ofloence   |
| 82871  | Confficient  |  |   |  |  |  |
| 22317  | Coefficient  | Error  |   | 12152+   |  | erval  |
| 11   | Accornición parame   | Error<br>ters  |   | *2<(1)   | Int  | erval  |
| (instant)  | Activation parame  | Error<br>ters<br>%.20200   |   | *5¢(z)   | Int<br>-17.05418   | erval<br>86383   |
| cnstant)   | Chrandon parame<br>=3.03995**<br>.76857*   | Error<br>4.20200<br>.49240   | 1.04  | *5¢(±)   | 1nt<br>-17.05418<br>05011  | erval<br>86382<br>1.60606  |
| ()<br>Courtant)<br>LNADC(<br>DE91)   | Cornidon parame<br>-3.00005**<br>.76887*<br>.06823***  | Error<br>ters<br>%.20220<br>.49243<br>.02539   | 2.92  | *5¢(z)   | Int<br>-17.05418   | erval<br>86392<br>1.60606  |
| (1<br>Constant)<br>LS&ADC1<br>DE91)  | Cornicion parame<br>-3.035554+<br>.76857+<br>.06823+++   | Error<br>6ers<br>8.20220<br>.49240<br>.02129   | 1.84<br>2.92  | (2)>Z*<br>.0503<br>.0722<br>.0035  | 1nt<br>-17.02424<br>08011<br>.02238  | erval<br>86382<br>1.65606<br>-11408                                  |
| ()<br>Cristant)<br>LSLDC)<br>DES1)<br>IS<br>SHRDCR)  | Corrandion parame<br>-3.03525**<br>.76831*<br>.06823***<br>Name for random<br>86365**  | Error<br>6.20200<br>.49240<br>.02029<br>peremetes<br>.10003  | 1.94  | (2)>2*<br>(503)<br>(1722)<br>(0035)<br>(0104)  | 1nt<br>-17.03414<br>03011<br>.02230<br>52394   | erval<br>86391<br>1.65606<br>.11400<br>10936                         |
| ()<br>Constant)<br>LNADC)<br>DESL)<br>LNADC)<br>LNADC)<br>LNADC)   | Cornidon parate<br>=3.0305**<br>.7685*<br>.0682***<br>lasts for random<br>6675**<br>1.16875***   | Error<br>4.20200<br>-44240<br>-02009<br>pereference<br>-18063<br>-18448  | 1,94<br>2,92<br>-2,65<br>4,59   | *5¢(s)<br>2000.<br>2005.<br>2005.<br>8010.   | 1nt<br>-17.02424<br>08011<br>.02238  | erval<br>86391<br>1.65606<br>.11400<br>10936                         |
| ()<br>Constant)<br>LNADC)<br>DESL)<br>LNADC)<br>LNADC)<br>LNADC)   | Corrandion parame<br>-3.03525**<br>.76831*<br>.06823***<br>Name for random<br>86365**  | Error<br>4.20200<br>-44240<br>-02009<br>pereference<br>-18063<br>-18448  | 1,94<br>2,92<br>-2,65<br>4,59   | *5¢(s)<br>2000.<br>2005.<br>2005.<br>8010.   | 1nt<br>-17.03414<br>03011<br>.02230<br>52394   | erval<br>86391<br>1.65606<br>.11400<br>10936                         |
| ()<br>constant)<br>LIGADT<br>DESL)<br>II<br>SHRUCA<br>LIGAS<br>LIGAS<br>()<br>SHRUCA   | Contriction parame<br>-3.03005++<br>.2685f+<br>.04823++<br>.04823++<br>.04825++<br>1.16875++<br>1.16875++<br>.0100011 #temant<br>.00100+++   | Error<br>6.20200<br>.49240<br>.02009<br>: permetere<br>.10000<br>.48448<br>a cf Choleak<br>.2040   | 1.94<br>2.92<br>41.85<br>4.59<br>7 matrix<br>2.75                               | *54(1)<br>2578.<br>2578.<br>2500.<br>8600.<br>6900.  | 2nt<br>-17.03428<br>08011<br>.03238<br>52591<br>.00713                               | 16392<br>1.66406<br>.11440<br>1.46408<br>1.46408<br>1.46408          |
| ()<br>constant)<br>LIGADT<br>DESL)<br>II<br>SHRUCA<br>LIGAS<br>LIGAS<br>()<br>SHRUCA   | Contraction parame<br>-2.030054+<br>-2.6851+<br>.06823+++<br>lease for random<br>s05654+<br>1.16805++<br>liagonal element  | Error<br>6.20200<br>.49240<br>.02009<br>: permetere<br>.10000<br>.48448<br>a cf Choleak<br>.2040   | 1.94<br>2.92<br>41.85<br>4.59<br>7 matrix<br>2.75                               | *54(1)<br>2578.<br>2578.<br>2500.<br>8600.<br>6900.  | 2nt<br>-17.03428<br>08011<br>.03238<br>52591<br>.00713                               | erval<br>86382<br>1.68606<br>.11400<br>10306<br>L.49025              |
| ()<br>Constant)<br>LUADE()<br>DE91)<br>()<br>SHRUCA()<br>LUADE9<br>()<br>SHRUCA()<br>()<br>SHRUCA()<br>LUADE9<br>()<br>SHRUCA()<br>()<br>()<br>SHRUCA()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>(   | Cornellon parame<br>-3.03050++<br>.06823++<br>.06823++<br>.06825++<br>.16955++<br>1.16975++<br>1.16975++<br>.10202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.00202++<br>.002 | Error<br>0015<br>01200<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>01205<br>010000000000   | 1.94<br>2.92<br>4.99<br>7 metrim<br>2.73<br>1.99<br>holeesy                     | 12(12)<br>12503<br>12503<br>12503<br>10045<br>10063<br>10063<br>11063<br>11063<br>11063<br>11063   | Int<br>-17.03428<br>08011<br>.03228<br>62598<br>.40713<br>.09520<br>03557            | 16392<br>1.66406<br>.11440<br>1.46408<br>1.46408<br>1.46408          |
| COLUMN AND A COLUM | <pre>Correction parame<br/>-3.03955**<br/>-76855*<br/>.06855**<br/>6895**<br/>4895**<br/>1.16075**<br/>Hagonal mismont<br/>2010***<br/>.17178<br/>Helow diagonal *<br/>22706***</pre>  | Error<br>4.20100<br>4.20100<br>.02009<br>1 parameters<br>.1000<br>.1048<br>.1048<br>.1048<br>.1048<br>.00603   | 1.34<br>2.02<br>4.35<br>4.39<br>y metrim<br>2.73<br>1.39<br>holesky<br>2.34     | 12(12)<br>12503<br>12503<br>12503<br>1000<br>1000<br>10063<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005<br>1005 | 2nt<br>-17.00428<br>-04011<br>.02228<br>52994<br>.00718<br>.05520<br>00957<br>.08573 | 66393<br>1.66606<br>.112403<br>10398<br>1.489029<br>.31801<br>.39512 |
| ()<br>(cnstant)<br>()<br>(cnstant)<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()   | <pre>intring parame</pre>  | Error<br>4.20200<br>4.10200<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.0205<br>1.020 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| Inglied st         | andard devis           | tints of random parameters |
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## Random Parameter Negative Binomial Model of High Injury Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

|                                   |                                |            | 15517115 |        |           |          | Implied covariance matrix of random payameters  |
|-----------------------------------|--------------------------------|------------|----------|--------|-----------|----------|---|
| Random Coe                        | efficience Hegh                |            |          |        |           |          |   |
| Dependent                         | veriable                       | BII        | tet.     |        |           |          | Coveriance matria   |
| log likels                        | bood function                  | -3681439   | 25-      |        |           |          | ***************************************   |
|                                   | 1 log likelihoo                |            |          |        |           |          | LILER BURDER  |
|                                   | SZ [ 8 0.11.]                  | 42,299     |          |        |           |          | +   |
| Significar                        |                                | .000       |          |        |           |          | 10/22/12/01   |
|                                   | iseudo 8-aquape:               |            |          |        |           |          | SHEDCH .14572-01 _74002-01  |
|                                   | * t no beead i                 |            |          |        |           |          | 2014년 - 1993년 1997년 1998년 1997년 1<br>1997년 - 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 19 |
|                                   | - 718-9 A                      |            |          |        |           |          | Implied standard deviations of random parameters  |
|                                   | mated: Sep 17,<br>2 pds and 11 |            |          |        |           |          | 3.5 Detai I   |
|                                   | inceial regrees                |            | +.R.     |        |           |          | 210_26081   |
|                                   | terrenan angaran               |            |          |        |           |          | £1 .179024  |
| 22                                |                                | Standard   |          | Frob.  | 958 Cr    | nfldence | 21 .0560210   |
| H111471                           | Coefficient                    | Error      | 1.0      | 121524 |           | ervial   |   |
|                                   |                                |            |          |        |           |          |   |
| (1                                | ionrandon parane               | NTHIN !!   |          |        |           |          | Implied correlation matrix of random parameters   |
| Constenti                         | -7,40850***                    | 1.01020    | -4,90    | .0000  | -10.06562 | -4.44535 |   |
| INADT (                           |                                | .10008     | 4,78     | .0000  | _467.69   | 1.11549  |   |
| NCVL(                             |                                | 100026     |          | ,0016  | +,00193   |          |   |
| 目になるのです。                          | .00029***                      |            | 3,18     | -2017  |           | ,00047   | Cor.Nat.   LHLEN SHNDCH   |
| KHYNDERC)                         | 03429**                        | .00000     | -2.03    | .0425  | +.06743   | 00516    |   |
| 13                                | Nats for rando                 | parameters |          |        |           |          | 181218  1.00000 .90100  |
| 2.012201                          | .30133***                      | 109607     |          | 10000  | -71384    | 1,00011  | Steptm: /#e146 1,00000  |
| BHHDCR:                           | ++07231+*                      | 102969     | -2.99    | .0171  |           |          |   |
|                                   | Lapinal element                |            |          |        |           |          |   |
| THIEN!                            | 117982***                      | 103435     |          | .0000  | .11245    | -24122   |   |
| SHRDCR (                          | .06100***                      | .01781     | 1        | ,0000, | .01708    | .11895   |   |
|                                   | Helow disgonal +               |            |          |        |           |          |   |
| LANN LHL                          | 002895                         | 101244     | 1,20     | 10744  | 00915     | 100700   |   |
|                                   | Laberarco berat                |            |          |        |           |          |   |
| SoelFerm!                         | -20343                         | 100328     | 1+80     | .1388  | 00109     | ~ 20T#2  |   |
| and a second second second second |                                |            |          |        |           |          |   |

## Random Parameter Negative Binomial Model of Just Injury Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

| Dependent<br>Log likels<br>Nethioted<br>Thi equate<br>Lignificar<br>Unfictation<br>Rodel wats<br>Sepple is  | hood function<br>  log likelihood<br>  8 4.f.  | UUSTI<br>-JIT.102<br>-238.125<br>88.009<br>.000<br>.00054<br>2129, X =<br>C/W = .2<br>2015, 14:44<br>10 indi+idus | 01<br>51<br>28<br>00<br>08<br>10<br>28<br>15                            |                         |                             |                            |
|---|--|---|---|-------------------------|-----------------------------|----------------------------|
| JUSTIN  | Coefficient  | Standard<br>Error   | 4   | Frob.<br>111524         |                             | nfldence<br>ecval          |
| 13  | correction parame  | THE   |   |                         |                             |                            |
|   | -10.2688+++  | 3.14495   |   |                         | -14,5117                    | -6.0158                    |
| LIGADT  | 1.00584***   | .22275  | 4.47  | .0000                   | _62968                      | 1.84201                    |
| SHRECKI   | -,22990***   | .04293  | =8,70   | .0000                   |                             | 13400                      |
|   | 00098**  |   |   | .0286                   | 00188                       | 00011                      |
|   | leave for random   | the second second   |   |                         |                             |                            |
| 13  | NAMES TOP PARADO   | bereters.   |   |                         |                             |                            |
| 131221  | 3.11248***   | .15097  | 0.10  |                         | .05526                      |                            |
| LNLEII)   | 1,11260***<br>.00740   | .15097  | 0.50  | +0410                   | -05528<br>+,00298           |                            |
| 1311E31)<br>5017035511  | 1.11266***<br>.0074D<br>Umgonal element  | .15007<br>.00903<br>a of Cholesk  | 0.50<br>1.57<br>2 BATELS  | +0010                   | +,00298                     | ,01719                     |
| 3<br>13(12))<br>(1)(3(521)<br>(1)(3(521))   | 1.11148***<br>.00740<br>Umponal element<br>.20255***                                 | .15007<br>.00905<br>a of Cholesk<br>.06350  | 0.50<br>1.57<br>9 SATELS<br>3.27  | .0010                   | +,0029E                     | .01719<br>.02729           |
| LHLEH<br>CHRXSEL<br>LHLEH<br>CHRXSEL  | 1.11266***<br>.0074D<br>Magonal element<br>.20255***<br>.00235**                     | .15097<br>.00903<br>a of Cholesk<br>.06350<br>.00135  | 0.50<br>1.57<br>5.27<br>2.19  | .0010<br>.0010<br>.0285 | +,00298                     | .01719<br>.02729           |
| ()<br>LICEN<br>CONSEL<br>LICEN<br>LICEN<br>SCONSEL<br>12  | 1.11244***<br>.00740<br>Nagonal element<br>.20255***<br>.00235**<br>Helow diagonal e | .15097<br>.00903<br>s of Cholesk<br>.06250<br>.00135<br>lements of D  | 0.50<br>1.57<br>V matrix<br>3.17<br>2.19<br>Holesky                     | .0010<br>.0010<br>.0285 | +.00298<br>_07700<br>_00031 | ,01719<br>,82709<br>,00535 |
| ()<br>13(12))<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)<br>13(2)(12)(12)<br>13(2)(12)(12)(12)(12)(12)(12)(12)(12)(12)( | 1.11244***<br>.00740<br>Nagonal element<br>.20255***<br>.00235**<br>Helow diagonal e | .15097<br>.00903<br>s of Cholesk<br>.06250<br>.00135<br>lements of D  | 0.50<br>1.57<br>V matrix<br>3.17<br>2.19<br>Holesky                     | .0010<br>.0010<br>.0285 | +.00298<br>_07700<br>_00031 | ,01719<br>,82709<br>,00535 |
| ()<br>LICEN<br>CONSEL<br>LICEN<br>LICEN<br>SCONSEL<br>12  | 1.11266***<br>.0074D<br>Magonal element<br>.20255***<br>.00235**                     | .15097<br>.00903<br>s of Cholesk<br>.06250<br>.00135<br>lements of D  | 0.50<br>1.57<br>y matrix<br>3.27<br>2.19<br>holesky<br>1.97<br>die dist | .0010<br>.0010<br>.0285 | +.00298<br>_07700<br>_00031 | ,01721<br>,82705<br>,00535 |

|                   | LHERM                    | NOVIDERE.                  |
|-------------------|--------------------------|----------------------------|
| LNLES<br>RCVMXHEL | . 1282E-01<br>. 0165E-09 | -11148-04                  |
| Implied an        | enderd Devie             | tions of vanion paymeters. |
| 5.D_Betal         |                          | 1                          |
|                   |                          | -                          |

Implied covariance matrix of random parameters

| Cor.Mat. | LULEH   | HCT/MCSE1 |
|----------|---------|-----------|
| LHLTH)   | 1.00000 |           |

# Random Parameter Negative Binomial Model of Low Injury Crashes on Small-Urbanized-Rural SPF Class Roadway Segments

|                          | efficients Negh   |                   |          | 113311133       |             | 1122-122272        | Implied constitute matrix of random parameters<br>Coveriance matrix |
|--------------------------|---|-------------------|----------|-----------------|-------------|--------------------|---|
|                          | Lhood function  | -929.850          |          |                 |             |                    | COVELECCE DETLE   |
| Restricted               | s log likelihood  |                   |          |                 |             |                    | TITTE HINDER  |
| Dignifics:<br>NoTadden 7 | ed ( 3 S.f.)<br>nom intel<br>Forudo A-squared<br>h based on N * |                   | 00       |                 |             |                    | LMLEN .22195-02<br>SWMDCM .3589E-03 .2090R-52                       |
| Inf.Cr.AI                | : 00000 00 0 0<br>: = 1077.7 LD<br>imated: Sep 17.              | C/II +            | 94       |                 |             |                    | Deplied standard deviations of random parameters                    |
| Sample is                | I pds and 10<br>Linuxial regress                                | 10 individue      |          |                 |             |                    | 5.0_Dets) 1   |
|                          | erundent tabtesa  |                   |          |                 |             |                    | 11 .148963  |
| L0333                    | Coefficient   | Standard<br>Error | . i.     | Prob.<br>12192* | Int         | nfidence<br>terval | 21 .0457121   |
|                          | Intrandos parama  |                   |          |                 | *********   |                    | Implied correlation matrix of random parameters                     |
| Constant)                | -7,28482***   | 179144            | -9.10    | .0000           | +8.74432    | -5,64371           |   |
| LIGADT                   | +65113***   | .00024            | 10.61    | .0000           |             | 1.0003#            |   |
| 1020233003               | -2,41042*   | ,16620            | -14.95   | .Desp           | -2.91814    | 108729             |   |
|                          | feane for ranitie   |                   |          |                 |             |                    | Gor.Nat.   1MLEN SHNDCK   |
| THERM                    |   | .09200            | 17,84    | .0000           | .19601      | .09673             |   |
| SSNDCR                   | -104277***  | .01430            | -2.99    | 10028           | 07051       | ~.91474            | ININE 1,00000 .52655  |
|                          | Diagonal element  |                   |          |                 |             |                    | IMMOCR.( .02888 I.00000   |
| THEFT                    | 114886***   | +05942            | 31.62    | ,2000           | -51011      | 124792             |   |
| SHNDCB                   |   |                   |          | .0000           | .02151      | .05419             |   |
|                          | Selny disponal a  |                   |          |                 | Contract of | 12121              |   |
|                          |   |                   |          | 10124           | :00521      | 101298             |   |
| LONG_NOIS                | -D2405**  | ,00583            |          |                 |             |                    |   |
| 18HW_LNL1                | UIEDS**<br>Dispersion payas<br>1.10073+**                       |                   | Rin dist |                 | .59340      | 1.01197            |   |

## Random parameter Negative Binomial Model of Total Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted                              | variable<br>Variable<br>thood function<br>5 log lixelibood<br>cd [ 6 d.f.]                         | TOTALA<br>+1275.578<br>-3049.918                          | 48                   |       |               |                   | 007823800                  | e matrix<br>LURA                                |          | LINGEN                        | BMANDIRC<br>Derenerers |
|--|--|---|----------------------|-------|---------------|-------------------|----------------------------|---|----------|-------------------------------|------------------------|
| Significat<br>NOTedden (<br>Estimation<br>Inf.Cr.AI)<br>Nodel est: | tos level<br>Pseudo R-squared<br>o based on H =<br>1 = 2559.3 Al<br>Imated: Sup 22,<br>2 pls and 1 | .000<br>(85013<br>1400, H =<br>10/H = 1.8<br>2015, 161551 | 00<br>32<br>16<br>10 |       |               |                   | LUADT<br>LUCEN<br>REVUELNC | .47328-0<br>.52342-0<br>-,16388-0<br>tendezd 04 | 10<br>12 | 175-01<br>082-02<br>9 03 1810 | .19462-03              |
| Regative b   | indmini regréss  | tion model  |                      |       |               |                   | S.D_Seta)                  |   | 1        |                               |                        |
| TOTALACC   | Coefficient  | Stenderd<br>Error   |                      | freb. | 369 C:<br>Tot | mfidende<br>erval | 10                         |   | 7152     |                               |                        |
|  | foorwiden parame   |   |                      |       |               |                   | -41                        |   | 11.1.8.6 |                               |                        |
| Constant   | -5.72401+++  | 1.04743   | -2.46                | .0000 | -7,17692      | -0.67500          |                            |   |          |                               |                        |
|  |  | .D0011  |                      |       | .00248        | .0100K            | Implied o                  | orrelation                                      | matrix   | of rando                      | an parameters          |
| INVORT   | 10227***   | .01453  | -7.04                | .0008 | -,13074       | 01879             |                            |   |          |                               |                        |
|  | 92455D-04++  |   |                      |       |               | 120042-04         |                            |   |          |                               |                        |
| VCRI   | 1.54500**  | .65168  | 2.21                 | .0234 | .20595        | 2.68103           |                            |   |          |                               | -                      |
|  |  | . 54215   |                      | .0314 | -2.22940      | -1060e            | Cor.Hat.                   | LUGOT   | SHERN    | perception.                   | ÷                      |
|  | leans for random   |   |                      | 1000  |               |                   |                            |   |          |                               |                        |
| LIFADT   |  |   | 4.05                 | 10000 | .14427        | .00100            | LERDY                      | 1,00000   | 37791    | ·                             | 6                      |
| LITLET   | .95379***  |   |                      | .0005 |               | 2.07494           | THERE                      | .87771  | 1,00000  | - 83314                       |                        |
| ENTRY INC.   | 03345***   | -00668  | 8.95                 | .0000 | -02396        | .04655            | ENVIRO 190                 |   |          |                               |                        |
| 1000   | Disgonal element   | p of Cholesk  | v natris             |       |               |                   |                            |   |          |                               |                        |
|  | .06872**   |   |                      |       | .01281        | -12512            |                            |   |          |                               |                        |
|  | .04076**   |   |                      |       |               | .07298            |                            |   |          |                               |                        |
| DRIGHTING  | .01082*  |   | 1.96                 | .0531 | 00044         |                   |                            |   |          |                               |                        |
|  | below disponal a   |   |                      |       |               |                   |                            |   |          |                               |                        |
|  | -13467+  |   |                      |       |               | 21895             |                            |   |          |                               |                        |
|  | 02353**  |   |                      |       | 04407         |                   |                            |   |          |                               |                        |
| LENY LSL   | .00352   | .00680  | 1.85                 | .0127 | 00902         | .01806            |                            |   |          |                               |                        |
|  | Dispersion paras   |   |                      |       |               |                   |                            |   |          |                               |                        |
|  |  |   |                      |       |               |                   |                            |   |          |                               |                        |

| Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small-Urban- | ÷ |
|--|---|
| Large-Urbanized SPF Class Roadway Segments   |   |

| Bandim Coeffic<br>Dependent vari-<br>Log Inselhood<br>Hestelated log<br>Chi squared [<br>Significance la<br>Mofodden Forudo<br>Estimation Same<br>Inf.Cr.ALC =<br>Nodel matimate<br>Sample la 3 po<br>Negative binom | Hole<br>Finctions<br>Likelibood<br>I d.f.]<br>Hell<br>S.Propusted<br>ed on N = 1<br>1052.4 Alt/<br>hi Sep 22, 20<br>hell regression<br>hell regression | H<br>-D68.1280<br>-1702.7760<br>1010.1700<br>.0000<br>.012200<br>4001.8 -<br>U = 1.01<br>15. 171421<br>Individual<br>n stodel | 11<br>10<br>10<br>10<br>10<br>10<br>10<br>10    |                                   |  |   | LNERN<br>RWINDINC -<br>Implied stat<br>N-D_Deta: | LELES SHYNDIN:<br>308/8E-01<br>1949E-03 .1013E-03<br>ndard deviations of random parameters<br> |
|--|--|---|---|-----------------------------------|--|---|--|--|
|  |  | Standard<br>Error   |   | Froh.<br>(#1)52*                  | \$54 Co  | nfidence<br>erVal   | 11   | .0100420   |
| 1Non/rat   | this paramete  |   |   |                                   |  |   | Testing the                                      | relation matrix of random parameters   |
| Constant) -5<br>LOADI<br>BERDI 1<br>SHOULT -<br>NCVCRAH<br>HCYOLAEL<br>HCYOLAEL<br>UMeans<br>LSLEN   | 03710***<br>02975**<br>02975**<br>00471***<br>00040**<br>00040**<br>for rendom p<br>02540***   | 1.36154<br>.14322<br>.65042<br>.02074<br>34310-08<br>.05529<br>.00177<br>415354518<br>.07240                                  | 2.05<br>-3.64<br>-5.02<br>1.92<br>1.96<br>12.59 | .0497                             | -8.50576<br>,25714<br>,09957<br>-,04536<br>-,04536<br>-,05027<br>-,05027<br>-,05027<br>-,05027<br>-,05027<br>-,05027 | .92558<br>8.07959<br>01406<br>00006<br>3.32042<br>.00498<br>1.07538 | Cor.Het.)  | 111211 PRYNNDIDC<br>.0000T712912<br>.000000  |
|  | .05750***  | :00807  | 1.5.17  | .0000                             | 109208   | -07372  |  |  |
| THAT THE   | nal elements<br>1888+***<br>diagonal ele<br>100734*<br>relon paramet   | .0381#<br>.00213<br>ments of Q<br>.00362  | 4.82<br>2.23<br>clasky<br>-1.92                 | .0000<br>.0012<br>matrix<br>.0551 | ,10818<br>,00271   | .28872<br>.01196<br>.01018  |  |  |
|  | 47824***   | .09354  |   |                                   | .49432   | .64216  |  |  |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| epetdent<br>og likel<br>esttiote<br>hi squar<br>lignificæ<br>ofinden<br>stinatio<br>nf.Cr.Al<br>fodel set<br>smple is | <pre>ffluents Sept<br/>variable<br/>incod function<br/>s log likeleboor<br/>of [ 1 d.f.]<br/>Socido 3-spuare<br/>i based on N =<br/>1 = 1155.5 Al<br/>sated i Sep 13,<br/>2 pds and 1<br/>incolal regress</pre> | F1<br>-560.663<br>-410.046<br>492.566<br>.000<br>1 .50550<br>1606, K =<br>.02/H = .7<br>3015, 17111<br>804 10014144 | 49<br>04<br>00<br>85<br>11<br>15<br>44                                    |  |                                     |                                      |
|---|---|---|---|--|-------------------------------------|--------------------------------------|
| FERIT   | Coefficient   | Stendard<br>Error   | t.  | Freb.                                      | ane co<br>Int                       | nfidénce<br>erval                    |
|   | Ponirendon pereme   | rtery   |   | 1000                                       |                                     |                                      |
| ingrant!  | -9.42081***   | 1.75979   | -8.47   | ,0000                                      | -15.06993                           | -6.17168                             |
| LHAPT   | 1.03698***  | 128505  | 3,60  | 10000                                      | .07620                              | 1.39967                              |
| 26211   | .01087*   |   | 1,98  |  |                                     |                                      |
|   | .03866***   | 101099  | 3.55  | 20004                                      | -01642                              | .0.5,690                             |
| INTERDED  |   |   |   |  |                                     | 00000                                |
| NCVCRAFT  | -10001844   | .00700-08   | -2.50   | 10104                                      | 00027                               |                                      |
| NOVCRAIL  | desirs for rendir   | costmeters  |   |  |                                     |                                      |
| NOVCRAIL  | Usens for rendis  | parameters  | -6,91   | ,0000                                      |                                     | 11496                                |
| BHVOLT I  | 0esi# for reads<br>16076***<br>.97917***  | .02676<br>.02711  | -6,91   | ,0000                                      |                                     |                                      |
| NOVCRAIL<br>IN<br>INVOLT<br>LISLEN  | Desis for readur<br>16076***<br>.07517***<br>Diagonal element   | t parameters<br>.02676<br>.09711<br>ts of Cholesk   | -6,91<br>10.00<br>Y Batrix  | ,0000<br>,0000                             | 22122                               | 11496                                |
| NOVCRAIL<br>IN<br>INVOLT<br>LISLEN  | 0esi# for reads<br>16076***<br>.97917***  | t parameters<br>.02676<br>.09711<br>ts of Cholesk   | -6,91<br>10.00<br>Y Batrix  | ,0000<br>,0000                             | 22122                               | -,11498<br>1.14950                   |
| NOVCRAIL<br>IN<br>INVOLT<br>LISLEN  | Usais for readur<br>16076***<br>.07517***<br>Diagonal element   | t parameters<br>.02676<br>.09711<br>ts of Cholesk   | -6,31<br>10.00<br>y matrix<br>2,17  | ,0000<br>,0000                             | 22121<br>_78884                     | -,11498<br>1.14950                   |
| MCVCRAII<br>BHWDLT)<br>LRLEN)<br>SHWDLT)<br>LRLEN)<br>LRLEN)  | Usais for rendum<br>16078***<br>.07017***<br>Diagonel element<br>.01062**   | (00676<br>.00676<br>.00711<br>(# of Cholesk<br>.00880<br>.00880<br>.02548   | -6,31<br>10.00<br>y matrix<br>2,17<br>2,88                                | ,0000<br>,0000<br>,0000<br>,0089           | 22121<br>_78884<br>.00179           | 11696<br>1.16950                     |
| NCVCRAN<br>NHVOLT<br>LNLEN<br>JHVDLT<br>LNLEN<br>LNLEN<br>LNL SSW   | <pre>demis for rends<br/>16878***<br/>.97917***<br/>Diagonal element<br/>.01662**<br/>.0788***<br/>Delry diagonal *<br/>.06138***</pre>   | i permitters<br>.02676<br>.09711<br>cs of Cholesk<br>.00358<br>.02548<br>detents of C<br>.02253                     | -6.91<br>10.00<br>y matrix<br>2.17<br>2.88<br>holesky<br>2.73             | .0000<br>.0000<br>.0000<br>.0038<br>metros | 22122<br>.78884<br>.00178<br>.02868 | 11696<br>1.16950                     |
| NCVCRAN<br>NHVOLT<br>LNLEN<br>JHVDLT<br>LNLEN<br>LNLEN<br>LNL SSW   | deens for rends<br>16878***<br>.97817***<br>Disgonel element<br>.01862**<br>.07858***<br>Belox disgonal *   | i permitters<br>.02676<br>.09711<br>cs of Cholesk<br>.00388<br>.02388<br>debents of C<br>.02285<br>meter for Neg    | -6,31<br>10.00<br>y matrix<br>2,17<br>2,88<br>holesky<br>2,73<br>Sin dist | .0000<br>.0000<br>.0000<br>.0038<br>metros | 22122<br>.78884<br>.00178<br>.02868 | 11496<br>1.14950<br>.03945<br>.12983 |

| Covariance      | sistrix (              |                             |
|-----------------|------------------------|-----------------------------|
|                 | SEVELT                 | LILLEY                      |
| BENDLT<br>LVLEN | .41748-04<br>.39462-05 | .81802-02                   |
| Duplies er      | andani devia           | stics; of random parameters |
| S.D. Setal.     |                        | 1                           |
| 11              | ,006440                | 12                          |
| 21.             | 095524                 | 62                          |

Implied correlation matrix of random parameters

|        | TIONNE  |         |
|--------|---------|---------|
|        | 1.00000 |         |
| LITERS |         | 1.00000 |

Random Parameter Negative Binomial Model of Evident Injury Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| Dependent<br>Log libels<br>Mertrioted<br>Chi square<br>Significan<br>McFadden 4<br>Setimetium<br>Inf.c.Al0<br>Model esti<br>Sargle im | hood function<br>I log Limelihood<br>94 [ 3 0-5-1   | 2<br>-370,480<br>-427,462<br>-118,880<br>-300<br>-13320<br>-1408, M +<br>-1408, M +<br>-1408, M +<br>-1408, M +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-1408, N +<br>-14 | 7 E<br>8 H<br>2 C<br>2 C<br>7 3<br>2 S                                   |   |  |                                     | UCPARER<br>RHYNDINC<br>Implied sta<br>S.D_Beba) | 134758-01<br>10658-02 | BHUNGING<br>.1541E-00<br>tions of rename personeters<br>1 |
|---|---|--|--|---|--|-------------------------------------|---|-----------------------|---|
| rvr i   | Coefficient   | Standard<br>Error  | x  | Prdb.<br> 112*                                      | 185  | nfidence<br>erMal                   | 11<br>21  | .15724                | 10  |
|   | fonrandon parabat   |  |  |   |  |                                     | Implied cos                                     | relation ma           | trix of reddom parameters                                 |
| Cusietanti  | -4.80664++  | 1.90027  | -2-53  | .0114   | -8,43110   | -1.00218                            |   |                       |   |
| LHADT)  | -43594**  | .21860   | 2.97   | +0384   |  | .04870                              |   |                       |   |
| 1107,8781   | .82788***   | 08240  | 10.05  | .0000   | 166630   | .98247                              |   |                       |   |
|   |   |  |  | _0081   | -,18228  | 02341                               | Cor.Man. 1 V                                    |                       |   |
| SHUDLT  | 07758***  | ,02949   | 8-27   |   | 1.000  | 1.16.2.2.5                          |   |                       |   |
| SHRELT  | leans for random  | galateters.  |  |   |  |                                     |   |                       |   |
| SHUELT  | leans for random17647**   | parateters<br>.00983   | -1.99  | .0470   | 38454  | 00240                               | VERARION 1                                      | .00000 .5             | 4030  |
| SHUELT (N<br>VCFARMA)<br>SWINDENC(  | leans for random<br>17647**<br>.03252**   | parateters<br>.02955<br>.01956   | -1.90<br>I.73  |   |  |                                     |   | .00000 .5             | 94030   |
| SHWELT (N<br>VCDADSA)<br>SWINDENC (<br>17   | leans for random<br>17647**<br>.03252**<br>Misgonal elements  | parametery<br>.01985<br>.01986<br>r of Choleek   | -1.90<br>I.23<br>( Hation  | .0470<br>.0255                                      | -,38454<br>,00399                                | 00340<br>.06105                     | VERARION 1                                      | .00000 .5             | 94030   |
| SHWELT (N<br>VCDADMA)<br>SWINDENC(<br>VCDADMA)  | leans for random<br>17647**<br>.03282**<br>hisgonal elements<br>.18725*   | parabeters<br>.01985<br>.01458<br>e of Choleek<br>.01112   | -1.90<br>2.23<br>/ Hatiox<br>1.94  | .0470<br>.0255                                      | -,38454<br>,00399<br>-,00176                     | 00240<br>.06105                     | VERARION 1                                      | .00000 .5             | 4030  |
| SHWELT (N<br>VCDADSA)<br>SWINDENC(<br>VCDADSA)<br>VCDADSA(<br>RWINDENC)   | leans for random<br>17647**<br>.03252**<br>Nagonal elements<br>.18725*<br>.01046***   | paraketers<br>.01983<br>.01458<br>cf Choleek<br>.01112<br>.00582   | -1.90<br>I.I3<br>(matrix<br>1.94<br>I.74                                 | .0470<br>10255<br>.0526<br>.0526                    | -,38454<br>,00399                                | 00340<br>.06105                     | VERARION 1                                      | .00000 .5             | 94030   |
| SHWELT<br>VCFAJBA<br>INTROCICI<br>IT<br>VCSARDA<br>RWENDERCI<br>(3  | <pre>leans for random</pre>   | parabeters<br>.01955<br>.01456<br>e of Cholesk<br>.01112<br>.00552<br>Lesents of Ch  | -1.90<br>I.I3<br>y metrix<br>1.94<br>I.74<br>Soleswy                     | .0470<br>.0355<br>.0526<br>.0562<br>Matcie          | 38454<br>.00359<br>00175<br>.00296               | 00240<br>.04209<br>.01428<br>.01799 | VERARION 1                                      | .00000 .5             | 4030  |
| AHNELT<br>VCRADIA<br>INTROLICI<br>VCRADIA<br>VCRADIA<br>RMTRDIACI<br>(3<br>LERV_VCF)  | <pre>leans for randim<br/>17647**<br/>.03252**<br/>Nisgosal element)<br/>.18725*<br/>.01066***<br/>beluw diagonal el<br/>.00471**</pre> | paraheters<br>.01985<br>.01186<br>.01112<br>.01112<br>.00112<br>.00552<br>lesence of Cl<br>.00290  | -1.90<br>I.23<br>y metros<br>1.94<br>2.74<br>bulesey<br>2.91             | .0470<br>.0355<br>.0526<br>.0562<br>Matcim<br>.0309 | -,38454<br>,00399<br>-,00176                     | 00240<br>.06105                     | VERARION 1                                      | .00000 .5             | 94030   |
| HHRLT<br>VCRADNA)<br>HWTHDENCI<br>VCRADNA)<br>RWTHDENCI<br>(2<br>LENY_VCF)  | <pre>leans for random</pre>   | paraheters<br>.01985<br>.01186<br>.01112<br>.01112<br>.00112<br>.00552<br>lesence of Cl<br>.00290  | -1.90<br>I.I3<br>y metrix<br>1.94<br>2.74<br>tolesky<br>2.91<br>bin dist | .0470<br>.0355<br>.0526<br>.0562<br>Matcim<br>.0309 | -,38454<br>,00399<br>-,00175<br>,00298<br>,00109 | 00240<br>.04209<br>.01428<br>.01799 | VERARION 1                                      | .00000 .5             | 94030   |

Random Parameter Negative Binomial Model of Serious Injury Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi squar<br>Significes<br>Mufsdden 1<br>Estimation<br>Inf.Cr.A3<br>Rodel est:<br>Ample 1s | <pre>rfficients BegB<br/>Veriable<br/>Unced function<br/>blog limition<br/>blog limitions<br/>blog limitions<br/>blog limition<br/>blog limiti</pre> | 83<br>-78,507<br>-81,208<br>1,204<br>.030<br>.03021<br>1408, W =<br>C/S = .1<br>2013, 15:00<br>04 individua | 15<br>78<br>20<br>70<br>6<br>25<br>21               |  |  |  |
|---|--|---|---|--|--|--|
|   |  |   |   |  |  |  |
| 1   | Coefficient  | Stanijarii<br>Errez   |   |  |  | nfldence<br>acval                              |
| SINJ  | Coefficient  | Irrer   |   | 12/24  | Int  | erval  |
| SINJ  | Coefficient  | Irrer   |   | 12/24  | Int  | erval  |
| SINJ  | Coefficient  | Irrer   |   | 12/24  | Int  | erval  |
| )<br>SENJ<br>Constant<br>FHYNDENC   |  | Errer<br>L.11378<br>.03767  | -6.00<br>3.21                                       | .0000  | 2n1<br>-9.00001<br>.03000  | 40000<br>-5.40000<br>.14007                    |
| SINJ<br>SINJ<br>Constant (<br>FHYNDINC)<br>VCVL (<br>13   | Coefficient<br>Anyeodom pereme<br>-7.46001***<br>.00053**<br>00430*<br>Heans for tandam  | Errer<br>1.11270<br>.02767<br>.00930<br>parameters  | -6.00<br>5.25<br>-1.31                              | .0000<br>.0010<br>.0561                            | 2nt<br>-9.00091<br>.03600<br>+,01276                             | erval<br>-3.45050<br>.16507<br>.00310          |
| SINJ<br>SINJ<br>Constant (<br>FHYNDINC)<br>VCVL (<br>13   | Coefficient<br>Annyendon persse<br>-7.46961***<br>.00685**<br>00695*   | Errer<br>1.11270<br>.02767<br>.00930<br>parameters  | -6.00<br>5.25<br>-1.31                              | .0000<br>.0010<br>.0561                            | 2nt<br>-9.00091<br>.03600<br>+,01276                             | erval<br>-3.45050<br>.16507<br>.00310          |
| )<br>SINJ<br>Constant<br>SHYNDINC<br>VCVL<br>SCVS   | Coefficient<br>Anyeodom pereme<br>-7.46001***<br>.00053**<br>00430*<br>Heans for tandam  | Errer<br>L.LLITO<br>.02767<br>.00330<br>PARAMETERS<br>.00363  | -6.00<br>3.28<br>-1.93<br>-1.97                     | .0000<br>.0010<br>.0581<br>.0481                   | 2nt<br>-9.00091<br>.03600<br>-,01276<br>00426                    | erval<br>-3.45050<br>.16507<br>.00310          |
| )<br>SINJ<br>Constant<br>SHYNDINC<br>VCVL<br>SCVS   | Coefficient<br>-7.40001***<br>.00003***<br>00430*<br>Heans for innoim<br>00715**<br>Socie parameters   | Errer<br>1.11370<br>.03767<br>.00330<br>paraeters<br>.00365<br>for dists.                                   | -6.00<br>3.25<br>-1.93<br>-1.97<br>vf rands         | .0000<br>.0010<br>.0581<br>.0491<br># perabe       | Int<br>-9.00001<br>.03000<br>01276<br>02428<br>term              | erval<br>-0.40000<br>.14507<br>.00010<br>00003 |
| J<br>SINJ<br>Constant<br>SHYNDINC<br>VCVL<br>SCVR<br>SCVR<br>SCVR   | Coefficient<br>Angedon perame<br>-7.46001***<br>.00035**<br>Hens for banden<br>0015***<br>Sole perameters  | Errer<br>1.11378<br>.02767<br>.00330<br>Parameters<br>.00365<br>For dists,<br>.00031                        | -6.00<br>3.21<br>-1.91<br>-1.91<br>vf rand:<br>2.64 | .0000<br>.0010<br>.0561<br>.0491<br>.0491<br>.0049 | Int<br>-\$.00081<br>.03600<br>+.01276<br>02428<br>term<br>.00009 | erval<br>-0.40000<br>.14507<br>.00010<br>00003 |

Random Parameter Negative Binomial Model of Unknown Injury Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel;  | officients Seph<br>Veriable<br>shood function<br>i log likelihood  | 0300300<br>-92.600  | 10   |                          |                              |                   | Implied covariance matrix of random parameters Covariance matrix Light Novarian   |
|--|--|---|--|--------------------------|------------------------------|-------------------|---|
| Gbi square<br>Significan<br>McFadden 4<br>Estimation<br>Inf.Cr.Ald<br>Hodal ast<br>Sample is<br>Negative b | <pre>cd [ 3 S.f.]<br/>ce level<br/>DesuGo R-equared<br/>to Eccel on N =<br/>l = 100.4 AD<br/>mated: dep 25,<br/>2 pdb and 5<br/>kinomial represe</pre> | 7.719<br>.001<br>.04001<br>1408. 8 -<br>0/N11<br>2018. 17119:<br>04 individual<br>100 model | 66<br>10<br>10<br>10<br>16<br>16<br>14<br>14 |                          |                              |                   | LIANT .500HZ-01<br>BHYNDINC -18664-52 .2300H-52<br>Implied standard deviations of sundom parameters<br>5.0_Beta: 1<br>1 .110754 |
| THERE WILL   | Doefficient  | Standard<br>Error   |  | Frob.                    | 258 00                       | nfidence<br>erval | 1) (186764<br>2) (0423730   |
| 11   | innrandon parame   | Cars  |  |                          |                              |                   | Implied correlation matrix of random parameters   |
| Cunstant:<br>LULEN:  | -0.26375**<br>.52099***<br>.01832*   | .14748  |  | .0003                    | -17.37278<br>.24190<br>00182 | .02008            |   |
|  | Nexts for isodum   | patameters  |  |                          |                              |                   | Cor.Mat. LMADI MEYHDING   |
|  | .01654+  | .00079  | 1.16   |                          |                              |                   |   |
| LNADT (<br>RETROINT )  | .00812*  |   | 1.97<br>metrix                               |                          | 00053                        | .00663            | LHART   1.0000093776<br>EXYRUINC95776 1.00000   |
| LNADT (<br>RFTNDLINC)<br>LNADT (<br>RFTNDLINC)   | .00312*<br>Diagonal element<br>.18878***<br>.01400**   | <pre># of Cholesk;<br/>.07049<br/>.00621</pre>  | 2.68<br>2.05                                 | -007+<br>-0407           | 00033<br>.08048<br>.00071    |                   | LIRAT: 1.0200093776<br>ENINGINC:92778 1.00000   |
| LHADT  <br>RWYNDINC  <br>LNADT  <br>RWYNDINC  <br>15WY_530A  | .00312*<br>Diagonal element<br>.18878***   | <pre># if Cholesk;<br/>.07049<br/>.00021<br/>lements of G<br/>.01919</pre>                  | / matrix<br>2.65<br>2.03<br>121##RV<br>-2.90 | .007+<br>.0407<br>matris | .08048<br>.00071<br>+.05291  | . 12494           | SWINDING) ~, 95776 1.00000  |

## Random Parameter Negative Binomial Model of High Injury Crashes on Small-Urban-Large-Urbanized SPF class roadway segments

| 2012.732949933   | variable<br>bood function   | <ul> <li>-248.203</li> </ul>   | 49  |  |                            |                            |
|--|---|--|---|--|----------------------------|----------------------------|
| Asstricted   | 1 log likelthood  | 1. HEDELTER  |   |  |                            |                            |
| Significan<br>KcTaddan A   | d [ ] d.f.]<br>We level<br>Waaudo R-aguared   | .000   | 00<br>88  |  |                            |                            |
|  | based on H =  |  |   |  |                            |                            |
|  | nated) Pep 26.  |  |   |  |                            |                            |
|  | 2 pds and 1   |  |   |  |                            |                            |
|  | crimpial regrams  |  |   |  |                            |                            |
|  |   |  |   |  |                            |                            |
| 120104   |   | Stenders.  |   | Prop.                                      |                            | nfligence.                 |
| HIINT  | Coefficient   | Error  |   | 2102*                                      | Int                        | lavia                      |
|  | ***********   |  | ********  |  |                            |                            |
|  | Cornection parame   |  |   |  |                            |                            |
| Constant)  | 0.003.6-++  |  |   |  |                            |                            |
| LIGHT  | .96699***   | ,09168   |   | + 0200                                     | ,78679                     |                            |
|  | .00903***   | ,00277   |   | +0008                                      | -90389                     | +01476                     |
|  | 02535*  |  | -1.95   | +0595                                      | 17408                      | .00343                     |
| SHMDCR   |   |  |   | 4.404.4                                    |                            |                            |
| 11   | leans for random  |  |   |  |                            | 00018                      |
| SHNDCA   | -,000006***   | +80.013  |   |  |                            |                            |
| SHKDCR  <br>10<br>HCVCRAR <br>SKSND2HC   | 000006***<br>.04007***  | ,00011<br>,01208   | 2,22  | .0008                                      | -,00188                    |                            |
| SHNDCR  <br>HOVORAII<br>RHSRD2HC  <br>H  | 00004***<br>.04007***<br>Nagonal element  | .00011<br>.01208   | 2,22<br>y metrix  | .0008                                      | 101407                     | 006427                     |
| SHMDCR  <br>HCVCSAII<br>HCVCSAII<br>HCVCSAII<br>HCVCBASI   | 0000+***<br>.04007***<br>Nagonal #Jement<br>.00424**  | .00011<br>.01208<br>cm of Cholesk<br>.02219                                    | 3.35<br>V metrix<br>1.99  | .0008<br>.0462                             | .01607<br>.00078           | 006427                     |
| SHNDCR<br>II<br>HCVCRAH<br>HCVCRAH<br>HCVCRAH<br>HCVCRAH<br>HCVCRAH<br>HCVCRAH   | 00536***<br>.04057***<br>Nagonal element<br>.09424**<br>.00745**                                  | .00011<br>.01208<br># of Chalesk<br>.02219<br>.00917                           | 3.31<br>y metrix<br>1.99<br>3.94                                | .0008<br>.0462<br>.0192                    | 101407                     | 006427                     |
| SHADCE<br>II<br>HEVERAL<br>HEVERAL<br>HEVERAS<br>HEVERAS<br>HEVERAS<br>HEVERAS   | 00006***<br>.04007***<br>Nagonal element<br>.00141**<br>.00741**<br>Melow diagonal 4              | .00011<br>.01208<br>m of Cholesk<br>.02219<br>.00917<br>dements of C           | 3.55<br>y metrix<br>1.99<br>J.94<br>holesky                     | .0008<br>.0462<br>.0192<br>matcis          | 101407<br>400078<br>20100- | 006421                     |
| SHADCE<br>HEVERAN<br>HEVERAN<br>HEVERAS<br>HEVERAS<br>HEVERAS<br>HEVERAS<br>HEVERAS<br>HEVERAS<br>HEVERAS  | 00004***<br>.04007***<br>Disgonal element<br>.00124**<br>.00745*+<br>below disgonal *<br>.00577** | .00011<br>.01208<br>m of Choles8<br>.00215<br>.00917<br>Lements of C<br>.00271 | 3.35<br>y metrix<br>1.99<br>J.94<br>holesky<br>2.13             | .0008<br>.0462<br>.0192<br>matcix<br>.0334 | .01607<br>.00078           | 006427                     |
| SHMDCR<br>II<br>HEVORAH<br>REVERAN<br>HEVERAN<br>HEVERAN<br>HEVERAN<br>III<br>IIII<br>IIII<br>SHMDCRC<br>IIIII<br>IIIII<br>IIIII<br>IIIIII<br>IIIIII<br>IIIIII | 00006***<br>.04007***<br>Nagonal element<br>.00141**<br>.00741**<br>Melow diagonal 4              | .00011<br>.01208<br>m of Choles8<br>.00215<br>.00917<br>Lements of C<br>.00271 | 1.11<br>y metrix<br>1.99<br>1.94<br>holesky<br>1.13<br>Bin dist | .0008<br>.0462<br>.0192<br>matcix<br>.0334 | 101407<br>400078<br>20100- | 006421<br>008173<br>001542 |

| Coveriance            | Batris                 |                            |
|-----------------------|------------------------|----------------------------|
|                       | BOVOBAS                | SHINDING                   |
| HEVERAS<br>REPRESENCE | .2991E-07<br>.9955E-06 | .11242-04                  |
| implied #1            | undand devis           | nions of random parameters |
| S.D_Bets;             |                        | £                          |
| 11                    | .1723555-0             | 10                         |

Cog.Hat. | HCVCRAR RNYNDING SCVCRAR 1.00000 .41452 SSTRDING .41452 1.00000

#### Random Parameter Negative Binomial Model of Just Injury Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel<br>Rescripte<br>Oti squaz<br>Significe<br>NoFedden    | Foeudo Roppusces  | 20911<br>-335.950<br>4 -498.476<br>175.952<br>1000<br>5 .18821   | 63<br>11<br>12<br>00<br>86  |  |  |   |  |
|--|---|--|---|--|--|---|--|
| Inf.Cr.AD<br>Model est<br>Ample is   | n hased on H =<br>C = 022.0 K<br>Ifrated: Sep 25,<br>I pds and<br>hinomial regres.  | 2015, 16:56:<br>2015, 16:56:<br>804 LOGLVIQUA  | 11<br>87  |  |  |   |  |
| JUNT DAL   | Coefficient   | Standard<br>Revor  | 1   | Fcob.<br>(2)>2*  |  | nfidence<br>erval                               |  |
| 1  | Sonrandom param   |  | ******  |  |  |   |  |
| Constant   | -2.99095+   | 2.14591  | -1.93   | 10040  | -8.24405   | .24616  |  |
| WOVE   | 00122**   | 000016   | -2.25   | :0226  |  | 00027   |  |
| WWWWDING   | .06857+++   | 101217   | 4.88  | .0000  | .08883   | .08822  |  |
| REVERSE  | 00018+*   | .85020-04  | 2.14  | .0322  | 00005  | 00002   |  |
|  | 1 STCCARS.  | .05246   | 1.1.1.1   | 1. N. H. M. M.   | register in the second                                   | 07867   |  |
| SHVDCR.  |   |  |   | 10002  |  |   |  |
| LOADT  | .0001844  | 100700-04  | 2.08  | 10390  | .00001   | .00035  |  |
| LOADT  | .0001844  | 100700-04  | 2.08  | 10390  | .00001   | .00035  |  |
| LOADT  | .00018**<br>Neans for rando<br>.06605***  | .86790-04<br>parameters<br>.00000  | 2.08  | .0390<br>.0000   | .00001   | .00035  |  |
| LNADT (<br>LIELEN )<br>SCYCKIEL (  | .00016**<br>Neens for rando<br>.06605***<br>.00927***   | .00303<br>.00311   | 2.08<br>9.83<br>3.01  | .0390<br>.0000<br>.0000                                      | .00001   | .00035  |  |
| LNADT (<br>LIELEN)<br>HCYNNIEL   | .00016**<br>Heans for sando<br>.06605***<br>.00927***<br>Diagonal elemen  | .00700-04<br>* parameters<br>.00000<br>.00511<br>to #E Cholese   | 2.08<br>9.33<br>3.01<br>V satrix                                    | .0390<br>.0000<br>.0026                                      | .00001<br>.68463<br>.00328                               | .00035<br>1.04352<br>.01547                     |  |
| LNADT (<br>LNLEH)<br>HCVIDLEL (<br>LNLEH)                                    | .00015**<br>Heans for rando<br>.B6609***<br>.00927***<br>Diegonal eleben<br>.08263***   | .00700-04<br>parametexe<br>.00000<br>.00311<br>te =C Cholese<br>.00140   | 2.06<br>9.32<br>3.01<br>9.8071x<br>2.99                             | .0390<br>.0000<br>.0026<br>.0096                             | .00001<br>.00928<br>.00928                               | .00035<br>1.04352<br>.01547<br>.14515           |  |
| LNADT (<br>LNLDH)<br>HCVRABL(<br>LNLRH)<br>HCVRABL(                          | .00018**<br>Neens for sundo<br>.06008***<br>.00927***<br>Disgonal eleven<br>.08263***<br>.00012***                              | .05790-04<br>parametexs<br>.05000<br>.00311<br>te df Choless<br>.00100<br>.00100<br>.00100   | 2.04<br>9.33<br>3.01<br>9.48071x<br>2.99<br>3.56                    | .0390<br>.0000<br>.0036<br>.0096                             | .00001<br>.68463<br>.00328                               | .00035<br>1.04352<br>.01547                     |  |
| LOADT (<br>LELDI)<br>HCVINAILL<br>LOLINI<br>HCVINAILL                        | .00018**<br>.06603***<br>.00037***<br>Disgonal eleben<br>.0023***<br>.00012***<br>Below disponal                                | .00790-04<br>parametezs<br>.00300<br>.00311<br>ts mf Cholese<br>.00190<br>.00195<br>elements of C  | 2.04<br>9.33<br>3.01<br>9 satrix<br>3.99<br>3.55<br>5.55<br>briesky | .0390<br>.0000<br>.0020<br>.0096<br>.0099<br>matrix          | .00001<br>.68463<br>.00328<br>.02018<br>.00147           | .00035<br>1.04852<br>.01547<br>.14835<br>.01078 |  |
| LOADT LILEDI<br>LILEDI<br>LOCHNEILL<br>LOCHNEILL<br>HCVHMILL                 | .00018**<br>Nesse for rondo<br>.06208***<br>.00327***<br>Disputal eleben<br>.03261***<br>.00612**<br>Below disputal<br>.00902** | .06750-06<br>.04000<br>.04000<br>.04000<br>.04000<br>.04100<br>.04100<br>elements of C<br>.04080   | 2.04<br>9.33<br>3.01<br>9 setrix<br>2.99<br>2.30<br>briesky<br>2.28 | .0390<br>.0000<br>.0020<br>.0095<br>.0095<br>matrix<br>.0229 | .00001<br>.68463<br>.00328<br>.02018<br>.00147<br>.01290 | .00035<br>1.04352<br>.01547<br>.14515           |  |
| LOADT I<br>LIELDI<br>LOCHOL<br>LOCHOL<br>HCYGOLATE<br>HCYGOLATE<br>HCYGOLATE | .00018**<br>.06603***<br>.00037***<br>Disgonal eleben<br>.0023***<br>.00012***<br>Below disponal                                | 20102125,<br>20200<br>20200<br>20211<br>20210<br>20210<br>20210<br>20210<br>20210<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>20200<br>2000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>20000<br>2000000 | 2.04<br>9.33<br>3.01<br>9 setrix<br>2.99<br>2.30<br>briesky<br>2.28 | .0390<br>.0000<br>.0020<br>.0095<br>.0095<br>matrix<br>.0229 | .00001<br>.68463<br>.00328<br>.02018<br>.00147<br>.01290 | .00035<br>1.04852<br>.01547<br>.14835<br>.01078 |  |

| Implied | CONNELLE | tos matris | of random | persheters |
|---------|----------|------------|-----------|------------|
|---------|----------|------------|-----------|------------|

| COVARIANCE         | netzix                 |           |
|--------------------|------------------------|-----------|
|                    | INIEN                  | BCARGEL   |
| LHLEN<br>BC/DOOREL | 134688-03<br>,3225E-04 | .27935-04 |

Implied standard deviations of random parameters

s.D\_Beta) 1

1) .0496465 2) .00618587

Implied correlation matrix of rendom parameters

Cor.Nat.| LMLEN HCMODISEL LMLEN| 1.00000 .10562 BCMMXSEL| .10562 1.00000

## Random Parameter Negative Binomial Model of Low Injury Crashes on Small-Urban-Large-Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Nestriote:<br>Dil sglarv<br>Significar<br>Nofedden 1<br>Estimation<br>Inf.Cr.A20<br>Nodel est:<br>Sample is | freide R-squeen<br>5 bared on N =<br>2 = 2234.3 Al<br>Insted: Sep 23,<br>2 pds and 3 | 105<br>-1104.126<br>1 -2297.116<br>2908.940<br>.000<br>1 .51082<br>1608.8 =<br>2/3 = 1.3<br>2015.16:57:<br>04 1.0191304 | 01<br>17<br>00<br>49<br>13<br>69                          |   |   |                                     |
|--|--|---|---|---|---|-------------------------------------|
| legenive 1   | rinobial regress   | Standays  | the the   | Pyob.   | ALL Co  | tidence                             |
| totat.   | Inefficient  | Error   |   | 12152*  |   | arval                               |
|  | CONTRACTORNES IN CONTRACTOR  |   |   | - Indiana   |   |                                     |
| 11   | fourandom parmie   | tere  |   |   |   |                                     |
| (onstant)  | -2.03010***  | 1.00606   | -2.32   | 04060   | -4.96000  | 70440                               |
| WYWDINC -  | 007334++   | .00655  | 20.59   | .0000   | .02422  |                                     |
| HEVCRAM  | 00021***   | -5020D-04   | -1.10   | .0000   | -,00031   |                                     |
|  |  |   |   |   | - 213 C C   | 1000                                |
| LULEN  | (man# for rendom<br>.86737***<br>.00732***<br>.32175***                              | .06345  | 13.66   | .3000   | .74293  | .99180                              |
| SCVDOLSEL  | .00732+++  | .00150  | 4,87  | .0000   | .00427  | .01027                              |
|  | , \$2175***  | 11658   | 2.78  | 10054   | .09528  | .55551                              |
| LINADTI  |  |   |   |   |   |                                     |
|  | riagonal alement   | a of rucreas  | L HECTT   |   |   |                                     |
|  | .15471+*   | .10476  | 2.09  | .0149   | 102778  |                                     |
|  | riagonal alement   | .10476  | 2.09  | .0149   | .02773  | .00163                              |
| LNLEN  | .15471+*   | .00209  | 2.39  | .0169   |   |                                     |
| LNLEN<br>SCVEXSEL<br>LEADT   | .15471**<br>.00460**   | .00476<br>.00209<br>.00514  | 2.09<br>2.20<br>2.05                                      | .0169<br>.0250<br>.0379   | .00050  | .00070                              |
| LNLEN<br>SCVIDASAL<br>LITADT   | .15471++<br>.00480++<br>.01067++   | .00476<br>.00209<br>.00514<br>Lements of C  | 2.39<br>2.20<br>2.05<br>bilesky                           | .0169<br>.0250<br>.0379<br>.0379                                      | .00050  | .00070                              |
| LNLED<br>SCVIDESEL<br>LISAIT   | .15471+*<br>.00460**<br>.01067**<br>Melow diegonal e<br>00486**                      | .00476<br>.00209<br>.00514<br>Lements of C  | 2.39<br>2.20<br>2.05<br>hilesky<br>-2.10                  | .0169<br>.0250<br>.0379<br>.0379                                      | .00050<br>.00060                                  | .00670<br>.02074                    |
| LNLEN<br>SCVIDISEL<br>LIBAIT   | .15471**<br>.00480**<br>.01067**<br>Selow diagonal e<br>05484**<br>.00278            | .00476<br>.00209<br>.00314<br>iements of C<br>.00332  | 2.09<br>2.20<br>2.05<br>hulesky<br>-2.10<br>1.95          | .0169<br>.0250<br>.0079<br>.0079<br>matrix<br>.2961                   | .00050<br>.00060                                  | .00670<br>.02074<br>00032<br>.00427 |
| LHLIN<br>CVIXEEL<br>LIALT<br>BCV_LHL<br>LHA_CHL<br>LHA_CHL   | .15471**<br>.00480**<br>.01067**<br>Selow diagonal e<br>05484**<br>.00278            | .00476<br>.00209<br>.00514<br>immente of C<br>.00232<br>.00277<br>.01327  | 2.05<br>2.05<br>2.05<br>hilesky<br>-2.10<br>1.95<br>-2.87 | .0163<br>.0250<br>.0379<br>.0379<br>matrix<br>.0361<br>.0646<br>.0615 | .00050<br>.00060<br>~.00941<br>~.00060<br>~.02933 | .00670<br>.02074<br>00032<br>.00427 |

Inglied covariance matrix of random parameters

Covariance satule LELES NUMMERS LNADT LELES - 299825-01 NUMMERS -75228-03 LENED -38008-03 -,21028-03 .11128-02

Implied standard deviations of random parameters

subtrue atmosta materiana et tannes Barmarata

| 1,5, | Seta | ł. |      |     |    |   |    |   |   |   | 1 |
|------|------|----|------|-----|----|---|----|---|---|---|---|
|      |      | +  | <br> |     | -  | - | +  | + | - | - | - |
|      | 1    | I. |      |     | 1  | 1 | \$ | 4 | 7 | 1 | q |
|      | - 2  | 1  |      | 14  | ia | e | ø  | 5 | 1 | e | 3 |
|      |      | 1  |      | - 1 |    | h | Ś  | ģ | 4 | d | à |

Implied posselation matrix of raidim parameters

| Cor.Mat.)  | 1.01.010 | BCVMX581     | 110,25 |
|--|----------|--------------|--------|
| a la constante de la constante | Anterine | and a second |        |
| LINGSTR  | 1,000000 | -,72645      | 115226 |
| HCVMMSEL   | -112668  | 1.00000      |        |
|  |          | -194228      |        |

### Random Parameter Negative Binomial Model of Total Crashes on Metropolitan Rural SPF Class Roadway Segments

| Dependent                                 | efficients Segi<br>variable<br>incod function                                   | TOTALA                               | 5C                             |          |                                      |                    | Corneland               | e Hatrid      |                         |          | n paranatere    |
|---|---|--------------------------------------|--------------------------------|----------|--------------------------------------|--------------------|-------------------------|---------------|-------------------------|----------|-----------------|
| Restricts                                 | d log likelihood  | -672.253                             | 74                             |          |                                      |                    |                         | LHI           | 20                      | VOL      | NOWLING         |
| Rignifice<br>NcFedder<br>Estimatio        | ed [ 6 d.f.]<br>nne level<br>Faculo R-squared<br>n haged on H =<br>C = 194.5 AJ | .900.<br>10114 - 1<br>1198, M =      | 69<br>54<br>14                 |          |                                      |                    | LNLEN<br>VCR<br>NOTLINC | -17738-<br>10 | -01                     | 53.48    | .74242-01       |
| Hodel est                                 | imated; Oct 05,   | 2014, 16(20)                         | 24 C                           |          |                                      |                    | Implied a               | taniard o     | ersecond                | of rail  | dom Interesters |
| Secative                                  | binomial regress  | Labom model                          |                                |          |                                      |                    | 3.5_Beta                |               |                         |          |                 |
| TOTALACC                                  | Crefficient   | Frandard<br>Errus                    |                                | Frob.    | 01% Cr<br>Int                        | infidence<br>arval | 11<br>21<br>31          | 1             | 33139<br>31364<br>72665 |          |                 |
|   | Sonrandon perame  |                                      |                                |          |                                      |                    | 21.<br>21.              |               | 12100                   |          |                 |
| Constanti<br>LRADI)<br>DESI/<br>HCVORSELI | -2.66645***<br>.31936***<br>01080**<br>.05298                                   | 10001.<br>10001.<br>00510.<br>86550. | -9.32<br>3.18<br>-2.14<br>1.93 | .032.5   | -1.23870<br>.12286<br>04807<br>00085 | .\$1441<br>00318   | Emplied o               | ovaelet10     | H MATELS                | of rands | on faramatera   |
|   | Seans for isodue  |                                      |                                |          |                                      |                    |                         |               |                         |          |                 |
| LUCER)                                    |   |                                      |                                |          | .44211                               |                    | Cor.Mst. ]              |               |                         | HOAT DO  |                 |
| ACATING (                                 | 3.00862***  |                                      |                                |          | -91403                               | 5.09724            |                         |               | -,59678                 |          |                 |
|   | Diagonal element  |                                      |                                |          | 102201                               |                    |                         |               | 3.00030                 |          |                 |
|   | .13014***   |                                      |                                |          | .05512                               | .31116             | HOFLINC                 |               |                         |          |                 |
|   | 8.89142***  |                                      |                                |          | 1.96981                              | 8.81214            |                         |               |                         |          |                 |
| 1008521001                                | .14200**  |                                      |                                |          | .00195                               | .28202             |                         |               |                         |          |                 |
|   | Seiny diegonal e  |                                      |                                |          |                                      |                    |                         |               |                         |          |                 |
| IVCH 1HL)                                 | -6.18902***   | 1,51725                              | -9.29                          | 10012    | -5.99084                             | -2.63820           |                         |               |                         |          |                 |
| 1HOF LHL                                  | .14353**  | .07197                               | 1.01                           | ,0443    | .00365                               |                    |                         |               |                         |          |                 |
| 1002 VCH                                  | .07145  | .06124                               | 5.97                           | .0434    | 04850                                | .19148             |                         |               |                         |          |                 |
|   | Distance form   | eser for Dep                         | Bin dist                       | rigution |                                      |                    |                         |               |                         |          |                 |
| 1   |   |                                      |                                |          | 110021                               |                    |                         |               |                         |          |                 |

| VER.<br>NOFLENC | 29445    | 1245<br>5-01                 | 13.<br>1.2 | 43<br>23 - 1.3 | 4248-01    |  |
|-----------------|----------|------------------------------|------------|----------------|------------|--|
| 1e/lq#1         | etandard | deviation                    | in of      | esidor         | parameters |  |
| 5.5_Bets        | Èrrina   | 4                            |            |                |            |  |
|                 | i        | 100109<br>1.01964<br>.272668 |            |                |            |  |

| Cor.Mst.() | 111231  | VCR     | 1071310 |
|------------|---------|---------|---------|
|            |         |         |         |
| 101.871    | 1.00700 |         | -,51218 |
| Veti       |         | 1.00030 | 194424  |
| BOFLINC    | 012218  |         | 1.00000 |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Metropolitan Rural SPF Class Roadway Segments

| log likel<br>instillte<br>hi squar<br>Significe<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden<br>fofadden | efficients Segfs<br>Variable<br>Incod Enotion<br>4 log Likelibood<br>ad ( 1 d.f.)<br>cos level<br>Forudo R-sputred<br>5 based on N =<br>C = 641.6 AD<br>Insteat Cot 07, 2<br>2 pdo and 40<br>Inconal regress | ************************************** | 40<br>04<br>91<br>92<br>20<br>20 |                          |          |                   |
|---|--|--|----------------------------------|--------------------------|----------|-------------------|
| abol  | Coefficient  | ftenderst<br>Excor                     | ×.                               | Frob.<br>(\$1>2*         |          | nfidence<br>erval |
|   | formation paraset  | 419                                    |                                  |                          |          | ******            |
| Constant  | -4.57022***  |  | -8.17                            | -00000                   | -6.02199 | -2.72445          |
| DEXLI   | 02690**  |  | -2.08                            |                          |          | -,00153           |
| 908.0   | 1.28656**  | .60421                                 | 2.12                             | -0338                    | 109663   | 2147870           |
| 1   | Neans for sandom   | <b>DALAMECETS</b>                      |                                  |                          |          |                   |
| LULEN   | .34036***  | :06863                                 |                                  |                          | ,20623   | 1.07560           |
| a local data of the   | .05133+++  | .05538                                 | 6.82                             | .0000                    | 156736   | .71465            |
| LEADT   | tiagonal elements  | of Chalese                             | V BALYSS                         |                          |          |                   |
|   |  |  |                                  |                          |          |                   |
|   |  | .04069                                 |                                  |                          | .01269   |                   |
| 200   |  |  | 3.75                             | .0002                    | .07289   |                   |
| LOLEN   | .15264***  | .03531                                 | 3.75<br>2.58                     | .0099                    |          |                   |
| LISLEN  | .15264***  | .03531                                 | 3.75<br>2.58<br>holesky          | .0099                    |          |                   |
| LSLEN<br>LSADT  | .15764+++<br>.09077+++<br>Below diagonal eJ  | .03521<br>C to stream<br>#1650.        | 9.75<br>2.58<br>holesky<br>2.95  | .0099<br>matcik<br>.0163 | .02177   | .15375            |

| COVALIBIO      | e hatiis               |                             |
|----------------|------------------------|-----------------------------|
|                | LHLDI                  | LHADT                       |
| LNLER<br>LNAUT | .25305-01<br>.11135-03 | , 19968-04                  |
| Isplied #      | tandart devis          | ations of random persenters |
| N.D. Betal     |                        | 1                           |

Implied sorrelation matrix of rendom parameters

Cor.Mat. | LHLEH LHLDC LULEN) 1.00000 .45739 LULEN) .45788 1.00000

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Metropolitan Rural SPF Class Roadway Segments

|   |  |  |  |  | *******  |  | Implied m   |
|---|--|--|--|--|--|--|---|
| Dependent<br>Log likel<br>Mestriute<br>Chi sgiar<br>Sagnifica<br>Nofelden<br>RetiMatio<br>Tof.Cr.AJ<br>Nodel wrt<br>Sapple is | afficients He<br>variable<br>bhood function<br>d log livelino<br>ed J = 8.67.1<br>Escodo R-squer<br>n bares on N =<br>C = 244.1<br>imated: Oct 09<br>2 gds and<br>mannal recre | 51<br>-113.04<br>od -121.780<br>17.400<br>.00<br>ed .07140<br>1284, K =<br>.1284, K =<br>.1284, K =<br>.1284, K =<br>.1015, 15:55<br>612 individuo | 1343<br>820<br>274<br>828<br>828<br>8<br>8<br>197<br>8<br>197<br>137 |  |  |  | Covariano<br>LOURD<br>REVERSA<br>Implied a<br>S.D_Reisa |
|   |  | Prandard   |  | Frob.  | .05% Co  |  | 11  |
|   |  |  |  |  | 1100110000                                     |  |   |
|   | Nonrandon para   | COLUMN TO A  |  |  |  |  | Implied :   |
|   | transferrence burger   |  | 1.000  | 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -            | the second states are an                       |  | coperate of   |
| Constant  | -7,00186+++  | 1,79641  | -1.23  | :0000  | +11.12235                                      | -6.00057                               |   |
| LNAST:  | -7.00146***  | 1,79641  | 2188   | 10004  | 127072   | 2101020                                |   |
| Constant)<br>LHADT  | -7.00146***<br>.63006***<br>0.04070**  | 1,79641<br>(18879<br>1,70306   | 1,00   | .0698  | 00280  | 5.01.020                               |   |
| Linkford<br>Linkford<br>VCM   | -7.00146***<br>.63006***<br>0.04070**  | 1,79641<br>(18879<br>1,70306   | 1,00   | .0698  | 00280  | 5.01.020                               | Cor.Met.  |
| Constant)<br>LHADT  | -7.00146***<br>.63006***<br>0.04070**  | 1,79641<br>(18879<br>1,70306   | 1,00   | .0698  | 00280  | 5.01.020                               | Cor.Net.  |
| Constant)<br>LHADT<br>VCR<br>LHLEN<br>LHLEN<br>HEVERAN  | -7.00146***<br>.68004***<br>3.54079**<br>Heats for rand<br>.70356***<br>.00021**   | 1,75641<br>,18875<br>1,70306<br>00 perameters<br>,11285<br>.5355-04  | 1.04<br>1.04<br>1.43<br>1.43   | .0498<br>.0498<br>.0000<br>.0150                   | .00204   | .92450<br>.00557                       | Cor.Net.  |
| Constant)<br>LHLDT<br>VCE<br>LHLEN<br>BCVCRAN   | -7.00146***<br>.68004***<br>3.54079**<br>Heats for rand<br>.70356***<br>.00021**   | 1,75641<br>,18875<br>1,70306<br>00 perameters<br>,11285<br>.5355-04  | 1.04<br>1.04<br>1.43<br>1.43   | .0498<br>.0498<br>.0000<br>.0150                   | .00204   | .92450<br>.00557                       | Cor.Net.  |
| Constants<br>LHLDT:<br>VCR:<br>UTLEN<br>BCVCRAH<br>LHLEN<br>RCVCRAH   | -7.00146-**<br>.68004***<br>3.94070**<br>Heats for rand<br>.70354***<br>.00021**<br>Didpinal elter<br>.04052**<br>.00009**   | 1,79641<br>(18679<br>0.70040<br>00 parateters<br>(11289<br>(15350-04<br>(15350-04<br>(10014<br>(10014<br>(10014)<br>(10014                         | 0.03<br>1.06<br>0.23<br>2.43<br>cy Matrix<br>2.01<br>2.05            | .0004<br>.0498<br>.0000<br>.0150<br>.0443<br>.0443 | .45220<br>.00280<br>.00204<br>.00204<br>.00204 | 5.01920<br>6.67876<br>.00557<br>.00057 | Cor.Nat.i   |
| Constants<br>LHLDT:<br>VCR:<br>UTLEN<br>BCVCRAH<br>LHLEN<br>RCVCRAH   | -7.00146-**<br>.68004***<br>3.94070**<br>Heats for rand<br>.70354***<br>.00021**<br>Didpinal elter<br>.04052**<br>.00009**   | 1,79641<br>(18679<br>0.70040<br>00 parateters<br>(11289<br>(15350-04<br>(15350-04<br>(10014<br>(10014<br>(10014)<br>(10014                         | 0.03<br>1.06<br>0.23<br>2.43<br>cy Matrix<br>2.01<br>2.05            | .0004<br>.0498<br>.0000<br>.0150<br>.0443<br>.0443 | .45220<br>.00280<br>.00204<br>.00204<br>.00204 | 5.01920<br>6.67876<br>.00557<br>.00057 | Cor.Net.  |
| Constants<br>LHLDT:<br>VCR:<br>UTLEN<br>BCVCRAH<br>LHLEN<br>RCVCRAH   | -7.00146-**<br>.68004***<br>3.94070**<br>Heats for rand<br>.70354***<br>.00021**<br>Didpinal elter<br>.04052**<br>.00009**   | 1,79641<br>(18679<br>0.70040<br>00 parateters<br>(11289<br>(15350-04<br>(15350-04<br>(10014<br>(10014<br>(10014)<br>(10014                         | 0.03<br>1.06<br>0.23<br>2.43<br>cy Matrix<br>2.01<br>2.05            | .0004<br>.0498<br>.0000<br>.0150<br>.0443<br>.0443 | .45220<br>.00280<br>.00204<br>.00204<br>.00204 | 5.01920<br>6.67876<br>.00557<br>.00057 | Cor.Net.  |
| Constants<br>LHADT:<br>VCH:<br>LHCEN<br>BCVCRAN<br>CHLEN<br>RCVCRAN   | -7.00146<br>.68004<br>3.54070<br>Naans for rand<br>.70504<br>.00021<br>Diepunal eltem<br>.04052  | 1,79641<br>(18679<br>0.70040<br>00 parateters<br>(11289<br>(15350-04<br>(15350-04<br>(10014<br>(10014<br>(10014)<br>(10014                         | 0.03<br>1.06<br>0.23<br>2.43<br>cy Matrix<br>2.01<br>2.05            | .0004<br>.0498<br>.0000<br>.0150<br>.0443<br>.0443 | .45220<br>.00280<br>.00204<br>.00204<br>.00204 | 5.01920<br>6.67876<br>.00557<br>.00057 | Cor.Nat.i   |

piled novariance matrix of random persenters warience setrik tatik mitvitää kiik .'Kest-os VVCRAM -.LISIR-05 .BEFTE-07

Implied standard deviations of random parameters

\_Beia) 1

1) .0417401 2) .196541E-03

uplied coordistion matrix of random parameters

| Cor Mat.           |         |        |
|--------------------|---------|--------|
| LILEN              | 1.00000 |        |
| Question (21) 1411 | -,31804 | 1:0545 |

# Random Parameter Negative Binomial Model of Evident Injury Crashes on Metropolitan Rural SPF Class Roadway Segments

| log likel:<br>Restricter<br>Thi squark<br>Rignifican<br>ArTadden 1<br>Spilmeticr<br>Inf.Cy.Al/<br>Nodal ast:<br>Sampla 1s | verable<br>incod function<br>i log likelihood<br>ed [ 1 H.F.]<br>ins lavel<br>Preudo R-aquared<br>i bared on N =<br>1 = 195.1140<br>mated Oct 12,<br>2 pts and 4<br>(insumal represent | -112.534<br>-116.130<br>#.152<br>.002<br>.03957<br>1236, % =<br>0/8 = .1<br>2015, 18:30;<br>18 individue  | 51<br>58<br>78<br>40<br>62<br>6<br>80<br>52                    |   |  |                                       |
|---|--|---|--|---|--|---------------------------------------|
|   |  | Standard<br>Erros   |  | Prob.   | \$58 Cs  | nfidence                              |
| £VI!  | Coefficient  | Erros.  |  | Carlora   |  |                                       |
|   | Conrandom parabe   |   |  |   |  |                                       |
|   | formandon parame   | 5#2#<br>1.91722   | -2.79  | ,0068   | -3.10202   |                                       |
|   | fourandon parabe   | 5#2#<br>1.91722   | -2.79  | ,0068   | -3.10202   |                                       |
| Conistanti<br>Listanti  | formandon parame   | 1.91703<br>.12440   | -2,19<br>5,60  | ,0058<br>,0000  | -3.10292<br>.40407   | -1.68494                              |
| Conistenti<br>Listin<br>VGE21   | forrandist parase<br>-5.34463***<br>.45021***<br>18783***<br>feans for rendus  | 1.91723<br>.12440<br>.05322   | -2,18<br>5,60<br>-3,53   | ,0058<br>,0000<br>,0004   | -3.11232<br>.45407<br>+.29214                              | -1,60490<br>.94240<br>05352           |
| Conistenti<br>Listin<br>VGE21   | 6trandim parabe<br>+5.34163***<br>.45021***<br>18725***  | 1.91723<br>.12440<br>.05322   | -2,18<br>5,60<br>-3,53   | ,0058<br>,0000<br>,0004   | -3.11232<br>.45407<br>+.29214                              | -1,60490<br>.94240<br>05352           |
| Contertanti<br>Lificiti<br>VCH2:<br>1<br>Lificiti<br>VCH2:<br>2<br>Lificiti   | Forrandom parales<br>-5.34163***<br>.60025***<br>18725***<br>forme for rendom<br>.41085**<br>Scale parameters  | 1.91723<br>.12440<br>.05322<br>Derencters<br>.19391<br>for dists.   | -2,18<br>5.60<br>-3.53<br>2,18<br>of rendo                     | .0059<br>.0000<br>.0004<br>.0017<br>n parame                      | -9,11232<br>-45407<br>+,25214<br>,03491                    | -1,60490<br>.94240<br>05352           |
| Contertanti<br>Lificiti<br>VCH2:<br>1<br>Lificiti<br>VCH2:<br>2<br>Lificiti   | Cotrandom parame<br>+5.34163***<br>.60025***<br>-18725***<br>Deans for rendom<br>.42089**  | 1.91723<br>.12440<br>.05322<br>Derencters<br>.19391<br>for dists.   | -2,18<br>5.60<br>-3.53<br>2,18<br>of rendo                     | .0059<br>.0000<br>.0004<br>.0017<br>n parame                      | -9,11232<br>-45407<br>+,25214<br>,03491                    | -1,68454<br>.94240<br>05355<br>.80486 |
| U<br>Codistenti<br>LUCLEU<br>VCE2:<br>LURADI<br>LURADI<br>LURADI  | Forrandom parales<br>-5.34163***<br>.60025***<br>18725***<br>forme for rendom<br>.41085**<br>Scale parameters  | L St72J<br>L St72J<br>L St72J<br>Datanetels<br>J State<br>L State<br>L State<br>L State<br>L State<br>L State<br>L State<br>L State<br>L State<br>L State<br>L St72J<br>L S | -2,79<br>5.60<br>-3.53<br>2.18<br>of rendo<br>2.49<br>Bun diet | .0069<br>.0000<br>.0004<br>.0017<br>m parame<br>.2146<br>ribution | -9.10202<br>.40407<br>.20214<br>.03491<br>.03491<br>.02120 | -1,68454<br>.94240<br>05355<br>.80486 |

Random Parameter Negative Binomial Model of High Injury Crashes on Metropolitan Rural SPF Class Roadway Segments

| Log likel:<br>Restricted<br>Significer<br>Significer<br>Schadden H<br>Estimation<br>Inf.Cr.AIG<br>Model esti<br>Sample La | Veriable<br>hood finction<br>i log likelihood<br>di [ 1 3.f.]<br>tts level<br>fandt F.squared<br>based on H =<br>2 = 296.7 AU<br>instat: Oct 11, 1<br>2 pBs and 6<br>incellal segress | -143.334<br>-150.577<br>14.484<br>.000<br>.04203<br>1234, H =<br>2/H = .2<br>1015, 16:481<br>18 individua | 93<br>28<br>65<br>14<br>71<br>8<br>40<br>15<br>14          |   |   |                              |
|---|---|---|--|---|---|------------------------------|
|   |   |   |  |   |   |                              |
| 811947  | Coefficient   | Standard<br>Error   |  |   | 95% Co<br>Int   | erval                        |
| 822947  | Coefficient   | Error   |  |   |   |                              |
| HIIN/   | -3.13945***   | Error<br>LATS<br>.52345   | -3.31  | (EI>C*                                    | Ini<br>-4.28319                                       | -1.39630                     |
| HIIN)   | -3.13945***<br>.40589***  | Error<br>.18345<br>.12170   | 4  | .0000<br>.0010                            | -4.28119<br>.16237                                    | -1.39630<br>.63393           |
| HIIN)   | -3.13945***<br>.40589***  | Error<br>.18345<br>.12170   | 4  | .0000<br>.0010                            | -4.28119<br>.16237                                    | -1.39630<br>.63393           |
| HIDH<br>HIDH<br>(Instant)<br>TOTLANE<br>LHLON   | -3.15945***<br>.40089***<br>Means for candom<br>.46523***   | Error<br>-SE345<br>-IJITO<br>primeters<br>-IS224  | 4<br>-3.34<br>3.22<br>8.62                                 | .0000<br>.0010<br>.0004                   | -4.28319<br>.16237<br>.20405                          | -1.39630<br>.63393           |
| HIIN)   | -3.13945***<br>.40589***  | Error<br>.BE345<br>.13170<br>primeters<br>.18234<br>for dists.  | 4<br>-3.36<br>3.29<br>8.62<br>of vando                     | .0000<br>.0010<br>.0010                   | 104<br>-4.28318<br>.14237<br>.20405<br>terme          | -1.39630<br>.83393<br>.72445 |
| HITH/<br>HITH/<br>CONSTANT<br>TOTLANE<br>LHLEN<br>LHLEN<br>LHLEN  | -3.13945***<br>.40085***<br>feans for random<br>.46523***<br>Rale parameters  | Error<br>.58345<br>.12170<br>parameters<br>.18294<br>for dists.<br>.05963<br>ster for Meg                 | 4<br>-3.35<br>3.29<br>8.83<br>of rando<br>2.30<br>Bin dist | .0000<br>.0010<br>.0014<br>.0217<br>.0217 | 104<br>-4.28119<br>.56257<br>.20405<br>term<br>.02006 | -1.39630<br>.83393<br>.72445 |

Random Parameter Negative Binomial Model of Just Injury Crashes on Metropolitan Rural SPF Class Roadway Segments

| Dependent<br>Ing likel:<br>Septricted<br>Chi square<br>Significar<br>Nofedden F<br>Estimation<br>Inf.Cr.AD<br>Social esti<br>Semple is | fficients Hegb<br>mariable<br>hood filention<br>(icg likelihood<br>d ( i d.f.)<br>tealset<br>secto 8-squared<br>based on 7 =<br>( i 40.0 Mi<br>mared: Oct 11,<br>7 pds and 6<br>inceal regrees | 201511<br>-63.600<br>-1256.000<br>2014.038<br>.000<br>.04622<br>1236, E =<br>0/E = ,1<br>2015, 14133<br>10 individue | 65<br>69<br>00<br>57<br>6<br>19<br>07                |                                  |   |  |
|--|--|--|--|----------------------------------|---|--|
|  |  | Local Decision   |  |                                  |   |  |
| 20121347   | Coefficient  | Joandard<br>Error  |  | 3100.<br>(2)>2*                  |   | nfidence<br>scval                      |
| 20022343   | Coefficient  | Errer  | ±  |                                  |   |  |
| Conecant:  | Contendon parase<br>-11.6545***  | E2202<br>tera<br>5.02900   |  | *24(1±)                          | Inte  | e2795                                  |
| Constant:  | Contendon parame<br>-11.4545***<br>1.00211***  | E2000<br>tera<br>1.02900<br>.24175   | 4:11   | *24(1±)                          | Inte  | -0.7542                                |
| Constant:  | Contendon parase<br>-11.6545***  | E2000<br>tera<br>1.02900<br>.24175   | 4:11   | *24(1±)                          | -19.8829                                      | -0.7542<br>1.47994                     |
| Constant:<br>Liller<br>SHINDEC:  | Contendon parame<br>-11.6545***<br>1.60215***<br>20175**<br>Pears for candom   | Erocr<br>4.02906<br>.24175<br>.05564<br>perameters   | 4,11<br>-2,29  | .0098<br>.0000<br>.0213          | 105<br>-19,8839<br>.52433<br>-,15156          | -9.7542<br>1.47994<br>01186            |
| Constant:<br>Liller<br>SHINDEC:  | Contandon parate<br>-11.6545***<br>1.00211***<br>09171**   | Erocr<br>4.02906<br>.24175<br>.05564<br>perameters   | 4,11<br>-2,29  | .0098<br>.0000<br>.0213          | 105<br>-19,8839<br>.52433<br>-,15156          | -9.7542<br>1.47994<br>01186            |
| Constanti<br>Liffeni<br>SHINDDEC)<br>LIGDTI  | Contendon parame<br>-11.6545***<br>1.60215***<br>20175**<br>Pears for candom   | E2000<br>4.02906<br>.24175<br>.03564<br>permeters<br>.46090  | 4,11<br>-2,23<br>2,78                                | .0098<br>.0000<br>.0219<br>.0064 | 2019<br>-19.8829<br>.52422<br>15156<br>.56961 | -9.7542<br>1.47994<br>01186            |
| Constanti<br>Linico<br>SWINDDEC)   | Infrancing parager<br>-11.6545***<br>0211***<br>02171**<br>Hemis for rendom<br>1.31205***  | Eroor<br>4.02906<br>.24075<br>.05564<br>porameters<br>.48090<br>dor diata.   | 4.11<br>-2.29<br>2.78<br>of recto                    | .0098<br>.0000<br>.0213<br>.0064 | -19.5829<br>-192432<br>-19156<br>.96951       | -0.7842<br>1.47904<br>01106<br>2.25469 |
| COLASANSI<br>LILLO<br>SMYNDDEC)<br>LIADTI<br>LIADTI  | Infrandom parage<br>-11.6545***<br>1.60115***<br>02171***<br>Hans for centom<br>1.31205***<br>Itale parameters   | Etter<br>4.02296<br>.24175<br>.05564<br>porameters<br>.40190<br>dor dists.<br>.44922                                 | 4,11<br>-2.29<br>2.78<br>of rendo<br>1.98<br>1001100 | .0098<br>.0000<br>.0213<br>.0064 | -19.5829<br>-192432<br>-19156<br>.96951       | -0.7842<br>1.47904<br>01106<br>2.25469 |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Metropolitan Rural SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Mestrioted<br>Chi aguare<br>Significer<br>Mofadden I<br>Letimatio<br>Inf.Cr.R2<br>Nodel exti<br>Sample is | officients Hegf<br>veriable<br>bhoof function<br>5 log likelihoos<br>d [ 1 d.f.]<br>(seide R-squared<br>) based on H =<br>2 = 104.5 ÅJ<br>marmed Oct 15,<br>7 pds and 4<br>rinsmial segress | 201<br>-341.225<br>4 -522.843<br>342.716<br>.000<br>1 .34704<br>1234, # =<br>2015.16:501<br>101.16:501 | 07<br>05<br>00<br>18<br>13<br>72<br>20 |                 |                   |  |
|--|---|--|--|-----------------|-------------------|--|
| L0197  | Coefficient   | Standard<br>Error  | 1                                      | Prob.<br>(8)>5* | 20% C:<br>[11]    | nfidence<br>ecval                        |
|  | fonzandom patama  | taza   | - 1 C -                                | 12,01221        | 10.13.13<br>19.13 | 1. |
| Scnstact)  | -4.24241***   | .29415   | -4174                                  | .0005           | -5.99490          | -2.48385                                 |
| LIGAT  | .54400***   | .08862   | 6.15                                   | .0000           | .37118            | ,71858                                   |
| 06011  | -,03799**<br>,18978*  | ,01499   | -2,84                                  | 0122            | 06722             | -,00068                                  |
| VERARMA  | +14976+   | 104403   | 3.96                                   | .0549           | 02848             | -34404                                   |
| ACAT?  | ++00063*  | 100024   | -1187                                  | 12824           | 00130             | ,00003                                   |
|  | .00031**  |  |  |                 | .00002            | .00021                                   |
| 19.0000  | tease for report  | parameters.  |  |                 |                   |  |
| LNLEN  | .97191+++   | .07\$\$7   | 12.81                                  | .0000           |                   | 3.12042                                  |
| VCK)   | .97191***<br>1.69556**  | 5.29752  | 2.08                                   | 20375           | .15774            | 5.23548                                  |
| 1.12   | icagonal mismant  | s of Cholese   | y mencice                              |                 |                   |  |
| INTER!   | ,11056***   | 102782   | 41.65                                  | 0000            | 107002            | 117206                                   |
|  | 2,08276**   |  |  |                 |                   | 2,15247                                  |
|  | Helow diagonal e  |  |  |                 |                   |  |
| VIE INT  | -1.70867+++   | ,63776   |  | .0074           | -7.35845          | 45249                                    |
|  | Laperator, paras  | mater for Neg  | Sin dist                               | ribution        |                   |  |
|  |   | and then be  | 7.68                                   | 1424            | 106191            | 3,74437                                  |

Implied ocvariance satrix of random parameters

### Coveriance Matrix

LHERH VER LHERH .18628-01 VER -.2128 T.287

Implied standard deviations of random parameters

8.0\_Sets) 2 1) 1124539 2) 2.69362

Implied correlation matrix of random parameters

| Cor.Hat. | LUL 23  | VER     |
|----------|---------|---------|
| LHLEN    | 1.00000 | 62422   |
| 1008     | 63822   | 1.00000 |

## Random Parameter Negative Binomial Model of Total Crashes on Rural Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log liveld<br>Restricted<br>Chi square<br>dignificar<br>McFadden F<br>Estimatice<br>Inf.Cr.All<br>Model esti<br>Schple 18 | efficients NegB<br>verimble<br>hood function<br>log limetion<br>d [ 10 d.f.)<br>celevel<br>secio R-squared<br>baced on R =<br>= 2004.5 AJ<br>mated: Sep 27,<br>2 pds son 7,<br>inconial regress | TOTAL<br>-1431.044<br>-04447.044<br>4470.422<br>.000<br>.40940<br>1492.8 =<br>2/9 = 2.0<br>2015.23104<br>24 LOGIVLOUE | 959<br>X00<br>21<br>21<br>149<br>1#                       |   |                                     |                               |
|--|---|---|---|---|-------------------------------------|-------------------------------|
| POTALACE   |   | Standard<br>Error   |   | Prob.<br>12122*                                   | 5HA Co<br>Int                       | nfidende<br>Gerei             |
|  | inzandom parame   | tera  | *******   | ******  |                                     |                               |
| HOVESHI<br>SHRDRT<br>VCFARME<br>NOVCRAII   | 0011000 parame<br>-7.00128***<br>1.02000***<br>-1.73714***<br>04702***<br>.09992**<br>.076882-04**  | .01528<br>.02638<br>.4470D-04   | -3,79<br>-5,04<br>2,28<br>1,84                            | 10002   | -2.64736<br>08287<br>.00932         | 1,18272<br>-,82682<br>-,04107 |
| LNLEN<br>TOTLANE:<br>DEH1:<br>RHYNDINC:  | <pre>leans fur sandok     .89443***     .02837***     .00668***     .02751*** Itaponal cleants</pre>  | -06866<br>-00775<br>-00202<br>-00787  | 38,81<br>-3,64<br>-3,28<br>3,75                           | +0002   | 04054<br>04054<br>01080<br>01007    |                               |
| LNLEN<br>TOTLANE:<br>DEGI:<br>FNYNDINC:  | .32577###<br>.15576###  | .08808<br>.08752<br>.00056<br>.00169  | 5.91<br>2.40<br>1.96<br>1.99                              | .0000<br>8800.<br>9419<br>1000.                   | -21780<br>-03902<br>09222<br>-09222 | 126353                        |
| 1707 LNL<br>LDES LNL<br>LDES DOD<br>LNNY LNL<br>LANY TOT<br>LANY DES   |   | .06633<br>.00636<br>.00561<br>.00726<br>.00726<br>.00632<br>.00632  | -3,83<br>-1,81<br>3,41<br>1,84<br>-1,94<br>-1,94<br>-1,97 | .0001<br>1072<br>.0001<br>.1298<br>.0878<br>.0978 | 36269<br>02182                      | .03137<br>.02642<br>.02971    |

Implied orvariance matrix of random parameters

Diplied standard deviations of random parameters

5.0\_Beta) 1 1.1 .325744 2( .291418 31 .0254053 4) .9405075

| Doc.Mat.   | 111.81  | TOTLAR  | DEGL    | REVEDING |
|------------|---------|---------|---------|----------|
| LICENI     | 1.00002 | 85997   | 40328   | .87814   |
| 00712/0R1  | -105997 | 1.00000 | .75576  |          |
| 2831       | 40323   | ,75575  | 1,00000 | 90604    |
| INTRODUCT: | .41014  |         | 00604   | 1,00000  |

# Random Parameter Negative Binomial Model of Property Damage Only Crashes on Rural Small Urbanized SPF Class Roadway Segments

| Bandom Co<br>Dependent<br>Log Itke)                          | efficients Heg<br>variable<br>ihood famotion  | SnReg Model  | F00                     |                  |               |  | Implied covariance matrix of random parameters<br>Covariance matrix                      |
|--|---|--|-------------------------|------------------|---------------|--|--|
| Significa  | d log likelihood<br>ed ( -6 d.f.)<br>noe level<br>Fetudo Noeguere:                                |  | 000                     |                  |               |  | LIGART LIFLEN HOVENSEL   |
| Estimatio<br>Inf.Cr.Al<br>Hodel est<br>Sample is<br>Recative | <pre>b based on M =<br/>C = 3400.3 A<br/>imated: Sep 38,<br/>2 pds and<br/>blocklal regres;</pre> | 1452, E =<br>10/H = 1.4<br>2015, 14494:<br>726 individua<br>sith madel | 17<br>150<br>182<br>148 |                  |               |  | IMALT .0788E-02<br>IMELN .2294E-02 .4294E-01<br>SCMMXXXI =.6196E-04 .,4775E-03 .3396E-04 |
| FDC  | Coefficient   | Standard<br>Reror  | 1                       | Paub.<br>12/192* | 01% Cc<br>Int | nfidence<br>erVal                      | Implied standard deviations of random parameters<br>5.0 Bets: 1                          |
|  | Singunden param   |  |                         |                  |               |  |  |
| BUVR   | -7.88393***<br>27490D-04*   | .15110-04  | -1.97                   | .0509 -          | . \$71080-04  | 212660-05                              | 21D615529<br>21207221<br>3660527724  |
| TOTLASE  |   | .09512   | -2.43                   | .0084            | 43694         | ~.06409                                | 3( .00582724   |
| ICARCILL)  | -2418486+++   | 0.41555  | -4.58                   | .0000.           | -30, \$779    | -14.2494                               |  |
| HOVORARI   | 400018***   | +++8.8.D-04  |                         |                  |               |  |  |
|  | .01103**  | +00499   |                         |                  | 100228        |  | leplied currelation matrix of random parameters  |
| SHEPATURI  | 05311**<br>Neans for rendu  | .05251   | -2.31                   | *0101            | -,14664       | 07854                                  |  |
| LIDADT   |   |  |                         | .0000            |               | 1.26155                                |  |
| ENG. ENG.  |   | -06678   |                         | .0000            | .74058        | 1.00218                                |  |
|  | _00405**  | .00198   |                         |                  | .03032        | .00787                                 | Cor.Nat.; LHADT LELEN SCYNKSEL   |
| the state of the   | Disgonal element  | te of Cholesi  | IV BOUCLE               |                  |               | 1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1. | *********************************  |
| LIDADT)  | 106155***   | .03255   | 2.40                    | .0072            | .01010.       | .10041                                 | 184001 1.00000 .9678317278   |
| 14718161   | .06255***<br>.05255*<br>.05225*   | .0297.0  | 1.96                    | _0585            | 20293         | .11042                                 | INLEN) .96767 1,0000039571   |
| SCYOSESEL  | .00227***   | .00075   | 2.89                    | .0055            | .00073        |  | SCVMXSEL) 17379 29971 1.00000  |
|  | Below diagonal (  |  |                         |                  |               |  |  |
| TTHE THY   | .200604**   | +07091   | 2.82                    | -2047            | 104195        | .33545                                 |  |
| THUAT THY  | 00102   | .00177   | -2.57                   | .007Z            |               | 00247                                  |  |
| THE VERI   | 00527+**  | _0014T   | -3.58                   | .0003            | 01016         | 00138                                  |  |
|  | Dispersion pares  | .06321   | DIN GLUT                | FIDUTIO:         | and a second  | .77554                                 |  |
| 1  |   |  |                         |                  |               |  |  |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Rural Small Urbanized SPF Class Roadway Segments

| Significer<br>Hofedden f<br>Estimation<br>Inf.Cr.Ald<br>Nodel esti<br>Sample is  | <pre>ffluients Hegt<br/>variable<br/>dood function<br/>i log livelihood<br/>di 3 d.f.)<br/>tra livel<br/>'sendo Broguaret<br/>tassed on S =<br/>= 1501.6 Al<br/>matet/ Sep ID,<br/>2 pús and<br/>inomial regress)</pre> | F1<br>-639,379<br>-898,830<br>197,801<br>000<br>4,31992<br>1452, K =<br>107M =<br>2018,201241<br>126 individue | 00<br>91<br>14<br>97<br>21   |   |  |                                       |
|--|---|--|--|---|--|---------------------------------------|
| and  | Coefficient   | Standard   |  | fron-   |  | ofidence<br>erval                     |
| FARET  | 10000.00000000  |  |  |   |  |                                       |
|  | Contranting paramy<br>-0.04953***<br>1.10185***<br>-30.2226***<br>.00023***   | 11418  |  |   |  |                                       |
| Constant:  | +0.06953***   | 5,42583  | -6.10  | 10000   | -11.85423  | -8.20203                              |
| INVOT:   | 1,00185***  | 116362   | 6,00.  | ,0000   | 72036  | 1.16538                               |
| CV9885511  | -35.2226***   | 17.128429  | -8;90  | 10000   | -48,2010   | +21.1977                              |
|  |   |  |  |   |  |                                       |
|  |   |  | 1.99   | 1.0540  | 00785  | 114524                                |
| VCEARIA  | 107880*   |  |  |   |  |                                       |
| VCEARMA  | .07880*<br>leens for cendus   | subjementers   |  |   |  |                                       |
| VCEAGOL  | tens for cendus<br>07665***   | .02440   | -1.14  | +0017   | 13442  | -,92879                               |
| VCEAGGA  | .07880*<br>leens for cendus   | .02440   | -1.14  | +0017   | 13442  | -,92877                               |
| VCTARICA<br>IS<br>BRRDCA<br>LICLEII  | tens for cendus<br>07665***   | .02440<br>.02440<br>.00340   | -1,14  | +0017   | 13442  | -,02879<br>1,04608                    |
| VCEARDA<br>13<br>13<br>13<br>13<br>13<br>13<br>13<br>13<br>13<br>13<br>13<br>13<br>13  | .07880*<br>leans for candus<br>07685***<br>.02224***  | n parameters<br>.02440<br>.00340<br>.00340<br>cs of Cholask  | -3.18<br>10.55<br>7 metris   | 10017   | 13+42<br>.71980                                  | 1,04608                               |
| VCEARDA<br>13<br>BRHDCRI<br>LICLEII<br>SBRDCRI   | .07880*<br>leans for cander<br>07665***<br>.02224***<br>leagonal element  | .02440<br>.02440<br>.00340<br>ts of Cholesk<br>.01805  | -3.14<br>10.18<br>9 matrix<br>2.45   | ,0017<br>,0000<br>,0143                             | 12442<br>.71980<br>.00885                        | 1,04608                               |
| VCEARICA<br>ISBRDCA<br>LICLEII<br>SIRKDCA<br>LICLEII<br>LICLEII  | .07880*<br>teans for candum<br>07665***<br>.52324***<br>itegonal element<br>.05517***<br>elow diagonal *  | a parameters<br>.02440<br>.00340<br>ts of Cholesk<br>.01808<br>.02342  | -3.18<br>10.18<br>12.48<br>2.48<br>4.13<br>341esty   | .0001<br>.0000<br>.0143<br>.0000                    | -,13443<br>.71980<br>.00855<br>.05228            | -1,04608<br>.07873<br>.114408         |
| VCEARICA<br>ISBRDCA<br>LICLEII<br>ISBRDCA<br>LICLEII<br>LICLEII  | .07880*<br>teans for candum<br>07665***<br>.52324***<br>itegonal element<br>.05517***<br>elow diagonal *  | a parameters<br>.02440<br>.00340<br>ts of Cholesk<br>.01808<br>.02342  | -3.18<br>10.18<br>12.48<br>2.48<br>4.13<br>341esty   | .0001<br>.0000<br>.0143<br>.0000                    | -,13443<br>.71980<br>.00855<br>.05228            | -1,04608<br>.07873<br>.114408         |
| VCEARICA<br>ISBRDON<br>LILLEN<br>SISKDON<br>LILLEN<br>LILLEN<br>()<br>LILLEN<br>()<br>LILLEN<br>()<br>LILLEN<br>()<br>LILLEN<br>()<br>LILLEN<br>()<br>LILLEN<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>()<br>() | .07880*<br>leans for candom<br>07655***<br>.02224***<br>Lagonal element<br>.05517***  | s parameters<br>.02440<br>.00340<br>ts of Cholask<br>.01808<br>.02342<br>timmete of S<br>.02142                | -3.18<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.10<br>10.100 | .0017<br>.0000<br>.0143<br>.0000<br>Matrix<br>.0056 | -,13443<br>,71980<br>,00855<br>,05224<br>-,10007 | 1,04608<br>.07873<br>.124408<br>01712 |

| Isplied c         | pyariance met         | tris of random parameters   |
|-------------------|-----------------------|-----------------------------|
| COVAFIADO         | e matizia             |                             |
|                   | SHRDOR                | TREA                        |
| ANNIDER<br>LIKLEN | .1963E-03<br>2595E-03 | .130-B-01                   |
| Implied s         | tandard devis         | sticos of random parameters |
| 5.D Betal         |                       | 1                           |
| 11<br>21          | .04429                | 21<br>27                    |

Implied correlation matrix of random parameters

Cor.Hat., SHNDCH LMLEN SHNDCR, 1.00000 -.51210 1MLEN, -.51290 1.00000

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Rural Small Urbanized SPF Class Roadway Segments

| estilute<br>hi equezo<br>officien<br>officien<br>nf.Cr.Al<br>odel esti<br>emple 18 | Variable<br>incod function<br>t log lighthood<br>nd ( 3 d.f.)<br>toe lavel<br>Facilo R-squared<br>t based of N =<br>2 = 405.5 mJ<br>immited: Sep 20,<br>2 pide 6rd 7<br>incomial regrees | -200.493<br>80.143<br>.000<br>1492, N<br>CON3<br>2015, 1715;<br>26 LUDIVIDIA | 46<br>7e<br>20<br>9<br>46<br>51 |                      |          |                   |
|--|--|--|---------------------------------|----------------------|----------|-------------------|
| RAT  | Coefficient  | Ptendard<br>Rezor  | r.                              | Frob.<br>(2)>2*      |          | nfidence<br>Grval |
| 12   | Sonrandom perame   | CALF   |                                 | and a set of a local |          |                   |
| oistent!   | +3.14247****<br>.43414***  | 1,30321  | -3.55                           | 10001                | +7.70655 |                   |
| LUMADT   | 2.04404**  | 153762   | 3,88                            | 10000                |          | .7639L<br>4.07164 |
| 2.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1  | farms for exercise   |  |                                 |                      |          |                   |
| CVMCRLL1   | -28,1481*  | 13.24584   | -1108                           | .0403                | -49.3208 | 217944            |
| LOLEN  | .95525***  | 110001   | 6,10                            | 10000                | .46251   | 1.79479           |
|  | bisgonal element   | s of Cholese   | y matrix                        |                      |          |                   |
| C'/0083L1  | .27004**   | 111140   | 2.24                            | 1910.                | .04343   | 121068            |
|  | .150082444   |  |                                 |                      | .04938   | 25223             |
|  | Selow diagonal e   | Levents of C   | tolesky.                        | metrix.              |          |                   |
| - 19   |  | .04698   | 1.1-24.98                       |                      | -,29345  | 04465             |
| LAL HEY  | 13459***   |  |                                 |                      |          |                   |
| LIFL_HEV   | 13959***<br>Disperator param<br>.01565**   | ster for Neg   | Sin dist                        |                      |          | 12110             |

| Implied | 37 | VACIANCE | matris | 14 | 18 | idole | parameters |
|---------|----|----------|--------|----|----|-------|------------|
|---------|----|----------|--------|----|----|-------|------------|

| <br>  | <br> | <br>- | - | -  | - | - | - |
|-------|------|-------|---|----|---|---|---|
| -     |      | ú     | - |    |   |   | - |
| - 4.1 |      | 2     | 2 | -  |   |   | ÷ |
|       |      | -     |   |    | 4 | ٦ |   |
|       |      | ÷     |   | ٦, |   |   |   |
|       |      |       |   |    |   |   |   |
|       |      |       |   |    |   |   |   |

Implied correlation matrix of random parameters

| Cari | Мı  | ÷. | ÷  | 13 | ЫÇ | Ν | 2 | Ņ | Ζ | L | а. |   |   |   | L  | 12 | n  |
|------|-----|----|----|----|----|---|---|---|---|---|----|---|---|---|----|----|----|
|      |     | -  | -  | ÷  | -  | 4 | ÷ | 4 | ÷ | - | 4  | - | - | - | -  | -  |    |
| 5012 | X3  | ć  | ź  | r  | 1  | 2 | 5 | b | 0 | ÷ | Ċ. |   | 4 |   | ė, | 1e | 65 |
| 1.1  | 101 | z  | 1Ì |    | -  | è | ÷ | Ó | 4 | 4 | 4  |   | 1 | ŝ | ъi |    | 00 |

# Random Parameter Negative Binomial Model of Serious Injury Crashes on Rural Small Urbanized SPF Class Roadway Segments

7 0

| Chi bogiari<br>Righifidan<br>Rofaddan 1<br>Estimation<br>Inf.Cr.All<br>Robal est<br>Sample is | <pre>d log likelihood d l 1 d.[.] de level % based on H = l = 203.% AI( nated of L = 203.%</pre> | 1,697<br>,100<br>,01197<br>1452, K =<br>1/8 = ,1<br>1018, 16:04:<br>16 1001:1008 | 76<br>49<br>20<br>20<br>24                     |   |   |                            |
|---|---|--|--|---|---|----------------------------|
|   |   |  |  |   |   |                            |
| 52971   | Coefficient   | Scandard<br>Eccet  |  | Frob.   | 010 Co<br>251                                 | erval                      |
| 52871   | Coefficient   | Leves  |  |   |   |                            |
| Constanti<br>DES1   | Coefficient<br>Surracdom paraker<br>-2.22764***<br>.02475   | Ecocd<br>.66233<br>.01557  | #<br>-9.34<br>1.99                             | 1=1>Z*  | 151   | erval                      |
| Constanti<br>DESLI  | -2.22164***<br>.02475<br>Seans for candom   | Eccor<br>.66233<br>.01557<br>parameters  | z<br>-9.34<br>1.99                             | .0008<br>.0158                                | 211<br>-3.82678<br>00576                      | 82999<br>.05526            |
| Constanti<br>DESLI<br>INLERI  | -2.22164***<br>.02475<br>Means for candon<br>.0000***   | Ecocr<br>.66233<br>.01557<br>parameters<br>.25121                                | =<br>-9.34<br>1.99<br>2.77                     | .0008<br>.0118                                | -3.82878<br>00576<br>.19693                   | 82999<br>.05526            |
| LNLEN   | -2.22164***<br>.02475<br>Seans for candom   | Erocz<br>.66233<br>.01557<br>persenters<br>.75121<br>for diace.<br>.20016        | =<br>-3.34<br>1.99<br>2.77<br>0f xendo<br>2.64 | .00008<br>.0133<br>.0034<br># Jackne<br>.0055 | -9.52578<br>00976<br>.10097<br>10092<br>10242 | 82949<br>.05526<br>1.05524 |

| Random Parameter Negative Binomial | Model of High In | jury Crashes | on Rural Small Urbanized |
|------------------------------------|------------------|--------------|--------------------------|
| SPF Class Roadway Segments         |                  |              |                          |

| Random Goe<br>Dependent<br>Log likeli<br>Seatrinted<br>Sightfiom<br>NoFadden F<br>Estimation<br>Inf.Cr.AlO<br>Model esti<br>Model esti<br>Megative b | <pre>incod function t log likelihood d [ 3 d.f.] top level top level top level top data d d top data d d top data d d top data d d top data d d top data d d top data d d top data d d top</pre> | Hang Notel<br>HII<br>-352,936<br>-453,056<br>140,137<br>.000<br>.11463<br>1462, N =<br>C/3 = .5<br>2013, 15:31<br>4 instructure<br>inn model | 83<br>98<br>98<br>99<br>90<br>10<br>10<br>41<br>18<br>18 |                  |  |  | Inglied covariance matrix of random parameters<br>Covariance matrix<br>LNADY SHORT<br>LNADY -109EE-52<br>SHMEAT2012E-52 .4725E-52<br>Inglied standard deviations of random parameters  |
|--|--|--|--|------------------|--|--|--|
| REINI  | Coefficient  | Boandard<br>Reyor  | ÷.   | Frob.<br>(\$1>2* | 056 Co<br>207                            | nfidence<br>erval                      | 5.D_Bete() 1<br>14 .0030622<br>20 .0020079   |
| 18   | fonreddon perame   | ters   |  |                  |  |  |  |
| Constant<br>LiftEN<br>AMMOLT(<br>MCV9062L1)  | +5.10082***<br>.81234***<br>.08281**<br>-15.8365*  | 1.01009<br>.11040<br>.04102<br>4.09100   | +8.01<br>7.80<br>2.28<br>+3.97                           | 10000            | -7.03535<br>.59546<br>.01241<br>-27.1386 | -3,10911<br>1.02000<br>.17320<br>.2658 | Implied correlation matrix of random parameters  |
|  | manb fir fablen  |  |  |                  |  |  | And a second a second of a second sec |
| ENADT :<br>BHADRT (  | -,12211.***  | ,09572<br>,29847   |  | ,0000,           | <br>                                     | 04675                                  | Ecc.Mat.  LHADT SHMIRT   |
|  | Disgonal sistent   |  |  |                  |  |  | LHADT: 1.0000074242  |
| 10ADT  <br>JEPORT  | .05300**<br>.05492***<br>Helow diaponal #  |  | 2,68   | 0100<br>0000     | .007TE                                   | .05843                                 | SHNDWI)74262 1.00000   |
|  | 06090***   | .02045   |  | .0029            | +.10095                                  | 02058                                  |  |
| 15HN LUA   |  |  |  |                  |  |  |  |
|  | Dispersion perso   |  |  |                  |  |  |  |
| Scalfarn   | erjegerer  | 128427   | 5,80   | 10001            | 129292                                   | 272748                                 |  |

# Random Parameter Negative Binomial Model of Just Injury Crashes on Rural Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log livels<br>Restricted<br>Thi square<br>Stunificer<br>Striftion<br>Istimation<br>Inf.Cr.Alt<br>Sodel est<br>Sample is<br>Repative 1 | efficients Hegs<br>variable<br>Lood function<br>d Log likelihnoo<br>d likelihnoo<br>tok level<br>based on H =<br>t = 160.0 Ål<br>matted Dt 02.<br>3 pds and 1<br>innoil represe  | 20971<br>-273.485<br>1 -448.377<br>130.184<br>.000<br>1 .14740<br>1452, N =<br>10/H = .8<br>2014, L6:11:<br>126 Individua<br>26 Individua | 46<br>87<br>88<br>88<br>88<br>88<br>88<br>88<br>88<br>88<br>88<br>88<br>88<br>88 |                                  |                  |                  |
|--|--|---|--|----------------------------------|------------------|------------------|
|  |  | Statdard  |  | Prob.                            | 854 Cr           | ofidence         |
| 31121283   | Coefficient  | Error   |  |                                  |                  | arvel.           |
|  | **************   |   |  |                                  |                  | ********         |
|  | Contandom parama<br>-0.00000***<br>.00000***<br>-33.0000***  | ters  |  |                                  |                  |                  |
| Starteant  | 10,00000000  | 2,09578   |  | 10000                            | +12.20206        | 145138723        |
| LUADT  | ,92568***  | ,22106  | 4,23.  | .0000                            | - 英原基本部          | 4,88884          |
| 10000311   | -33_6450+++  | 12.10433  | +2180  | 10052                            | -57.5690         | +10.1208         |
| SHERTCH  | =.22042<br>.00027  | 107522  | -1.95  | ,0234                            | 1.26788          | -02702           |
|  | 100017   | .00011  | 2192   | .011#                            | ~,0005t          | +00038           |
| SCHORAN  | the section of the last of the section of the secti | DATAMATACS.   |  |                                  |                  |                  |
| BUYCHAN  | teens for randos   |   |  |                                  |                  |                  |
| LILLEN   | .19202***  | .18291  | 6.71   | .0000                            | .63153           | 11110251         |
| DILEN<br>SHARE   | . 19202***<br>-,01581  | .18291  | 6.71   | .0000<br>(0187                   | .43153           | .00995           |
| THIAN  | .10202***<br>05551   | .13291<br>.02957  |  |                                  |                  |                  |
| LHLEN<br>SEMERT  | .10202***<br>05551   | .13291<br>.02957  |  |                                  |                  |                  |
| LULEU<br>LULEU   | .59202***<br>04561<br>Nagonal element<br>.07474**  | .12291<br>.02967<br>a of Cholesk<br>.02284  | 3.08   | ,0376                            | .00400           | 114110           |
| LHLEN<br>LHLEN<br>LHLEN<br>SHADEL  | .10202***<br>05551   | .13291<br>.02987<br>a of Cholese<br>.03234<br>.01762  | 3.08   | .0374<br>.0001                   | .00400           | 114110           |
| UNLEN<br>UNLEN<br>SIMURT<br>UNLEN<br>SIMURT<br>SIMURT  | .50202***<br>04561<br>Megonal element<br>.07474**<br>.07061***<br>Maire diagonal *   | .13391<br>.02967<br>a of Cholese<br>.03184<br>.01762<br>(lements of C   | 3.08<br>4.01<br>balesky  | .0376<br>.0301                   | .00400<br>.03608 | .14510<br>.10914 |
| ()<br>LHLEN<br>SEMURT<br>()<br>LHLEN<br>SEMURT<br>()<br>LHEV LHL)  | .19202***<br>-,05561<br>Negonal element<br>.07474**<br>.07061***   | .15391<br>.02957<br>s of Cholese<br>.0319e<br>.01763<br>(lements of C<br>.01526   | 3.08<br>4.01<br>bolesky<br>-3.57   | 0001<br>1000.<br>MATIIA<br>1000. | .00430<br>.03408 | .14510<br>.10914 |

| Coverier        | sinter en               | 0.000440045  |              |
|-----------------|-------------------------|--------------|--------------|
|                 | LUCEN                   | RENDAT       |              |
| LNLEN<br>STRONT | .55665-02<br>+.99172+02 | .77818-02    |              |
| Implimi         | PLANDARD DOVLA          | time of rang | m parameters |

3.0\_Beta) 1 1( .0747405 2) .0679287

| Cogl.N##.1 |    | L | jiî, | 3  | п  |    | ş | ij | R | ŀ | 8 | 9 |
|------------|----|---|------|----|----|----|---|----|---|---|---|---|
| LHLEH)     | 1. | 0 | 10   | 10 | ġ. | 7  | į | 5  | ģ | ŝ | à | - |
| SENDER     | -  | ÷ | 24   | 13 | 4  | 11 | ÷ | ά  | è | a | 0 | ł |

# Random Parameter Negative Binomial Model of Low Injury Crashes on Rural Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restricted<br>Chi square<br>Significer<br>Hofedden f<br>Estimation<br>Inf.Cr.Alf<br>Bodel esti<br>Bodel esti<br>Sample is | fficients Heg<br>Variable<br>thood function<br>i log likelihoo<br>sei [ 64.7.]<br>tra lavel<br>Fendo H-equare<br>i cased on N =<br>2 = 2601.7 &<br>inated Oct 07.<br>2 p0s and<br>thomial regres | 109<br>-1254.857<br>-1254.857<br>-2852.870<br>1056.029<br>.000<br>-15963<br>-1452. X =<br>10/W = 1.7<br>2019.16:29<br>124 L001v10v6 | 007<br>91<br>24<br>29<br>20<br>24<br>24<br>24<br>24<br>24<br>24<br>24<br>24 |                 |           |                    |
|--|--|---|---|-----------------|-----------|--------------------|
| 10102  | Coefficient  | Standard<br>Excor   | 1   | fron-<br>(21>2* |           | nfidence<br>(#X781 |
|  |  |   |   |                 |           |                    |
| Constants  | Conrandum param<br>-7.95795***<br>1.07611***   | 044144  | 0.04  | 10000           | -0.55724  | -8.41531           |
| THE POP -  | 1.0000000000   | 200400  |   | anne.           |           |                    |
| RTVHX8111  | -21.2087***  | 4,48854   |   | ABBA            | -90,8850  | -12 0148           |
| 111 23 243 1   | A6570  | 105548  | 3.84  | 10043           | 07564     | 10000              |
| Manager  | 957730-04**  | 19800.04  | 3.58  |                 | DANATE OF | Laters, es         |
| DUTURAL  | -3,81821**   | 1 10754   |   | 10800           |           |                    |
| A Labor  | leans for cando  |   | wine.   | 10004           | -01000-1  | -ielaun            |
| and state of the   | 1007 401 10000   | Corners.  |   | - manne         | ******    |                    |
| TRACTOR .  | .86102***<br>-,74666***  | 01400   |   |                 | 77.078    |                    |
| ponten a l   | -,23572*   | 101400  | -31.54  | 1.0000          |           | .00268             |
|  |  |   |   |                 |           |                    |
| + 101 0001   | adquida tatema   | CE OF CHORES  | 1 10  |                 | 1.1.0.0.0 | .23545             |
| 1011010  | .13181***<br>.13181***<br>.22121***<br>.29079***   | .00241  |   |                 |           | 15205              |
| 2000011  | 1202020000   | 102218  | 1104  | 10000           | .00036    | 120200             |
| HOAPSEC!   | elor dispotal -  | 108578  | 9193  | 10000           | -11222    | +39500             |
|  | seron credorer -   | standing of t   | DOTABLY.  | natria          |           |                    |
| THAN THE   |  | -27.648   | -9-91   | 10000           | 11940     | 一一,安徽考高度。          |
| THOL THEY  | -,0892?***<br>.40035***  | 110041  | 4.70  | +0000           | .23354    | .4772.8            |
| THUL 2981  | +137327***   | 109535  | -5.19   | 10000           |           | -128243            |
|  | lapersion pere   | neses for Nes   | 1011, 11100   | 1201010         | .50485    | 1.111              |
|  |  |   |   |                 |           |                    |

| Covaysan | De MACIEN             |           |         |  |
|----------|-----------------------|-----------|---------|--|
|          | LULEN                 | SHNURT    | SOFLDEC |  |
| LIFLEN   | .54205-51<br>19052-01 | .21962-01 |         |  |
| NOFLEEC  | -1100-01              |           | 12487   |  |

3.0\_Ders) 1 1) ,202516 2) 140195

| 21 |                |
|----|----------------|
| 3) | +1403<br>+6072 |
|    |                |

Implied correlation matrix of random parameters

| Cor.Mai. | LNLEN   | SHADEL  | NOTIDEC |
|----------|---------|---------|---------|
| LNLEN    | 1.00000 |         | .79100  |
| SHMDOT   | 57637   | 1.00000 | →,99515 |
| HOFLDEC  | .79100  |         | 1,00000 |

### Random Parameter Negative Binomial Model of Total Crashes on Small Urbanized Small Urban

SPF Class Roadway Segments

| Nodel estis<br>Sengle Ls | <pre>hased on N =     1470.5 h3 hased: Oct 14,     2 pds and    t nomial regress</pre> | 10/8 = 1.1<br>2015, 16:04:<br>106 indl+iduk   | 18<br>104<br>31   |                   |           |           |
|--------------------------|--|---|---|-------------------|-----------|-----------|
| 1                        |  | Shendard  |   | Frob.             | 958 Cr    | nfldence  |
| TOTALACO                 | Coefficient  | freed   |   | 121324            | Int       | erval     |
| 110-                     | nrandom parama   |   | ********  |                   |           | ****      |
|                          | -4.16274+++  |   | -8145   | .0000             | -8.01114  | -3182534  |
| LMADTI                   | .80447***  | 12563   | 6.70  | .0000             | .63901    | 1.16915   |
| HEVERALL .               | ******   | .24070-04   | 2.22  | .0363             | 34913D-08 | 105690-08 |
| MOFLORCT                 | 26446**  | .12879  | -2.14   | .0827             | 85709     |           |
| DIFFERENCE               | 26446**<br>09002***  | 01854   | -1.66   | . 0000            | 10792     | 05312     |
| 1.764                    | and for species  | the support of the second second second second second second second second second second second second second s |   |                   |           |           |
| 10281                    | -9.00909*  | 1.84478   | +1.87   | .0014             | -6.03668  | 001841-   |
| DEGUI                    |  | .01108  | +2.14   | .0022             | 04071     | 10216     |
| 1301001                  | .01241***  | .04165  | 14,77   | .0000             | .79319    | 1.02444   |
|                          | ABORT AT ADDRESS   | a set we at a late  | and the second se |                   |           |           |
| VCK?                     | 3.92043***   | 1,45654   | 2,69  | .00TL             | 1.06406   | 8,77480   |
| DEGG                     | 104369***  | 101072  | 3.84  | 1000.             | -02148    | .06870    |
| LHLEIT                   | 3.92093***<br>.04269***<br>.07572***   | :01#20  | 4.62  | .0000             | .04306    | .107WT    |
| 120                      | tion disgonal s  | clements of C   | holesky:  | RIII/A            |           |           |
| LDEG. VOK:               |  | 101946  | -1.86   | 10440             | 04604     | 100672    |
| LINE YORI                | 18552***   | .03285  | -5,83   | .0000.            | +.25372   | 12811     |
| LLHL DEGI                | .21108***  | .02812  | 4.66  | .0000.            | .06785    |           |
| 2 D 1                    | searching that the black   | anter For Hart  | Car diam.   | and being the set |           |           |
| ScalParmi                | 2.70455***   | .2952.9   | 8,22  | .0000.            | .55376    | 2.45502   |

### Explicit covariance matrix of random parameters

| Coveries             | ice matrix        |       |          |  |
|----------------------|-------------------|-------|----------|--|
|                      | 728               | ting1 | LHLEH    |  |
| VCR<br>DESL<br>LNIKE | 15.87<br>7710E-01 |       | 414/4-11 |  |

Explied standard deviations of random parameters

| STRUES. | Shi I |       |   |   |    |    |   |   | 1 |
|---------|-------|-------|---|---|----|----|---|---|---|
| ++++++  |       | <br>+ | - | - | -  | -  | - | - | - |
|         | 11    |       | 3 | ÷ | \$ | 2  | 1 | ŝ | 3 |
|         | 21    | i,    | D | t | 2  | þ  | à | ł | 0 |
|         |       |       | 4 | 1 | 4  | Ġ, | 4 | z | ŝ |

| Cor.Net. | 100     | 28.94   | LHLKS   |
|----------|---------|---------|---------|
| VCR)     | 2.00000 | -141037 |         |
| 1531     | 41887   | 1,00000 |         |
| 1111.81  | *6418   | ,78848  | 1100000 |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small Urbanized Small Urban SPF Class Roadway Segments

| Dependent<br>Log livel<br>Chi eguaro<br>Significar<br>NoFadden /<br>Estimation<br>Inf.Cr.AJI<br>Nodel esti<br>Model esti<br>Magle 10 | hood fundtion<br>1 log libelinoo<br>4 log libelinoo<br>5 l 3 d.f.]<br>100 level<br>5 eido R-squared<br>1 e lased on N =<br>1 e libed ort 4.<br>2 pos ens 1<br>110011 square | P<br>-845,405<br>-471,666<br>-256,323<br>-2000<br>-1000<br>-1000<br>-1000<br>-1000<br>-1000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-00<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-000<br>-0 | 83<br>01<br>83<br>11<br>30<br>13<br>18 |  |               |                   | Deplied coverience matrix of ration parameters<br>Coverience matrix<br>UNLES DESS<br>UNLES DESS |
|--|---|--|--|--|---------------|-------------------|---|
| FD0:   | Coeffinient   | Stendard<br>Error  | =                                      | Frob.<br> E >2*                          | 96% Cc<br>Int | mfldenve<br>Geral | 11 .176069<br>21 .0066742   |
|  | fonrandum parama  |  |  |  |               |                   | Implied correlation matrix of sandom parameters   |
| Constant)  | -6,73073+++   |  |  | +0000                                    |               | -2.03267          |   |
| LNADT (  | .701874**   |  |  | +0009                                    | .81275        | 189100            |   |
| HCALTHE !  | -4.19455***   |  | -4.27                                  |  |               | -2,24778          |   |
| SCONCIEL   | .00743***   |  | 3,67                                   |  | .00332        | .01395            | Cur.Mat.) INTEN 1601  |
| HCVCRAI!   |   | 1,36565-04   | 5,36                                   | 10001                                    | _00007        | .00022            | 3   |
|  | Weans for sendor  |  |  |  |               |                   | LHLEN  1,0000000000   |
| THTEN)   | 2.029996***   |  |  | 10000                                    |               | 1.1.1.1.2.4793.0  | DE31 = .00330 1.00000   |
| DEGL   | +,05593***  | .01655   | -3.26                                  | +0011                                    | 01616         | +102149           |   |
| 11   | isegonal element  | s of Cholesk   | ty matrix                              | () () () () () () () () () () () () () ( |               |                   |   |
| INLEW  | 137608***   | .01996   | 8,87                                   | +0000                                    | +13714        | +21499            |   |
| DEGIE  | ·28211+++   | .00583   | 8.28                                   | 10000                                    | .02224        | .04137            |   |
|  | ielow diagonal e  | Semente of C   | bolesky.                               | Matrix                                   |               |                   |   |
|  |   |  |  |  | 01210         | +102248           |   |
| 18   |   | .50737   | -5154                                  | 110000                                   |               |                   |   |
| 1200_1011  |   |  |  |  |               |                   |   |
| 1280_LHL   | 03793***  | eter for Neg   | Bin dist                               | ribution                                 |               | 8,99131           |   |

# Random Parameter Negative Binomial Model of Possible Injury Crashes on Small Urbanized Small Urban SPF Class Roadway Segments

| Rependent<br>Ing likel:<br>Restricter<br>Rignificer<br>Infected<br>Infect.AI<br>Dodel est:<br>Resple 14<br>Repetive 1 | dficients HegB<br>variable<br>hhood function<br>6 log likelihood<br>the lavel<br>Facedo R-aguared<br>1 Daped on R =<br>1 = 667.6 AJ<br>marsel Oct 16,<br>2 pde and 5<br>minsual represe | 51<br>-267.023<br>-290.022<br>44.107<br>.000<br>.07613<br>1130, M =<br>2018, 16:23<br>S6 andividua<br>201 model | 357<br>55<br>67<br>79<br>00<br>72<br>12<br>68<br>13<br>13 |  |                             |                             |
|---|---|---|---|--|-----------------------------|-----------------------------|
| 10000   | Goefficient   | Standard  |   | Prom.<br>(#152*                            | ##\$ Confidence<br>Interval |                             |
| 1   | Corrandom pacame  |   |   |  |                             |                             |
| Innetant!   | -4.604204**   | 1,68977   | -2.99   | -0024                                      | +7,42211                    | -1.36690                    |
| LNADT   | _60060***   | ,15924  | 2.76  | .0002                                      | .28728                      | .91392                      |
| VCFARMA   | -117778**   | .05728  | -2.04   | 10416                                      | 36884                       | 00.673                      |
|   |   | 1.08223   | -2.42   | .0167                                      | -9.12320                    | -,99941                     |
| HOVLINE:  |   |   |   |  |                             |                             |
| HOWLINI  <br>CVFTCVA  | .01095**  | .00435  | 2.54  | .0112                                      | .00348                      | 221846                      |
| HOVLINI  <br>ICVPTOVA   | .01095**  | .00435  | 2.54  | :0112                                      | .00348                      | 201846                      |
| HOVLINI  <br>COVEDNA  <br>LILES   | -4.50420**<br>-60040***<br>-117778**<br>-5.55130**<br>-01045**<br>Gang for random   | .00435<br>permeters<br>.11310   | 2154  | .0112                                      | .00348                      | 2.07525                     |
| 201220  | 100001755   | 132320  | 1422  | 1.00000                                    | 103133                      | 201840<br>1.07523<br>.00408 |
| 08911   | .01095**<br>.01095**<br>.05057***<br>05652*<br>Diagonal element   | .03214  | -1.91   | .0466                                      | 11842                       | .00408                      |
| 08911   | 08692*  | ,03214<br># of Cholese  | -1.91<br>V matrix   | -0666                                      | 11842                       | .00408                      |
| 100011<br>100011  | 08692*<br>Diagonal alement<br>.09601  | .03214<br># of Cholesk<br>.03499  | -1.93<br>y matrix<br>1.99                                 | .0485                                      | 02236                       | .00408                      |
| LHLEN<br>DEGL   | 08682*<br>Diagonal alement<br>.04601<br>.03321*   | .03214<br># of Chalesk<br>.03499<br>.02003  | -1.91<br>-1.91<br>V matrix<br>1.99<br>1.96                | .0466<br>.0455<br>.0675                    | 02236                       | .00408                      |
| DRIELSI<br>DRIELSI<br>DRIELSI<br>DRIELSI  | 05652*<br>Diagonal element<br>.05601<br>.03321*<br>below diagonal e   | .03214<br># of Chalesk<br>.03409<br>.02000<br>Lements of C  | -1.91<br>y matrix<br>1.99<br>1.96<br>hdlesky              | .0485<br>.0485<br>.0485<br>.0673           | 11992<br>02256<br>00601     | .00408<br>.11455<br>.07247  |
| LULEN<br>DEGI<br>DEGINI   | 08682*<br>Diagonal alement<br>.04601<br>.03321*   | .03214<br># of Cholesk<br>.03499<br>.02009<br>Lemmins of C<br>.09319  | -1.93<br>y matrix<br>1.99<br>1.96<br>hdlasky<br>=1.99     | .0485<br>.0485<br>.0673<br>matrix<br>.0468 | 02136<br>02136<br>00603     | .00408<br>.11455<br>.07247  |

|                    | Implied ( | DOTASIADJe | 392129 | of vendo | E DWINDALWIG |  |
|--------------------|-----------|------------|--------|----------|--------------|--|
| Complement manuful |           |            |        |          |              |  |

| www.assasses |       |       |
|--------------|-------|-------|
|              |       |       |
|              | LHLCH | 12031 |
|              |       |       |

INTEN .2117E-02 DES1 -.3333E-03 .1176E-07

Implied standard deviations of random parameters

5.0\_Beta) 1 1) .0460133 2) .0342942

|        |      |    |     | -   |     |    |   | - | - | - | - |
|--------|------|----|-----|-----|-----|----|---|---|---|---|---|
| Cor.Ma | 4.1  |    | 12  | st, | 20  |    |   | þ | ż | Ü | 1 |
|        |      |    | -   |     |     |    | - | - | + | - | - |
| INI    | Z11) | 11 | 300 | 10  | 00: | 1  | 2 | 4 | ş | z | 1 |
| 112    | 511  | -  | 2   | 10  | 21  | 1. | đ | D | ö | d | ¢ |

# Random Parameter Negative Binomial Model of Evident Injury Crashes on Small Urbanized Small Urban SPF Class Roadway Segments

| estricter<br>hi squarf<br>ignificar<br>bFadden H<br>atimatin<br>nd.Cr.AD<br>Ndel esti<br>Ndel esti<br>Ndel esti   | Variable<br>hood function<br>8 log likelihood<br>00 [ 3 d.f.]<br>00 level<br>Faedd R-squared<br>1 hased on U =<br>1 = 313.3 AZ<br>matel Oct 14.<br>2 pds and 6<br>pinnmial regrass | -154.595<br>14.199<br>.002<br>.04275<br>1182, X =<br>C/H = .2<br>2015, DOI111<br>H6 LDG1V1604                    | 76<br>71<br>76<br>27<br>8<br>62<br>30  |   |   |   |
|---|--|--|--|---|---|---|
| avt   | Coefficient  | Standard<br>Error  |  | #rob-<br>(\$)+2+  |   | erval   |
|   | fonrandim perame   | ters   |  |   |   |   |
|   |  |  |  |   |   |   |
| instant:  | -7,15910***<br>.80812***   |  | 3.69   | -0005   | .07447  |   |
| UNACANII<br>INADDI<br>SHNDRII   | .80812***<br>16416***  | .03126   | 3.65   | 2000.<br>2500.  | .21447<br>26031   | 1.24177   |
| UNECENTI<br>SHADTI<br>SHHORTI<br>LHLRH<br>HCVNI   | .80812***<br>16416***<br>Name for random<br>1.12066***<br>00093*   | .22126<br>.05525<br>patameters<br>.15679<br>.00017   | 3.65<br>-3.05<br>4.81<br>-2.04   | 2000.<br>1500.<br>0000.<br>1510.                                      | .31447<br>26031<br>.71326                                     | 1,24177<br>05072<br>1/82196                     |
| UNECRICI<br>LULICI<br>SUNCETI<br>LULICI<br>ECVE   | .80812***<br>16414***<br>Nemte For random<br>1.92065***<br>00093*<br>Disponal element  | .22126<br>.05525<br>patameters<br>.15679<br>.00017<br>* of Cholesk   | 3.65<br>-3.08<br>4.81<br>-2.04<br>y satria                                     | 2005.<br>1205.<br>0000.<br>1210.                                      | .21447<br>26831<br>.71326<br>*.00047                          | 1,24177<br>05972<br>1,82196<br>.00000           |
| UNACANTI<br>INADTI<br>SHNDRTI<br>INACHI<br>HCVRI<br>INALENI<br>HCVRI  | .80812***<br>1641****<br>Hemme For verdom<br>1.02058***<br>00033*<br>Disponal sizeent<br>.15108***<br>.0081***   | .22126<br>.05325<br>parameters<br>.16679<br>.00017<br>s of Cholesk<br>.04435<br>.00305                           | 3.65<br>-3.08<br>4.81<br>-2.04<br>V SALTIS<br>5.12<br>2.00                     | 2000.<br>1200.<br>1210.<br>1210.<br>9200.                             | .31447<br>26031<br>.71326                                     | 1.24177<br>05972<br>1.82196<br>.00000<br>.24504 |
| NUMERANI<br>SHADO<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI<br>SHADATI | .80812***<br>16414***<br>Name for random<br>1.32068***<br>00033*<br>Disponal element<br>.15308***  | .22126<br>.05315<br>parameters<br>.15679<br>.00017<br>s of Cholesk<br>.04835<br>.00305<br>lemente of C<br>.00011 | 3.65<br>-3.05<br>4.81<br>-2.04<br>y matrix<br>3.12<br>2.00<br>holesky<br>-1.85 | .0000<br>.0021<br>.0021<br>.0121<br>.0121<br>.0452<br>Metrix<br>.0404 | .31447<br>26037<br>11326<br>01047<br>05432<br>.03032<br>00042 | 1.24177<br>05972<br>1.82196<br>.00000<br>.24504 |

Implied covariance matrix of random parameters

Covariance metrix

LHIEN MOVE INIEN -2243E-01 NOVE -2331E-04 -4301E-01

Implied standard deviations of random parameters

angines standars deviations of random parameters

Implied correlation matrix of random parameters

| Cor.Mat. | INTEN   | 80/1    |
|----------|---------|---------|
| LULEN    | 1.00000 |         |
| 8CV81    | 93225   | 1,00000 |

# Random Parameter Negative Binomial Model of High Injury Crashes on Small Urbanized Small Urban SPF Class Roadway Segments

| Negriite<br>Ni square<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nignifican<br>Nig | variable<br>hood function<br>( log likelihoo<br>do [ 3 4.f.]<br>we level<br>feedr R-square.<br>) hase for H =<br>1 + 376.7 A<br>mates Oct 24.<br>2 pds and<br>inomial regres | 6 -106.143<br>15.555<br>.001<br>4 .04176<br>1182, % =<br>20/83<br>2016, 16:83<br>586 individue      | 21<br>40<br>40<br>24<br>24<br>24<br>23                                  |  |   |  |
|--|--|---|---|--|---|--|
| 31137  | Coefficient  | Duandard<br>Error   |   | From.<br>1x152*  | 954 Cm<br>Int   |  |
| 11   | fonrendnn peram  | iters   |   | *******  |   |  |
| Innstant   | +.882814   | , \$2126  | -2199   | +0708  | -1.90456  | 123874   |
| 1410070-1  | 00092***<br>.11006***  | 100085  | -2.62   | .0088  | 00148   | 00021  |
|  |  | - A. m. M. m. M.  | 2.78  | 10000  |   | 80783  |
| DTLAME   | .31006+++  |   |   |  | -09428  |  |
| CYCEAH)  | .31000+++  | ,76040-04   | 2.02  | .0422  | .000000   | .000033  |
| (CYCRAIL)  | (50016**   | 176560-04   | 2.02  | 10432  | .00000  | ,00031   |
| (CYCRAIL)  | (50016**   | 176560-04   | 2.02  | 10432  | .00000  | ,00031   |
| (CYCRAIL)  | (50016**   | 176560-04   | 2.02  | 10432  | .00000  | ,00031   |
| HOYCKAH<br>HOYCKAH<br>SLHLOT<br>VCYBYCK  | .00016**<br>teans for sando<br>1.13993***<br>00574**   | ,TCCCD-04<br>6 parameters<br>.19741<br>.00263   | 2.02<br>8.30<br>-2.03   | ,0432<br>,0000<br>,0421                                      | .00000<br>.01058<br>01129                               | ,30031<br>1,40927<br>00020                     |
| HEVCRAH<br>INLOT<br>VEVENCE<br>LNADE   | (50016**<br>teans for sendo<br>1.13993***<br>00574**<br>hagonal elesen<br>.12906**   | .7884D-04<br>6 Bacameters<br>.19743<br>.00293<br>18 of Choleak<br>.06272                            | 2.02<br>8.30<br>-2.03<br>Ty matrix<br>2.45                              | ,0432<br>,0421<br>,0144                                      | .00000<br>.01058<br>01129                               | ,30031<br>1,40927<br>00020                     |
| INLAST<br>LNLAST<br>VCVBVCA:<br>LNLAST   | .00016**<br>Wans for sando<br>1.13993***<br>00574**  | .7884D-04<br>6 Bacameters<br>.19743<br>.00293<br>18 of Choleak<br>.06272                            | 2.02<br>8.30<br>-2.03<br>Ty matrix<br>2.45                              | ,0432<br>,0421<br>,0144                                      | .00000<br>.01058<br>01129<br>.02519                     | ,30031<br>1,40927<br>00020                     |
| HOVCAAH)<br> 8<br>LHADT <br>VCVEVCA)<br>LHADT <br>VCVEVCA)   | (50016**<br>teans for sendo<br>1.13993***<br>00574**<br>hagonal elesen<br>.12906**   | .7664D-04<br>6 Bacameters<br>.19743<br>.00293<br>18 of Cholesk<br>.06272<br>.00109                  | 2.02<br>8.30<br>-2.03<br>17 matrix<br>2.45<br>2.82                      | ,0000<br>,0425<br>,0149<br>,0149                             | .00000<br>.01058<br>01129<br>.02519                     | .00031<br>1.40927<br>00020<br>.29299           |
| ICVCRAII)<br> 1<br>LILLOT  <br>/CVEV/CA<br>LILLOT  <br>LILLOT  <br>/CVEV/CA  | .00010**<br>teans fur sando<br>1.13990***<br>00574**<br>lisgoral element<br>.1990***<br>.00534***<br>leine diagoral -  | .7884D-04<br>s parameters<br>.1974I<br>.00293<br>is of Cholesk<br>.06272<br>.00100<br>slements of C | 2.02<br>8.30<br>-2.03<br>17 matris<br>2.45<br>2.82<br>3.62<br>3.62      | .0432<br>.0425<br>.0144<br>.0048<br>BBTX18                   | .00000<br>.01058<br>01119<br>.02519<br>.00142           | .00031<br>1,40927<br>00020<br>.23291<br>.00905 |
| HEVCRAIN<br>LHADT<br>VC/BYCAN<br>LHADT<br>VC/BYCAN<br>VC/BYCAN<br>HEV_LHAN   | .50016**<br>(tans fur sandu<br>1.1399***<br>00574**<br>Liagonal elemen<br>.12906**<br>.00514***  | ,7884D-04<br>s parameters<br>.19743<br>.20753<br>is of Cholesk<br>.06272<br>.00109<br>elemente of 0 | 2:02<br>-2:03<br>-2:03<br>ty matrix<br>2:45<br>2:82<br>3:01eeky<br>2:50 | .0432<br>.0425<br>.0445<br>.0049<br>.0049<br>MBTX18<br>.0209 | .00000<br>.01058<br>01129<br>.02819<br>.00143<br>.00143 | .00031<br>1,40927<br>00020<br>00020<br>00005   |

| Coveriani        | e metris               |                            |
|------------------|------------------------|----------------------------|
|                  | Letter                 | VEVENCE                    |
| LHADT<br>VEVBVCA | .1666E-01<br>.5217E-03 | .4482E-04                  |
| Implied #        | tandard devia          | tions of rendom perameters |

8.0\_Besai l

Ingiled novariance matrix of random parameters

|     | +  | <br>- |   | ÷ | ÷  | ÷ | - | - | ÷ | ÷  | - |
|-----|----|-------|---|---|----|---|---|---|---|----|---|
| - 1 | ί. |       |   |   |    | ŝ | z | ý | à | 5  | ÷ |
| 3   | 1  |       | 2 | 0 | ¢, | ¢ | ¢ | ø | 5 | ō, | a |

| Cor.Net.} | 190.69  | ACABACY |
|-----------|---------|---------|
| LISADT    | 1.00000 | .60384  |
| VCVSVCA1  | .80304  | 1,00000 |

Random Parameter Negative Binomial Model of Just Injury Crashes on Small Urbanized Small Urban SPF Class Roadway Segments

| Restricted<br>Chi aquere<br>Significer<br>NoPadded H<br>Estimation<br>Inf.Cr.AJC<br>Nodel seti | hood finotics<br>i log likelihood<br>d [ i d.f.]<br>ne level<br>seudo R-squared<br>based on N =<br>1 = 160.5 A2<br>msiedi Oct II.<br>2 pde and 4 | 9.204<br>.007<br>.02566<br>1192, H =<br>C/H =2<br>2015, 10157;                       | 13<br>17<br>41<br>86<br>6<br>92<br>17                 |   |   |                               |
|--|--|--|---|---|---|-------------------------------|
|  | inimial regress  |  | 48.   |   |   |                               |
| JUSTIN   | Coefficient  | Standard<br>Error  | Ŧ   | Brob.   |   | mfidence<br>terval            |
|  | Coefficient  | Exect  | Ŧ   |   |   |                               |
| Cotatianti<br>MCVR.<br>LUC.RIV   | Correction person<br>+5.45400****<br>*100012*<br>.71888***   | Error<br>1.04107<br>.00021<br>.16048   | #<br>-2.78<br>-2.98<br>-2.98<br>4.48                  | 18193*  |   | -1.68463                      |
| Cotatianti<br>MCVR.<br>LUC.RIV   | Conrection person<br>+5.65400***<br>+1.00012*  | Error<br>1.04107<br>.00021<br>.16048   |   | 18193*  | -2,60905<br>-,00062                               | -1.48463<br>.00003<br>3.09383 |
| ()<br>Constant)<br>SCVN<br>LUCEN<br>()<br>LUGADT)  | forrabdom perame<br>-5.65605***<br>-100012*<br>.71888***<br>Bens for randum  | Error<br>1.04107<br>.00011<br>.16048<br>parameters<br>.15942                         | *2.95<br>4.48<br>2.43                                 | -0054<br>-0721<br>-0000<br>-0157                      | -8,65905<br>-,09062<br>,40429<br>,09094           | -1.48463<br>.00003<br>3.09383 |
| ()<br>Constant)<br>HCVN<br>LUCED<br>()<br>LUGADT)  | Connection person<br>-5.45400***<br>*.00012*<br>.71828***<br>Weite for rendum<br>.41105**<br>Voele personeters                                   | Error<br>1.04107<br>.00011<br>.16048<br>parameters<br>.15942                         | +1.98<br>4-48<br>2.43<br>02 14080                     | .0054<br>.0721<br>.0000<br>.0157<br># paramet         | -8,65905<br>-,09062<br>,40429<br>,09094           | -1.48463<br>.00003<br>3.09383 |
| II<br>Constant<br>SCVS<br>LIELES<br>LIEADT<br>II<br>LIEADT                                     | Connection person<br>-5.45400***<br>*.00012*<br>.71828***<br>Weite for rendum<br>.41105**<br>Voele personeters                                   | Error<br>1.04197<br>.00011<br>.16048<br>parameters<br>.13942<br>Tur dists.<br>.01463 | +1.95<br>4-48<br>2.43<br>01 14000<br>8.56<br>810 diat | .0054<br>.0721<br>.0000<br>.0157<br># parmer<br>.0004 | -8,68905<br>-,92062<br>,40429<br>,03056<br>,03056 | -1.48463<br>.00003<br>3.09383 |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Small Urbanized Small Urban SPF Class Roadway Segments

| Dependent<br>Log likel<br>Sestricts<br>Chi equez<br>Significe<br>McFadden<br>Setimetin<br>Inf.Cr.Al<br>Nodel set<br>Sample is | efficience Beg<br>variable<br>intend function<br>ed ing ilkelinnose<br>red ( 6 d.T.)<br>note layel<br>Fasudo R-spurse<br>m based on N =<br>10 = 1242.6 Al<br>likebedi Oot 13,<br>r 2 pds and 9<br>binneiel segress | L01<br>-804.267<br>1 -759.163<br>197.552<br>.000<br>1197.64<br>1197.6<br>1197.6<br>2018.1711<br>2018.171171<br>2018.171171   | 80<br>80<br>79<br>17<br>40<br>87 |             |   |                   |
|---|--|--|----------------------------------|-------------|---|-------------------|
| LOUNT   | Coeffocient  | Sienderd<br>Errus  |                                  | Preb.       | 996 CU<br>Int   | mfldence<br>arvel |
|   | Noncendon perese   | CALS   | 10.00                            |             |   |                   |
|   | -6.52006***  |  | -5.48                            | .0000       | -8.05753  | +4.19110          |
| LINADT  |  | .15463   | 7148                             | ,0000       |   | 1.26464           |
| NOVCEAR   | .9293TD-06**   | .37710-04  | 2.54                             | .0111       | 11063D-04   | 17001D-01         |
| CODUSES   | .000004***   | .00247   | 2.29                             | .0005       | _00476  | .01446            |
| SHEDRY  | 00040***<br>07036***<br>*.00075***   | 62002  | -3.52                            | .0004       | 10969   | 09114             |
| SUVL.   | +.000TB4+*   | 00019  | -4.25                            | .0000       | 00118   | +.00042           |
| NOTIDECT  | 33250×+  | 122346   | -2.48                            | 10140       |   | 06741             |
|   | Name for random  | permistars   |                                  |             |   |                   |
| LICEN   |  | .06006   | 114,96                           |             | .78078  | 1.01422           |
| 20101   |  | .01668   | -2.58                            | .0001       | 09748   |                   |
| VEW   | -6.67882**   | 2.28584  | -2782                            | 10117       | -10.08758   | -1.26028          |
|   | Disconal element   | a of Cholese   | V matrix                         |             |   |                   |
| List. MIL   | .07635***  | .02525   | 3.03                             | 10024       | _02710  | .13001            |
| 10.01   | .02920***  | .02525   | 3.43                             | ,5006       | _01210  | .04429            |
| VCK   | 8.88028***   | 1,33634  | 2,00                             | 10087       | 1.28108   | 6.49940           |
|   | Selow disponal e   |  |                                  |             |   |                   |
| LDEB LHE  | .01211**   | 101342   | 2142                             | 10280       | _00624  | .01663            |
| LVCR LBL  | 02588**  | .41251   | -2.08                            | 10424       | 04904   |                   |
|   | .02044**   | .01318   | 2.17                             | 10302       | .00275  | .05420            |
| LVCN DEG  |  | And Address of the local division of the loc | Die oligh                        | WEIGHT'S CO | A 100 March 1 |                   |
| LVCN DEG  | Dispersion paras   | MC41 201 1040  |                                  |             |   |                   |

Implied covariance matrix of random parameters

Covariance matrix ----1001 YOR LILES ----LUILEN DEGI VCN

.58412-02 .24912-02 .18942-02 -.32458-01 .59908-01 22.05

Implied graniant deviations of random parameters 2

5.0\_Sets:

| 11 | .0763040 |
|----|----------|
| 21 | .0430526 |
| 21 | 4.69612  |

| Cor.Net.] | LALEN   | DEGI   | VCE     |
|-----------|---------|--------|---------|
|           | 1,00000 |        |         |
|           | 09026   | .29593 | 1,50000 |

#### Random Parameter Negative Binomial Model of Total Crashes on Metropolitan Small Urban SPF **Class Roadway Segments** 249

| Dependent<br>Log likeli<br>Restricted<br>Chi square<br>Significan<br>Nofedden B<br>Estimation<br>Inf.Cr.AIO<br>Nodel esti<br>Nodel esti<br>Nodel esti | fficients (Heg)<br>Variable<br>hood function<br>(ing limethood<br>d ( 0 d.f.)<br>tra limet<br>Secolo H-squared<br>( based on N =<br>1 = 2010.0 AJ<br>mated Ser 02,<br>2 pd8 and 1<br>troppial regress | TOTALA<br>-1143.376<br>-9093.027<br>1897.001<br>2000<br> | 06<br>43<br>00<br>19<br>56<br>41<br>26 |                 |               |                   |
|---|---|--|--|-----------------|---------------|-------------------|
| rotatace  | Coefficient   | Pusciarii<br>Ervor                                       |  | Frob.<br>(2)>Z* | 954 Ci<br>2nt | nfidenve<br>erval |
| 13  | ionrendum parama  | terr   |  |                 |               |                   |
| Interant (  | -2.96536+++   | .44442   | -4,60                                  | .0000           | -4.22679      | -1.69994          |
| LIGADT  | -2.94130***<br>.55541***<br>.08149***   | 100935   | 8:01                                   | ,0000           | -02963        | .00100            |
| SHOLDCR.  | .0.9168***  | 101047   | 3.52                                   | .0004           | -01658        | -06640            |
| CUPTORA   | 00659***  | .00147.  | -6.49                                  | .0000           | 00947         | 00371             |
|   | 04810***  |  |  |                 |               |                   |
| HOVE SME 6  | -1.24044**  | 180728   | -2.04                                  | .0410           | -2.63055      | =;08048           |
| 1 N   | Heane for random  | parameters   |  |                 |               |                   |
| VORABULA (  | .00202++  | 104129   | 1.90                                   | 10470           |               | .14195            |
| DEGLI   | +.06237+++  | :01103   | +3.52                                  | .0004           | +.06336       | 01879             |
|   | .86235***   |  |  |                 |               |                   |
| 1000  | tatonal element   | s of Cholesk   | to materia                             |                 |               |                   |
| VCREAKER  | .04912  | .63173   | 1.94                                   | .0414           | -,01351       | .11131            |
| DEG1;   | .04912  | .00794   | 6.12                                   | .0000           | .03334        | .06465            |
| INTERNI   |   | 101546   | 2.04                                   | 1485.           | .0018#        | .06214            |
| 12  | alov disgensi e   | Lements of C   | holesky:                               | BATILS          |               |                   |
| DEG VCF1  | -01746  | 101882   | 5.89                                   | .0564           |               | 0.04896           |
| SHE WORL  | 102901  | 02739  | \$197                                  | .0403           | 02432         | .00506            |
| LSL DEGI  | .01746<br>.02907<br>.16706***   | .02124   | 6.92                                   | 10000           |               | .18549            |
|   | 19De29100 Der40   | eter for Set   | 615 0181                               | 11001100        |               |                   |
| Joal Parmi  | 184547***   | .09249   | 10.09                                  | .0000           |               | 1.12910           |
| ScalParmi   | .54547***   | .09249   | 10.09                                  | .0000           |               | 1,129             |

| plied. | COVALIANCE. | matris. | άĒ | randum. | parameters |
|--------|-------------|---------|----|---------|------------|
|        |             |         |    |         |            |

| COAMAITWUG | 6 BOLITH   |      |       |      |
|------------|------------|------|-------|------|
|            | VCPARNA.   | 0801 | LULES | <br> |
|            |            |      |       | <br> |
| VEFAREA    | 124122-02  |      |       |      |
|            | · #57#8+05 |      |       |      |

1HLER 19978E+08 18724E+08 19448E+08 17708E+08 12861E+01

Implied standard deviations of random parameters

| 2.D_Beta) |                  |
|-----------|------------------|
|           |                  |
|           | Dept ren         |
|           | 1000000000000000 |
|           | 10521110         |
|           | 1.9.6.8.8.8.9.9  |
|           |                  |

Deplied correlation matrix of random parameters

| Cor.Mat. | VERANIA | 0001    | 10120   |
|----------|---------|---------|---------|
|          |         |         |         |
| VCFARMA) | 1.00000 | .111111 | 1100107 |
| DEG1     | 133512  | 3,00000 | .30796  |
| LHLERI   | 129257  | 1.94796 | 1,90000 |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Metropolitan Small Urban SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Kestricted<br>Di square<br>Significar<br>Nofeiden H<br>Estipation<br>Inf.Cr.AD<br>Sugit Le | rflavents. Hegf<br>Variable<br>Xood function<br>1 log likelahood<br>is [ 4 c.f.]<br>isoudo N-squared<br>1 mated Sov 05.<br>2 pds and 9<br>uncomial regress | 9<br>-948.854<br>-3262.000<br>.000<br>.000<br>.70919<br>879, K =<br>2/H = 2.11<br>2015, 15/01/<br>39 LOGUVIOUA | 97<br>94<br>00<br>68<br>14<br>95<br>52 |                  |             |          |
|---|--|--|--|------------------|-------------|----------|
| 9001  | Coefficient  | Standard<br>Error  | 1                                      | Fcob.<br>(\$)>2* |             | erval    |
|   | the second second  |  |  |                  |             |          |
| Constant  | -2.10182**<br>-2.68701**   | .04331   | -2.22                                  | 10255            | -3.93033    | 25265    |
| 0800)   | *1.69702**   | 03766  | +2.52                                  | 0122             | -3,03550    | 4.35540  |
| 1343.07   | 140717***  | +12040   | 1.69                                   | .2002            | 116678      | 162556   |
| CVPT GRA  | ~,00662***   | .00129   | -5.12                                  | .2000            | 00915       | -,00400  |
|   | -3178383***  | 100230   | -2.73                                  | 20.6%            | -T. C.655.8 | - Abgine |
| TOTLASE   | ,06261   | ,08719   | 2,97                                   | :0507            | 0300-       | ,19630   |
|   | wans for cannot  | DECONTRACT   |  |                  |             |          |
| SENDER  | ,01612+++  |  |  |                  | .01520      | .05784   |
| SHNULT  | +1045574++   | 101804   | -2.08                                  | ,0055            | 00579       |          |
| INTERI  | 187856***  | 104171   | 14.24                                  | ,0000            | ,75762      | 189992   |
| 11  | liapinal element   | a of Cholesi   | V RATELS                               | 1.000            |             |          |
| SENDCR  | .010104**  | .00948   | 1.10                                   | .0480            | -00017      | .03811   |
| SENDLT  | .00221**   | 101041   | 7.24                                   | 10294            | 00392       | 104045   |
| 工材工業材目  | 104056**   | 101030   | 8,13                                   | 12485            | :00418      | 101693   |
| 12  | elou disgonal a  | lements of 0   | balesky.                               | matris           |             |          |
| LENK ANN:   | -,00601  | 101912   | -2.28                                  | ,0218            | 04278       |          |
| MOL JOR   | -,D8956++  | .03595   | +2.20                                  | .0215            | 16102       |          |
| LUIL SHW  |  | 102550   | 7,36                                   | 10000            | 15398       | .26588   |
|   | ispersion paras  | eter for Neg   | bin dist                               | fibutión.        |             |          |
|   |  |  |  |                  | .42918      | 1.01026  |

| implied | CUMPSCIANCE. | metrix | -at | Denistra. | parameters. |  |
|---------|--------------|--------|-----|-----------|-------------|--|
|         |              |        |     |           |             |  |
|         |              |        |     |           |             |  |

Covariance matrix SENDLT LUCKS DENDOR ----

LUNDCR SEMILT LULEN .3464E-03 -.1016E-03 .1066E-03 -.1716E-02 .7234E-02 .8348E-01

Implied standard deviations of random parameters 1

8.D\_Becki 1 :0191404

| 21  | .0326160 |
|-----|----------|
| -31 | .231631  |

| Cor.Nat. ) | SENDCR  | TJONHR  | THEFT  |
|------------|---------|---------|--------|
| BHHDCR)    | 1,05000 | 16265   | 10678  |
|            | 18260   | 1.90000 | .95666 |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Metropolitan Small Urban SPF Class Roadway Segments

| Dependent<br>Log livel<br>Chi equari<br>Significer<br>Mofeiden M<br>Estipation<br>Inf.Cr.All<br>Model esti<br>Model esti<br>Sample Le<br>Depative M | efficients Hegf<br>Veriable<br>blood function<br>4 hog likelchood<br>set [ 6.5.]<br>the Level<br>Freedo N-squared<br>1 heseo on D =<br>2 = 1143.4 AJ<br>instead Nev 05.<br>2 pds And 3<br>insteal regress | F)<br>+887.722<br>+949.824<br>843.427<br>1000<br>4708.8 =<br>2/H = 1.3<br>2015, 19-217<br>39 LOGLVIGAN<br>100 model | 345<br>848<br>850<br>72<br>000<br>838<br>348<br>322<br>838<br>348<br>322<br>838<br>348<br>322<br>838<br>348<br>348<br>348<br>348<br>348<br>348<br>348<br>348<br>348 |                  |          |                   |
|---|---|---|---|------------------|----------|-------------------|
| ¥183  | Coefficient   | Standard<br>Revor   |   | Fcob.<br>(\$)>2* |          | nfidence<br>Arval |
| 18  | Corrandon parama  | 142.5   |   |                  |          |                   |
| Constant)   | -4.74002***<br>-4.74002***<br>-100886***<br>.10245**  | +68537  | -6.03   | .0000            | -6.10078 | -5.20500          |
| LHEDT   | .940704**   | 104139  | 0,12  | 10000            | 112522   | ,64218            |
| (CVFT08A)   | -1008884***   | 100206  | -2,75   | ,0068            |          | -,00184           |
| VCFARMA!  | .10245**  | ,05150  | 12109   | .0466            | .00153   | .20088            |
| 11111   | laans for ranitos<br>,01536*  | parameters.   |   |                  |          |                   |
| SEMDORY   | .01536*   | 100575  | 1.00  | .0480            | 00118    | ,03311            |
| 08051   |   | 105497  | -2.05   | 10440            | -,05982  | -,00082           |
| THURN   | -,0001***   | .05000  | 16.16   | .00.00           | 175045   | .04434            |
| 14  | lisponal elemant  | s of Cholesk  | y patrix  |                  |          |                   |
| SENDLE  | +02057**  | 100566  | 2,33  | .0215            | .00501   | 100770            |
| 0501  | 10310344  | ,01765  | 2.00  | .0354            | .00254   | .07182            |
| LHLEN:  | .06948***   |   |   |                  |          |                   |
|   | selov disponal e  | lenents of C  | ticlesky.   | matrix           |          |                   |
|   | -:005234*   | .00240  | -2.14   | 10522            | -100965  | 00043             |
| 108G 38N  |   | 104282  | -2.23   | :0365            | +.00043  | .07655            |
| 108G 38N  | # + D058T   |   |   |                  |          |                   |
| 108G 38N  | +13840***   | .00211  | 4.85  | .0000            | 107546   | 120124            |
| 1585_5000<br>1101_5000<br>1101_5000   | +:0058T<br>;13940***<br>Dispersión paras  |   | 4111  | .0000            | 107536   | .201.04           |

|                         | OF MALIXE                         |                       |               |
|-------------------------|-----------------------------------|-----------------------|---------------|
|                         | UNNDER                            | DES1                  | tateu         |
| SHWDCR<br>SEG1<br>LALEA | .4140E-03<br>1906E-08<br>1154E-08 | 14558-02<br>.61718-02 | -14018-01     |
| Impland                 | standerd devi                     | etions of sec         | nden paramete |

| <br>- | *  | <br>- | - | + | - | • | - | - | - | - | - | + | - |  |
|-------|----|-------|---|---|---|---|---|---|---|---|---|---|---|--|
|       |    |       |   |   |   |   | - |   | - | 2 |   | - |   |  |
|       | а. |       |   |   |   |   | v | 2 | ы | - | ъ | 0 | 1 |  |
| 3     | 1  |       |   |   |   | ÷ | 0 | 3 | à | i | 8 | ą | ĥ |  |
| 3     | ŧ. |       |   |   |   |   |   | 2 | ŝ |   |   | ÷ | 4 |  |
|       |    |       |   |   |   |   |   |   |   |   |   |   |   |  |

Implied correlation matrix of random parameters

| Cor.Mat.1 | SENDOR  | 25.01   | 101207  |
|-----------|---------|---------|---------|
|           |         |         |         |
| JHNDCR (  | 1.20000 |         |         |
| DEG1 (    | -124426 | 1,00000 | 107604  |
| - INSENI  | -,0353E | 187924  | 1.20000 |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Metropolitan Small Urban SPF Class Roadway Segments

| Reprinte<br>Di sgist<br>Significe<br>Arfailen<br>Estimatio<br>Inf.Cr.AJ<br>Nodel est<br>Sample 19 | rfficients Degs<br>Variable<br>Nood function<br>4 log likelihood<br>nd [ 3 d.f.]<br>Joe level<br>1 based on 8 =<br>1 = 102.4 AT<br>market Dec 32,<br>2 pde and 4<br>innumil represe  | E<br>-255.319<br>-209.339<br>105.839<br>.000<br>.17548<br>875.8 =<br>C/N = .6<br>2015.15:50:<br>38 individua | 47<br>74<br>60<br>11<br>36<br>58            |                                   |                            |                  |
|---|--|--|---|-----------------------------------|----------------------------|------------------|
| 1   |  | Standard   |   | Frob.                             |                            | ofidence         |
| 2721  | Coefficient  | HEE00  | 1   | (1)254                            | 185                        | esvál.           |
| 1   | imrandon parame  | ters   | 10.000                                      |                                   | 0.000                      |                  |
|   | -1.52041***  |  | +8.88                                       | .0000                             | +6.81900                   | +2.60178         |
| LIRADT  | 152034***  | .06295   | 6.10  | .0000                             | .35055                     | . 65324          |
|   | -,28241***   | ,06887   |   | .0000                             | -, 01182                   | +,15330          |
| SHNDRTI   | .20401***  | .04606   | 8.62  | -001#                             | 107454                     | . 33546          |
|   | -6.82581**   |  | -2.18                                       |                                   | -12.93063                  | 70040            |
|   | leans for randos   | tistemeters.   |   |                                   |                            |                  |
|   | and a state of the |  | 18.02                                       | .0000                             | .84565                     | 1,10392          |
|   |  |  |   |                                   |                            |                  |
|   | DS973++  | .02541   | -2.83                                       | .10114                            | ~.10601                    | D1343            |
| LNLEN/<br>SEG1  | .97605***<br>05973**<br>Nagonal element  | .02541<br>e of Tholese   | -2.83<br>y matrix                           | -0114                             | 10601                      | 01343            |
| DEG1  | 05973**<br>Nagonal element<br>.02384**   | s of Cholesh   | y matrix                                    | 0.000                             |                            |                  |
| DEG1  | Magonal element<br>.00184**  | s of Cholesh   | 1 MATELA<br>2.20                            | 10240                             |                            |                  |
| LALEN<br>DEGL<br>JILLEN<br>DEGL   | Magonal element<br>.00184**  | <pre>s of Tholesh<br/>.01630<br/>.01115</pre>  | U MATIIA<br>3.30<br>2.17                    | -0240                             | .01054                     | .15317           |
| LALEN<br>DEGL<br>DEGL<br>DEGL   | Nagonal element<br>.03184**<br>.02415**<br>Selow diegonal e  | <pre>s of Tholesh<br/>.01630<br/>.01115</pre>  | y Matria<br>3.30<br>2.17<br>bolmsky         | .0245<br>.0297<br>Matrix          | .01055<br>.00055           | .15317<br>.04997 |
| LIKLEN<br>DEG1<br>JI<br>LIKLEN<br>DEG2<br>JEG2<br>JEG2<br>JEG2<br>JEG2                            | Nagonal element<br>.03184**<br>.02415**<br>Selow diegonal e  | e of Cholesk<br>.01630<br>.01112<br>lemmts of Q<br>.01709  | y Matria<br>3.20<br>2.17<br>bolmsky<br>2.60 | .0245<br>.0297<br>MATILA<br>.0014 | .01055<br>100058<br>101258 | .15317           |

Implied covariance matrix of random parameters

Coveriance Metria

LNLEH .6698E-02 DR91 .2746E-02 .3247E-02

Implied standard deviations of random parameters

1.0\_3ete) 1 1( .0818405 2) .0484441

| Cor.Mat. | LUG-RH  | 1891    |
|----------|---------|---------|
| 101.631  | L.05000 | 194542  |
| 06010    | 194542  | 1,00000 |

Random Parameter Negative Binomial Model of Severe Injury Crashes on Metropolitan Small Urban SPF Class Roadway Segments

| Dependent.  | efficients HegB<br>Marisole   | 82   |  |   |   |                                    |
|---|---|--|--|---|---|------------------------------------|
|   | Lbood function  |  |  |   |   |                                    |
|   | i log likelihood  |  |  |   |   |                                    |
| Chi square  | ed [ _ 1 d.f.[  | I. 650   |  |   |   |                                    |
| Significa<br>NoFadiaen 1                                  | nce level<br>Pawido R-aquared   | ,00765   |  |   |   |                                    |
|   | t based on II +   |  |  |   |   |                                    |
|   | C = 195.1 AI  |  |  |   |   |                                    |
|   | innsed: Dec 22.   |  |  |   |   |                                    |
| 5enplt 1#   | 2 pds and 4   |  | 1.0  |   |   |                                    |
|   |   |  |  |   |   |                                    |
| Degative)   | sincmial regress  | ann seuten   | 2011110  |   |   | 111100110                          |
| Heparive )  | iinimial regress  | Standard   | 2011/122   | Freb.   | 98% Co  | nfidence                           |
|   | Coeffloiess   |  |  | Frah.<br>(1)>2*                               |   | ndidence<br>c:Vel                  |
| 82197   |   | Stendard<br>Eczox  |  |   |   |                                    |
| 82197   | Coefficient   | Stendard<br>Errox  |  | 1021  | Int   | esval                              |
| SIN7)   | Coefficient   | Stendard<br>Errox<br>tars<br>1.56562   | 1  | 1021  | -1,66135  | 34524                              |
| SIN7)   | Coefficiess<br>Conrandom parame<br>+8.00980**   | Stendard<br>Efitox<br>tars<br>1.56562<br>.10490  | -2.15<br>1.06  | 18/0-24                                       | -1,66135  | esval                              |
| SIN7  | Coefficiess<br>Incrandom parame<br>+1.00180**<br>.25355<br>Tense for rendom<br>.78383***                              | Iters<br>L.56562<br>.15690<br>parameters<br>.13224   | 1<br>-2.15<br>1.96<br>8.85                           | .1046<br>.0008                                | -7.68135<br>12556<br>.47430                             | 34524                              |
| SINT<br>Constant<br>LNADT                                 | Coefficiess<br>Incandom parame<br>-4.00480**<br>.23353<br>Teens for random  | Iters<br>L.56562<br>.15690<br>parameters<br>.13224   | 1<br>-2.15<br>1.96<br>8.85                           | .1046<br>.0008                                | -7.68135<br>12556<br>.47430                             | +,34524<br>-,34524<br>-,55532      |
| SZN7)<br>Constant<br>LINET<br>LINET                       | Coefficiess<br>Ionrandom parame<br>(9.00100**<br>.25355<br>Seans for rendom<br>.78888***<br>Scale parameters<br>.1280 | Stendard<br>Errox<br>tars<br>1.86562<br>.18590<br>parameters<br>.18234<br>foc dists.<br>.07550       | 2.15<br>1.06<br>8.85<br>of rando<br>1.93             | .0008<br>.0520                                | -1,66135<br>-,12556<br>,47480<br>:#18<br>-,0140         | +,34524<br>-,34524<br>-,55532      |
| SINT)<br>Constant<br>LINET)<br>LINET)<br>LINET)<br>LINET) | Coefficiess<br>Innindom parame<br>-1.00480**<br>.25355<br>Teams for random<br>.73858***<br>Scale parameters           | Deridari<br>Errox<br>1.86562<br>.26592<br>sameters<br>.33224<br>for dists.<br>.07250<br>eter for Neg | 2.15<br>1.06<br>8.88<br>of rends<br>1.93<br>Hin diet | .1315<br>.1046<br>.0008<br>.0120<br>2150/1200 | 1nt<br>-1,66135<br>-,12556<br>.45480<br>:#24<br>:.56140 | erval<br>34524<br>.53532<br>.86276 |

Random Parameter Negative Binomial Model of High Injury Crashes on Metropolitan Small Urban SPF Class Roadway Segments

|   | efficience Heph  |   |   |   |   |  |
|---|--|---|---|---|---|--|
| Dependent   | variable<br>(bood function   | 111   | 11.7  |   |   |  |
| Log likels  | ibood function   | +414.617  | 23  |   |   |  |
| Restricter  | s log likelihoos   | +650.970  | (6 ft )   |   |   |  |
| Chi Agiaze  | eo [ 1 d.f.]<br>now level<br>Freudo X-repared  | 472+704   | 44  |   |   |  |
| Significar  | nce level  | 1000  | 6¢;   |   |   |  |
| NoTedden 7  | Preudo X-squared   | 136307  | 23  |   |   |  |
|   | t taret in it -  |   |   |   |   |  |
|   | C = 013,2 33   |   |   |   |   |  |
|   | umated: Dec 24;  |   |   |   |   |  |
|   | 2 pds and 4  |   | La  |   |   |  |
|   | inomial repress  |   |   |   |   |  |
|   |  |   |   |   |   |  |
|   |  |   |   | Prick.  | 254 22  | officience.  |
|   | Coefficient  |   |   | Prob.   | #54 da  | ecositation and the second                         |
|   |  | Dtandard<br>Error   |   | Prob.<br>(s)sI*   | 854 č:<br>Int   | nfidence<br>erval                                  |
| 81292   |  | Diandard<br>Error   |   | Prob.<br>(s)>1*   | #54 da<br>Int   | nfidence<br>serval                                 |
| SIIN2   | Coefficient<br>Intranium parame<br>-6.07535444   | Diandard<br>Error<br>Lebe   | a<br>-3.75  | .0003   | ********  | ******   |
| SIIN2   | Coefficient<br>Intranium parame<br>-6.07535444   | Diandard<br>Error<br>Lebe   | a<br>-3.75  | .0003   | ********  | -2.36753   |
| SIIN2   | Coefficient<br>Intranium parame<br>-6.07535444   | Diandard<br>Error<br>Lebe   | a<br>-3.75  | .0003   | -10.55403   | -2,36733   |
| BIIS/2  | Coefficient  | Diendard<br>Error<br>Lete<br>1.54025<br>.54568<br>.01232  | 2<br>-2,70<br>8,06<br>4,54                                      | .0003<br>.0021<br>.0000   | -10.55403   | -3,34733<br>2,84855<br>.06407                      |
| BIINZ<br>CONFIGNO<br>LHISH<br>HOFIINC<br>VCVL11   | Cpefficient<br>-6,97555***<br>5,73933***<br>.05574***  | Dtenderd<br>Error<br>1-540055<br>-54566<br>-01250<br>6.07634  | a<br>-3,79<br>3,05<br>4,54<br>-2,77                             | .0003<br>.0021<br>.0000   | -10.55403   | -3.36733<br>2.84855<br>.08407                      |
| BIINZ)<br>()<br>Constant)<br>()<br>LHIEN<br>()<br>SOFITHC)<br>()<br>VCVL11<br>()<br>()<br>LHENT | Coefficient<br>-6,07000 perame<br>-7,07000***<br>-00074***<br>-10,000***<br>Nears for rendom<br>-40200**                                       | Standard<br>Error<br>1.56025<br>.56565<br>.01252<br>6.07654<br>parmeters<br>.21904                          | 3,70<br>3,08<br>4,54<br>-2,77<br>1,97                           | .0002<br>.0021<br>.0000<br>.0055                                | -10.55403<br>.69112<br>.03341<br>-23.0350<br>.00134           | -3,34733<br>2,84859<br>.06407<br>+3,4530           |
| BIINZ<br>COLLEGADU<br>LHLEN<br>HOFLINC<br>VOVLII<br>LHLDT                                       | Coefficient<br>Information persent<br>-6,97555***<br>1,73083***<br>.05374***<br>-0.3005***<br>teans for renson<br>.43225**<br>Scale persenting | Standard<br>Error<br>1.54025<br>.64565<br>.01332<br>6.07634<br>parmeters<br>.31604<br>for dists.            | 3<br>-3,70<br>3.08<br>4.54<br>-2,77<br>1.87<br>of rands         | .0003<br>.0021<br>.0000<br>.0055                                | -10.55403<br>.69119<br>.03341<br>-33.0350<br>.00134           | -3,3673<br>2,84650<br>.06407<br>-3,6530<br>,64320  |
| BIISS<br>COLDANART<br>INTER<br>BOFLINC<br>VCVL11<br>INTER<br>LHLDT<br>LHLTT                     | Coefficient<br>(mranne perme<br>-6,37535***<br>-10,305***<br>-10,305***<br>tens for range<br>,43215**<br>Scale perspeters<br>.0605***          | Dtandaos<br>Error<br>1.54005<br>.64565<br>.01392<br>0.57634<br>parameters<br>.21504<br>fmr dipts,<br>.51501 | 3<br>-3.70<br>3.08<br>4.54<br>-2.77<br>1.97<br>of rands<br>5.82 | .0003<br>.0021<br>.0000<br>.0055<br>.0055<br>.0480<br>m. pacene | -10.55403<br>.69112<br>.03341<br>-23.0350<br>.00134<br>.00134 | -3,3673<br>2,84650<br>.06407<br>-3,6530<br>,64320  |
| BIISS<br>COLDANART<br>INTER<br>BOFLINC<br>VCVL11<br>INTER<br>LHLDT<br>LHLTT                     | Coefficient<br>Information persent<br>-6,97555***<br>1,73083***<br>.05374***<br>-0.3005***<br>teans for renson<br>.43225**<br>Scale persenting | Dtandaos<br>Error<br>1.54005<br>.64565<br>.01392<br>0.57634<br>parameters<br>.21504<br>fmr dipts,<br>.51501 | 3<br>-3.70<br>3.08<br>4.54<br>-2.77<br>1.97<br>of rands<br>5.82 | .0003<br>.0021<br>.0000<br>.0055<br>.0055<br>.0480<br>m. pacene | -10.55403<br>.69112<br>.03341<br>-23.0350<br>.00134<br>.00134 | -3,36733<br>2,84855<br>,08407<br>-3,4553<br>,94323 |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Metropolitan Small Urban SPF Class Roadway Segments

| Dependent varis<br>Log likelihotd<br>Restricted Log<br>Chi agusted 1<br>Significence 1s<br>NoZedden Freudr<br>Estimation base<br>Inf.Cr.ALC * | anta HagBnRag I<br>hla<br>function<br>likelihood<br>S d.f.( E<br>rel<br>S Regulard<br>S ON F TTE<br>2014.6 AIC/E =<br>1 Dec 24, 2015. | 2010/<br>998,23400<br>995,43961<br>914,99134<br>.00000<br>.1473963<br>. # = 11<br>2.395 |                |                  |                     | Covariance<br>Latin<br>Latin | ##1214<br>LM<br>2132E- | 1<br>23 1<br>43<br>-01 .321) | f rendom perame<br>LMADT<br>NE-01<br>of sendom pera |        |
|---|---|---|----------------|------------------|---------------------|------------------------------|------------------------|------------------------------|---|--------|
|   | is and 400 Lt.  |   |                |                  |                     | 0.0_Setal                    |                        |                              |   |        |
| 10DHZ Coes  |   | ndexú<br>Tror z   | From.          | 954 C:<br>Int    | nfideoce<br>terral  | 21                           | 34<br>28               | (\$3102<br>(\$1014           |   |        |
| (Nonser<br>Constant) -3.<br>SHMDGT; -   | dom paxameters<br>95007***<br>05503***  | 10300 -6.70<br>11435 -3.04  | 0000,<br>1900, | -1.11248         | -3.80724<br>-,02690 | Inglied pd                   | crelatio               | n matrix :                   | of candom pacam                                     | eters. |
|   | 46D-04*** .199  |   |                | 00209D-05        |                     | Cor.Met.)                    | 101,831                | 150,00                       |   |        |
| 191EH) L.   | for sandom para<br>04930***<br>85545***<br>al elemente of   | 0408100<br>0602100.09   | ,0000          | .95951<br>.55745 |                     | LNLENS                       | 1.00000                | 1,00000                      |   |        |
| INTER:  | 46310*** _:<br>.00999**   | 04096 11,31   | 0005           | -58292           | .84399              |                              |                        |                              |   |        |
| 1184_INL -  | diagonal element  | 01234 -9,72   | .0002          | 0102#            | -,021.74            |                              |                        |                              |   |        |
|   | sion persseter  |   |                |                  | 11,14914            |                              |                        |                              |   |        |

LNADT \_2219E-01 vistions of buildin perspectary

| Cor.Mat.)       | 201,831  | 130400 |
|-----------------|----------|--------|
| LSLEB)<br>LNAD7 | 1.000000 |        |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Metropolitan Small Urban SPF Class Roadway Segments

| Dependent<br>Log likel<br>Mestricte<br>Chi squer<br>Significe<br>McFedden<br>Estimatio<br>Inf.Cr.AJ<br>Kodel est<br>Semple is | efficience Degl<br>variable<br>thood function<br>6 log Likelihood<br>no 1 2 0.1/<br>too 1 evel<br>preudo R-equared<br>1 bared on W =<br>7 = 194.8 Al<br>transdi Dec 34.<br>2 pds and<br>2 pds and | JUNTI<br>-907.419<br>-400.450<br>210.400<br>.000<br>.21960<br>.21960<br>.21960<br>.275, E *<br>.2015, 10041<br>.30 10041 | 22<br>66<br>00<br>10<br>27<br>28<br>27                                    |  |                                     |                                     |
|---|---|--|---|--|-------------------------------------|-------------------------------------|
| JUNTERS   | Coefficient   | Stenderd<br>Excor  |   | frib.<br>(#1>2*  |                                     | ofidence<br>exval                   |
| 1   | Ronrandom perane  | 1417   |   |  |                                     |                                     |
|   | -4.95366***   |  |   |  | ~#. \$0094.                         |                                     |
|   | .18146***   |  |   |  |                                     |                                     |
|   | 12923+*   |  |   |  |                                     |                                     |
|   | 15, 1478+4  |  |   | 100002   | ,0805                               | 22:0045                             |
|   |   | Denemeters.  |   |  |                                     |                                     |
| 1   | MARTA TOX TRUGON  | And a state of the second  |   |  |                                     |                                     |
|   | BOAT AREA   | 05704  | 24.04   | .0600  |                                     |                                     |
| LILEU   | .00014***<br>.47376***  | -05744<br>-07600   | 14.04<br>8.26   | ,0000  |                                     | .01071                              |
| LICEN   | .00814***<br>.47376***<br>Diagonal element  | .05744<br>.01600<br>a of Coulesk   | 14.04<br>6.26<br>y matrix   | ,0000  | .52450                              | .42472                              |
| LISLEN<br>LISLEN<br>LISLEN  | .00014***<br>.47376***<br>Diagonal element<br>.00120***   | .05744<br>.07600<br>a of Chulesk<br>.08082   | 14.04<br>6.26<br>y matrix<br>8.14   | .0000  | .52850                              | .82472                              |
| LSLEE<br>LSADT<br>LSLEE<br>LSLEE<br>LSADT   | .BOEL4+++<br>.4TIT6+++<br>Diagonal elevent<br>.SE120+++<br>.06883+++  | .05744<br>.07630<br># of Chulesk<br>.08082<br>.02632   | 14.04<br>6.26<br>y matrix<br>8.19<br>2.62                                 | .0000.<br>.0000  | .52850                              | .82472                              |
| LICER<br>LINEDT<br>LINET<br>LINET   | .80414***<br>.47276***<br>Diagonal elemant<br>.06120***<br>.06583***<br>Below diagonal e  | .05746<br>.07600<br># of ChoLesk<br>.05082<br>.02632<br>Lements of C   | 14.04<br>6.26<br>9 Batris<br>3.14<br>2.62<br>holesky                      | 0000.<br>0000.<br>0000.                                | .52450<br>.14181<br>.01428          | .42472<br>.86080<br>.12041          |
| LISLEN<br>LISLEN<br>LISLEN<br>LISLEN<br>LISLEN<br>LISLEN  | .80414***<br>.41116***<br>.0610***<br>.0600***<br>Below diaponal =<br>02450**   | .05744<br>.07430<br># of Chulese<br>.08082<br>.02432<br>lements of C<br>.01244   | 14.04<br>8.26<br>9 Matrix<br>3.14<br>2.62<br>holesky<br>-1.05             | .0000<br>.0000<br>.0059<br>matris<br>.0451             | .52850                              | .42472<br>.86080<br>.12041          |
| LISLEN<br>LISLEN<br>LISLEN<br>LISLEN<br>LISLEN<br>LISLEL  | .80414***<br>.47276***<br>Diagonal elemant<br>.06120***<br>.06583***<br>Below diagonal e  | .05744<br>.01600<br>a of Chulesk<br>.01083<br>.02632<br>lements of C<br>.01244<br>ater for Neg                           | 14.04<br>6.26<br>y matrix<br>3.14<br>2.62<br>holesky<br>-1.05<br>Sin dist | .0000<br>.0000<br>.0059<br>marris<br>.0451<br>ribution | .52650<br>.16181<br>.01428<br>04196 | .82972<br>.86080<br>.12085<br>00020 |

|                | LHLEN                 | LIADY                      |
|----------------|-----------------------|----------------------------|
| LHLEN<br>LHADT | .60108-01<br>04118-01 | .84615-05                  |
| Deplies .      | standard devis        | erious of random paymeters |
| 3.D_Bets       |                       | 1                          |
| 1              | .1412)<br>.02941)     | 57<br>89                   |

Deplies opvariance matrix of random parameters

| Cor.Nat. | LILLEN  | 1,119,01 |
|----------|---------|----------|
|          | 1,00000 |          |
| THAD?    | 99708   | 1,00000  |

# Random Parameter Negative Binomial Model of Total Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

| Dependent   | efficients Segi<br>Mariable<br>thord function  | TUTAL   |                                       |                |               |                   | Implied orwarizatie matrix of random persectors<br>Covariation matrix   |
|---|--|---|---------------------------------------|----------------|---------------|-------------------|---|
| Restricts   | d log likelihood   | -9002.75  | 452                                   |                |               |                   | Aller Aller Aller   |
| Significe<br>HoFaiden<br>Estimatio<br>Inf.Cr.AI<br>Hodel est<br>Semple is | ed ( 6 d.f.)<br>hoe level<br>Faeudo R-aquarat<br>o based on H =<br>C = 2006.7 AJ<br>imateo: Dec 19.<br>2 pds end (<br>binomial pegress | .00<br>554, E =<br>10/3 = 3.<br>2015, 22:49<br>125 individu | 000<br>979<br>15<br>459<br>197<br>819 |                |               |                   | LNART .000HE-00<br>SHUDCR .1798E-02 .5761E-05<br>INTER .1798E-02 .247EE-02 .6688E-01<br>Implied standard deviations of vandom parameters<br>3.0_Beta: 1 |
| TOTALACC  | Coefficient  | Standard<br>Error   | 10                                    | frob.<br>trop: | 258 Co<br>Ins | nfidence<br>ervel | 2/ _0182800<br>2/ _0199539  |
|   | Sunrandon parame   |   | 23,004,3                              | 2000           | 102103        | 0/2/2/2010        | *I .24*/08  |
|   | ~6.84025***  | .94108  | +8.74                                 | ,0000          | +8.18459      | -8.69580          |   |
| HOVERAFT  | .338960-04***  | _1040D-04   | 4.24                                  | .0000          | .94825D-04    | .124970-03        | Implied currelation matrix of random parameters   |
| VCVLII  | 1.31728***   | .11260  |                                       | 10036          | .00055        | 2.30362           |   |
| BHYNDINC)   | .01423***  | -00417  | 11.41                                 | .0006          | .00608        | .02298            |   |
| 101003211   | -5.71807***  | 2.10001   | -2.61                                 |                | -10.01190     | -1.42417          |   |
|   | Deans for cendin   | t persenters  |                                       |                |               |                   | Cor.Net.) LHADI SHOCE LHIEN   |
| LIMADT  | .81481***  | .06126  | 10,08                                 | 10000          |               |                   | and a second second second second second second second second second second second second second second second  |
| BHWDCR1   | 01646***   | .00607  | +9.35                                 | 10012          | 02639         | -:00459           | 1312071 1.000003000046065   |
| 1.011.010   | .81595***  | .03366  | 27130                                 | 10000          | .005500       | .95495            | INNER:50980 1.0000050101  |
|   | Disponal element   | ts of Chales  | my matting                            | e              |               |                   | 1H1EH;4604550101 1.00008  |
| 130401  | ·01#1#**   | -00911  | 13,200                                | 10469          | .00088        | .119408           |   |
| 254DC91   | .01868***  | .00413  | 3.50                                  | .1001          | .00268        | .02490            |   |
| LINLEN  | .04996***  | 17010.  | 4.66                                  | .0000          | .02996        | .070.96           |   |
|   | Below disponal #   |   |                                       | matrix.        |               |                   |   |
|   | 00969**  | .00673  | -2,06                                 | 10592          | 01929         | 00749             |   |
| 1209 130k   |  | -01002  | -6,26                                 | 10000          | 1T668         | -:06457           |   |
| 13MM 13MA   |  | 01070   |                                       | .0000          | 24420         | 19430             |   |
| 11112_3881)   |  |   |                                       |                |               |                   |   |
| 11112_3881)   | 21825***<br>Dispension param   |   | gfin dist                             | .DCOD          | E             |                   |   |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

| Mandom Co<br>Dependent<br>Log likel<br>Restricte<br>Di agiati<br>Significe<br>NiFalden<br>Estimation<br>Inf.Ct.RJ<br>Nodel est<br>Sample is<br>Regative | efficients Deg<br>Variable<br>Nood function<br>d log livelibod<br>es [ 3 d.f.]<br>Fecht S-squared<br>to Lawed on H =<br>C * 2529.8 AC<br>immed De 28,<br>2 gde and 4<br>binnel regress | mBeg Model<br>P<br>-1356.0031<br>-5540.001<br>3567.456<br>.000<br>.07516<br>556, E =<br>C/M = 2.5<br>2018, 14:001<br>26 Individual | 00<br>17<br>19<br>19<br>10<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20 |  |  |   | COMMITANCE EATLIN<br>HOTOGOELI LINEEH<br>HOTOGOELI 10.27<br>LINEEN 11657 .477352-D1<br>Inglies standaru deviatinus if random parameters<br>5.5_Eare) 1<br>17 000000 |
|---|--|--|--|--|--|---|---|
| EDO:  | Coefficient  | Standard<br>Ector  | 10   | \$20b.<br>(1))[*                                   | 95% Ce<br>215  | ofidance<br>ezval   | 21 .228478  |
|   | Menrandon parame   |  |  | 2392   | 9.22.0   | 1.225.200   | Deplied scorelation matrix of rendem parameters   |
| SCORTECCI<br>SCVCRAH<br>SSRDCRI<br>LHADT<br>VCVCI<br>ENVROISC   | .84435D-06***<br>01777***<br>.84173***   | 1,05256<br>,10205-04<br>,00565<br>,08028<br>,00025<br>,00025   | 4.40<br>-3.24<br>9.32<br>-2.36   | 0000,<br>0500,<br>1100,<br>0000,<br>0100,<br>0000, | +9.28188<br>+48234D-04<br>+.02382<br>+66477<br>+.00024<br>.00782 | -5.15945<br>.12208D-03<br>00109<br>1.01068<br>00008<br>.02463 | Cor.Nat. (NCHORL1 LNLEN<br>NCHORSEL1 1.00000 .31340<br>INTERSEL1 .22240 1.30000   |
| VCEANSA (   | 124328***  | 108586   | 4.43   | -0000  | -1865e   | + 19057   | 101120] (21244 210000   |
| BCVIDERL  | Heans for random<br>-9.36400***  | 2.51653  | -3.00  | annt   | -14.49924  | -4,62010  |   |
| LHLEN   | . 90492+++   | .05874   | 24.42  |  | 53232  | .97692  |   |
| - 0   | Disponal element   |  |  |  |  |   |   |
| HCVIDIBL1   | ,01373***<br>.21949***<br>Selov diagonal e   | .00492<br>.01296   | 14.47  |  | ,00511<br>.18009   | .02310  |   |
|   | .06860***  |  | 3.27   |  | 101857   | .07428  |   |
| 11NL HOV:   |  |  |  | aubutios   |  |   |   |

Note: \*\*\*, \*\*, \* \*\*> Significance at 10, 50, 100 lavel.

# Random Parameter Negative Binomial Model of Possible Injury Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel<br>Restricte<br>Chi egiar<br>Sigrifica<br>McFadden<br>Estimatic<br>Inf.Cr.AD<br>Nodal est<br>Sample is<br>Nodal est | efficients Depu<br>variante<br>ibood function<br>d Log Likelihoos<br>en 1 3 6.6.1<br>noe Level<br>Freudo 3-squared<br>n Based on N =<br>C = 5633.7 8<br>2 pds end -<br>tinnonial regress | 4 -1879.421<br>3147.172<br>.000<br>1 .57123<br>856, K =<br>10/H = 1.0<br>3015, 19:01,<br>130 individua<br>kion model | N2<br>29<br>48<br>39<br>20<br>20<br>20<br>21<br>20<br>20<br>21<br>20<br>20<br>21 |                                      |               |                   | ODPARIANCE REFLIX           NOVCRAM         LINDT           BOVCRAM        10022-07           LINDT        10022-04           Taplied standard deviations of random parameters           3-0_Bets(         1           -         1) |
|--|--|--|--|--------------------------------------|---------------|-------------------|---|
| PINO   | Coefficient  | Stendard<br>Error  | 10   | Foub.                                | 99% Co<br>200 | efidence<br>ervel | 2) ,0640948   |
|  | Nonrandos parana   |  | C  |                                      |               |                   | Implied correlation patrix of random parameters   |
| Congeant!  | -8.88218***  | 1127378  | -5.35  | ,0058.                               | -2.31853      | -1,33778          |   |
| INLEN  |  | .00621   | 15.00  | .0000                                | .76650        | .90569            |   |
| 5394D9(T)  |  | .01261   | -3:11  | .0019                                | -, D#628      | -,01688           |   |
| BOFLINC  |  | .09070   |  | .0177                                | ,03788        | ,29294            | Cox.Mat.) HOVCEAN INADT   |
| 101/200322   |  | 1.29396  | -2.25  | .0244                                | -12,00680     | 07050             |   |
|  | Neens for randos   |  |  |                                      |               |                   | MCVCRAF) 1.00000 +,82058  |
| HUNCHAN  |  | -20440-04  |  | -0000                                | +00023        | ,00019            | LNADT192289 1.00000   |
| LIGADT   |  | 1221868  |  | -0000                                | .50629        | .97030            |   |
|  |  | te of Chilesk  | 3 metris   |                                      |               |                   |   |
|  | Disgonel element   |  |  |                                      |               |                   |   |
| neverall)  | .00031***  |  |  | .0000                                | +00035        | .00087            |   |
| HCYCRAIL<br>LHADT  | .00031***<br>.02425***   | .0042T   | 5.56   | .0000                                | +00025        | .00017            |   |
| U<br>NCVČKAJI<br>LIGADO<br>U   | .00031***<br>.02425***<br>Below diagonal 4   | 10042T<br>10042T<br>10042T   | 5.5E<br>Nolesky  | .0000<br>MA125N                      | .01682        | .03238            |   |
| U<br>ROVČRAJI<br>LIGAJO<br>LIGAJO<br>LIGAJOVI  | .00031***<br>.02425***<br>Below disposal e<br>~.05902***   | .00427<br>.00427<br>clements of C<br>.00496  | 5.50<br>nolesky<br>-11.09  | .0000<br>##105#<br>9000-             | .01682        |                   |   |
| U<br>REVERSIT<br>LUGET<br>1<br>LUGET   | .00031***<br>.01425***<br>Below diagonal 4<br>05002***<br>Diaperation paras  | .00427<br>.00427<br>clements of C<br>.00496  | 5.56<br>nolesky<br>-11.09<br>Sin diwt  | .0000<br>MATISA<br>.0000<br>Fibution | .01682        | .03238            |   |

# Random Parameter Negative Binomial Model of Evident Injury Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

|            | *****                          |               | +++++++++ |         | +++++++++++++++++++++++++++++++++++++++ | +++++++++++++++++++++++++++++++++++++++ | - Inplied covariance matrix of random parameters |
|------------|--------------------------------|---------------|-----------|---------|---|---|--|
| Random Co  | efficients Hepl                | inSeg Mndel   |           |         |   |   |  |
|            | : Turishle                     |               |           |         |   |   | Covariance matrix                                |
| Log likel  | ibood function                 | -38T.863      | 979       |         |   |   |  |
|            | d log likelihood               |               |           |         |   |   | LMADT REMOLTOR                                   |
|            | 162 ( S.S.E.)                  | 244,923       |           |         |   |   |  |
|            | nce lavel                      | -000          |           |         |   |   | LNRDT .2002E-12                                  |
|            | Presidi E-squares              |               |           |         |   |   | SEMDLICE .4988E-02 .1210E-01                     |
|            |                                | 256, F =      |           |         |   |   | 김 비행 비행 지난 회원은 것은 것을 잘 하는 것은 것을 많은 것은 것을 것 같다.   |
|            | 10 = 118.7 AI                  |               |           |         |   |   | Inplied standard deviations of random parameters |
|            | insted: Der 26,                |               |           |         |   |   |  |
|            | 2 pds and 4                    |               | 11.0      |         |   |   | p.p_seta: 1                                      |
|            | binomial regreat               |               |           |         |   |   |  |
|            |                                | Standard      | 0.001002  | Prob.   |   | nfidence                                | - 1/ .0015970<br>2/ .109009                      |
|            | Coefficient                    | Error         |           |         |   | arvel                                   |  |
|            | Sector contractors             |               |           |         |   |   |  |
|            | Honrandon parasa               |               |           |         |   |   | Implied correlation watrim of rendom payameters  |
| Constant   |                                | 2.21111       | -5.11     | :00002  | -12,40101                               | -3.92101                                | AND ADD ADD ADD ADD ADD ADD ADD ADD ADD          |
|            |                                | 136120-04     | 2.29      |         | .119160-04                              |   |  |
| INTER      |                                | .0096J        |           | .0005   | .77678                                  | .55169                                  |  |
| SCHOOSEL 1 |                                | 11220-04      |           | .0387   | 100003                                  | .00010                                  | Cor.Mat.   LNADT SHMDLTCH                        |
| 10000      | Heans for random               | parameters.   |           |         |   |   |  |
| INGOT      | .19192***                      | .10487        | 4.24      | 10000   | .42998                                  | 1.15426                                 | 18291 1.00000 .00291                             |
| SHUDLICS.  | +,04540++                      | -02140        | +2.11     | .0346   | +.08755                                 | 00528                                   | SMMDLTCH:  |
|            | Disputal element               | is of Cholesi | ty matrix |         |   |   |  |
| LNADT      | .06140***                      |               | 6.16      |         | 1003304                                 | 104778                                  |  |
| SHOOLTCR!  | -05175***                      | -64714        | 5.92      | .0126   | 101815                                  | .00539                                  |  |
|            | Below disponal +               |               | Indissky. | matrix  |   |   |  |
|            |                                |               | 4.52      | .0000   | .05631                                  | -13760                                  |  |
|            |                                | -34588        |           |         |   |   |  |
| LOUN_LNR   | .09705+++<br>Dispersion parent |               | gfin dist | -ibutis | n<br>04041                              | *. 12174                                |  |

Random Parameter Negative Binomial Model of Serious Injury Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

| Nestricted<br>Thi aguary<br>Nighificen<br>NoTadden H<br>Letimation<br>Inf.Cr.A2<br>Hodel esti<br>Hample is | verieble<br>thood function<br>i ing likelihood<br>ed [ 1 Sif.]<br>tot level<br>"peudo & equared<br>: based on H =<br>T = 136.3 AL<br>Meted; Deo 27,<br>2 pds and 4<br>innomial ceptees | -76,945<br>5,756<br>,016<br>1.09798<br>254, H =<br>10/N = .1<br>7015, 14(41)<br>10 individua | 98<br>23<br>15<br>69<br>6<br>98<br>49<br>18        |  |  |   |
|--|--|--|--|--|--|---|
|  |  |  |  |  |  |   |
|  | Coefficient  | Standard<br>Erzez  |  | 3¢ob.<br> ± >0*  | 988 Cc<br>3115   | esvál                                     |
| SING)  | Coefficient  |  |  |  |  |   |
| SISS   | Coefficient<br>forrandom parame<br>97853++   | ters   | -2.57  | .0102  | -1.72923   | +.23242                                   |
| 2157   | Coefficient<br>forrandom parama<br>-,97813**<br>6.87987***   | .30003<br>1.78886  | -2.57  | .0002  | -1.72923<br>9.07847                                      | -,28242                                   |
| 2157   | Coefficient<br>forrandom parama<br>-,97813**<br>6.87987***   | .30003<br>1.78886  | -2.57  | .0002  | -1.72923<br>9.07847                                      | -,28242                                   |
| SINT<br>(1)<br>Constant (<br>VCVL1<br>LULEN (<br>U)  | Coefficient<br>forrandom parame<br>-,97853**<br>6,57957***<br>.97985***<br>Leans for rendom  | 1,50005<br>1,78086<br>.17000   | -2.57<br>3.68<br>9.64                              | .0102<br>.0002<br>.0000                                | -1,72923<br>9,07847<br>,41904                            | -,25242<br>10,08567<br>5,92064            |
| SING<br>VCVL1<br>LNLEN<br>SINDCR   | Cotfficient<br>forrandom parama<br>97053++<br>0.07965+++<br>Leans for random<br>28094++  | .50003<br>1.78086<br>.17009<br>1 persmeters<br>.10076  | -2.87<br>3.68<br>9.64<br>-2.21                     | .8102<br>.0002<br>.0000                                | -1.72923<br>9.07847<br>.41904<br>04822                   | -,28242<br>10.08867<br>1.92064<br>-,03264 |
| SINT<br>Constant<br>WCVLL<br>LNLEN<br>SINDCR   | Cotfficient<br>forrandom parama<br>97053++<br>0.07965+++<br>Leans for random<br>28094++  | .50003<br>1.78086<br>.17009<br>1 persmeters<br>.10076  | -2.87<br>3.68<br>9.64<br>-2.21                     | .8102<br>.0002<br>.0000                                | -1.72923<br>9.07847<br>.41904<br>04822                   | -,28242<br>10.08867<br>1.92064<br>-,03264 |
| SIST<br>Constant<br>VCVLL<br>LICEN<br>SINDCR   | Confficient<br>forrandom parame<br>-,97853**<br>0.87985***<br>Legns for random<br>28094**<br>Itale parameters<br>.38850**  | .5005<br>1.78886<br>.17986<br>1.98786<br>1.98786<br>1.98786<br>1.9876<br>1.97371             | -2.57<br>3.68<br>0.64<br>-2.21<br>of rends<br>2.56 | .0002<br>.0000<br>.0000<br>.0271<br>.0271<br>m parame' | -1.72923<br>9.07347<br>.41904<br>04122<br>term<br>.04403 | +.21242<br>10.08567<br>5.02064<br>+.01264 |
| SIST<br>Constant<br>VCVLL<br>LICEN<br>SINDCR   | Coefficient<br>forrandom parame<br>-,97853**<br>6,57957***<br>.97985***<br>Leans for rendom  | .5005<br>1.78886<br>.17986<br>1.98786<br>1.98786<br>1.98786<br>1.9876<br>1.97371             | -2.57<br>3.68<br>0.64<br>-2.21<br>of rends<br>2.56 | .0002<br>.0000<br>.0000<br>.0271<br>.0271<br>m parame' | -1.72923<br>9.07347<br>.41904<br>04122<br>term<br>.04403 | +.21242<br>10.08567<br>5.02064<br>+.01264 |

Random Parameter Negative Binomial Model of High Injury Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

| lependent   |   | 9111  |                                  |                 |               |                   | Covariance matrix  |
|---|---|---|----------------------------------|-----------------|---------------|-------------------|--|
| lestrartes  | heed function   | +865.708  | 63                               |                 |               |                   | SEVERAS LIGADE   |
| lignificao<br>Orfaddan P<br>Defination<br>Def.Cp.AlC<br>Codel esti<br>Sample is<br>Degative b | saudo R-squared<br>based in N =<br>= 988.9 AT<br>mated: Jun 22,<br>2 pds and 4<br>inimial regress | 856, ff =<br>0/N = 1.0<br>2016, 18:24:<br>25 individue<br>ion model | 00<br>72<br>10<br>90<br>11<br>1# |                 |               |                   | NCV(DAA:ISI2F-07<br>LNEAT01992-09SEGIE-02<br>Implies standard deviations of random parameters<br>S.C Sets) 1<br> |
| NI283   | Coefficient   | Standard<br>Essor   |                                  | #200.<br> #]>2* | 96% Co<br>Int | nfidenoe<br>erval | 2) .0458138  |
|   | onrendon perane   |   |                                  | 1000            |               |                   | Implied currelation matrix of random parameters  |
|   | -7,48927***   |   | -8.81                            |                 | -11, 34808    |                   |  |
| SHOULD -  | _07863***<br>~_02398***   | .02900  | 19.55                            |                 | .1904T        | .04679            |  |
| VCVLINE!  | 1.24903*  | .70391  |                                  | .0697           | -112942       | 2.62745           | Cos.Net.1 ECVORDS INADT  |
|   | leans for random  |   |                                  |                 |               |                   |  |
| BOVORANT:   | -00011+**   |   | 4.28                             |                 | +00004        | .80016            | MCVCRAN( 1.0000000024  |
| LSBDT (   | 1242477+++  | .16417  |                                  |                 | +42294        | 1104749           | LBADT) 95325 I.00000   |
| BEVENUT   | isgonal element   | -3713D-04   |                                  |                 | ,00008        | ,00019            |  |
| LNBDT 1   | 101747***   | 100667  |                                  | .0021           | .00635        | 102888            |  |
|   | slow disponal s   |   |                                  |                 |               |                   |  |
| LNA MCVI  | +,05929***  | .00700  | +8.47                            | .0000           | 1,01002       | - HL04557         |  |
|   | ispersion paran<br>2.49143  |   |                                  |                 |               |                   |  |
|   |   | 6.67165   | 1.47                             | .0781           | -4.55422      | 21.54753          |  |

# Random Parameter Negative Binomial Model of Just Injury Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

| Random Co<br>Dependent<br>Log likel<br>Restricter<br>Chi squar<br>Highifion<br>HoTeiden<br>Tstination<br>Inf.Cr.Ad<br>Nodel est<br>Nodel est<br>Sample is<br>Hegetire I | efficients HegB<br>VeriAble<br>Licod function<br>d log likelihood<br>of [ 3 d.f.]<br>Deel cred<br>Pasut R-squared<br>n based on W =<br>2 = 1023.2 AI<br>immovid Veries<br>inconial regress | cReg Nodel<br>2011<br>-101.384<br>-755.710<br>500.207<br>.000<br>.35627<br>516, X =<br>C(M = 1.1<br>2016, 27:03<br>28 individue<br>100 model | 90<br>91<br>75<br>97<br>97<br>97<br>97<br>97<br>14<br>10<br>95<br>17<br>18 |                 |               | 5111451151114 | Covariance matrix           LHADT         SHRDCE           LHADT |
|---|--|--|--|-----------------|---------------|---------------|--|
| JUSTING   | Coefficient  | Freedard.<br>Erzor   |  | #205-<br>(21)2* | 954 Co<br>105 | ervel         | 1002880. (1  |
|   | Nonrandom parama   | tecs   |  |                 |               |               | Implied correlation matrix of random parameters                  |
| Copistant!  |  | 1111041  | -2.90  | -0037           | -7,30007      | -1.43200      |  |
|   | .110260-06***  | _2191D+04  | 3.21   |                 | 420762-04     | .127970-03    |  |
| 101223101   | .24510**   | 121762   | 2.24   | 10239.          | 10没币工作        | 145622        |  |
| TREAM (   | .\$3500***   | .04463   | 18.71  | .0000           | .74788        | .92246        | Cor.Nat.   LHAD7 SHNDCR  |
|   | Weans for rendhm   |  | 2.5.3.5  |                 | 10000         | - CONSIGN     |  |
| LNROT   | ,43632***  | .13965   | 3.28   | .0012           | ,17197        | .05067        | LMADI) 1.00000 .21283  |
| JENDON/   | -,02542***   | ,00908   | -2.82  |                 | -,04922       | -,00778       | 8HW009127209 1.00000   |
|   | Ciagonal element   |  |  |                 |               |               |  |
| 110,071   | .02755***  | .00699   |  | .0000           | +01452        | .52977        |  |
| SUBIDCR   | ,03678***  | .00884   |  | _dooo           | ,02335        | .2502.8       |  |
|   | Selow disponal a   |  |  |                 |               |               |  |
|   | 101042   | 100825   |  | 2048            | +,00887       | : 你是相考志       |  |
|   | The probability of the basis   | eter for Neg   |  | _0000           |               |               |  |
| ScalParm  | 28187478   | 104428   |  |                 | 128504        | . 34047       |  |

# Random Parameter Negative Binomial Model of Low Injury Crashes on Large Urbanized Small Urbanized SPF Class Roadway Segments

----- Implied covariance matrix of random parameters

| Dependent<br>Log likel<br>Hestricte<br>Chi equar<br>Significe<br>Hofedden<br>Letimatio<br>Ind Cr.AI<br>Hodel est<br>Sample is<br>Repative | efficients Heg<br>veriable<br>inned fudetist<br>d leg likelines<br>ad [ 3 d.f.]<br>nee isvel<br>feeddo N-squaren<br>n baasd on N =<br>C = 3772,7 A)<br>imated: Dec 37,<br>2 pds and<br>binimial regres | L01<br>-1372.550<br>\$ -6003.744<br>11061.727<br>.000<br>\$ .001<br>\$ .000<br>\$ .0000<br>\$ .00000<br>\$ .0000<br>\$ .0000<br>\$ .0000<br>\$ .0000<br>\$ .00000<br>\$ .0000<br>\$ .00000<br>\$ .00000<br>\$ .0000<br>\$ .0000<br>\$ .00000<br>\$ .0 | 100<br>100<br>100<br>100<br>100<br>100<br>100<br>100<br>100<br>100 |         |   |                   | LNADT<br>TOTLADE<br>Depiled str<br>S.D_Dets) | 1302<br>. 35332-0<br>. 51248-0<br>externi - 0 | or rotz<br>12 .74828<br>eviations o<br>1<br>1 | LUTE     | 00100101010 | <br> |
|---|--|---|--|---------|---|-------------------|--|---|---|----------|-------------|------|
| LOINJ   | Coefficient  | Standard<br>Error   | Ŧ  | Prob.   | 358 Co<br>Int   | nfidence<br>erval | 31   |   | 16256   |          |             |      |
|   | Renranden param  |   |  |         |   |                   |  | relation                                      | i natria of                                   | Interest | mataza      |      |
| Constant)   |  | 1.02887   |  | +9000   | -6.61107  |                   |  |   |   |          |             |      |
| UCVLAI  | -2.02394*  | 1.10942   | -2.24  | .0181   | +0.19037  | .15050            |  |   |   |          |             |      |
| SERVICE   | +;01871+**   | .00835  | -2,73  | .0065   | -,22526   | 00418             |  |   |   |          |             |      |
| LULEY   | .84185***  | .03476  | 24.15  | .0000   | .77538  | .90969            | Cor.Mat.I.                                   | LARDI   | TUTLAME                                       |          |             |      |
| REVESSED.   | .81097D-04***  | +17510-04   | 6.75   | .0000   | -48792D-04  | .117*1D-03        |  |   |   |          |             |      |
| VCRARKA!  | 22245+**   | .05454  | 2:43   | 10001   | .11140  | .22111            | LHADT  | 1.00000                                       | 192726  |          |             |      |
| HC10005111  | -5.56530***  | 2,53852   | +5.37  | ,0001   | -13.91395   | ~3.57533          | TOTLARE                                      | 198728  | 1.00000                                       |          |             |      |
| 1   | Heans for sandom   | n payaseters.   |  |         |   |                   |  |   |   |          |             |      |
| 195307  | .57820***  | -09752  | 5.95   | .0008   | -38706  | .76935            |  |   |   |          |             |      |
| TOTLASE   | .18360+**  | .04535  | 4.05   | 10001   | .09495  | .27268            |  |   |   |          |             |      |
| 0000000   | Disgonal element   | ts of Chilssie  | y matrice  |         |   |                   |  |   |   |          |             |      |
| LIMATES   | .18795***  | .02121  | 5.58   | .0000   | .14639  | .22952            |  |   |   |          |             |      |
| TOTLAIGT  | 06203***   | -00877  |  | 10000   | +02045  | -01/20            |  |   |   |          |             |      |
| - 20 - 10 II  | Below disgonal +   | lepence of C  | tolasky.   | DATE18  |   |                   |  |   |   |          |             |      |
|   | .27274***  | .04058  | 6,72   | .0000   | .19320  | .35221            |  |   |   |          |             |      |
| 1TOT INA  |  | hatar for Neg   | fish dist  | ributin | <ul> <li>1</li> /ul> |                   |  |   |   |          |             |      |
|   | Dispection parat   |   |  | .0000.  | 1.60274   | 2.999446          |  |   |   |          |             |      |

# Random Parameter Negative Binomial Model of Total Crashes on Small Urban Metropolitan SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restriuted<br>Chi sguare<br>Significan<br>Nofedsen J<br>Estimation<br>Inf.Cr.AJC<br>Nodel esti | fficients Deg5<br>variable<br>hood function<br>log liMeilScool<br>a [ 4 m.f.]<br>om level<br>beußt R-squared<br>beard on R =<br>1599.7 AJ<br>mated: Nay 15.<br>2 0de mod 1 | TOTALA<br>+552,635<br>+2528-825<br>5695,968<br>,000<br>1,75006<br>\$50, H =<br>10/H = 2.5<br>2016, 23141: | 85<br>88<br>60<br>60<br>42<br>27<br>27 |        |           |             | Implied novariance matrix of rankes parameters<br>Covariance matrix<br>LUART TOTLANE<br>LUART TOTLANE<br>LUART |
|---|--|---|--|--------|-----------|-------------|--|
| Negative b  | inimial represe  | icon model  |  | Frob.  |           | ofidecce    | 1, .0423341<br>21, .0613470  |
|   | Coefficient  | frint   |  | 101>2* | Int       | erval       | 4) .19484/0  |
|   | INVALUE DATAILS  |   |  |        |           |             | Ingilies correlation matrix of random parameters   |
| Constant  | 5.25411+**   | 1.20775   | 9.48                                   | .0000  | 2.91697   | 7.65136     |  |
| THEFT!  | . 94249***   | ,07003  | 32.40                                  | .0000  | 170347    | 1,00150     |  |
| 0 BHADCR I  | -,55417  | .02539  | -1.96                                  | .1442  | ⇒,08002   | :01168      |  |
| VCVPTORA  | ++900999+*   | .00195  | -2.07                                  | .0997  | ++00778   | 00031       | Gog.Nat.) LEADT INTLANE  |
| HONORSEL :  | +.00401**  | .00186  | -2.42                                  | .0157  | +,007.24  | 00074       |  |
| SMMDLT  | +:07106+**   | ,000966   | ~3.15                                  | 1000e  | 11194     | -,03073     | LURDI 1.00000 .00070   |
|   | wants for raddom   |   |  |        |           |             | TOTIANE: . 90470 1,00000   |
| LHADTI  | -,24343***   |   | -2,56                                  |        | 55055     | +,1278*     |  |
| TOTIANE)  | 189354+++  | 104884  |  | 10001  | -16ST#    | - E2043     |  |
|   | dagonal element  |   |  |        |           |             |  |
| LMADT   | 196233**   | ,02987  |  | .9199  | _01427    | .11030      |  |
|   | 103453**   |   | 2,25                                   |        | .91158    | 08780       |  |
|   | elow disponal e  |   |  |        | 115000    |             |  |
| TLOL TOP!   | :07423   | .05962  |  | .2146  | ~. \$435L | .10147      |  |
|   | rabelation bacan   |   |  |        |           |             |  |
| POBLFRIN(   | ,65681***  | 108785  |  | -2010  | 182488    | 18479       |  |
|   | and as live, to be a series in the late  |   |  |        |           | *********** |  |
|   | **, * **> 310  |   |  |        |           |             |  |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small Urban Metropolitan SPF Class Roadway Segments

| egenden<br>og like<br>autricts<br>hi egna<br>hignifiss<br>hFadder<br>atimatis<br>hf.Cr.A<br>hdel er<br>lengle i | <pre>variable<br/>(variable<br/>Linkoof function<br/>ad log likelihood<br/>red [ 3 d.f.]<br/>Nonde level<br/>Parado R-squared<br/>on based on R =<br/>0 = 1146.8 AD<br/>classed i Jun 23,<br/>s 1 pps gnd 1<br/>binnend regrees</pre> | 540.400<br>-540.400<br>1482.200<br>1853.565<br>(000<br>1.42241<br>855, H =<br>10/H = 2.0<br>2010, 14351<br>75 Lodividue | 09<br>35<br>00<br>87<br>10<br>85            |                 |            |                   |
|---|---|---|---|-----------------|------------|-------------------|
| PDO   | Coefficient   | Standard<br>Eritz   | E.  | Proh.<br>(E))2* |            | nfidence<br>erval |
|   | Sonrandon parana  | CALL  | - 1. S. | 1000            | 0.080.000  | 1281.000          |
| instant   | 5.47397***  | 1.63819   |   |                 |            |                   |
| LELES   | .04559-**   | .05901  | 11.25                                       | 10000           | .76075     | 1.11005           |
| DILANE  | .27122***   | .09818  | 2.91  | ,0038           | ,05810     | .65375            |
| 116.8677  |   | -00180  | +3107                                       | ,7384           | -,00728    | 00020             |
| 319901.1  | 05095+++  | -01247  | -3,63                                       | .0005           | 12100      | 01693             |
| VOVEVUA.  |   | .07752  | 1124  | 10823           | +.00574    | .02035            |
| CVFT08A.  | 01962**   | .00980  | +2,25                                       | 10348           | 03185      | 00140             |
|   | Heans for random  | guranaters.   |   |                 |            |                   |
| LUADT   | 35725+++  |   |   |                 | +.47217    | 10228             |
| SHUDCR  | 06161+*   | .03944  | +2.27                                       | .0002           |            | 00109             |
|   | Disgonal alement  |   |   |                 |            |                   |
| LIMADT  | .02561***   | .00426  | 0.75  | 10002           | 012221     | 33901             |
|   |   |   |   |                 | 00210      | .04267            |
| AHADCR.   |   |   |   |                 | 0.01010355 |                   |
| AHADCR.   | Delch disponal 4  |   |   |                 |            |                   |
| SHADCH  | Below diagonal e  |   |   | ,0328           | 07811      | 00325             |
| AHADCR<br>LSCH_LSCA   |   | .01039<br>meter for Neo   | -2.15<br>Bin dist                           | ribution        |            | 00325             |

Inglied ocvariance matrix of random papameters

| Cowarier        | se matrix             |               |  |
|-----------------|-----------------------|---------------|--|
| 200003          | *********             | <b>JINDCB</b> |  |
| LHADT<br>BINDOR | .65518-03<br>10148-02 | _2409E-02     |  |

Implied standard deviations of random parameters

1,0\_9ete: 1 1: .0214079 2: .0404902

| Cos.Nat. |   | LNA  | p | (ř | ÷, | ii i | W  | p | d | 8 |
|----------|---|------|---|----|----|------|----|---|---|---|
|          |   |      | - |    |    | -    | -  | - | - | - |
| LIMADT   | 1 | .000 | 0 | ٥. | -  | .7   | ġ, | 5 | 3 | 3 |
| SHNDCR   | - | 144  | 9 | 8. | 1  | 3    | b  | à | 6 | b |

Random Parameter Negative Binomial Model of Possible Injury Crashes on Small Urban Metropolitan SPF Class Roadway Segments

| apendent  | fficients RegB<br>veriable<br>hood function  | nlleg Model<br>FI<br>-342.973                                      |                                  |                 |               |                   | Covatiance                             |   |
|---|--|--|----------------------------------|-----------------|---------------|-------------------|--|---|
| (estainted  | 1 log likelinood   | +875,343   | 66.                              |                 |               |                   |  | LICEN VOVITISIA                         |
| Significen<br>NoFedden F<br>Éstisation<br>Inf.Cr.AIC<br>Nodel esti<br>Daugle is<br>Degative b | Teudo R-squared<br>based on N *<br>1 * Til.3 AD<br>meteds Dun 24.<br>2 pds and 2<br>tinonial regress | 860, X =<br>C/M = 1.3<br>J016, 19(43)<br>TS individua<br>ion model | 00<br>42<br>18<br>84<br>24<br>18 |                 |               |                   | VOVETSEA -<br>Implied sta<br>D.D_Betal | .55532-02                               |
| *1112   | Coefficient  | Standard<br>Error  |                                  | FEGD-<br>(#1>Z* | SEA CO<br>Int | ofidence<br>erval | 21                                     | . Disealph                              |
|   | Ionzandim parame   |  | ******                           | 1               |               |                   |  | relation matrix of random parameters    |
| Donetant }  | 5.57941+1  | 1.09161  | 22,561                           | .0104           | 164000        | 4131840           | angeware sole                          | and the substant of an and be been as a |
| LHLOT (   | -,07480***   | 102154   | -8.41                            | -0005           |               | -,03258           |  |   |
| DIFFEDRIT (   | 05055*   | .00018   | -1.46                            |                 | 10914         | .00905            |  |   |
| VEVEN   | .18915**   | 207735   |                                  | .0352           | .03637        | 158192            | Cor.Nat.I                              | LULEN VOVFTURA                          |
| WOWLINT?  | -394.881**   | \$12,3655  | -2.41                            | 0160            | -1804,083     |                   |  |   |
| VEVEVEL   | -,00790+   | -21043   | -1.97                            |                 | 07536         | .00076            | titten) o                              | 1.0000030107                            |
| DOM/GOIDT /   | +.20747++#   | .00246   |                                  | .0024           | 01229         | 00268             | VOVETORA: -                            | .00107 1.00000                          |
|   | Mang fur pandos  |  |                                  |                 |               |                   |  |   |
| INTER   |  | 121862   | 1.8.21                           | .0000           | 72258         | -1/17530.         |  |   |
|   |  |  |                                  | .0200           |               | 21454             |  |   |
|   | isquist element.   |  |                                  |                 |               |                   |  |   |
| LHLEH   | +21470.  |  |                                  | .0114           | 00900         | 115837            |  |   |
| (CVFTGRA)   | +00370++   | .00147   |                                  | .0118           | .03082        | .00656            |  |   |
| 1.5   | wiow disconsi e  | Lesents of C   | nolesty.                         | matrix          |               |                   |  |   |
|   | -,00111  | ,00166   |                                  | .8277           | -;01480       | 100244            |  |   |
|   | isparsion param  | ster for Neg   | din dist                         | ribution        |               |                   |  |   |
| D D   |  | 111279   |                                  | .0000           | .19601        | .73814            |  |   |

Random Parameter Negative Binomial Model of Evident Injury Crashes on Small Urban Metropolitan SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Eastricter<br>Significer<br>Erfedien (<br>Estimation<br>Inf.Gr.AI)<br>Nodel epti<br>Skople 18<br>Septive 1 | hood finction<br>5 log likelihood<br>50 ( 1 d.f.)<br>100 level<br>700 devel<br>1 based on H =<br>2 = 200.3 AJ<br>100 test of JA 20,<br>2 pds and 1<br>2 constant regress | -130.150<br>-167.397<br>-64.876<br>-2000<br>-2005<br>-2005<br>-550, H =<br>-52014, 13459<br>75 Individus<br>75 Individus<br>100 model | 40<br>58<br>47<br>00<br>50<br>52<br>4<br>01<br>54<br>01<br>54<br>01<br>54 |  |  |                              |
|---|--|---|---|--|--|------------------------------|
|   | Coefficient  | Standard)<br>Erxox  |   | FroD:<br>(2)32*  | SEN CO<br>Int                              | ofidence<br>ertel            |
| 14  | ionrandom parame   | CALS  |   |  |  |                              |
| Dinstant)   | 5.21021**  |   |   |  | ,20588                                     |                              |
|   | 1,17942***   |   |   |  |  | 1,61996                      |
|   |  |   |   | -0491  | - 3-boto                                   | 164768                       |
| TOTLAHEL  | 797555.  |   |   |  |  |                              |
| TOTLAHE  <br>SWIDRT   | 18060***   | 105201  | -2.95   | .0044  | -133451                                    | 64708                        |
| TOTLAHE  <br>SWIDRT   |  | 105201  | -2.95   | .0044  | -133451                                    |                              |
| TOTLAHE  <br>SHNDRT  <br>CVFTGRA/   | 18060***   | .01118  | -2.95   | .004#<br>.0029   | -133451                                    | 01040                        |
| TOTLANE:<br>SHEDRT:<br>CVFTGRA:<br>VCVVFTGRA:   | 18060***   | .05201<br>.01118<br>.00929  | -2.95<br>-2.99<br>2.49  | .004#<br>.0029<br>.0089                                | -123411                                    | 01040                        |
| IOTLAHE)<br>SHNDRI)<br>(CVFIGAA)<br>VCVVFIA)<br>()  | 18060***<br>03231***<br>.02442***  | .05241<br>.01118<br>.00929<br>parenetere  | -2.90<br>-2.99<br>2.69  | .0044<br>.0029<br>.0089                                | 23411<br>-,05422<br>.00622                 | 01040                        |
| INTLANE)<br>SUNDAT:<br>(CVFTGDA)<br>VCVVFIA)<br>(<br>LHADT)   | 18060***<br>03231***<br>.02442***<br>Means for tendos  | .05201<br>.01118<br>.00929<br>parameters<br>.05302  | -2.95<br>-2.99<br>2.49<br>-3.26   | .004#<br>.0039<br>.0089                                | 23411<br>-,05422<br>.00622<br>-,27624      | +.01040<br>.04242            |
| INTLAHE<br>SHNDRT:<br>CVFTGDA:<br>VCVVFIA<br>VCVVFIA<br>INADC)  | 10060***<br>03231***<br>.02412***<br>Gens for tendos<br>17263***   | .05201<br>.01118<br>.00929<br>pareneters<br>.05302<br>for Hists.  | -2.95<br>-2.99<br>2.49<br>-3.26<br>of rands                               | .004#<br>.0039<br>.0089<br>.0031                       | 23411<br>-,05422<br>.00622<br>-,27624      | +.01040<br>.04242            |
| TOTLAHE<br>SHNDET:<br>CVFTGRA:<br>VCVFIA:<br>104DT:<br>104DT:<br>104DT:   | 18060***<br>03231***<br>.02442***<br>Geans for bendes<br>17243***<br>Foals perassents  | .05261<br>.01118<br>.00929<br>Parameters<br>.05302<br>for Mists.<br>.01585  | -2.95<br>-2.99<br>2.49<br>-3.26<br>of rands<br>2.07                       | .0044<br>.0029<br>.0009<br>.0011<br>m paramet<br>.0226 | 23411<br>-,05422<br>.00622<br>27634<br>ecs | +.01040<br>.04242<br>+.04872 |

Random Parameter Negative Binomial Model of High Injury Crashes on Small Urban Metropolitan SPF Class Roadway Segments

|              | officients Begi<br>variable<br>bood function |                         | 762            |                 |                    |           |
|--------------|--|-------------------------|----------------|-----------------|--------------------|-----------|
| og likeli    | bood Sunction<br>1 log 118t118.000           | -202.007                | 29             |                 |                    |           |
|              | 40 I 3 6.f.]                                 |                         |                |                 |                    |           |
|              | ice level                                    |                         |                |                 |                    |           |
| t-Yadden 3   | seudr R-squares                              |                         | 17.0           |                 |                    |           |
|              | based on 11 +                                |                         |                |                 |                    |           |
| Inf. Cr. Alt | <ul> <li>+ 444.0 Å</li> </ul>                | 10/11                   | 07             |                 |                    |           |
| Model esti   | mated: Jun 25,                               | 2014, 201184            | 2.6            |                 |                    |           |
|              | 1 pds and 1                                  |                         | 100            |                 |                    |           |
|              | inimial represe                              | Labor model             |                |                 |                    |           |
| ********     |  |                         | *******        | 10000           | **********         | ********* |
|              | and the second second                        | STANDARD                |                | Pyck.           |                    | nfidence  |
|              | Coefficient                                  | Error                   | 1              | 121324          |                    | erval.    |
| ********     |  |                         | *******        |                 | *********          | ********  |
|              | 4,41595*                                     | 11425                   |                | ada a           |                    |           |
|              |  |                         |                |                 |                    |           |
|              | -, +8+60*                                    | 124924                  |                | .5560           | -,94118            | .01194    |
| TOTLANE      | .25051**<br>02060**                          | .11830                  | 2.55           | .0118           | .04588             | 00220     |
| (CVPTURA)    | 102848*                                      | .00932                  | -4.18          | -0282           |                    |           |
|              | 003899                                       | .00269                  | 1.12           | 10494           | ~.00088<br>~.00921 | +00124    |
|              | 51402**                                      | .24075                  |                |                 | -3.02506           | 02295     |
|              |  |                         |                | 000             |                    |           |
| 14           | feane for canitor                            | . parameters            |                |                 |                    |           |
|              | 1.07018***                                   |                         | 8,00           | ,0000           | 100010             | 1,00222   |
|              | cale payameters                              |                         |                |                 |                    |           |
|              | 100.000.000                                  | .04571                  | 2.58           | .0097           | 102564             | .20703    |
|              |  |                         | and the second | and hearing the |                    |           |
| LIGER        | inspersion pares                             | Neter for Dep<br>.73641 |                |                 |                    |           |

# Random Parameter Negative Binomial Model of Just Injury Crashes on Small Urban Metropolitan SPF Class Roadway Segments

| Log likel<br>Restricte<br>Chi squar<br>Significe<br>Rofedden<br>Estimatic<br>Inf.Cr.Al<br>Nodel est<br>Resple 10 | efficiences Hegd<br>variable<br>hood finction<br>1 log likelphood<br>et [ 1 a.E.]<br>ine level<br>retuin R-reposite<br>1 massed an R =<br>2 a 425.2 AL<br>imated: Jan 25,<br>2 pps 6nd 2<br>innumial represe | 0051<br>-206.123<br>-335.826<br>250.004<br>-250.004<br>-000<br>1 .37529<br>580. E =<br>12/H = .7<br>3016.201541<br>75 instructure | 83<br>59<br>50<br>79<br>54                                  |  |   |  |
|--|--|---|---|--|---|--|
|  |  | Standard  |   | Froh.  |   | nfidence<br>erval  |
| JUST184  | Coefficient  | Score   |   | 141-14-  | -405  |  |
|  | Innrandor, parame  | tera  |   |  |   |  |
|  | *****  | tera  | 1.99  |  |   | 12.41039   |
| ()<br>Congtant)<br>LHADT   | fonrandos parame<br>6.05562*<br>65515**  | 5.22494<br>1.22494  | -2.30   | .0500  | 23113<br>75942                                      | 12.41033   |
| ()<br>Congtant)<br>LHADT   | fonzandos parame<br>6.05962*<br>*.42525**<br>.60522*   | tere<br>3.22494<br>.15270<br>.32000   | -2,30   | .0500<br>.0172<br>.0588  | 23113<br>75942<br>02184                             | 12.41030<br>07694<br>1.28241                                     |
| Congtant)<br>LNRDT<br>HOFSDED<br>BINDLT  | Intrandom parame<br>6.05963*<br>*.65535**<br>.60532*<br>*.01076**  | ters<br>3.22494<br>.18276<br>.82000<br>.03400   | -2,30<br>1,89<br>-2,29                                      | .0500<br>.0172<br>.0588<br>.0920   | 23113<br>75942<br>02194<br>14414                    | 12.41039<br>07634<br>1.28341<br>01127                            |
| JI<br>Conwtant)<br>LKADT(<br>HOFIDED(<br>JINDLT)<br>HOVNKDEL(  | Innrandos parame<br>6.05962*<br>65932*<br>07076**<br>07036**   | 45808<br>3.22494<br>.18278<br>.82000<br>.03408<br>.00192  | -2,30<br>1,89<br>-2,29<br>-1,96                             | .0500<br>.0172<br>.0588<br>.0920   | 23113<br>75942<br>02194<br>14414                    | 12.41030<br>07694<br>1.28241                                     |
| II<br>Constant<br>LSADT<br>BOFLDED<br>SINDLT<br>BOVNORL  | Finzandos parame<br>6.05963*<br>63532*<br>07076*<br>07016**<br>Pang for randos   | 1.22494<br>3.22494<br>.15276<br>.32000<br>.03498<br>.08792  | -2,30<br>1,89<br>-2,29<br>-1,96                             | .0500<br>.0172<br>.0588<br>.0020<br>.0489                                | +.25115<br>+.75942<br>02184<br>+.14614<br>+.14660   | 12.41039<br>07434<br>1.28341<br>01127<br>00000                   |
| JI<br>Conwtant)<br>LISADT<br>URCEDED<br>JINDLT<br>RCVNDAEL<br>JICEN  | Tonrandos, parame<br>6.05962*<br>65828**<br>.65822*<br>07036**<br>07656**<br>Heans for randos<br>2.23904***  | 5,25494<br>5,25494<br>15576<br>32000<br>03498<br>03498<br>03498<br>1 parameters<br>12947  | +2,38<br>1,89<br>-2,29<br>-1,96<br>8,22                     | .0500<br>.0172<br>.0588<br>.0020<br>.0489                                | 23113<br>78942<br>02184<br>14414<br>14008           | 12.41039<br>07434<br>1.28341<br>01127<br>00000                   |
| Constant)<br>LSRAT:<br>NOVINGEL<br>NUMBEL<br>NUMBEL<br>LNLEN   | Variandos parame<br>6.05963*<br>65012*<br>07614*<br>07614**<br>Heane for randor<br>1.20904**   | 122494<br>3.22494<br>.15278<br>.5200<br>.03498<br>.03192<br>parameters<br>.15947<br>for dists.                                    | -2.30<br>1.89<br>-2.29<br>-1.96<br>6.22<br>of reno:         | .0000<br>.0172<br>.0988<br>.0020<br>.0489<br>.0000<br>m gerawtt          | 23113<br>78942<br>02184<br>14414<br>14008<br>.82788 | 12.42030<br>07434<br>1.28341<br>01127<br>00100<br>1.99020        |
| UNLEN<br>LIGADI<br>LIGADI<br>UNESLOED<br>JUNDEL<br>LIGADI<br>LIGADI<br>LIGADI                                    | Innrandos parate<br>6.05962*<br>45552**<br>07494**<br>07494**<br>leans for randos<br>1.20904***<br>lotte parameters<br>.22240***   | 122494<br>3,22494<br>12276<br>32000<br>03408<br>03792<br>1 parameters<br>12947<br>1 for Bisto.<br>04832                           | -2.30<br>1.89<br>-2.29<br>-1.96<br>6.22<br>of reno:<br>3.64 | .0500<br>.0172<br>.0588<br>.0020<br>.5489<br>.0000<br>m gardset<br>.0000 | 23113<br>78942<br>02184<br>14414<br>14008<br>.82788 | 12.42030<br>07434<br>1.28341<br>01127<br>00100<br>1.99020        |
| Constant)<br>LIADT<br>URELDED<br>BINDLT<br>ROVINGEL<br>DILEN   | Variandos parame<br>6.05963*<br>65012*<br>07614*<br>07614**<br>Heane for randor<br>1.20904**   | 1,22494<br>15270<br>33200<br>03438<br>03438<br>03438<br>12947<br>100 01859<br>04832<br>04832<br>04832                             | -2.30<br>1.89<br>-2.29<br>-1.96<br>6.22<br>of reno:<br>3.64 | .0500<br>.0172<br>.0588<br>.0020<br>.5489<br>.0000<br>m gardset<br>.0000 | 23113<br>78942<br>02184<br>14414<br>14008<br>.82788 | 12.41031<br>07494<br>1.2824<br>0112<br>0011<br>1.99020<br>.38044 |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Small Urban Metropolitan SPF Class Roadway Segments

| Appendent<br>og itæl<br>Mastrictæ<br>Na spiær<br>Nagnificen<br>Istimation<br>Istimation<br>Istimation<br>Istimation<br>Istimation<br>Istimation<br>Istimation<br>Istimation<br>Istimation | efficiente BegB<br>warinble<br>incod fubecton<br>4 log itablihood<br>es [ 3 d.f.]<br>Dome level<br>Dome level<br>Dome don H =<br>5 = 1200.0 AT<br>immted Con 20.<br>3 pds and 2<br>innomial represe | 103<br>-608,400<br>-1818.479<br>2426.350<br>.000<br>.66704<br>560, X =<br>0/N = 2.2<br>2014.31:06:<br>75 17d1/v16us | 04<br>74<br>00<br>48<br>48<br>48 |        |          |         |
|---|---|---|----------------------------------|--------|----------|---------|
|   |   | Standard  |                                  | Frab.  |          | fidence |
| T0384)  | Coefficient   | Erebe   |                                  | 181357 | 20.53    | 12101   |
| 51  | funrandice parane   | 1428  |                                  |        | 11221222 |         |
|   | 5.00343***  |   |                                  |        | 3.04836  | 5.27233 |
| 10807   | ~,38786***  | /13427  |                                  |        | 63102    |         |
| BOFLDEC:  | 10804***  | 112962  | 3.01                             | .0026  | 13029    | 101322  |
| SHULT   | ,10804***   | 101848  |                                  |        | -+14726  | 01088   |
| CVPT MBB  | -+00323+  | 100188  | -1198                            | .0646  | 00882    | .00032  |
| 08/03/1   | 13016444  | 104500  | 3.56                             | 10004  | .10250   | ,35773  |
|   | teans for sandom  | parameters  |                                  |        |          |         |
|   |   | .07702  | 52.57                            |        | .78660   |         |
| HCVIRGEL  | 00649***  | 100239  | +2.79                            | 10055  | 01108    | +,00100 |
| 21  | liaponal element  |   |                                  |        |          |         |
|   | .00045444   |   |                                  |        |          | .18233  |
| THUCK   |   | 100108  |                                  |        | 100174   | 100580  |
| LHLEN<br>SCV5X58L   | 1000758***  |   |                                  |        |          |         |
| LILEN)<br>MCVHXSEL  | Helov disgonal #  |   |                                  |        |          |         |
| LHLEN)<br>SCVHXSEL  |   |   |                                  |        | 05518    | .00169  |
| LHEY_LIFE(  | Helov disgonal #  | 101608  | -1,47                            | .1417  | 05519    | .00789  |

Inglied orvariance matrix of random parameters

Covaciance matrix

HCVIOLET. LICES LNLEN .01002-02 NCVNEDEL -.7014E-04 .1491E-04

Implied standard deviations of random parameters

ete/ 1 1/ .0904440 2/ .00354055 S.D\_Betai

Implied correlation matrix of random parameters

| Cor. Hat. )  |    | 1  | н | L1  | ×  | 20 | VHICERI  |
|--------------|----|----|---|-----|----|----|----------|
|              |    |    | - |     | -  |    | ++++++++ |
| LULEN        | 3. | .0 | Þ | ā s | ٥. |    | .20056   |
| HOVHOUSES, I | -  | 2  | b | d B | ÷. | 1  | ,00000   |

### Random Parameter Negative Binomial Model of Total Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments

| Randum Co-<br>Dependent<br>Log 1:kel:<br>Sestricte<br>Chi dguari<br>Significe<br>NiFaiden I<br>Estimatico<br>Inf.Ct.A2<br>Nodel est | efficiente (RegB  | 1842 Hodel<br>TUTALA<br>-644.200<br>-6293.105<br>L1267.205<br>.000<br>.84642<br>476, X =<br>2/9 = 5.6<br>2018, 21:361 | 20<br>83<br>24<br>22<br>00<br>24<br>25<br>00<br>24<br>20<br>26<br>20<br>00<br>20<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00 |          |               |                   | Implied covariance matrix of random parameters      Covariance matrix      LOADT    RCVL  LOADT    16/98-02  RCVL    16032-03    .46647-07  Implied standard deviations of random parameters  5.0 Seta    1                         |
|---|-------------------|---|--|----------|---------------|-------------------|---|
| Segative 1  | ninomial segreas  | ion model   |  |          | 2012201022    |                   |   |
| TOTALACC  |                   | Standard<br>Erect   |  | Frab.    | 24% Co<br>2nt | nfidence<br>trvsl | 2 .2225042-05   |
|   | Intransice parane |   |  | 1153     | S. 18 1.8 1.  | 0.00              | Implied correlation matrix of candim parameters   |
| Consoant /  | -1,52063***       | 1.18087   | ~3.72  | 3200.    | -8.53550      | =Z:D1575          | 1. 7. 1997년 1998년 1997년 - 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1997년 1<br>1997년 1997년 
| INLEY   | ,93249***         | .75211  | 17.89  | 10000    | .83035        | 1.02462           |   |
| FCFARER   |                   | .08702  |  |          | -,82234       | +,09881           |   |
| ROVERSEL  | .00781+++         | .00180  | 4.34   | .6000    | 200438        | .01184            | Cos-Hat() LHADS HOVL  |
| TOTLASE   | 121549***         | 105972  |  | 10000    | .14146        |                   |   |
| SHOUT   | N.07054+++        | 101644  |  | 0000     |               | -,03832           | LHADT   1.02000 .00008  |
| INTRODUCT:  |                   | 100991  |  | 0189     |               | -,00897           | MCV51 ,99666 1,00000  |
| DEGIN   | .35413***         | .06038  | 4.22   |          | .13598        | .37237            | ( 75(75) - 13273) (Frights 7)   |
|   | Neutis for random |   |  |          |               |                   |   |
| LIGSTI  |                   |   | 0.00   | .0000    | .52475        | 1104714           |   |
| 80751   |                   | +2001+  | -5.43  |          |               | 00089             |   |
|   | Diaponal elemant  |   |  |          |               |                   |   |
|   | ,04080***         |   |  |          | .03066        | 105134            |   |
|   | .00023++          |   |  |          | .00005        |                   |   |
|   | Below disconal a  |   |  |          |               |                   |   |
|   |                   |   |  | .0233    | ,00000        | .00041            |   |
|   | .00022**          | 19708D-04   |  |          |               |                   |   |
| LHOV LHA  | .00022**          |   |  | indution |               |                   |   |
| 1807_184  |                   |   | Gin dist   | ilbetion | 109920        | 1.45104           |   |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likels<br>Restricted<br>Highlfloor<br>Highlfloor<br>Inf.Cr.Al<br>Nodel estis<br>Heaple 18<br>Deplit 18 | efficients HegB<br>vecienie<br>Lood function<br>t log likelihood<br>d [ 3 0.1;]<br>oe lavel<br>based of Jack Schwarz<br>based of H =<br>2 uit sol Al<br>instead of Jack Schwarz<br>2 uit sol and<br>2 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit sol and<br>3 uit s | +<br>-718.725<br>-7291.251<br>-0055.100<br>-00165<br>-00165<br>-00165<br>-0016.21:45<br>-0016.21:45<br>-0016.21:45<br>-0016.21:45<br>-0016.21:45<br>-00161 | 00<br>96<br>89<br>85<br>00<br>16<br>13<br>22<br>35<br>18 |                 |               |                     | Coveries:<br>LNADT<br>DSNDLT | UU<br>.27138-<br>83205-<br>man5azd s | 1<br>125 39<br>152<br>152 - 5155<br>59714512004 |                     |
|---|---|--|--|-----------------|---------------|---------------------|------------------------------|--------------------------------------|---|---------------------|
| 800   | Coefficient   | Standard<br>Ervor  |  | Fron-<br>isist* | 50 #86<br>702 | infidence<br>terval | 1                            |                                      | 130837<br>944570                                |                     |
|   | Correndum person  |  |  |                 |               |                     | Institut :                   | errelart.                            | e materia d                                     | f random parameters |
| Conetaris!  | -3.50003***   | 1,15085  | -2.21  | +0009           | -#,28548      | -1,01241            |                              |                                      |   |                     |
| 101501  | .55555***   | .08211   | 10.00  | .0000           | .72240        | .35740              |                              |                                      |   |                     |
| 100801  | 00101**<br>.10539***<br>02950***  | -00048   | -2.13  | .0891           | -,00196       | 00008               |                              |                                      |   |                     |
| SOFLERCI  | .20539***   | .11545   | 2.34   | -0508           | .16912        | .61167              | Cor Not .                    | LIGADT                               | AMOUNT T  |                     |
| SKYNDDECI   | 02990***  | .01022   | -2.81  | .0041           | 04937         | 00927               |                              |                                      |   |                     |
| 10010870051   | a.d033644   | 00121  | -5.64  | 1201            | 0.008.007     | +.66571             | LHADT                        |                                      |   |                     |
| HCVCS20;  |   | 3950D+04   | -2.55  | -0595           | 00018         | 00003               | SHMDGT                       |                                      |   |                     |
|   | Mans for randos   |  |  |                 |               |                     | - Strates                    |                                      |   |                     |
| LINADT  |   |  |  | .0000           | -41478        | 035665              |                              |                                      |   |                     |
|   | 06501***  | 01770  | -2.87  | .0002           |               | -100032             |                              |                                      |   |                     |
|   | isponal alement   |  |  |                 |               | 3                   |                              |                                      |   |                     |
| 1 MARCHINE .  | .05208***   | NAME OF CASES  | 1.11   | 0000            |               | .26827              |                              |                                      |   |                     |
|   | .15763++  |  |  |                 | .00871        |                     |                              |                                      |   |                     |
|   | alow disgonal a   |  |  |                 |               |                     |                              |                                      |   |                     |
| 12997 13041   | +1042754+*  |  |  |                 |               | 01202               |                              |                                      |   |                     |
|   | Laperalon paras   |  |  |                 |               |                     |                              |                                      |   |                     |
|   |   |  |  |                 |               | 1.79611             |                              |                                      |   |                     |
| ScalParn  |   |  |  |                 |               |                     |                              |                                      |   |                     |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Nestrinted<br>Uhi sqlare<br>Significae<br>Nofedden I<br>Estimetico<br>Inf.Cr.A20<br>Nodel esti<br>Sample is | <pre>ffinients Hegd<br/>variable<br/>hood function<br/>( hop likelihood<br/>d [ 3 s.f.]<br/>ics lawel<br/>variat N-squared<br/>bared on N *<br/>- \$62.4 Al<br/>mated Jun 25,<br/>2 pds and 2<br/>instal representation<br/>( instal representation)</pre> | FT<br>-676,275<br>-1365,520<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1,000<br>1, | 89<br>38<br>00<br>16<br>49<br>00 |        |            |          |
|--|--|--|----------------------------------|--------|------------|----------|
|  |  | Standard   |                                  | Froh.  |            | ofidence |
| \$1337   | Enefficient  | Erste  | E                                | 12122* | Int        | Isrral   |
|  | terra propia di lotta e a la a   |  |                                  |        | ********** |          |
|  | Intransioni pacenie  | tez#   |                                  |        |            |          |
| Constant!  | -7.13222+**  | 3,63048  | -4.0T                            |        | -10.32761  | -3.93464 |
| LHE-EN I   | .95805+++  | 1074E3   | 12.84                            | 10000  | 281176     | 1.10424  |
| HCVFTTSA   | 00089  | +00209-  |                                  | .6722  | 00499      | _00922   |
| ROFLEEC  | . 42283***   | -14249   | 2.55                             | 10044  | .13180     | .71366   |
| RWYNDDEC:  | 06114***   | .00328   | -3.10                            | .0019  | +-06711    | +.81517  |
| VEVPTORB   | 00583***   | .00191<br>.01536   | -1.06                            | 10022  | -,00959    | 05210    |
| 0593   | .01135   | 101534   | -74                              | -4598  | 01871      | .04144   |
| BCV000582.1  | .00362   | -0038Z<br>-00223   | .12                              | .3453  | +:00398    | -01110   |
| 8072.1   | -,01046**  | .00023   | -1.98                            | 12478  | -,00098    | 000.01   |
| 1  | leans for random   | DATABACACS.  |                                  |        |            |          |
| LNADT  | .93906***  | .17616   | 5.53                             | 10008  | .59578     | 1.25454  |
|  | 09490***   |  |                                  |        | 14355      |          |
|  | Lagonal element  |  |                                  |        |            |          |
| LINET  |  |  |                                  |        | .04156     | _prebe   |
| SHADRY :   |  | 101224   |                                  |        | 00414      | -04888   |
|  | alow disponal a  |  |                                  |        |            |          |
|  | +.D5205***   |  |                                  |        | 07set      | 02948    |
|  |  | eter dor Seg   |                                  |        |            |          |
|  | 1.34237***   |  |                                  |        |            |          |

Implied covariance matrix of sendom parameters

Covariance patrix IMANT SHMERT IMANT .94815-05 SHMERT -.90715-05 .91025-02 Implied standard deviations of random parameters

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| SEMIRIC                      | ÷ | ÷ | 5  | 3 | ł | ÷ | ÷ |    | 1 | ÷ | Ż | b | 2 | ò | \$ |

Random Parameter Negative Binomial Model of Evident Injury Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments

| INTER INVEST  |
|---|
| INTER (1948-01 )<br>SHEAR (1918-03 )<br>Implies standard deviations of random parameters<br><u>5.5_Beis) 1</u><br>1 ).14094 |
| 5.5_Sets) 1<br>51 .116084   |
| 11 .116084  |
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| Implied correlation matrix of ramion parameters   |
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| Cor.Mat.i INLEN SHWERT  |
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| 1311EN  1.00000 .53630  |
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### Random Parameter Negative Binomial Model of High Injury Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments

| Matricta<br>Di Squar<br>Significar<br>AnPadden<br>Estimation<br>Inf.Cr.AD<br>Social est<br>Sample is | variable<br>ihudd funstion<br>d Log Hidelihood<br>dd [ 5 d.f.]<br>net level<br>Faendo R-aquared<br>t based on N =<br>2 = 107.8 Al<br>imated: Jun 24,<br>2 pis end 2<br>binomial regress | 1 -158.109<br>154.380<br>.000<br>1 .32731<br>476, K =<br>0/N = 1.6<br>2016, 15:55:<br>36 individue | 22<br>TO<br>00<br>85<br>23<br>47<br>25                    |  |                                    |                           |
|--|---|--|---|--|------------------------------------|---------------------------|
| 81193  | Coefficient   | Standard<br>Error  |   | Frob.<br>(1)27   |                                    | ofidence<br>erval         |
|  | toursodom parame  | itezs  |   |  |                                    |                           |
| Constant!  | +3+138471+++  | 2.00801  | -2.48   | 00086  | +9;12430                           | -1.24018                  |
| LIADT  | .62728+++   | .20425   | 3.07  | .0021  | .22697                             | 1.02761                   |
| TODARNA  | 16820**   | .07633   | +2147   | .0137  | ×,33760                            | 03560                     |
| TOTLANEL   | .26880**  | .00798   | 2.80  | .0128  | .05824                             | .47958                    |
| WWEDEC   | 05334***  | .01715   | -5.41   | .0018  | 05495                              | 01973                     |
|  | +.00010++   | .01715   | -2.42   | 10158  | ~.00105                            | 00011                     |
|  | +00019  | .00010   | 1.10  | .0048  | ~,00000                            | .00038                    |
| SCYCRAPI-  | teans for random  |  |   |  |                                    |                           |
| 1  |   |  |   |  | 171656                             | 1,01753                   |
| THESN!   | .56653***   |  |   |  |                                    |                           |
| LULEN  |   |  |   |  |                                    | 02217                     |
| LHLEN<br>RENDLT  | .56633***<br>20459**<br>Huagonal element  | .08927<br>a of Cholesk   | -2.20<br>y matrix   | .0280  |                                    |                           |
| LHLEN<br>BRHDLT  | -56653***<br>20499**  | .08927<br>a of Cholesk   | -2.20<br>y matrix   | .0280  |                                    |                           |
| LHLEN<br>BRHDLT  | -56653***<br>20499**<br>Stagonal element<br>.12943***   | .08327<br># of Cholesk<br>.03197   | -2.20<br>y matrix<br>3.74                                 | .0280<br>.0002   | 98790                              | 02217                     |
| LHLEN<br>SHNDLT<br>LNLEN<br>SHNDLT   | -56653***<br>20499**<br>Stagonal element<br>.12943***   | .08327<br># of Cholesk<br>.03197<br>.01108   | -2.20<br>7 matris<br>2.74<br>2.44                         | 0820.<br>2000.<br>#500.                                | 98780                              | 02217                     |
| UNLEN<br>LINLEN<br>BRHDLT<br>LINLEN<br>BRHDLT<br>J   | .56653***<br>20499**<br>Nagonal element<br>.11943***<br>.05051***   | .08327<br>a of Choleak<br>.03197<br>.01108<br>lements of C   | -2.20<br>y matrix<br>3.74<br>2.65<br>iolasky              | .0002<br>.0002<br>.0028                                | 98780<br>.05677<br>.00782          | 02217<br>.15205<br>.05320 |
| INLEN<br>SANDLT<br>SANDLT<br>SANDLT<br>SANDLT<br>(<br>LINTY LITL)                                    | -S6653***<br>20489**<br>Nagonal element<br>.11943***<br>.03051***<br>Below diagonal e   | .09327<br># of Cholesk<br>.03197<br>.01188<br>Lements of C<br>.00541                               | -2.20<br>y hatris<br>2.44<br>bolasky<br>-1.66<br>Bin dist | .0280<br>.0002<br>.0058<br>matris<br>.0962<br>cibution | 98780<br>.05677<br>.00782<br>03124 | 02217<br>.15205<br>.05320 |

Implied covariance matrix of random parameters

Coverience mentie INLEN INNELT INLEN INTER-02 SMRELT -.1714E-02 .1157E-02

Implied standard Deviations of random parameters

| S.D_Bet | #2  |       |   |    |   |    |   | 2  |
|---------|-----|-------|---|----|---|----|---|----|
|         |     | <br>7 | 7 | 7  | t | 7  | 1 | 1  |
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|         | 2.5 | 5     | s | 1  | ÷ | 'n | × | 'n |

| Cox.Nat. 1 |   |   | t | ş | Ľ | ε | 11 |   |   | 3  | Н | Ņ | 4 | ĉ |   |
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| 13(1.571)  | Ξ | ì | b | d | ò | ó | d. |   | - | i. | 4 | 2 | 5 | đ |   |
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### Random Parameter Negative Binomial Model of Just Injury Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>Chi squari<br>Significan<br>NuFadden i<br>Estimation<br>Inf.Cr.A2<br>Nodel est<br>Sample is | efficients Hegg<br>Variable<br>Lood function<br>1 og likelikbod<br>d ( 3 d.f.)<br>Sædec R-squared<br>i based og H =<br>5 = 429.9 af<br>2 g ds and 2<br>unonial regress | Heg Nodel<br>JUST<br>-101.741<br>-502.819<br>905.355<br>.000<br>.40057<br>476, X =<br>C/M = 1.5<br>2016, 14:060 | NJ<br>88<br>75<br>75<br>75<br>75<br>75<br>75<br>75<br>75<br>75<br>75<br>75<br>75<br>75 |                |               |                   | COVARIANCE MATEIN<br>INTER VCRANKA<br>INTER 255HT-01<br>VCRANK -251HT-01<br>VCRANK -251HT-01<br>INTERN 255HT-01<br>Inter standard deviations of random<br>5.0 Bets 1 |
|--|--|---|--|----------------|---------------|-------------------|--|
| JUSTINA  | Coefficient  | Scenderst<br>Error  | 1  | Frob.<br>E1>2* | SS& Co<br>Int | ofidence<br>eyval | 11 .159199<br>21 .159398   |
|  | Conrandom parame   |   |  | 1000           | 1922          | 100000            | Implied correlation patrix of random ;   |
| Constant!  | -8.02226**   | 2.16659   | -2.52  |                | -9,28870      | +,17882           |  |
| LIGADE   | .82686***  | 173199  | 3.70   | .0069          | 157195        | 1.05134           |  |
| TOTLANE!   | .22296**   | .21019  | 1.97   | .0455          | .00119        | .44170            | 3  |
| SANDLT   | 56377+   | 0.8558  | -1.97  | -0616          | 18432         | 200819            | Cor.Mat.   INTEN VCPARSA   |
| ERYNDIDIC:   | -5.02226**<br>.62694***<br>.22259**<br>03226*<br>03226*<br>.0038***  | 101601  | -1.97  | -0530          | -106820       | .00068            |  |
| HOVLI  |  | .00013  | -3.0Z  | -0026          | -,00004       | +,00020           | LHLEN! 1.00000 +.36579   |
| 06011  | .23443***  | 10144   | 2.91   | 10060          | 104681        | (46538)           | WCRASHA: 56875 1.00000   |
| 10000  | Gans for random  | USINDALADS.   |  |                |               |                   |  |
| INTER!   | .32423***  | .1001#  | 9.17   | _0000          | 172675        | 1.12171           |  |
|  | ~.16571*   |   |  |                |               |                   |  |
| 11   | Lagonal element  |   |  |                |               |                   |  |
| INCENT   | +10000***  | ,03668  | 9.51   | .0000          | 108738        | 23105             |  |
| VCFARML:   | 114635**   | .07228  | 2.08   | .0421          | ,00527        | ,20842            |  |
|  | alow diagonal a  |   |  |                |               |                   |  |
|  |  | A second or   | 1.1.1.1.1.1  | 2671           | 18177         | 764.67            |  |
| 1  | 05830  |   |  |                |               |                   |  |
| IVCE_LEL   | 05830  |   |  |                |               |                   |  |

Depiled covariance matrix of random parameters

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#### Random Parameter Negative Binomial Model of Low Injury Crashes on Metropolitan Small Urbanized SPF Class Roadway Segments Terlint conscions parvis of rando DELECT

| Random Co.   | efficients (Deg  | SnReg Model   |                                  | ×                          |               |                   | Inglied p                                    | Contante se | trix of random parameter               |
|--|--|---|----------------------------------|----------------------------|---------------|-------------------|--|-------------|--|
| Dependent  | variable   | 101   | 37                               |                            |               |                   | Coveriance                                   |             |  |
| Sestricte:   | theod function<br>d log limelihoo  | d -++1++2,-1+2  | 2.8                              |                            |               |                   |  | 100.818     | BOVERAU                                |
| Significa<br>NoTadden<br>Estimation<br>Inf.Cr.AD<br>Nodel est<br>Sample is<br>Segutive 1 | ed [ 3 d.f.]<br>nce level<br>Freudo R-rquarm<br>Samedo in N =<br>C = 1001.0 k<br>IMATES: Jun 20,<br>2 pds and<br>binomial regres | .000<br>d .82753<br>474, K =<br>2014, 14169<br>2014, 141169<br>2014, 141169<br>2014, 141169<br>2015, 141169 | 00<br>50<br>16<br>65<br>45<br>18 |                            |               |                   | Lating<br>Hoverage<br>Deplied an<br>S.D_Data |             | .33755-02<br>solons of rendom parametr |
| LOINT  | Cuefficient  | Standard<br>Error   |                                  | Prob.                      | 95% Co<br>Int | nEldence<br>erval | <u>a</u> 1                                   | .9492338-   | 04                                     |
|  | Fourshills, parse  |   |                                  | and the state of the state |               |                   |  | reelahion a | atrix of pandom paramete               |
| COLUMN STATES  |  |   | 12.23                            | -0076                      | -7.23547      | -2.04291          | 100 grave 200 - 200                          | CONCRETE OF | sector, or the sector sector           |
| LNADT  | 02407**<br>02407**<br>02550***<br>02358***<br>02358***<br>00094***   | .14507  | 6.96                             | .0000                      | 46271         | 1.06196           |  |             |  |
| 7072   | 02687**  | .91074  |                                  | -0124                      | 04795         | 00501             |  |             |  |
| TOTLASEY   | .23250+++  | 07272   | 3.20                             | .0014                      | 109008        | .87515            | Cor. Hat. 1                                  | LALEN HI    | VCEAN                                  |
| SHNULTI  | *.D6358***   | .02009  | -3.16                            | .obte                      | m,20292       | .87515<br>02418   | ********                                     |             |  |
| REVIEDECI  | ~.02928***   | .01065  | -2.05                            | .0056                      | 65027         | -,00891           | LNLEN  | 1.00000     | \$7193                                 |
| 8072-0   | .00004***  | .00188  | 2.22                             | .0013                      | .00231        | .00057            | IIC/(CRAIL)                                  |             |  |
| VEVPTORS   | 0008644  | 100157  | -2.40                            | -0162                      | 4.0006Z       | 00065             |  |             |  |
| BCVLUNT :  | +24.0364***  | 10.43621  | -9.95                            |                            | -66.8910      | -14.6810          |  |             |  |
| DE011  | .02653**   | 101204  | 2.04                             | -0416                      | 100092        | 104813            |  |             |  |
| 1.500  | limans for random  | n parameters  |                                  |                            |               |                   |  |             |  |
|  | .01167***  |   |                                  |                            |               |                   |  |             |  |
|  | +.00015+   |   |                                  |                            | -100021       | .00001            |  |             |  |
|  | Diagonal element   |   |                                  |                            |               |                   |  |             |  |
|  | .11264***  |   |                                  |                            |               |                   |  |             |  |
|  | ,794310-044  |   |                                  |                            |               | -162670-08        |  |             |  |
|  | Beloy disponal :   |   |                                  |                            |               |                   |  |             |  |
|  | .00366D-04**   |   |                                  |                            |               | 1105908-05        |  |             |  |
|  | Dispersion parm  | neter for Seg<br>.14384   | Cin dist                         | ributio                    | n             |                   |  |             |  |
| 1.1.1.1.1  |  |   |                                  |                            |               | 12242524          |  |             |  |

### Random Parameter Negative Binomial Model of Total Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel<br>Bestricted<br>Chi aquist<br>Highifite<br>McFeddet<br>Ertimatic<br>Inf.Cc.A20<br>Model est<br>deple is | efficients Heg<br>variable<br>thood function<br>d log lixelithoor<br>ad ( 3 d.f.)<br>freedo K-equare<br>to based on H =<br>C = 1651.4 &<br>march Jun JT.<br>2 pos and<br>pinomial segree | TOTALA<br>-001.001<br>-1705.301<br>1513.579<br>.000<br>1 .53071<br>522, H =<br>10/W = 1.5<br>2014, 141877<br>111 individua | 22<br>00<br>03<br>14<br>09 |          |           |           |
|---|--|--|----------------------------|----------|-----------|-----------|
|   |  | Standard   |                            | Frab.    | 259.20    | ofidence. |
| TOTALACCI   | Coefficient  | Erron  |                            | 18156*   | 201       | HEVEL .   |
|   | Sontandon marane   |  | 00.002                     | 0.000    | 11030.05  | 100.000   |
|   | avenueza   |  | -4.52                      | .0001    | AR. BRITT | -2.95681  |
| LEADTI  | .85390***  | .14548   | 5.87                       |          | .54075    |           |
| Increasors  | *.13704**  | -06461   | -1.99                      |          |           | +,00167   |
| VOVETOEL  | 12567+*  | 108220   | -2.46                      | 01117    | -,22078   |           |
| V277.12   | *:13204**<br>-:12867**<br>5:47036*<br>*:05555***   | 3.10474  | 1.03                       | .0676    | 91076     | 12.74747  |
| SHYDET  | +-05555++++  | .01787   | -5.10                      | 0010     | 09041     | +,02035   |
| REPRESENCE  | 01887  | -00970   | -1.58                      | 11198    | 03438     |           |
| VEVETORE  | 01887<br>.12895**  | :05264   | 5.39                       | -0167    | .02272    |           |
| 13  | Steans for random  | parameters.  |                            |          |           |           |
| 1002201   | .93667444  | .07082   | 13.26                      | .0000    | , 19606   | 1.07488   |
| BOVLE   | 05588***   | .00010   | -8.87                      | .0000    | -,00014   | 00039     |
| 1   | biagonal element   | is of Cholesk  | y matris                   | E        |           |           |
| 1.01.8191   | .16762***  | .01908   | 8.79                       | -0000    | .19028    | .20501    |
| BCV1 (  | .16762***<br>.00019**  | .81950-04  | 2.25                       | .0226    | .00005    | .00035    |
|   | Below disconsl a   | C.To sconnell  | holesky.                   | matrix   |           |           |
| 180V_18111  | .00014*  | .7048D-D4  | 1.91                       | .0822    | ,00000    | ,0002e    |
| 13  | Dispersion para  | meter for Heg  | Biz dist                   | ribution |           |           |
| ScalParm)   | .72543***  | .00165   | 7182                       | .0000.   | .34523    | 190501    |
|   | encoder and the property of the  |  |                            |          |           |           |
| Note: nnn   | tn.D-жж су D+мж  | *> multiply  | 89.10 10                   | -10 88-  | TRN.      |           |
| Note: ***   | 10.10-38 Cf D-88   | mificance at   | 24, 34,                    | 10% leve | 1.        |           |

Inglied opvariance matrix of random parameters

ALCER SCHLOOD

|           | COLUMN 1  | BCVI. |  |
|-----------|-----------|-------|--|
| ********  |           |       |  |
| 1000 0000 | 104102 01 |       |  |

101289 .36102-01 NCVL .3901E-04 .8374E-07

Implied standard deviations of random parameters

3.0\_Seta: 1 1; .167421 2; .201517E-09

Implied correlation matrix of random parameters

| 264 | .108 | ÷., | 1  |   |   | Ļ | 1 | 1 | 2 | 13 |   |   |   |   | H | ç | 2 | ţ |
|-----|------|-----|----|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|
|     |      |     | +- | + | - | - | + | + | + | -  | - | ÷ | - | - | ÷ | + | - |   |
|     | LHL  | 71  | Ľ  | 1 | 2 | đ | D | 2 | 0 | 0  |   |   | ŝ | đ | 3 | 2 | 2 | 5 |
|     | 30   | vi. | 1  |   |   | * | 4 | ż | 1 | ð  |   | 1 | 3 | b | à | b | 6 | b |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

35% Confidence Incerval

Pandom Coefficience HegBulleg Nodel Perendent workship Harrited Variation -465,47541 Harrited 100 likelihoo -1074.80436 Chi agusted | 3 dif.] 502.13780 Significance level 0000 NiTadden Feedo P-equared .3913924 Estimation based on H = £22, X = 14 Inf.Cr.10 = 1305.4 ACC/H = 1.438 Bodel arismated Jun JP, J014, 1511133 Despite 2 gids and 41 Individuals Despite Discutal regression model

MD01 Coefficient:

Standard Error Inglied ocvariance matrix of fandom parameters

| Coverlan      | oe mairix              |           |  |
|---------------|------------------------|-----------|--|
| 301300        | LHERS                  | aciri.    |  |
| LNLEN<br>NCVL | .24138-01<br>.2776E-04 | .76108-01 |  |

implied standard deviations of rendem parameters

### S.D\_Beta) L

11 .115348

| Tmp | list | DOCTORIN | 871.071 | matrix. | -12 | random. | DADADACADS. |
|-----|------|----------|---------|---------|-----|---------|-------------|

|           | onrandum parama |               | 2102000     | 0.0000000 |          |          |
|-----------|-----------------|---------------|-------------|-----------|----------|----------|
|           | -5.59078***     |               | 1.14        | 0.000     | -7.98121 | -2.08034 |
| LICKOT    | .72067***       |               |             |           |          |          |
|           |                 |               |             |           |          |          |
|           | -,13907**       |               |             |           |          | 00429    |
|           | -00088**        |               |             |           | _00007   |          |
|           | -1094164+4      |               |             |           |          | 02360    |
| TRUKSS    | -, D6607***     | .01121        | -2.67       | .00TT     | 07392    | 01221    |
| VCVFT0RA! | -129802**       | .08977        | -2147       | -0198     | 25842    | 02765    |
| WCVPTGRB( | .132284++       | 105259        | 2.48        | .0243     | -02425   | .25628   |
| 116       | eans for random | parameters.   |             |           |          |          |
| 181201    | +87629+++       | 207100        | 11.14       | 10000     | -72597   | 1.01641  |
| HCVL)     | +++E000E1444    | :00017        | -2.50       | 10004     | 00095    | 00027    |
| 100       | Logonal element | of of Chaless | (/ metris   |           |          |          |
| LICEL     | +15835***       | .02115        | 7.24        | .0000     |          | 119481   |
|           | .00021**        |               |             |           |          |          |
| 15        | slow diagonal ( | alements of C | holesky.    | matrix    |          |          |
| INCV LNLI | .0001E**        | 17121D-04     | 2,81        | .0121     | .00004   | .00082   |
| 1 D       | Lapersion paras | pecey for Reg | iftin diant | ribution  | 8        |          |
| DIELFermi | 178863***       | .18286        | 8.94        | 10000     | .82829   | 1.04908  |

Frob.

.

| 0.5 | c.Mst.                                | LILER    | NUVI    |
|-----|---------------------------------------|----------|---------|
| -   |                                       | *****    | ******* |
|     | LULDI                                 | 3.000000 | .04172  |
|     | · · · · · · · · · · · · · · · · · · · | 44444    | +       |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

| Random Co-<br>Dependent | efficiente RegB<br>varimble<br>incod futotion | sReg Notel<br>FI       | 97        |          |               |               | COVALIANCE | overience hairis of rendom paismoters<br>t matrix |
|-------------------------|---|------------------------|-----------|----------|---------------|---------------|------------|---|
|                         | d log likelihood                              |                        |           |          |               |               | 200000     | LHLEN VCVPTGRA                                    |
| Chi squar               | ed [ 3 d.f.]                                  | 285.251                | 60        |          |               |               |            |   |
| 51gm1fice               | nce level<br>Pamudo R-aguared                 | .000                   | 90        |          |               |               |            | ,1008E-01   |
| No.Fadden               | Paweudo R-aquased<br>n baswd do II =          | 120.074                | 46<br>1 k |          |               |               | ACABLORY   | .24212-03 .14502-04                               |
| Inf. Cr. Al             | C = 770.5 ÅD<br>Imated: Zun 29,               | C/8 = .5               | 50        |          |               |               | Implied pt | tenderd deviations of rendom persenters           |
| Sample is               | 2 pds and 4                                   | 11 individua           | La:       |          |               |               | S.D_Sete:  |   |
| Dedectoe                | binomial regress                              | ION MODEL              | 2011/17   | 2018500  | 2011/02/11/22 | 111122112225  |            | .100424   |
|                         | Coefficient                                   | Standard               |           | Frab.    | 559 55        | ofidance      | 2          | ,00051916   |
| #1071                   | CDeffL(les)                                   | Erspr                  |           | 181357   | 111           | ·生土平市3        |            |   |
|                         | Munrandos parane                              |                        |           | 1.0.0    |               | 10215215-00-0 |            | corelation matrix of random parameters            |
| Constant                | 小市, 白色下色的木井井                                  | 2.25296                | +2.8T     |          |               |               |            | 경제 방법에서 감독을 통하여 감독을 위한 것이라. 것이 같은 것은 것이라. 것       |
| LHADT:                  | ,77336***                                     | ,21648                 | 9.87      | :0004    | 194989        | 1,18780       |            |   |
| VCPARMA                 | -,01415***                                    | 120485                 | +2.74     | .0062    | -2143227      | 20710         | ********   | 10221000331202000                                 |
|                         | 9,3655944                                     |                        | 2,22      | :0269    | 1,07088       | 17,68035      | Coy.Mat.)  | LHLEH VCVFTARA                                    |
| MEVL                    | -100078+++                                    | .00015                 | -5.06     | 10000    | 00108         | 00048         |            |   |
| SENDED                  | ×.00375+*                                     | .02670                 | -2.01     | 10449    | 10622         | -,00123       | LULEN      | 1.00000 .63134                                    |
| VCVPTORB:               | +71088***                                     | 122395                 |           | .0086    | 127369        | 1,24747       | VCVPTHRA!  | _49194 1,00000                                    |
|                         | Neans for sandos                              | parameters.            |           |          |               |               |            |   |
| LHLEN                   | .940394+4                                     | .09809                 | 3.39      | 10000    | .74016        | 1113266       |            |   |
| VCVFTURA!               | +,708594++                                    | .27316                 | -2.35     | .0097    | -1.24233      | -,17128       |            |   |
|                         | Disponal elements                             |                        |           |          |               |               |            |   |
| THIAN                   | +10042+++                                     | .00300                 | 5.00      | .0016    | 20303.0       | .14069        |            |   |
| 1000270251              | ,00296*                                       | 100156                 | 1.30      | .0550    | 00010         | ,00602        |            |   |
|                         |   | Lements of C           | holssky   | satrix . |               |               |            |   |
|                         | Below disgonal a                              |                        |           |          |               |               |            |   |
| 1VOV LNL                | .00241+                                       | ,00129                 |           |          |               | ,00514        |            |   |
| 1/07_101_0              |   | .50129<br>ever for Reg | 810 0191  | x1Nvt1co |               | ,00514        |            |   |

# Random Parameter Negative Binomial Model of Evident Injury Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

| Dependent<br>Sog likel:<br>Destricte<br>Chi square<br>Difedden J<br>Estimatico<br>Inf.C.AI<br>Nodel esti<br>Sample is | <pre>fflorense Hein<br/>waxiable<br/>ihood function<br/>i log likelihood<br/>fo [ 0.6.]<br/>ine level<br/>secto &amp; sequend<br/>i based on H =<br/>i slowed on H =<br/>i slowed on 24,<br/>3 pde and 4<br/>inimial regress</pre> | -140.410<br>-140.400<br>2.772<br>.000<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.0010<br>0.00000000 | 80<br>80<br>88<br>154<br>154<br>154<br>154<br>154<br>154<br>154<br>154<br>154<br>154 |   |  |                                      |
|---|--|---|--|---|--|--------------------------------------|
| T/T   | Coefficient  | Standard<br>Rerar   |  | Prot-<br>(x)>2*                           | 96% C1<br>Int                              | nfi3ecoe<br>arval                    |
| 11  | innrandon parana   | ters  |  |   |  |                                      |
|   | -* ##STR+*   | 2.45373   | -2.52  | .0203                                     | -10.41977                                  | -187973                              |
| [otistant]  |  |   | 100 C (100 C)  | - Andrewski der                           |  | 1.00020                              |
| 1172-2117   | ·94198***  | 114320  | R) 22.   | 10000                                     | . 66120                                    |                                      |
| 1172,8343   | .94198***  | 100017  | -2104  | 1468.                                     | 00048                                      | -,05800                              |
| LIFLEN<br>SHNDRT  | ·94198***  | 100017  | -2104  | 1468.                                     | 00049                                      | -,05800                              |
| BRADET<br>BRADET  | .94198***<br>-;00035**   | ,00017<br>,00018  | -2.04<br>-3.97   | 1468.                                     | 00048                                      | -,05800                              |
| LIFLEN<br>TATUER<br>BENDES<br>ICTS  | .94198***<br>00036**<br>00030**  | ,00017<br>,00018<br>parameters  | -2.04<br>-3.97   | .8894<br>.0492                            | 00048<br>+.00070                           | -,05800                              |
| LIFLEN<br>SENDET<br>BEVL)<br>JI   | .94190***<br>00036**<br>00030**<br>Gans for random   | ,00017<br>,00018<br>parameters<br>,25231  | -2.04<br>-1.97<br>2.50   | .0391                                     | 00040<br>00070                             | -,05800                              |
| LIFLEN<br>SHNDAT<br>BEVLI<br>LNADT  | .94190***<br>00035**<br>00030**<br>Cans for random<br>.65703**   | ,00017<br>,00018<br>parameters<br>,25251<br>for dists.  | 40.4-<br>74.1-<br>74.5<br>01.5<br>00000 bo   | .8391<br>.0492<br>.0168<br>#. pacane      | 00048<br>00070<br>-10171<br>ters           | -,00800<br>,00000<br>1,01238         |
| LIFLEN<br>SHOULT<br>HEVEL<br>LINADT<br>LINADT   | .94196***<br>00035**<br>00030**<br>Gens for random<br>.65703**<br>Scale parameters<br>.65706***<br>Dispession param  | .00017<br>.00018<br>.parameters<br>.25231<br>for dists.<br>.21574<br>eter for Heg   | -2:04<br>-1:97<br>2:40<br>05 setdo<br>2:50<br>din dist                               | .0168<br>.0168<br>.0168<br>.0096<br>.0096 | 00048<br>00070<br>-10171<br>ters<br>-13521 | 00000<br>.00000<br>1.01234<br>.97969 |
| LIFLEN<br>SHOULT<br>HEVEL<br>LINADT   | .94196***<br>00035**<br>00030**<br>Geans for random<br>.65703**<br>Koale parameters<br>.55705***   | .00017<br>.00018<br>.parameters<br>.25231<br>for dists.<br>.21574<br>eter for Heg   | -2:04<br>-1:97<br>2:40<br>05 setdo<br>2:50<br>din dist                               | .0168<br>.0168<br>.0168<br>.0096<br>.0096 | 00048<br>00070<br>-10171<br>ters<br>-13521 | 00000<br>.00000<br>1.01234<br>.97969 |

Random Parameter Negative Binomial Model of High Injury Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

| Bendum Com<br>Dependent  | officients Heph<br>variable<br>hood function | ulley Nodel<br>HII<br>Tit day | 8.2                 |                |               |         | Coverience |                        |                             |
|--------------------------|--|-------------------------------|---------------------|----------------|---------------|---------|------------|------------------------|-----------------------------|
| Restricted               | 1 log liwelshood                             | -249,228                      | 22                  |                |               |         |            | LOLEN.                 | VOVETORA                    |
| Significan<br>Nofadden f | d [ 3.d.f.]<br>ice level<br>Seudo X-registed | 1000                          | 00<br>89            |                |               |         | LULEI      | .10075-01<br>.91692-09 |                             |
| Inf.Ct.AIC               | 1 haddd on H =<br>1 = 457.0 AS               | C/H = .5                      | 56                  |                |               |         |            |                        | ations of random parameters |
| Sample is                | 2 pds and 4                                  | 11 Individua                  |                     |                |               |         | E.D_Beim)  |                        | 1                           |
| Negative D               | conmisi regreso                              | ion model                     |                     |                |               |         | I.i        | .10035                 |                             |
| #I100                    | Coefficient                                  | Standard<br>Error             |                     | 11122-         | asa Cu<br>Int | erval   | 2)         | 101010                 |                             |
|                          | Intranson parame                             |                               |                     |                |               |         |            |                        | strim of vandom payameters  |
|                          | -6.14507**                                   |                               |                     | .0235          | -11.46133     | \$2880  |            |                        | tites in terms formations   |
| LINADI                   | .76078***                                    | 125512                        | 2.55                | .0052          | .25474        | 1,26678 |            |                        |                             |
| VCRARMA-                 | +,28698                                      | 114424                        | -1.96               | .0646          | +.88089       | .062.92 |            | **********             |                             |
|                          | 04646  |                               |                     |                |               |         |            | LHIER VOV              | PTORA                       |
| 80753                    | 50097***                                     | 100024                        | -4,08               | .0000          | 00143         | 00088   |            |                        |                             |
| VCVFTSRB                 | .23571+                                      | 132627                        | 1,96                | 10424          | 01237         | .48378  | LULEN      | 1.00000 .1             | 00535                       |
| NOVIDISEL                | .01164+++                                    | .00549                        | 3.33                | .0009          | .00479        | .01249  | VCVFT08A1  | 190688 1.1             | 0000                        |
|                          | iesks for random                             |                               |                     |                |               |         |            |                        |                             |
| -THERH!                  |  |                               |                     |                |               |         |            |                        |                             |
|                          | -,23068*                                     |                               |                     |                | 47018         | +01684  |            |                        |                             |
|                          | hisponal elements                            |                               |                     |                |               |         |            |                        |                             |
|                          | ,10054**                                     |                               |                     |                |               |         |            |                        |                             |
| VCVPIDEA                 |  | .00201                        |                     |                | 03018         | .03887  |            |                        |                             |
|                          | Melov disponal a                             |                               |                     |                |               |         |            |                        |                             |
|                          | .D0944***                                    |                               |                     |                | ,00078        | .01312  |            |                        |                             |
| 1927 LHL                 |  |                               | 8 a m 1 m 2 m 2 m 2 | # 1 Dirt 1 pit |               |         |            |                        |                             |
| 1969_LHL                 | Leperaton param<br>1.75705                   |                               |                     |                | +.23752       |         |            |                        |                             |

## Random Parameter Negative Binomial Model of Just Injury Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likel<br>Restricte<br>Chi equar<br>Significe<br>Nofeddat<br>(stimatio<br>Inf.Cr.AJ<br>(odel est<br>Sample is | officients Hepf<br>versable<br>ibood function<br>d log lixetimoo<br>ed [ 2 m.f.]<br>focudo R-spinstel<br>focudo R-spinstel<br>d based on H =<br>C = 424.7 Al<br>instedi Jun 28.<br>I pod and 4<br>intonial regress | 20511<br>-216.358<br>1 -280.203<br>27.502<br>:000<br>1 .06016<br>822. K =<br>10/K = .5<br>2016.13:561<br>11 individue | 38<br>89<br>50<br>50<br>50<br>51<br>50<br>51<br>50<br>51<br>50<br>51<br>50<br>50<br>51<br>50<br>50<br>50<br>50<br>50<br>50<br>50<br>50<br>50<br>50<br>50<br>50<br>50 |                            |         |                   |
|---|--|---|--|----------------------------|---------|-------------------|
|   | Coefficient  | Inendard<br>Errur   |  | Feeb.                      |         | nfidence<br>erval |
|   |  | *********   |  | 1atre-                     |         |                   |
|   | Sonrandosi parassi   |   |  |                            |         |                   |
| T/DATAD/T   |  |   |  |                            |         |                   |
|   |  |   |  |                            |         | 1.02022           |
|   | .61243+*   |   |  |                            |         |                   |
|   | 00107++  |   |  |                            |         |                   |
|   | 8-32127  |   |  |                            |         |                   |
| Contract of   | Means for random<br>.59425**   | parameters :  |  |                            |         |                   |
| LEADT   | .39425**   | 127627  | 2.15   | .0315                      | .05259- | 1.13502           |
| 124008361   | 02.172***  | -00899  | +2.82  | 10002                      | -102255 | 00605             |
|   | Disgunal element   |   |  |                            |         |                   |
|   | .04640**   | _02338  | 5.00   | 12472                      | .00058  | .99223            |
| LINADT  |  |   | N 1944   | 124611                     | 00031   | 100557            |
| LIGHT   | .00251*  | .00145  |  |                            |         |                   |
| LNADT   | .00251*  |   |  |                            |         |                   |
| LNADT   | .00251*  |   |  |                            |         |                   |
| LNADT<br>HCINE(SEL<br>LECV_1384)  | .00251*  | Lements of E<br>.00204<br>Heter for Neg   | ntlasky<br>-1.07<br>Min dlat   | matrie<br>.2529<br>F104104 | 00563   | 100262            |

Isplied covariance matrix of random parameters

Covariance matrix

18407 .01535-03 HUMSKEL -.14175-03 .1571E-04

Deplied standard deviations of rendom parameters

f.D\_Bets) 1

1) .0464043 2) .00366382

Deplies occoelstics matrix of random parameters

| (ing | , itta | ¢., | ÷  |   |    | 1 | Ņ | 1 | 2 | 5 |   | 11 | ĉ | 17 | Ņ | ц | 2 | 4 | 5 |
|------|--------|-----|----|---|----|---|---|---|---|---|---|----|---|----|---|---|---|---|---|
|      |        |     | ÷  |   | -  | - | - | - | - | - | - | -  | - | 4  | - | - | - | - | - |
|      | 1374   | DΤ  | î. | 1 | i, | đ | Ó | b | ò | Ó |   |    |   | ÷  | 7 | 9 | Ó | à | Η |
| adv  | HOCH   | £1. | i. | - | 5  | 3 | ę | ė | à | 1 |   |    | 1 | 4  | t | á | ò | d | k |

# Random Parameter Negative Binomial Model of Low Injury Crashes on Small Urbanized Small Urbanized SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restricted<br>Chi eguare<br>Signifacen<br>Mofeaden I<br>Estimatico<br>Inf.Cr.Ali<br>Model esti<br>Denple is | officience Heyd<br>variable<br>ibrod function<br>8 Jog livelihood<br>ed [ 9 m.f.]<br>net lavel<br>Potudo N-squared<br>6 based on H =<br>7 = 1656.6 Ad<br>imated Jun 28,<br>7 pds and 4<br>incente process | LOT<br>-718,314<br>-1315,889<br>-1315,889<br>-1315,884<br>-1000<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-14551<br>-145511<br>-145511<br>-14551 | 97<br>79<br>65<br>13<br>74<br>30 |                 |               |          | Implied covariance matrix of randos parameters<br>Covariance matrix<br>IMADT VCRAMA<br>IMADT .1567E-01<br>VCRAMA .2135E-02 .1655E-02<br>Implied standard deviations of random parameters<br>3.0_Bets  1 |
|--|---|---|----------------------------------|-----------------|---------------|----------|---|
| tatoz  | Coefficient   | Standard<br>Errtr   |                                  | Feeb.<br>(#)>2* | SIN Co<br>Int |          | 1) ,0395823<br>3) ,225841   |
|  | Sonzátácel gáráme   |   |                                  |                 |               |          | Implied correlation matrix of vanion parameters   |
|  | -1.14916***   |   | -5.14                            | 10052           | -0.44221      | +2.45404 | Schung differences sector of commentation   |
|  | .83752+++   |   | 11.00                            | .0000           | 60003         | .07903   |   |
|  | 05199+++  |   | -2.97                            | .0030           | 00620         |          |   |
| DEDI   |   | -01004  | +2.17                            | 0015            | 02503         | 02256    | Cor.Nat.   LHADT VCFARMA  |
| VOVETHEL   | 14164**   |   | -2.98                            | .0168           | 28184         |          |   |
| VCVPTGRB   | -13975++  | 105957  |                                  |                 | .02276        | .25569   | LSEDT   1.00000 .43640  |
| SCVL   | +.00035+++  | .00031  | +5.02                            |                 |               | -,00033  | VCRADDA .43540 1.00000  |
|  | Name for random   | personaters   |                                  |                 |               |          |   |
| LUADT  | .75414***   | +14985  | 8,88                             | :0000           | .99507        | 1.09121  |   |
| VCEAREAL   | 15887**   | .07648  | +2.11                            | ,2352           | 30264         | 02050    |   |
|  | Disgonal element  |   |                                  |                 |               |          |   |
| LINDTI   | _03955+***  | .03646  | 6.12                             | .0000           | .02891        | .05225   |   |
| VORASHA.   | .10553***   | .00100  | 2.63                             | .0085           | .02800        | .19205   |   |
|  | felow misconal e  |   |                                  |                 |               |          |   |
|  | .00542  | 104206  | 3127                             | .2343           | 02000         | 12588    |   |
| IVCP INK   |   | and the second se   | the second second                | + ( burn h tom. |               |          |   |
|  | Dispersion peran  | Maisz 202 Heg   |                                  |                 |               |          |   |

# Random Parameter Negative Binomial Model of Total Crashes on Metropolitan Metropolitan SPF Class Roadway Segments

| Degendent<br>Lod likel<br>Dastricts<br>Chi equar<br>Highlfice<br>KoFadden<br>Letimetio<br>Letimetio<br>Letimetio<br>Sample is | effiniencs Neg<br>variable<br>ihood fanttion<br>d log likelihood<br>ed [ 3 d.f.]<br>nor level<br>Pseudo K-aquared<br>o based on H =<br>C = 18010 AU<br>immredi Jun 27.<br>. J pds md 3<br>bindmah regress | inRey Model<br>TOTALA<br>-798.459<br>1 -10724.547<br>18972.107<br>1 -10724.547<br>18972.107<br>1 -10724.547<br>18972.107<br>1 -10724.547<br>19972.107<br>10000000000000000000000000000000000 | 07.12.20992.2.3<br>20992.2.3<br>42 |                |               |                   | Coveriande   | Netzia<br>135<br>,1918E-<br>,1958E-<br>andard d | 1<br>25<br>-03<br>-03<br>-03<br>-03<br>-03<br>-03<br>-03<br>-03<br>-03<br>-03 | LHIEN<br>LE-01 |            |  |
|---|---|--|------------------------------------|----------------|---------------|-------------------|--------------|---|---|----------------|------------|--|
| TOTALACC  | Coefficient   | Standard<br>Exect  |                                    | Fook,<br>E192* | 354 Co<br>115 | nfidence<br>erval | 2            |   | 114800  |                |            |  |
|   | Winrandon parana  |  | -                                  | 10.12          | 2.55.577      | 10000             | Implied co   | rpelatio  | n metrix  | of random      | personates |  |
| intstant  | 47.620394***  | .79549   | -2.83                              | .0000          | -3.25595      | -8.12592          | 0.02,000,000 |   |   |                | 126622010  |  |
| 801781  | .696722-06**  | .33402-04  | 2.06                               | 10375          | .401870-05    | .184930-03        |              |   |   |                |            |  |
| ALTTONY   | +,00239***  | 100106   | -2.87                              | ,0071          | 00902         | 000T7             | +            |   |   |                |            |  |
| 12801W1W8   | 00948   | .03577   | -1194                              | 10417          | -102017       | -00189            | Cor.Mat.     | LINKOT  | 1012,810  |                |            |  |
| SHNDLTCR  | .19726++  | 20024  | 1.95                               | .0478          | 100279        |                   |              |   |   |                |            |  |
| SHNDRICRI   | 09310*  | 105022   | -1,00                              | 20637          | 19195         | .00831            | LIMITI       | 1.00000.2                                       | -92202  |                |            |  |
| 10000   | means for random  | Entenectry.  |                                    |                |               |                   | 1,112,8191   | 192202  | 2,00000   |                |            |  |
| LEADT   | 1.02384***  | .07628   | 12.85                              | .0000          | .88434        | 1.18334           |              |   |   |                |            |  |
| LOLEN   | .02552***   | .04396   | 11.12                              | .0000          | .04210        | 1.01649           |              |   |   |                |            |  |
| 1   | Disgonal element  |  |                                    |                |               |                   |              |   |   |                |            |  |
|   | .03149  | .po706   |                                    | 20752          | -,00240       | .02556            |              |   |   |                |            |  |
| LIGADI  |   | and show in  |                                    | ,0032          | 01702         | 00116             |              |   |   |                |            |  |
| LNADI   |   | -01715   |                                    |                |               |                   |              |   |   |                |            |  |
| LATER   |   |  |                                    | matrix's       |               |                   |              |   |   |                |            |  |
| LATEN   |   |  | bolesky                            | R45168         | .07199        | .18924            |              |   |   |                |            |  |
| LULEN   | Below disponal +  | lements of C   | tolesky<br>4.14                    | .10000         |               | -18924            |              |   |   |                |            |  |

Random Parameter Negative Binomial Model of Property Damage Only Crashes on Metropolitan Metropolitan SPF Class Roadway Segments

|   |  |   |                            |                 |               |                   | Inglass of | VARIADOS                     | matrix                     | a of success parameters               |
|---|--|---|----------------------------|-----------------|---------------|-------------------|------------|------------------------------|----------------------------|---------------------------------------|
|   | afficients Negli   |   |                            |                 |               |                   |            |                              |                            |                                       |
| Dependent   |  |   | 50                         |                 |               |                   | Covariance |                              |                            |                                       |
| Restilotes  | ihood function<br>d log liktlihood   |   | 11                         |                 |               |                   |            | 1.10                         | DT.                        | THER                                  |
| Significar<br>NoTadden S<br>Estimation<br>Inf.Cr.Alt<br>Nodel esti<br>Bargle 18 | ed [ B H.C.]<br>http://www.<br>Preudo H-squared<br>n based on 3 *<br>C * 1209.5 AI<br>imated: Jun 37.<br>3 pds and 2<br>biochiel retrieved | .000<br>.10590<br>428, K +<br>2/N + I.3<br>2014, 001111<br>13 individua | 00<br>29<br>12<br>80<br>44 |                 |               |                   | LINDT      | .46132<br>.43425<br>andaru ( | 04<br>05 ,<br>Neviati<br>I | 17375-03<br>cone of random parameters |
| FDC   | Coefficient  | ST-BOGARS<br>Erros  | 1                          | #200-<br>12 32* | 96% Co<br>Int | nfidence<br>erval | 1          | 120                          | 27454                      |                                       |
|   | Nourandow parane   |   |                            |                 |               |                   | Insiled of | drelatio                     | 0 0012                     | is of random parameters               |
| Constant  |  | 1157840   | -6.11                      | .0000           | -9143971      | -4,09488          |            |                              |                            | and the second particulation of the   |
| ENVYNDDEC:  | -,00878  | ,00705  | -1.94                      | 10648           | -,02287       | ,02827            |            |                              |                            |                                       |
| SIDIOGTCR.  | -22599**   | -09814  | 2.50                       | 10216           | .0330+        | +41778            |            |                              |                            | 14.45                                 |
| SHNDRTCR  | -110037+4  | 105014  | -2.00                      | 10453           | -,19569       | -100209           | Cut.Mat. ( | INADT                        | LHL                        | 21                                    |
| VEVENCE   | .00216+++  | :00061  | 2.70                       | .0069           | ,00040        | .00376            |            |                              |                            | <u>111</u>                            |
| VEVE  | 00010**  | ,00533  | -2.14                      | 10822           | -,005.84      | -,00004           | LINADT     | 1.00000                      | 1882                       | 66                                    |
| 13  | Neans for random   |   |                            |                 |               |                   |            | .01104                       |                            |                                       |
| TRADI   | 100635***  | 100944  | 3.00                       | 10000           | 1779561       | 1.20635           |            |                              |                            |                                       |
| 115.211.2   | .97224***  | 104652  | 21.06                      | 10000           | 188908        | 1:04145           |            |                              |                            |                                       |
| 1000  | Disgonal element   | s of Cholesk  | y natris                   | L (1755)        |               |                   |            |                              |                            |                                       |
| LHLDT   | ,23592**   | 81680.  | 2.38                       | .0116           | 04188         | ,48081            |            |                              |                            |                                       |
| INLEN)  | .04135+*   | 101979  |                            | 10942           | .03266        | 100001            |            |                              |                            |                                       |
|   | Salow disponal a   | Lements of C  | holesky.                   | metrix          |               |                   |            |                              |                            |                                       |
| 12  |  | 102504  | 2.95                       | :0029           | 202471        | 122512            |            |                              |                            |                                       |
|   |  |   |                            |                 |               |                   |            |                              |                            |                                       |
| LINL LNR  | Dispereico paras   |   | 915 0181                   | atherios.       | 2.44616       | 4.71765           |            |                              |                            |                                       |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Metropolitan Metropolitan SPF Class Roadway Segments

| Dependent<br>ing likels<br>hestrioted<br>hi squary<br>lignificer<br>lofadden<br>liftimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimation<br>hetimatio | officients Hegd<br>variable<br>thood fumetion<br>1 log likelihood<br>d [ 3 d.f.]<br>Variab R-squared<br>1 based on H =<br>2 = 103.5 AZ<br>Mates: Jun J7,<br>2 pds and 2<br>2 intenial recrease | 92<br>-410.742<br>-2069.206<br>3018.208<br>.000<br>.0005<br>324, 8 =<br>C/H = 1.3<br>2014, 0015/<br>13 individua | 68<br>97<br>00<br>01<br>11<br>00<br>28<br>18 |                 |           |            |
|--|--|--|--|-----------------|-----------|------------|
|  |  | STADSALS.  |  | Fron.           |           | nfilierice |
| EIST)  | Coefficient  | Irror  | =  | 121>2*          | Int       | drysl.     |
|  | Convendor sevene   |  |  | 1000            | - C       |            |
| Constant.  | -0.23416+++  |  | -6.78  | .0000           | -10,41397 | -5.85453   |
| HNULTCS:   | .08386*  | ,04846   | 1.94   |                 | 00824     | 117294     |
| VCVEVCA!   | +80100.  | .00070   | 1.92   | .0243           | 00000     | 100271     |
| 100 Y 10   | 10021744   | 100100   | 2:11   | .0385           | 100015    | .00421     |
| 1.136106/0   | ~,09896**  | >04262   | -2.05  | -0345           | 4,27249   | -,00541    |
|  | leans for random   | parameters   |  |                 |           |            |
| LISADT   | .94022***  | .10594   | 0.05   |                 | .73259    | 3.14784    |
| 10181  | 3.02771***   | .05832   | 18.92  | .0000           | 192128    | 1.13418    |
|  | Lagonal element  |  |  |                 |           |            |
|  |  | Contract of the second second  | 1.95   | 07.9.0          | w.00744   | 202201     |
|  | .01018   | .00844   |  |                 |           |            |
|  | .001018  |  |  |                 |           |            |
| LINADT (<br>LINADT)  |  | -01078   | 1.96   | -0104           | 100047    |            |
| LNADT (<br>LNADR)  | ······································   | .00078<br>Lesence of C   | 1.96   | .0104           |           | .00883     |
| LNADI (<br>LNGRH)<br>(1  | 100198**   | .00078<br>Lesence of C<br>.03456   | 2196<br>holesky<br>4,74                      | .0104<br>matrix | ,00041    | .00883     |

Implied covariance matrix of random parameters

Constitute mattix INADI INLEN LINED .0037E-03 INLEN .0001E-07 .1920E-01

Implied standard deviations of random parameters

| 2.D_B | 1471 |       |   |   |   |   |   | 1 |
|-------|------|-------|---|---|---|---|---|---|
|       |      | <br>  | - | - | - |   | - | • |
|       | 1.11 | <br>ń | 1 | b | 1 | h | 2 |   |
|       | 3    |       |   | 2 | 6 |   |   |   |

| Car | SNAT-1   | THAIT   | 210183  |
|-----|----------|---------|---------|
|     | LIGAT    | 1.00000 | .06597  |
|     | Littest: |         | 1.00400 |

### Random Parameter Negative Binomial Model of Total Crashes on Two lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Bastricies<br>Chi Square<br>Rofedden i<br>Cotination<br>Log. Ar<br>Nodel est<br>Nodel est<br>Nodel is<br>Bagative b | efficients (Regi<br>Variable<br>those function<br>d log likelihoos<br>ed ( 5 m.f.)<br>Freido R-regueres<br>to besed on N = 1<br>C = Tolt2.1 Al<br>Limateli Nay 23,<br>3 pde tho 720<br>Economial regress | TOTAL<br>-18052.17<br>-4922.43<br>29935.63<br>-00<br>-1961.<br>19136. N =<br>1014. 17103<br>2014. 17103<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.04<br>101.0 | 629<br>221<br>268<br>100<br>155<br>19<br>687<br>101<br>101 |                  |                    |                   | CCONFLATOR<br>LNADT<br>RAVINDING<br>LNLED | : HHITELK<br>LIGADE<br>.2242E-03<br>.99592-03<br>.3512E-03<br>and&rd dev | RNYNDIN<br>.1104E-04<br>.2244E-03<br>Letione of 1 | LHIRH<br>1462E-01<br>andom payameters |
|---|--|--|--|------------------|--------------------|-------------------|---|--|---|---------------------------------------|
| TOTALACC  | Coefficient  | Stendard<br>Error  | 1  | frail:<br>(2)>2* | sta Co<br>Int      | mfidende<br>erval | 11  | .0148  | 722   |                                       |
|   | foorandom parame   |  |  |                  |                    |                   | 81  | -122   | 197   |                                       |
| Interior  | -2,58940***  | -09029   | -55.15   | 40000            | -2.76636<br>.00122 | -E. 01200         |   |  |   |                                       |
| TANKING CARD  | -1-17876***  | 14924  | -1.53  | 1000             | -1.62418           |                   |   |  |   | ndon parameters                       |
| 410/D/S   | 19020+++   | -03140   | -6.05  | .0050            | -117053            |                   |   |  |   |                                       |
| VCEARMA   | .03270+++  | .00724   | 4.45   | 10000            | .01805             |                   |   |  |   |                                       |
| BCVL1881  | .03220***<br>-1.56953***<br>02568***   | -09004   | -18.21   | 10000            | -2.84458           | -1.15305          |   |  | **********  |                                       |
| 24040087  |  | .00047   | +7,40  | 10000            | +,05248            |                   | Cor.Net.                                  |  | ANDDIC TI   | C. K.H.                               |
| BCVCRAR   | .06002D-54**+  | _4744D-05  | 10124  | .0000            | 17764HD-04         |                   |   |  | .30018 .83  |                                       |
| I.ARGTRYDY  | 000356**   | .00020   | 2121   | 100.65           | .000006            | .00203            |   |  | .00000 .70  |                                       |
|   | teans for rendus   |  |  |                  |                    |                   |   |  | .70132 1.00                                       |                                       |
|   | 5.05039***   |  |  | +0000            | 1-03474            | 1.08004           | 202201                                    | 100.524  | 000040627541005                                   | NORCE:                                |
|   | .08370***  | .02287   |  | ,0000            |                    | -03878            |   |  |   |                                       |
| 1.105.816   |  | 100856   | 105.63   |                  | 292416             | -95779            |   |  |   |                                       |
|   | Diágonal element   |  |  |                  |                    |                   |   |  |   |                                       |
|   | 01487***   |  |  |                  |                    | 02424             |   |  |   |                                       |
|   | .01936   |  |  |                  | .00902             | 0.0649            |   |  |   |                                       |
|   |  |  | 3.34   |                  | -01001             | _02288            |   |  |   |                                       |
|   | Selov disponal e   |  |  |                  |                    |                   |   |  |   |                                       |
| LEWY LINE   | 00067  | 100292   | (23  | 10100            |                    | -00499            |   |  |   |                                       |
| ALCAL_GINA (  | .10100***  |  | 10-93  | 12400            | -08294             | .11966            |   |  |   |                                       |
| TTOP NAL  | Dispersion paras   |  |  |                  |                    | +966313           |   |  |   |                                       |
|   |  |  |  |                  |                    |                   |   |  |   |                                       |
| ScalParn  |  |  | 38.17  |                  | .72138             |                   |   |  |   |                                       |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Two lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Eni squar<br>Significer<br>NoFedden<br>Estimatio<br>Inf.Cr.AJ<br>Nodel est:<br>Semple is | efficience Sept<br>variable<br>ihood finition<br>i log likelihood<br>ef [ 3 m.f.]<br>fatodo R-squared<br>i based or N = 1<br>= 50007.1 År<br>immaed Hay 34,<br>7 pds ent 720<br>incenti regress | 1<br>-28447.53<br>-01220.61<br>10541.06<br>.2397<br>44120, R =<br>2/3 =<br>2/3 =<br>2016.1017 | 931<br>979<br>993<br>994<br>56<br>304 |                 |            |                   |
|--|---|---|---------------------------------------|-----------------|------------|-------------------|
| 800  | Confficient   | Standard<br>Evror   |                                       | Frob.<br>12/32* |            | nfidence<br>erval |
|  | Tonrandom parate  | C828  | *********                             | ******          |            | *********         |
|  | -9.21762+++   |   | -01.00                                | ,0000           | -9.92865   | -0.99857          |
| LICEN  | .90136***   | .00069  | 101.40                                | .0050           | .05432     | .91540            |
| 28.53  | .00257***   |   | 3.07                                  | 10022           | 100105     | .02470            |
| VCVL1  | +.77890+**  | -10705  | -3.95                                 | 10005           | -1.16868   | 39214             |
| 1000000  |   | -02987  | +5.46                                 | 10005           |            | -: 08354          |
| NCVLINI  | -2.20280+++   | .11065  | -10.99                                | .0000           | -1.82130   | -1:06025          |
| SHWERT   | 02056***  | 02400.  | -5.05                                 | .0000           | 02888      | 01201             |
| NVYNDISC   | .04191***   |   | 16.45                                 | .0000           | .03697     | .04696            |
| CUPTORA  | .00158+++   | .00028  | 4.10                                  | 10000           | -00042     | -00178            |
| BEVERAS  | -1.29220+++<br>02004+++<br>.04191+++<br>.05110+++<br>.77526D-06+++<br>Gears for render<br>1.06373+++  | .97302-05   | 13.53                                 | .0005           | ,682950-06 | .887568-04        |
| 1  | leans for render  | parameters  |                                       |                 |            |                   |
| LINADT   | 1.06373***  | .01352  | 72,66                                 | ,0000           | 1.05723    | 1.01023           |
| VCR1   |   | .21239  | -3,55                                 | 10008           | -1,16820   | 33265             |
|  | Diagonal elémént  | a of Coolesi  | CY NATILA                             | E               |            |                   |
|  | .03411+***  |   |                                       |                 |            | _02652            |
|  | .36671**  |   |                                       |                 |            | +71690            |
|  | teloù diagonal e  |   |                                       |                 |            |                   |
|  | 98505+++  |   |                                       |                 |            | 11032             |
|  | Dispersion perso  |   |                                       |                 |            |                   |
|  | .71100+++   |   | 10 m ( 10 m)                          |                 | 112368     | -83015            |

| Implied | 1.001 | writers | matrix | ±£ | random | parameters. |  |
|---------|-------|---------|--------|----|--------|-------------|--|
|         |       |         |        |    |        |             |  |

| Coverience | matria |                |   |
|------------|--------|----------------|---|
|            | LHADT  | VCN            |   |
|            |        | ************** | *************************************** |

18801 .50312-03 1028 -.88282-02 .2877

Implied standard deviations of random parameters

1 .0241482 .507614 0.D\_Beth) 31 21

Deplied correlation matrix of random parameters

 Cur.Met.)
 LHKDT
 VCH

 LHADT
 3.00000
 -.60580

 VCH
 -.69580
 1.00000

#### Random Parameter Negative Binomial Model of Possible Injury Crashes on Two lane SPF Class Roadway Segments Im

| Dependent<br>Log likel<br>Nestricte<br>Chi equar<br>Significe<br>Nofedden<br>Estimatio<br>Ind.Cr.Al<br>Nodel art<br>Sample is | variable<br>Variable<br>Ubond function<br>d log itWelline<br>ed [ 5 d.f.]<br>Detudo S-square<br>d baced on S =<br>C = 51104.8 Å<br>immedi Nay 24,<br>2 gds and 72<br>tinomial regres | F:<br>-10577.440<br>d -11975.941<br>2408.004<br>.200<br>s .11009<br>149138, R =<br>12/H =<br>2016, 16:55<br>009 individue | 2833<br>199<br>243<br>407<br>100<br>271<br>16<br>147<br>147 |            |            |            |
|---|--|---|---|------------|------------|------------|
|   |  | Standard  |   | Frob.      | 955 00     | ofidence   |
| #1831   |  | Laror   |   | 12152*     |            | erval      |
|   |  |   |   | *****      |            |            |
|   | Sonrandom parent   | eteze   |   |            |            |            |
| Constant  | -12.4684***  | .30940  | 一方家,花井  | .0000      | -12:0709   | -12.0380   |
| LIADT   |  | .02464  | 55.14   | +0000      | 1.26095    |            |
| WOWLINES.   |  | .01988  | -2.82   | 10048      | -,07099    |            |
| VCEARMA:  |  | 201421  | 2,55  | .0043      |            |            |
|   | -12.3229***  |   | +8.18   | ,0000      | -18,1878   |            |
| STRUKES :   | 23039***   | :00719  | -4.22   | .0000      | 计上层编码电影    | 01424      |
| REVEDUC   | .03830+++  | 100652  | 8,17  | .0000      | 102964     | .04001     |
| SCYCRAN   | 1262240-06***  | -12070-04   | 4.52  | .0000      | -30936D-04 | .792320-08 |
| HEVLI   | .10323   | .00054  | 8,69  | 10008      | -00094     | .00815     |
| HEAR  |  | -10050-04   | -1196   | +0495      | 415850-04  | 435200-07  |
|   | Neans for rando  |   |   |            |            |            |
| THERE'S   | .90304+++  |   |   | .0008      |            |            |
| SENDCE  | +,24778+44   | .04965  | -4.95   | .0000      | 40460      | 21005      |
| 31  | Diagonal element   | ts of tholes)   | ty satura   |            |            |            |
| LHIER   | +10258***  | .00870  | 18,07   | 10000      | :009193    | .11417     |
|   | .54017**   |   |   |            |            | .27694     |
|   | Selow disgonal (   |   |   |            |            |            |
| LONG_LINE   | +.81805*   | .02115  | -1-34   | -0540      | +1,24741   | +01132     |
|   | praletaron betw  | meter for Hes   | pern dist   | 1,75000723 | #          |            |
| 1011 A 10   |  | 1000001   | 14191   | .0000      | 1.100472   | 10140      |
| ScalFarm;   | .52511***  |   |   |            |            |            |

| LUCER SHROCK                                  |           | BATTIK   |           |
|---|-----------|----------|-----------|
|   |           | LILES    |           |
| 30,53 .10615-01<br>19MDCB .34495-02 .20765-01 | SEMIDICES | 10615-01 | .2076E-01 |

| * 4 |    | - |    | - | 14 | 51 | ٤. |
|-----|----|---|----|---|----|----|----|
|     |    | - | 1. | 4 | -  | *  | ۶. |
| 24  | ., | 1 | 4  | 4 | ī, | ş  | ł  |
|     |    |   |    |   |    |    |    |

Inglied correlation matrix of random parameters

|           | • • |   |   | - |    | 1 | -  | - |    |   |   | 7 | 2 | 1 | ۰ |
|-----------|-----|---|---|---|----|---|----|---|----|---|---|---|---|---|---|
| COP.HMt-1 |     |   | Ļ | 1 | I. | ł | 3  |   |    | 2 | ę | н | p | Ç | R |
| LISER()   | ï   | 1 | ä | 1 | ŝ  | 2 | 5  | t |    | Ì | į | 1 | ż | 1 | 1 |
| SHNDCR    |     | 2 | ż | à | â  | à | \$ |   | i. |   | ŝ |   |   |   |   |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Two lane SPF Class Roadway Segments

| Astidop Co.                 | efficients Hegi            | InReg Nodel  |                                |           |           |            |
|-----------------------------|----------------------------|--|--------------------------------|-----------|-----------|------------|
| Dependent                   | veriable<br>inced function | TO DECK VIS  | EVI                            |           |           |            |
| Log likel:                  | incest function            | -8818,453  | 156                            |           |           |            |
|                             | 1 log likelihoo:           |  |                                |           |           |            |
| Chi square                  | nd [ 3 d.f.]               | 809,340  | 128                            |           |           |            |
| Significations              | ice lavel                  | -000   | 107                            |           |           |            |
|                             | Paesdo N-aquated           |  |                                |           |           |            |
|                             | n massed un N = 1          |  |                                |           |           |            |
|                             | C = 16062.0 A              |  |                                |           |           |            |
| Nodel esti                  | insteil Day 27,            | 2014, 19:28:                                       | 111                            |           |           |            |
| Sample 14                   | 2 pte and 120              | MS individua                                       | 1.0                            |           |           |            |
|                             | minimial regrees           |  |                                |           |           |            |
| +                           |                            |  |                                | 0.1277.07 |           |            |
| 1000                        | 201226-220                 | Scandard   |                                | Prob.     |           | nfidence   |
| EV21                        | Coefficient                | freer  |                                | 12(52*    | Int       | Levis.     |
|                             | Innration parees           | eters.   |                                |           |           |            |
| Constant)                   | +8.01769***                | 19401  | -41.000                        | .0000     | -5.00174  | -7.63124   |
| 13128301                    | .00018+++                  | .01628   | 36.03                          | . 0000    | .27641    | .93985     |
| DR01                        | .00544***                  | :00188   | 2.88                           | .0098     | .00176    | .00912     |
| SHMDCR.)                    | H-0987844                  | .0417e   | -2.97                          | +0150     | -,10042   | -,01695    |
| HOVESNE                     | +1.366504+*                | 104178<br>114511                                   | -8.28                          | .0500     | →1.69010  | -1.0+200   |
| INNER:                      | -10302744+                 |  | -4172                          |           |           | 02239      |
| HOVORAN!                    | .297630-04***              | 00+012121  | 7.95                           | .0000     | 47836D-08 | -111090-07 |
|                             | Sease for vantos           | DAVABALANS.  |                                |           |           |            |
| SHADTI                      | .10441***                  | .02362   | 34.05                          | +0000     | .75812    | -188272    |
|                             | 69086**                    |  |                                |           | -1.34145  | 02961      |
|                             | Dispinal element           |  |                                |           |           |            |
|                             |                            | -86211-  | 8178                           | +0000     | .00809    | 101431     |
| LHADTI                      | .01228***                  |  |                                |           |           | 1.48700    |
|                             | 87288***                   |  | 2.95                           | +0001     | ,28529    | 1.188700   |
| UNADE  <br>VCE              | .atzagers.                 | .29627   | Inclesky.                      | matrix    |           | 1(45)00    |
| UNADE  <br>VCE              | 8728944+                   | .29627   | Inclesky.                      | matrix    |           |            |
| LHADEI<br>VCEI<br>LVCE_LUKI | .atzagers.                 | .25017<br>Niemenis of (<br>.04155<br>Nate: for Nec | Tholesky<br>-J.35<br>phin dist | .0188     | 10013     |            |

| Implied covariance matrix of rathon parameter |
|---|
|---|

Covariance Extris ----LINADT Vite: LHADT VCM .14995-03 -.90685-03 17657

Inglies standard deviations of vanious parameters

ī.

| 3 | ÷ | Φ. | 2 | et. |   | з. |      |   |   |   |   |   |   |   |   | 4 |
|---|---|----|---|-----|---|----|------|---|---|---|---|---|---|---|---|---|
| - | - |    | - |     | - | ÷  | <br> | ÷ | - | - | - |   | + | - | - | - |
|   |   |    |   |     | 1 | ł. |      |   | í | ٥ | 1 | 2 | 2 | ş | 1 | 1 |
|   |   |    |   |     | z | 2  |      |   |   | 4 | 5 | 1 | 2 | ż | 1 | 1 |

Implied correlation matrix of random parameters

092.Hat.| LHADT VCR ISADT| 1.00000 -.04743 VCE: -.04745 1.00000

Random Parameter Negative Binomial Model of Serious Injury Crashes on Two lane SPF Class Roadway Segments

| Hastricter<br>Di squary<br>Highificer<br>HoFadden H<br>Stimutico<br>Hf.Cr.AJ<br>Hodel est<br>Hample is | Veriable<br>Whyod function<br>A log likelihood<br>ed [ 2 d.f.]<br>toe level<br>Facudo R-squared<br>i based on H = 1<br>C = 5056.7 AI<br>Wested: Hay IS.<br>1 pds and 750<br>insmial regress | -2001.43<br>134.18<br>.00<br>.0243<br>44135.0243<br>44135.0243<br>2014.20149<br>49 indivinu | 566<br>789<br>000<br>052<br>8<br>055<br>451<br>451              |   |  |   |
|--|---|---|---|---|--|---|
| 1187   | Contficient   | Standard<br>Extor   | 1   | P#s0.<br>181>0*   | 90% Co<br>324  | infidence<br>erval                              |
| 11   | Ronrandon parame  | 6828  |   | 122.7   |  | 12.00   |
|  | -8.895074-4   | .51673  | -21.41  | ,0000   | -9.2106E   | 17,71848  |
| COST ADT   |   |   |   |   | 67946  | . 78905   |
| LMADT  | .66583***   | 2.057992  | 1471147   | 1.                          | 10.040   |   |
| LNADT:<br>LNADT:<br>LNLEH  | .66583***<br>.01436***  | 101000  | 30,24   | .0000   | .76564   | .06013  |
| LMADT  <br>LMADT  <br>LMLEN()<br>DEG1  | -8.09507***<br>.66583***<br>.01436***<br>.00097   | .0249E<br>.0249E  | 30,24   | .0000   | .76344<br>00232  | .01425  |
| DEGL(<br>SCVL(SCI)   | -2.04531***   | .00428  | 1,95  | 10001   | -3.08200   | -1.00063  |
| DEGL!<br>BCVLINE!<br>BCVCRAF   | -2.04531+++<br>.00014+++  | .00428<br>.52892<br>.2025D-04   | -5.87<br>6.70   | 10001   | -3.08200   | -1.00063  |
| DEGLI<br>BCVLINTI<br>BCVCRAFI  | -2.04531***<br>-00010***<br>Seane for random  | .00428<br>.52892<br>.7025D-04<br>parameters   | 1,95<br>-5,87<br>8,70   | .0001<br>.0005<br>.0000   | -2.00292<br>-3.08200<br>.00010                         | -1.00063  |
| DEGL(<br>BCVLINI)<br>BCVCRAII)<br>JWULT(   | 100037<br>-2.04531+**<br>.00014***<br>Seane for random<br>05112***  | .00428<br>.52892<br>.2025D-04<br>paraxeters<br>.05747                                       | 1,95<br>-5,87<br>6,70<br>-2,93                                  | ,0001<br>,0000<br>,0000   | 00232<br>-3.08200<br>.00010<br>08535                   | -1.00063  |
| BCVLINI<br>BCVLINI<br>BCVCRAI<br>SWULT   | .00037<br>-2.04531***<br>.00014***<br>Seane for random<br>05112***<br>Scale parameters  | .00428<br>.52580<br>.70250-04<br>persecteds<br>.05747<br>for dists.                         | 1,91<br>-5,87<br>6,70<br>-3,88<br>of rando                      | .0001<br>.0000<br>.0000<br>.0034                                  | 00252<br>-5.00200<br>.00010<br>08535                   | -1.00963<br>-000018<br>01689                    |
| BCVLINI<br>BCVLINI<br>BCVCRAI<br>SWULT   | .00037<br>-2.04531***<br>.00014***<br>Seane for random<br>05112***<br>Scale parameters  | .00428<br>.52580<br>.70250-04<br>persecteds<br>.05747<br>for dists.                         | 1,91<br>-5,87<br>6,70<br>-3,88<br>of rando                      | .0001<br>.0000<br>.0000<br>.0034                                  | 00252<br>-5.00200<br>.00010<br>08535                   | -1.00963<br>-000018<br>01689                    |
| DEGLI<br>BCVLINTI<br>BCVCRAITI<br>SHWULTI<br>SHWULTI   | 100037<br>-2.04531+**<br>.00014***<br>Seane for random<br>05112***  | .00423<br>.52852<br>.7725D-04<br>parameters<br>.05747<br>fur dists.<br>.0595<br>etes fox He | 1,95<br>-3,67<br>6,70<br>-3,83<br>of cando<br>2,19<br>0810 0140 | .0000<br>.0000<br>.0000<br>.0004<br>m perate<br>.0200<br>ribution | 00252<br>-5.06200<br>.00010<br>08535<br>twrw<br>.00209 | .01425<br>-1.00963<br>.00028<br>01489<br>.03715 |

# Random Parameter Negative Binomial Model of Fatal Injury Crashes on Two lane SPF Class Roadway Segments

| Restricto<br>Chi eque:<br>Algnific:<br>Orfedden<br>Ertimati:<br>Inf.Cr.Al<br>Nodel es<br>Sample in<br>Negative | <pre>t variable<br/>libbod function<br/>ed log libelikood<br/>red ( 1 d.f.)<br/>ands level<br/>Temudo R-squared<br/>ob Seped in N = 1<br/>C = 2047.8 kG<br/>timeted: Nag 17,<br/>s J pds and 720<br/>binomial regress</pre> | -1022.445<br>12.967<br>.000<br>.00614<br>44135.7f =<br>0/9 = .0<br>2016.15.411<br>69 individue<br>ion model | 94<br>92<br>10<br>10<br>10<br>10<br>10<br>10<br>10                     |   |  |  |
|--|---|---|--|---|--|--|
| FATAL  | Coefficient   | Standard<br>Exam  |  | Fcotr.<br>(#1)27*   |  | erval  |
|  | Wangender, parate   | baza  |  |   |  |  |
|  | and the second second   | 64645   | -3148  | Some  | -10.14068  | -8,65814   |
| instant.   | -5.39934***   |   |  |   |  |  |
| 1102.818   | .91964=++   | -05130  | 17.95  | 10000   | 105820   | 1.02018  |
| 102.81   | .91964***   | .05150  | 17.95  | .0000<br>.0323  | 01920  | 1102018<br>.37643  |
| LUCLEU<br>SEMELICE<br>NYZYCLEC   | _15752<br>11998**   | .05150<br>.11274<br>.05171  | 11.90<br>1.90<br>-2.22   | .0000<br>.0323<br>.0201   | 11920.<br>4400<br>55912  | 1.02018<br>.37843<br>01370                                   |
| LUCLEU<br>SEMELICE<br>NYZYCLEC   | _15752<br>11998**   | .05150<br>.11274<br>.05171  | 11.90<br>1.90<br>-2.22   | .0000<br>.0323<br>.0201   | 11920.<br>4400<br>55912  | 1.02018<br>.37843<br>01370                                   |
| LNC.BU<br>SEMULICER<br>INVENDING<br>BUVORAN  | .01904***<br>.15752<br>1190***<br>.87014D-04***   | .01100<br>.11274<br>.05171<br>.3355D-04   | 17.95<br>1.90<br>-2.22<br>2.59   | ,0000<br>,023<br>,0261<br>,0005   | .00344<br>00344<br>21488<br>.212480-04                             | 1.02018<br>.37843<br>01370<br>.16276D-03                     |
| LNC.BU<br>SEMULICER<br>INVENDING<br>BUVORAN  | .91964***<br>.15752<br>11909**<br>.87016D-06***   | .01100<br>.11274<br>.05171<br>.3355D-04   | 17.95<br>1.90<br>-2.22<br>2.59   | ,0000<br>,023<br>,0261<br>,0005   | .00344<br>00344<br>21488<br>.212480-04                             | 1.02018<br>.37843<br>01370<br>.16276D-03                     |
| LICLEU<br>SEMELICE<br>MYPHOLICE<br>HOVORAU<br>LIGADT   | .01904***<br>.15752<br>1190***<br>.87014D-04***   | .01130<br>.11274<br>.05171<br>.3355D-04<br>persectory<br>.00890   | 11.90<br>1.90<br>2.22<br>2.50<br>7.91                                  | .0000<br>.0323<br>.0262<br>.0095  | .00344<br>00344<br>21435<br>.21248D-04<br>.49346                   | 1.02018<br>.37643<br>+.01370<br>.16276D-02<br>.64228         |
| LNCEN<br>SENDLICS<br>MENDLICS<br>HEVCRAS<br>LNADT  | .01964***<br>.15751<br>11909**<br>.870140-04***<br>Means for rendom<br>.66785***<br>Scale parameters<br>.03004***   | .01130<br>.11274<br>.05171<br>.3385D-04<br>persectors<br>.00890<br>for mists.<br>.00965                     | 17.95<br>1.90<br>-2.22<br>2.50<br>7.91<br>of rends<br>3.19             | .0000<br>.0323<br>.0265<br>.0095<br>.0000<br>.0000<br>m perem           | .01815<br>00344<br>21895<br>.21248D-04<br>.49346<br>.03213         | 1.02018<br>.37643<br>+.01370<br>.16276D-02<br>.64228         |
| LNCEN<br>SENDLICS<br>MENDLICS<br>HEVCRAS<br>LNADT  | .91364***<br>.15752<br>11309**<br>.870140-04***<br>Means for readom<br>.66786***<br>Scale parameters<br>.23004***<br>Dispersion param   | .01130<br>.11274<br>.05171<br>.3385D-04<br>persectors<br>.00890<br>for mists.<br>.00965                     | 17.95<br>1.90<br>-2.22<br>2.50<br>7.91<br>of rends<br>2.19<br>810 0101 | .0000<br>.0323<br>.0261<br>.0005<br>.0005<br>m param<br>.0000<br>rparts | .01810<br>00344<br>21825<br>.21280-04<br>.49346<br>etary<br>.05115 | 1.02018<br>.37843<br>01370<br>.163760-03<br>.84228<br>.06695 |

### Random Parameter Negative Binomial Model of Unknown Injury Crashes on Two lane SPF Class Roadway Segments

|   |  |   | +++++++++++++++++++++++++++++++++++++++ | +++++++++++++++++++++++++++++++++++++++ |             |                    | Implied covariance matrix of random parameters  |
|---|--|---|---|---|-------------|--------------------|---|
| Dependent<br>Log likel:   | andom Coefficients Neghtney Model<br>Appendient vertable INDECHN<br>og Likklihood Sumetion -1530.2003<br>Herrinstel og likelihood -1540.2586 |   |   |   |             | Covariance metris  |   |
| Chi egunt<br>Significer<br>NoVedden 1<br>Estlestion<br>Inf.Cr.Ald<br>Hodel est<br>Sample is<br>Negative 1 | ea [ 3 d.f.]   | 40.39<br>.00<br>4 .0189<br>44138, W =<br>1078 = .1<br>2034, 13016<br>2034, 13016<br>108 induced | 000<br>421<br>10<br>001<br>164          |   |             |                    | LHADT .5050E-03<br>LHEER .5396E-02 .7576E-02<br>Implied standard deviations of random parameters<br>E.D_Bekal 1<br> |
| TINOTONI  |  | Erroz   | -                                       | Fron.                                   | 986 00      | nfidence<br>serval | 1) -0174883<br>51 -0897891  |
|   | ***********  |   | *******                                 |   | *********** | **********         |   |
| Constant  | -9. Tisis ***  |   | -17.76                                  | inne.                                   | -10.79071   | -1.64568           | Implied correlation matrix of random parameters   |
| SUMPLENCE:  | 08622***   | 02411   | -3.85                                   |   | 14247       | 54787              |   |
| BUVLINT)  |  | .75402  | -2.28                                   |   | -3.11615    | 23575              |   |
| SCVCR8.0  | .00011+++  | .22200-04   |   | .0002                                   |             | 00017              | CON'NAT.) LHEDT LHER  |
| 10  | teans for sample   | t beinneters  |   |   |             |                    |   |
| LHADT   | , T9652***   | 104679  | 32,221                                  | .0000                                   | 1.66267     | .92647             | LHANT1 1,00000 .54176   |
| LNLFI   | .01128***  | .04105  |   | .0000.                                  | .87143      | 1.03235            | INIEN/ .54176 3.00000   |
|   | hagtnal element  |   |   | £30,0570                                |             |                    |   |
| LNARTI  | ,我立节要要并非   |   |   | .0488                                   | +00033      | .03660             |   |
| THERE !!  | ,07460***  | ,22496  | 2.99                                    |   | 002547      | 112050             |   |
|   | Helow mispons) a   |   |   |   |             |                    |   |
| TINE THE  | ,04808+  | . 52808   | 1.40                                    |   | 00692       | .00006             |   |
|   | isperator paras<br>.46541**  | .19104  |   | .0200                                   | .07019      | .82083             |   |
| Scalfern  | 13404744   | 122455  | 6,-22                                   | 10400                                   | 101013      | 104000             |   |

### Random Parameter Negative Binomial Model of High Injury Crashes on Two lane SPF Class Roadway Segments

| Log likel:<br>Restricted<br>Chi square<br>HoFadden W<br>Estimation<br>Tof.Cr.Al(<br>Model est:<br>Sample is  | <pre>i log likelihood id [ 3 d.f.] hot level peuts X-aquare i based un H = 1 = 2:550.1 Al mated: Nay 30, 2 pds and 72.</pre> | 5 -11489.72<br>1996.37<br>.007<br>5 .0428<br>644126, U<br>2016, 17:25<br>105 indivision | 048<br>523<br>350<br>000<br>834<br>14<br>150<br>:35 |                 |             |           |
|--|--|---|---|-----------------|-------------|-----------|
| arrest.  | Transfer Street  | Statidant   |   |                 |             |           |
| mt130/1  | Coerciverent.  | 12100   |   | 18194           | 205         | -CE-184   |
| 1  |  |   |   |                 |             |           |
|  |  |   |   |                 |             |           |
|  |  |   |   |                 |             |           |
|  |  |   |   |                 |             |           |
| LEASTORYCH   | .03315***  |   |   |                 |             |           |
| 3 BIND CR  | 09514++  |   | A2,45   | .0152           |             | +.01832   |
| SINGET   | 03606***   | +00757  | +4,76   | 10000           | 05088       | 02120     |
| 100100213421   | 一人自己的考虑中中并   | .00638  | -2,88   |                 |             | -,00388   |
|  |  |   |   | 10008           | -,436850-04 | 127990-04 |
| HIDW         Coefficient         Error         a         (\$)*2*         District           INterandom parameters         -10.02         -50.02         -50.02         -6.54201           Intrate         -6.70761***         -174.02         -50.02         -5.522         .97783           Intrate         -6.70761***         01047         63.72         -0000         -5.522         .97783           Intrate         -6.70761***         01047         63.72         -0000         -00014         .07784           Intrate         -6.94201         1.164         -0000         -00014         .01784         .0100         -00014         .01444           INTROCE         -0.0534**         100064         4.43         .0000         -0.0144         .01444           INTROCE         -0.0534**         100164         0.016         .02201         .01445           INTROCE         -0.0144**         .00177         4.74         .0000         .02201         .01388           INTROCE         -0.01445**         .00177         4.168         .00204         .02170         .01388           INTROCE         .01445**         .00177         4.174         .0002         .02201         .012700-04 |  |   |   |                 |             |           |
|  |  |   |   |                 |             |           |
| BCVL18II   |  |   |   |                 | -1,01000    | 26071     |
|  |  |   |   |                 |             |           |
|  | 00000-00   | +00200  | 10.17   |                 | 101646      |           |
| LNR.DT   |  |   |   | - A1 84         | 109573      |           |
| TGIN1  | .3292244   |   |   |                 |             |           |
| LHADT<br>BEVLINT   | .39921**<br>Melow disponal e   | lements of 1  | Chiclesky.  | matris.         |             |           |
| LHADT<br>BEVLINT   | .39921**<br>Melow disponal e   | lements of 1  | Chiclesky.  |                 |             |           |
| LNADT<br>BEVLINT<br>13<br>1907_LNA   | .39921**<br>Melow disponal e   | lements of 1<br>.11931  | Chiclesky<br>+1,17                                  | matris<br>,0000 | *.75624     |           |

| Implied | DOVED140D6 | matrix. | ¢Ť. | rendom | parameters |  |
|---------|------------|---------|-----|--------|------------|--|
|---------|------------|---------|-----|--------|------------|--|

| COVERENCE | ot mataim |          |  |
|-----------|-----------|----------|--|
| 1001003   | LUADT     | MOVILIMI |  |
| a set out | #1848-08  |          |  |
| REVISION  | 1110E-01  | .4774    |  |

Implied standard deviations of random parameters

1.0\_Deta) 1 1.0203044 21.020305

Implied correlation matrix of random parameters

Cor.Set.| IMADE SCVIINI INADE 1.00000 -.81621 MCVLINI -.81621 1.00000

### Random Parameter Negative Binomial Model of Just Injury Crashes on Two lane SPF Class Roadway Segments

| Bestricted<br>Chi squisr<br>Significen<br>McFadden<br>Ertimation<br>Inf.Cr.Al<br>Nodel est<br>Sample is | efficiente Hegi<br>veriable<br>bhood function<br>d log Lixelihood<br>not Lixelihood<br>for Level<br>De Lixelihoo K-equared<br>o based on H = 1<br>o based on H = 1<br>c = 11006,6 AD<br>materi May 30,<br>2 pds end 720<br>nincelel segreés | JUST<br>-1905.81<br>-6322.30<br>534.33<br>.000<br>.0659<br>44130.8 =<br>C/W =<br>2014.14:33<br>45 individu<br>iuw model | 204<br>255<br>200<br>271<br>10<br>202<br>267<br>41# | 201550                   |   |                   |
|---|---|---|---|--------------------------|---|-------------------|
|   | Coefficient   | Standard<br>Erros   | - 90  | Prob.                    | 29% 20<br>11  | nfidence<br>drval |
| 11  | Honrandom parame<br>-13,8105***<br>.56336***  | CASE  | 201001-   | 21.52                    |   | 1991-1991-ce      |
| Constant  | -13,8105***   | . 50467   | +11.35  | .0000                    | +14,2115  | =13.0094          |
| LITLET  | .55336***   | -02073  | \$1.65  | 10000                    | .62273  | .90336            |
| CHUDLY  | *:05006***<br>-2:19908***   | .00905  | ~9.32   | 0000                     | 06788   | F,08227           |
| ACVLINT   | -2.18908+++   | 1,20470   | -7.21   | .0000                    | +3119837  | -1+60089          |
| SMITHTER  | 31242+++  | -100DE  | -3:16   | 0014                     |   | -112141           |
| ANIMODECI   | -02462+++   | .00422  | 5.56  | .0000.                   | .02228  | 01010             |
|   |   |   |   |                          | ,00918  | 101074            |
| 1.223.04  | Neans for random  | parameters.   |   |                          |   |                   |
| LIMADT  | 1.34324***  | .034#1  | 39.03   | 10000                    | 1.27578   | 1.41089           |
| and with the local distance in  | _00011+**   | .12690-04   | 0.69  | 10000                    | .00000  | ;00034            |
| THE VERMENT   | Discount atomics  | a of Choles   |   |                          |   |                   |
| 13  |   |   |   | 10000                    | the second second second second second second second second second second second second second second second se |                   |
| LSADTI  | .02384***   | ,00219  | 8.84  | 10000                    | 192001  |                   |
| LSADT  <br>HOVORADI   | .02354***<br>.18354D-04*  | -120340-04  |   | 9449                     | 155140-06   | .290470-04        |
| LSADT)<br>ROVCRADT;<br>11   | .02354***<br>.19354D-04*<br>Below diagonal #  | lamants of (  | 1.97<br>Dinlagky                                    | .9449<br>matrix          | 155140-06   | .390410-04        |
| LSADT)<br>REVERANT<br>REVERANT  | .02354***<br>.18354D-04*  | .1004D-04<br>lements of (<br>.6772D-05  | 1.97<br>DunissRy<br>-1.85                           | .9449<br>matrix<br>.1158 | 35914D-06   | .390410-04        |

|                  | LHADT                 | BOVCRAM                     |
|------------------|-----------------------|-----------------------------|
| ықарт<br>Беусқал | .10415-02<br>32655-06 | .5670E-29                   |
| Implied a        | tandard devi          | ations of sandom parameters |
| 5.D Seta         |                       | 1                           |
| D'D DETR         |                       |                             |

| Cox.Mat.1 |    | Ŀ | 242 | α  | H¢  | 7 | 9  | ц, | 52 |
|-----------|----|---|-----|----|-----|---|----|----|----|
|           |    | - |     |    |     | ÷ | -  | ., | ÷  |
| LHADT     | 1. | Ó | 000 | ā. | ÷., | s | ż. | ŝŝ | ÷  |
| HEVERAN   | -1 | 2 | 525 | ė. | 1.  | 0 | Ď0 | 10 | 2  |

## Random Parameter Negative Binomial Model of Low Injury Crashes on Two lane SPF Class Roadway Segments

| Bestriote<br>Chi squar<br>Aignifice<br>McFadden<br>forimatic<br>Tof.Cr.AJ<br>Nodel est<br>Seeple is | variable<br>ihood function<br>d log livelihoon<br>ed [ 6 d.f.]<br>noe level<br>Periodo R-equares<br>h bared on H = 1<br>C = 56437.6 M<br>Imstedr Jus D1.<br>F pds and 72<br>biocsial regress | - 38547.432<br>20058.060<br>.000<br>44130.85<br>144130.85<br>10/M = .1<br>2014.34401<br>109 1001/100 | 120<br>120<br>20<br>191 |                 |                   |                   |
|---|--|--|-------------------------|-----------------|-------------------|-------------------|
| LOIGI   | Coefficient  | Standard<br>Error  |                         | 9205.<br>13122* |                   | nfidence<br>erral |
|   | Surrandon param  |  |                         |                 |                   |                   |
| Constant)   | -11.5061***<br>02662***  | 1111100  | -69.42                  | 0000            | -11.4204          | -10.7932          |
| HUVLINT   |  | .11261   | -11.44                  | .0000           | +5,53200          |                   |
| SHADCE!   |  | 101363   | ~5.21                   | .0000           | 17645             | .06102            |
| VCVL182   | -1.37755+++  | .00028<br>.20472<br>.00047   | 2.43                    | .0149           | .00013            |                   |
| NCPRENA)<br>NOFLINC   | 2-64973+++   |  | 14.35                   | 0000.           | 1,42961           |                   |
| 1990 B. 1   | Heans for randor   | parameters.  | 1.123.66                |                 |                   |                   |
| DEGLI   | 1-11288***   | 100100   | 2.24                    | .0000           | 1.06747<br>.00038 | .00419            |
|   | .95010***<br>Disgonal element  | te of Coolest  | v vetris                |                 | .99118            | 194905            |
| DEBLI   | +00597   | 100121   | 2.97                    | 0741            | -,00040           | -01517<br>-00434  |
| 1012201   | .01526***<br>Below disconsl +  |  |                         | .0000.          | ;00535            | 102217            |
|   | 00090  | .00135   | 86<br>9.91              | .5064           | 00355             | .00175            |
| 10102010  | Dispersion pares   | stan for Net   | Bin dist<br>32.57       |                 | 1 20122           | .77831            |

Inglied covariance matrix of random parameters

| COTAPLE | lot netrix |       |       |  |
|---------|------------|-------|-------|--|
|         |            |       |       |  |
|         | LIGET      | DEG1- | LULES |  |
|         |            |       |       |  |
| LIGDT   | -8264E-04  |       |       |  |
| mm-5.1  |            |       |       |  |

DED1 --B102-08 .4473E-08 INERS .7E91E-02 .7B37E-04 .1371E-02 Implies standard deviations of random parameters

| subres : | ar-annuar a | decreasing. | 1.112 |  |
|----------|-------------|-------------|-------|--|
| I.D_Beta | 0           | 1           |       |  |
|          |             | 2202022     |       |  |

| -    |     |   |   |   |    |   |   |   | 2 |
|------|-----|---|---|---|----|---|---|---|---|
| 21   | 1.1 | ò | b | à | è. | 4 | Ł | 8 | ð |
| 51 U |     |   |   | 1 | c. | 2 |   | 2 | 2 |
| 21.  |     |   | ÷ | a | 4  | х |   | s | ¢ |
|      |     |   |   |   |    |   |   |   |   |
|      |     |   |   |   |    |   |   |   |   |

Duplies occrelation matrix of random parameters

| Cor.Mat. | 1404.017 | 20034   | LHER    |
|----------|----------|---------|---------|
| LNADTI   | 1.00000  | 41623   | .762.0  |
| 2020111  | 41625    | 1,00000 | .21988  |
| 1211.021 | .78146   | .20088  | 1,00000 |

### Random Parameter Negative Binomial Model of Total Crashes on Three lane SPF Class Roadway Segments

|  |   |                                 |            | *******  |  |            |
|--|---|---------------------------------|------------|----------|--|------------|
| Rendom Co  | cefficients Hepl  | InReg Nodel                     |            |          |  |            |
| Dependent  | t variable  | TOTALS                          | 100        |          |  |            |
| Log likel  | t variable<br>Libood function<br>ed log likelihood<br>red [ & d.f.] | +2493,370                       | 191        |          |  |            |
| Restricts  | en log likelinger   | <ol> <li>-48.81, 623</li> </ol> | 68         |          |  |            |
| Chi sgaat  | red [ 6 d.f.]   | 84040404                        | 14E        |          |  |            |
| Significa  | snice level   | .000                            | 199        |          |  |            |
| Noradden   | Preudo R-squares  | 195301                          | 「下巻く」      |          |  |            |
|  | in based on B =   |                                 |            |          |  |            |
|  | 10 + 3026.7 A3  |                                 |            |          |  |            |
|  | cimated: Hay 31,  |                                 |            |          |  |            |
|  | a 2 pds and 21  |                                 | 1.2        |          |  |            |
| Depetite:  | Dimonial repress  | Labout moise                    |            |          |  |            |
|  |   |                                 |            | *******  |  |            |
| 110-5500   |   | Standard                        |            | Frak.    |  | nfilience  |
|  | Coefficient   | Errat                           | - <b>F</b> | 12/22*   | Int                                      |            |
|  |   |                                 |            | ****     |  |            |
| and the second s | Nonrandon pagang  | ecera                           | 1100000    |          | 1000 Barrier                             |            |
| CILITATE   | -10.9822***   | 162005                          | -21,28     |          | -12.2341                                 | -8-1287    |
| LNLEN  | 104007  | 104036                          | 11-03      | 2000     | 479221                                   | . 93130    |
| DEG1   | -,01611   | 100520                          | 11100      | -1039    | 7,71631                                  | 109405     |
| NC/LINA.   | 01611<br>-2.03014***<br>.02344***<br>.0041?***                      | -89189                          | -2.43      |          | -8-18011                                 |            |
| ANTHEODE.  |   | 000000                          | 4.42       | .0000    | .01319                                   | -03410     |
| VCVL   | 00417***  | -00121                          | -9174      | 10003    | -100636                                  | 00197      |
| NEVERAL  | .90134D-04***   | 108180-04                       | 2-94       | _0000    | .423030-04                               | .133700-02 |
| AND DEC.   | .01491**<br>18.8008***  | 100600                          | 2,91       | -02.84   | +00505                                   | 102676     |
| With a state   | -16.7642***   | 4.00700                         | E          | - 2040   | 10.0100                                  | 81.881.9   |
| an conductor   | Martin Fox station  | 3.00018                         |            |          | -42-1814                                 | -2-23/2    |
|  | Heats for random<br>1.22796***<br>.00562***<br>04010***             | parapaters.                     | 10.00      | 10.00    |  | 1. 435.00  |
| Undedbut   | 102200+++   | .09565                          | 1 66       | 00000    | 03224                                    | -Lesan     |
| KONSIDE T  | - 14110+++  | 01148                           | -1.16      | 0003     | - 14145                                  | - 02547    |
| ana france a   | Disponal element  | and The last                    | to maximum |          | C. C. C. C. C. C. C. C. C. C. C. C. C. C |            |
| THEFT  | -08132***   | .00816                          | 9.85       | DARKS.   |  | 104743     |
| VCEARMA  |   | 02347                           | 2.85       | 0.087    | 01844                                    | .11163     |
| PODICT.  | .04543***   | 0.050/1                         | 2.41       | .0000    | .00841                                   |            |
|  |   |                                 |            |          |  |            |
| Avera they   | 225.98  | 1.111.4                         |            | 1011     | - 03823                                  | .04452     |
| STRAIL THE   | Beliny diagonal +<br>02596<br>00422                                 | 01036                           | + 41       | 64.95    | 4.02492                                  | -01608     |
| LARN VCF   |   | .00787                          | -1.54      | .1180    | 02609                                    |            |
|  | 00422<br>01165<br>Dispersion perso                                  | samer for Had                   | flin dist  | ribution |  |            |
| ScalParm   | .31131***   | .01387                          | 14.07      |          | ,27338                                   | .84927     |

#### Coveriance setris LIGADT VERAROSA SHWDLT LNADT TCPARMA SHEDLT .86756-13 -.81565-03 .40015-52 -.13275-03 -.85495-03 .33128-03

Inglied standard deviations of random parameters

|    |    | - | - | - | - | - |   |
|----|----|---|---|---|---|---|---|
| 11 | 12 | á | à | á | à | 2 | ŝ |
| 21 |    | Ó | 9 | à | 6 | à | 5 |
| 21 | 3  |   | 1 | 2 | 3 | 2 | 2 |

Implied correlation matrix of random parameters

| Cor.Nat.  | LINADT  | ACAYSOF | SENDLY  |
|-----------|---------|---------|---------|
| LHADT     | 1.00000 |         | -129182 |
| VICEARIGA | 38775   | 1.00000 | 50043   |
| TIMES     | 29192   |         | 1,00000 |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Three lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Chi Squar<br>Significa<br>Mifedden<br>Crimatiu<br>Inf.Cr.A2<br>Nodel est<br>Sample is | efficience Hegi<br>Veryable<br>hhood function<br>d Log Likelihoo<br>ed [ 5 0.5.]<br>Desido R-square<br>n besed on N =<br>C = 3938.0 k<br>Insceli Nay 31.<br>J pds en 1.<br>J pds en 1.<br>J pds en 1. | -1848.48<br>-1848.49<br>5 -3017.58<br>2734.17<br>.00<br>4 .4123<br>4306. N =<br>1078 =<br>2014.13754<br>153 individu | 302<br>597<br>000<br>754<br>10<br>919<br>104 |                  |                            |                   |
|---|---|--|--|------------------|----------------------------|-------------------|
| 800   | Coefficient   | Standard<br>Error  | Ŧ  | Frail:<br>(2)>2* |                            | mfidende<br>erval |
| 1   | Tourandon garan   | there  |  |                  |                            |                   |
| Constent  | -10,9568>>>   | .72879   |  |                  |                            |                   |
|   | .62125***   | .01482   |  | +0000            | 170847                     | .83264            |
| NOVIINT   |   |  | -3.91  | .0001            | +4.02220                   |                   |
| DISTURBENCE   | ***17000  | .00051<br>.00020   | 3,05   | 10021            | -00805                     |                   |
| WINL  | 000.  | 1000ZD   | -3.62  | 10005            | 40100.+                    |                   |
| VCVLSSI   | 2.95261+  | 2.07014  | 2,67   | 10875            | <ul> <li>320T1.</li> </ul> |                   |
|   | ~14-9798**  |  |  |                  | -21,7848                   | +1,4124           |
|   | .01761**  |  |  | 10000            | .00144                     | -01391            |
| 11  | Beans for render  | pacameters   |  |                  |                            |                   |
| LINDTI  | 1,31954***  | .08111   | 24.26  | .0000            | 1.16006                    | 2.47822 :         |
| REVERAN   | 182975D-54+++   | _2553D-04  | 3,29   | 10025            | -33531D-04                 | -182430-05        |
| 3HWDLT  | 1.31954***<br>.82975D-54***<br>04425***   | .01244   | -3.50  | .,0005           | 06801                      | 01948             |
|   |   |  |  |                  |                            |                   |
| LIADT   | _03740***   | .03883   | +.28   | ,0000            | .0201€                     | 005565            |
|   | 15554D-04**   |  |  |                  |                            |                   |
| #HWDLT (  |   | -00721   |  |                  | -00429                     | -03465            |
| 1.2.2.2.2.1   | Baloy disponal (  | lements of   | Cholesky.                                    | natrix.          |                            |                   |
| HCV LSA   | 1980660-04***   | 31552-04   | 5,11   | .0019            | +382320-04                 | +15990D-US        |
| 1.689 L304  | - 024ZZ   | .01192   | +1,38  | +1736            | -,03555                    | -00714            |
| LENGE HOVE  | .90060-04***<br>-:01422<br>-:00910  | .00642   | -4,000                                       | 12794            | 02168                      | .00758            |
|   | Dispersion pares  | miter for He   | gDin dist                                    | ribitiz          | 1                          |                   |
|   | .27917+++   |  |  |                  | 23773                      | .31860            |

Implied ocvariance matrix of random parameters

Covariance satria LSAUT SENDLT SUVURAT .15992-02 .36692-05 .12682-07 -.80882-05 -.25932-05 .78302-08 LHADT HCVCRAS SHNDLT

Implied standard deviations of random parameters

3.0\_Deta) 1 .0374030 .112424Z-03 .0274255 1 ( 2 | 2 |

| COX-MAL.  | LHADT   | HOVCEAR   | RHUDLT  |
|-----------|---------|-----------|---------|
| LHADT     | 1.00000 | .57076    | 58737   |
| HOVCEARE) | .87074  | 1.00000.1 | 87348   |
| SHNDLT    |         | 67344     | 1,08000 |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Three lane SPF Class Roadway Segments

| Dependent<br>Log livel<br>Restricte<br>Chi squar<br>NoFaiden<br>NoFaiden<br>Estimatic<br>Inf.Cr.AD<br>Nofel est<br>Semple is | efficients Heg<br>variable<br>Lood function<br>d log Likelihoo<br>ad ( d.f.]<br>hoe level<br>Freedo R-square<br>t hazed on R =<br>1 = 1830.7 &<br>Langed Nay 31,<br>2 pds and 2<br>hinzmial regres | F<br>-904.37<br>d -1157.64<br>506.58<br>.20<br>d .2187<br>4306, E =<br>10/3 +<br>2016, 16:31<br>155 individu | 496<br>300<br>824<br>14<br>427<br>205 |          |                |            |
|--|--|--|---------------------------------------|----------|----------------|------------|
| - 19 C   |  | Standard   |                                       | Frob.    |                | nfidence   |
| 823421   | Coefficient  | Error  | · · · ·                               | 计数据数据    | 101            | erval.     |
|  | Intrandom param  | stars.   |                                       | +=>+++   |                |            |
|  | +15.0013***  | 1.26220  | -10,77                                | .0000    | -16.0652       | -11.1178   |
| REYNDERC   | .01449*  | 100750   | 1.95                                  | 10297    | 00060<br>00589 | 102997     |
| VCVVPIA  | - 000000ama  | -00102   | -3.82                                 | 10005    | 00589          | 00188      |
| SWNDLT   | 05415***   | .62016   | -2.69                                 | .0071    | -,08959        | 01476      |
|  | deans for random   |  |                                       |          |                |            |
| 100.01   | 1.41921+**   | 114256   | 9.96                                  | .0000    | 1,13950        | 1.60842    |
| HOVERAD  | ++01010++  | 148870-04  | -2.02                                 | 0442     | +,00020        |            |
| LHLEN  | .71420+++  | 109048   | 7,90                                  | -0000    | 153847         | 188282     |
|  | Discons! element   | ts of Choles   | to matrix                             |          |                |            |
| LMADT (  | .08025*  | .02722   | 2,95                                  | .0659    | -,00319        | ,19360     |
| REVICEAR   | ,00016***  | ,89350-04  | 2.45                                  | -9974    | .00054         | +00028     |
| INLEN:   | .09025*<br>.00016***<br>.09982***  | .02092   | 0.01                                  | .0000    | 105531         | 113532     |
|  | Helphr Glagsonal (   | 电复数照频的复数 的第三人  | Choice #WV                            | 新教会官法員 二 |                |            |
| LHEY LHE:  | 66871D-04  | :43400-04  | -2.00                                 | 10814 -  | 1205400-08     | .174470-04 |
| SIML INA   | .1110/11   | 100463   | 1.41                                  | .1595    | +,54663        | 128509     |
|  | -,11061***   |  |                                       |          |                | -,21683    |
| 1  | limpersion para  |  |                                       |          |                |            |
| ScalFace)  |  |  |                                       |          |                | .17291     |
|  |  |  |                                       |          |                |            |
|  | mt. D-xz or D+ax   |  |                                       |          |                |            |

Inplied covariance matrix of random parameters

| Severier                  | stite et                           |                         |           |         |
|---------------------------|------------------------------------|-------------------------|-----------|---------|
|                           | LNADT                              | BOYCRAM                 | LULEN     | 9.22.55 |
| LHADT<br>MCVCRAH<br>LHLEH | .21262-00<br>33662-00<br>.89912-02 | .29748-07<br>*.29558-04 | .95928-01 |         |

Teplied standard deviations of random parameters

5.D\_Bets . 1 1) .()552946 2) .172453E-03 3) .187931

Implied correlation matrix of random parameters

| CHE-NAT-          | LINET   | HOVERAN | Turra  |
|-------------------|---------|---------|--------|
| LHADT             | 1.00000 | 35537   | ,63430 |
| BCVCAAB)<br>LHLEN | -,98887 | 1.00000 | 75523  |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Three lane SPF Class Roadway Segments

| Mestricte<br>Uni agiar<br>Significar<br>NoTeitian 1<br>Estimation<br>Inf.Cr.Al<br>Hodel est:<br>Sample 14 | <pre>twriable<br/>lbood function<br/>d log II#tlihood<br/>ed [ 3 d.f.]<br/>new lawel<br/>Breudo B-squared<br/>6 Bated on 3 =<br/>C = 1092.8 AJ<br/>imated Jun 02,<br/>3 pds and 20<br/>binchial regress</pre> | -598,271<br>45,796<br>.000<br>.04102<br>5306, ff =<br>0/8 = .2<br>J016, 151261<br>53 intividua | 39<br>34<br>35<br>35<br>11<br>55<br>84 |                       |           |           |
|---|---|--|--|-----------------------|-----------|-----------|
| 1022  |   | Statiszci  |  | Prob.                 |           | infldence |
| 271   | Coefficient   | firzot   |  | 12(52*                | Tere      | arval.    |
|   |   | the distance product of the latent   |  | a to boot in the last |           |           |
|   | Homzandom parame  |  | 10000                                  |                       |           |           |
| Constant  | +0.32102***   | 1.26222  | -6,59                                  | .2000                 | -10.00421 | -1.04143  |
| THURH   | -0.2202***<br>-17.7510<br>01472**<br>00545***<br>Reads for yandom   | 1407 <b>4</b> 18   | 11,25                                  | 100.00                | .46894    | -99343    |
| SCARGET   | +17.7510  | 12.04014   | -1.97                                  | ,0712                 | -41.2477  | 1,0016    |
| SHNDG T   |   | .02006   | 12124                                  | .0326                 | 4,00305   | ++00375   |
| UCVFT28A)   | +,00565***  | 100192   | -2,83                                  | 10146                 |           | 05168     |
| 101212  | Neaks for vandom  | Banaperese.  |  |                       |           |           |
| 116407  | 172264444   | ,54255   | 5105                                   | +0000                 | . 64004   | -99353    |
| ENZADIRE  | ,03559***   | 00000  | 1,75                                   | ,000T                 | ,02729    | 00440     |
| + 1   | Disgunal element  |  |  |                       |           |           |
|   | .11858***   | .02073   | 3.85                                   |                       | 97623     | +10750    |
| 1.198.071   |   | .00910   |  |                       |           | .01879    |
| LMADT  <br>RHYWDDNC   | +00175**  |  |  |                       |           |           |
| LNAD7  <br>HNYRDINC   | Windowid woled  | Lamants of C   | bolesky.                               | BETTLE .              |           |           |
| LNADT  <br>HNYSDINC  <br>   | Below diagonal e  | Lements of U<br>.00647   | -8.55                                  | .0000                 |           | 01895     |
| LNADI<br>SUCCEPTING<br>SUCCEPTING<br>SUCCEPTING   |   | dements of C<br>.00647<br>eset for Neo   | -1.55.<br>515 dist                     | .0000<br>ribution     |           |           |

implied covariance matrix of random parameters

Covariance matrix

```
LNAIT
                         References:
LIGLDT .1966E-01
RNYNDCHC -.3964E-02 .9100E-03
```

Implied standard peviations of random parapeters

5.D\_Bets) .

| to be an an an an an an an |             |
|----------------------------|-------------|
|                            |             |
| :14                        | 122340010   |
|                            | .050e272    |
|                            | 0.030.64.14 |

Implied correlation matrix of random parameters

Cor.Mak.) LISADI SWIMDING 13GADT| 1.00000 -.04782 #HINDINC| -.96752 1.00000

### Random Parameter Negative Binomial Model of Serious Injury Crashes on Three lane SPF Class Roadway Segments

|                          | efficiente NegB   |                |          |                  | 00000000   | 1801 (SAN 1993)   | 1220020        |                        | trix of random parameters   |  |
|--------------------------|---|----------------|----------|------------------|------------|-------------------|----------------|------------------------|-----------------------------|--|
| Depènient<br>Log làkeld  | Chood function  | -149.0423      |          |                  |            |                   |                |                        |                             |  |
| Reptricted               | netristed log likelihodd =4305.00000<br>12 Subared [ 0.4.4.] 8271.91484 |                |          |                  |            | LILET LITER       |                |                        |                             |  |
| Significar<br>Nofedden S | nce lavel<br>Result R-squared   | .0000          | 26       |                  |            |                   | LNRDT<br>LNLEN | -12945-01<br>-91946-01 | -93968-11                   |  |
| Inf.Cr.AIC               |   | 5/8 H 1.00     | 183      |                  |            |                   | Inglish at     | anders devi            | stions of random parameters |  |
| Resple is                | imarad: Jun 01,<br>3 pila anii 31                                       | \$3 Individual |          |                  |            |                   | 0.D_Bets)      |                        | 1                           |  |
|                          | binomial regress  |                |          |                  |            |                   | 21             | -1237                  |                             |  |
| 51871                    | Coefficient   |                | Ŧ        | 8208.<br> \$ 52* | Int        | nfidense<br>arrai | 2)             | .3055                  | 23                          |  |
|                          | Concandum pasane  |                | ******   |                  | ********** |                   | lucied on      | rrelation to           | atris of random parameters  |  |
| Constant!                | +8.86899***   | 21223249       | -4708    | .0000            | 1241238788 | -1,97460          |                |                        |                             |  |
| VOPARKA:                 | .10684**  |                | 2.93     |                  | ,00616     | .26716            |                |                        |                             |  |
| ACAT!                    | -,00109   | 300071         | -1.92    | +8777            | -100249    | .00031            |                |                        |                             |  |
| 13                       | leans for random  | parameters     |          |                  |            |                   | Cor.Mat.)      | LINADI                 | LNLED                       |  |
| 1304071                  | .03166+++   | ,25660         | 12.70    | .0049            | 15973      | 1,15556           |                |                        | diana di antina             |  |
| 1111211                  | 188855***   | 116632         | 4.02     | -0001            | +90177     | 187833            | LHADTI         | 1.00000                | 90455                       |  |
| 10                       | lispinal element  | s of Cholesky  | / natria |                  |            |                   | THTEN:         |                        | 00000                       |  |
| LIGADT)                  | ,11374***   | 104149         | 2.75     | .0084            | ,03208     | 128544            |                |                        |                             |  |
| INTEN                    | 12009**   | 108587         | 2.15     | .0311            | 101178     | .21611            |                |                        |                             |  |
|                          | Allow diagonal +  | lements of UP  | intenky. | MATELN.          |            |                   |                |                        |                             |  |
| SINI LHE                 | .21781++  | 151082         | 2.55     | .0114            | .04055     | .49436            |                |                        |                             |  |
|                          | Disparation param   | ster for Deck  | in dist  | estimates        | r          |                   |                |                        |                             |  |
|                          | .25228***   | .10868         | 2.40     | -0094            | 104926     | 119552            |                |                        |                             |  |

### Random Parameter Negative Binomial Model of Fatal Injury Crashes on Three lane SPF Class Roadway Segments

| Aggnificte<br>Chi squar<br>Sognificte<br>Arimatic<br>Estimatic<br>Inf.Cr.AJ<br>Acdel est<br>Dample 14 | Previo R-equared<br>n bared on N =<br>C = 355,6 A2<br>Imated: Jun OF,<br>2 pds and 21<br>binomial regress | -4305.899<br>5271.995<br>.000<br>.90045<br>4305. X =<br>C/S = .0<br>2016.19:201<br>53 individua<br>206 model | 95<br>90<br>05<br>9<br>73<br>92<br>14                       |  |  |                                       |
|---|---|--|---|--|--|---------------------------------------|
| PATAL   | Coefficient   | Standers<br>Ricent   |   | Frob.  |  | infidence<br>erval                    |
|   |   |  |   |  |  |                                       |
|   | -2,38832***   | ters   |   |  |  |                                       |
| Constant de P-12 1  |   |  |   |  |  |                                       |
|   |   | 137961   | 1.8188  | 10007  | -23606                                       | .96111                                |
| COLEN   | -40409+++   |  |   |  |  |                                       |
| LIELEW  | .00075  | .00309   | 1.21  | ,2250  | 00231  | .00862                                |
| LINLEW)   | .00575  | .00309   |   | ,2250  | 00231  |                                       |
| LINLEW)   | .00575  | .00309   |   | ,2250  | 00231  |                                       |
| LRLEN<br>NOVETIVA<br>I<br>LNADI<br>DESI   | .00075<br>Heans for rendom<br>.73679**<br>07032   | .00000<br>parameters<br>.20060<br>.06719   | 2.81  | ,2250<br>.0121<br>.0635                                      | 00231  |                                       |
| LISLEN<br>LINADT I<br>LISADT I<br>DESI  | .00075<br>Maans for random<br>.73479**<br>07032<br>Diagonal element                                       | .00300<br>parameters<br>.20360<br>.06719<br>e of Cholese   | 2.51<br>-1.67<br>V matrix                                   | ,2250<br>,0121<br>,0635                                      | -100231<br>-16134<br>-,21002                 | 1,31224                               |
| LNLEW<br>NOVPTIVA<br>LNADII<br>DESII<br>LNADII  | .00075<br>Means for rendum<br>.73479**<br>=.07032<br>Diagonal element<br>.01402*                          | .00300<br>parameters<br>.20360<br>.06719<br>s of Cholese<br>.01935   | 2.51<br>+1.67<br>V Batrie<br>1.91                           | ,1250<br>,0121<br>,0435<br>,0141                             | -100231<br>-16134<br>-,21002<br>00096        | 1.31224<br>.05335<br>.07481           |
| LIGLEN<br>HCVPTTVA<br>LINADTI<br>DESL<br>LINADTI<br>DESL  | .00071<br>Means for rendom<br>.73679**<br>07632<br>Diagonal edment<br>.02602*<br>.04995                   | .00300<br>parameters<br>.20360<br>.06719<br>s of Unolese<br>.01933<br>.03793                                 | 2.51<br>>1.87<br>V Matrie<br>1.95<br>1.36                   | ,1250<br>,0121<br>,0635<br>,0561<br>,1078                    | 00231<br>.16134<br>+,21302<br>00004<br>02432 | 1.31224<br>.05335<br>.07481           |
| LIGLEW<br>CONFITUR<br>LIGRATI<br>DESI<br>LIGLT<br>DESI  | .00071<br>Means for rendem<br>.73679**<br>07032<br>Diagonal element<br>.04035<br>Selaw diagonal e         | .00308<br>parameters<br>.28340<br>.06719<br>s of Cholese<br>.01938<br>.03793<br>lessible of C                | 2.61<br>-1.67<br>V Matrix<br>1.91<br>1.32<br>Nolesky        | ,1250<br>,0121<br>,0635<br>,0861<br>,1875<br>metrix          | 00231<br>.16134<br>+.21502<br>02036<br>02435 | 1,91224<br>.05358<br>.07481<br>.12429 |
| LIGADI<br>LIGADI<br>DESI<br>LIGADI<br>DESI<br>LIGADI<br>DESI  | .00071<br>Means for rendom<br>.73679**<br>07632<br>Diagonal edment<br>.02602*<br>.04995                   | .00000<br>parameters<br>.20040<br>.06719<br>e of Cholesw<br>.01935<br>.03793<br>lements of C<br>.03159       | 2.51<br>>1.67<br>y matrim<br>1.91<br>1.54<br>holesky<br>.40 | .2250<br>.0121<br>.0435<br>.0141<br>.1675<br>metrix<br>.6074 | 00231<br>.16134<br>+.21002<br>02432<br>02432 | 1.31224<br>.05335<br>.07481           |

| Covariance      | BRILLN                 |                             |
|-----------------|------------------------|-----------------------------|
|                 | LUADT                  | DICUL.                      |
| LIFADT<br>DRINS | -13635-92<br>-46995-03 | .26878-32                   |
| inplied st      | andairt Sevia          | tions of vanious parameters |
| S.D_Sets        |                        | 1                           |
| 1               | .096924                | 7                           |

Implied correlation matrix of random parameters

Implied covariance matrix of candim parameters

|           |     |     |    |     | -  |     |
|-----------|-----|-----|----|-----|----|-----|
| Cog Mas . |     | LIA | DT |     | D  | ÉÈL |
|           |     |     |    | ·   | -  |     |
| LIGADT    | 1.  | 000 | 50 |     | 4  | 656 |
| 0001      | 1.1 | 244 | 58 | 150 | i0 | 000 |

Random Parameter Negative Binomial Model of Unknown Injury Crashes on Three lane SPF Class Roadway Segments

| Dependent<br>Log likels<br>Restricted<br>Chi sgiare<br>Significar<br>NoTadden I<br>Estimation<br>Inf.Cr.Alt<br>Nodel esti | fficiency Peeb<br>variable<br>food fumition<br>( hog likelihood<br>d [ 1 d.f.]<br>peido R-squared<br>baseb on S =<br>; = 274.3 AJ<br>mated: Jun 02,<br>3 pds 400 Z1 | USBUD<br>-132,129<br>-5008,939<br>8347,650<br>.0000<br>.0030<br>.0030<br>4504, K =<br>2/H = .0<br>2016, 20:241 | e7<br>55<br>66<br>00<br>80<br>64<br>03         |  |  |                    |
|---|---|--|--|--|--|--------------------|
|   | innmial represe   | ion model  |  |  |  |                    |
|   |   |  |  |  |  |                    |
| CONTRACTORN I   |   | Standarii<br>Error   |  | Froh.<br> = >2*                              | ADA CO<br>Inte                                       | nfidence<br>ecval  |
| C54204 (340)  | Coefficient   | Standarii<br>Error   |  |  |  |                    |
| CH2010401   |   | Standari<br>Ertor  | =  | 3=1>2*                                       | Int  | erval              |
| CONCIONAL   | Coefficient   | Standard<br>Erfor<br>texe<br>3.20006   | =  | 121524                                       | Int  | erval              |
| CHICHCHOID<br>COLOREDADE  | Coefficient<br>Corfficient<br>Corrandom parame<br>-14.6611***   | Drandarii<br>Error<br>5428<br>3.20006<br>(33530  | -4.46  | 121524                                       | -21.1141   | erval<br>-8.2301   |
| CHICHCHOID<br>COLOREDADE  | Coefficient<br>Otrahoom parame<br>-14.6611***<br>1.00567***   | Drandarii<br>Error<br>5428<br>3.20006<br>(33530  | e<br>-4.46<br>3,20                             | 1#152*                                       | Int<br>-21.1141<br>.46549                            | erval<br>-8.2301   |
| CHRORONO()<br>Congrant()<br>LHRDT()<br>LHRDT()<br>LHRDT()   | Coefficient<br>-14,6611<br>1.2550<br>tenp for random  | Drandarii<br>Error<br>3.20006<br>(33530)<br>permeters<br>.22455  | =<br>-4.4£<br>3,30<br>1.89                     | ,0000<br>,0015<br>,1157                      | Int<br>-21.1141<br>.44549<br>14355                   | -8.2301<br>1.76254 |
| CHRORONO()<br>Congrant()<br>LHRDT()<br>LHRDT()<br>LHRDT()   | Coefficient<br>Onrandom perawe<br>-14.4651***<br>1.10567***<br>teans for random<br>.2000<br>tosie paraweters  | Drandarii<br>Error<br>3.20006<br>(33530)<br>permeters<br>.22455  | -4.46<br>3.30<br>1.19<br>of rando              | .0000<br>.0010<br>.1557<br>w payawe          | Int<br>-21.1141<br>.48549<br>18355<br>Tete           | -8.2301<br>1.76254 |
| CHECKON<br>CONFERENCE<br>LINET<br>LINET<br>LINET  | Coefficient<br>Onrandom perawe<br>-14.4651***<br>1.10567***<br>teans for random<br>.2000<br>tosie paraweters  | Standard<br>Error<br>5438<br>3.28086<br>.33530<br>geometers<br>.22656<br>foc illesta.<br>.07612                | =<br>-4.46<br>3.30<br>1.09<br>0f rendo<br>2.54 | .0000<br>.0015<br>.1557<br>w payawe<br>.0113 | Int<br>-21.1161<br>.48500<br>18355<br>1915<br>.04302 | -8.2301<br>1.76254 |

### Random Parameter Negative Binomial Model of High Injury Crashes on Three lane SPF Class Roadway Segments

| Randos, Co-                            | effinience DegB<br>Variable<br>thoos function                                    | inkes Nodel                  |                |        |               |          | Coveriano      | H RETILL                |                         | in parameters   |
|--|--|------------------------------|----------------|--------|---------------|----------|----------------|-------------------------|-------------------------|-----------------|
| Restricted                             | f log likelihood   | -662.671                     | #2             |        |               |          |                | 131.01                  | LOADT                   | VCVFTGAB        |
| Bignifice/<br>HoFadden 1<br>Estimation | nd [ 6 d.f.]<br>Sof level<br>Feault R-squared<br>t based in H =<br>0 = 1243.4 AN | .000<br>.019811<br>4304, E = | 20<br>58<br>12 |        |               |          | LHLEN<br>LHADT | .+637E-01<br>-,2672E-05 | .20018-01               | .91642-04       |
| Model esti                             | imsted: Jon 02,  | 2016, 22:10:                 | 0.0            |        |               |          | Implied #      | CADIANS Jeys            | ectone of sw            | udos parameters |
| Negative is                            | 2 pds and 21<br>pinceial regress   | 53 individua<br>Soh Rodel    | 1.             |        |               |          |                | leannean                |                         |                 |
| errori                                 | Coefficient  | Standard<br>Error            | 12             | Frich. | 258 Co<br>Int | erval    |                | 2153                    | 181                     |                 |
|  | Foorandom parama   |                              | 100.00         |        | 12.012.012    |          | - 4)           | 100000-0                | 1/24                    |                 |
| Constant)                              | -8.30673***  | 1.11802                      | -8.87          | 1000E  | +11.62607     | 07.11352 |                |                         |                         |                 |
| SINDRY                                 |  |                              | -2,43          | .0152  | 09601         | D104E    | Inglied o      | verglation a            | strix of two            | ton parameters  |
|  | tearis dur randos  | parameters.                  |                |        |               |          |                |                         |                         |                 |
| LUC-EX                                 |  | .04320                       |                | -0000  | -70104        |          |                |                         |                         |                 |
|  | .94560+++  |                              | 7,31           |        | .69006        |          |                |                         |                         |                 |
|  | 00713***   |                              | +2,54          |        | 01111         |          |                |                         | THEFT ACABLE            |                 |
|  | Disgunal element   |                              |                |        | 1             | 2222     |                |                         |                         |                 |
|  | .21823**   |                              |                |        | -03542        | .31924   |                |                         | 87714 ,720              |                 |
| VCVPTORS /                             | .06794+++  | 100114                       |                | \$206. | .01880        | .11004   |                |                         | 00000964<br>96482 I.000 |                 |
|  | Telcs disponel e   |                              | 2.19           |        |               | .00384   | (APABTR02)     | 100/40232-010           | 26405 211000            | 990 - C         |
|  |  |                              |                |        | -128942       | +-85874  |                |                         |                         |                 |
|  |  |                              |                |        |               |          |                |                         |                         |                 |
| 1106 (105)                             |  | 00295                        |                |        |               |          |                |                         |                         |                 |
| 1130 1305  <br>1907 1805               | .00690**   |                              |                |        |               |          |                |                         |                         |                 |
| 1108 105<br>1VCV 185<br>1VCV 185       |  | 100236                       | -2.81          | 10030  | 01126         | 90201    |                |                         |                         |                 |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Three lane SPF Class Roadway Segments idin parameters

| Dependent                          | efficiente RegB<br>variable              | sReg Model<br>UUSTI         | 17              |                 |               |                   | 5         | e settin            | 101114-01 | 1.54103   | a parameters. |
|------------------------------------|--|-----------------------------|-----------------|-----------------|---------------|-------------------|-----------|---------------------|-----------|-----------|---------------|
| Restricte                          | inced function<br>d log likelihood       | -656.318                    | 22              |                 |               |                   |           | Liste               |           |           | SHNDRTCR      |
| Significe<br>StFadden<br>Estimatio | es [                                     | .000<br>.09466<br>4304, X = | 00.<br>97<br>14 |                 |               |                   | 101.89    | -12908-0            |           | 28-00     | .1324         |
| Nodel est                          | imated: Jun 02.                          | 2016, 221891                | 24              |                 |               |                   | Implied # | CADIALI De          | viesione. | of an     | ice parameter |
|                                    | 2 pds and 21<br>hinomial septear         |                             |                 |                 |               |                   | 0.0_Reta  |                     | 14        |           |               |
| 3087197                            | Coefficient                              | Standard<br>Erxis           | 1               | -dost<br>*2<181 | 29% Co<br>201 | ofidance<br>ervel | 11        | .011<br>.048<br>.36 | 4368      |           |               |
|                                    | inrandon parana<br>-13.4502***           |                             |                 |                 |               |                   |           |                     | 14.00     |           |               |
| Constant                           | +13.4502***                              | 1.39899                     | -2.27           | .0000           | +18.0942      | =10.8083          |           |                     |           |           |               |
| VCVFT08A:                          | -,00485**<br>-,000¢1**                   | 100210                      | -2.17           | 10958           | -,00067       | -,00049           | Inglied o | urrelation.         | matrix o  | totatt Sc | on parameters |
| 002512.0                           | 00041++                                  | .00525                      | -2.47           | 10134           | 00200         | 00013             | 0.000     |                     |           |           |               |
| RNY9DINC)                          | .00141***                                |                             | 2.24            | 10004           | 201404        | 204678            |           |                     |           |           |               |
| 10                                 | Nagna for random                         | beramaters.                 |                 |                 |               |                   |           | ********            |           |           |               |
| LNLEH                              | ,66405***                                | .10027                      | 6.43            | .0000.          | 148762        | 1.06088           | Coc.Met.  | 111101              | LHADT 3   | SEMINETC  | E             |
| 1.112.071                          | 1-24897***                               | .19082                      | 8.30            | .0000           | . 95235       | 2-64188           |           | ********            |           |           | -             |
| BENDRY'CR                          | -,28385++                                | 154093                      | +2.01           | -0442           | 55974         | 00796             | LHLEN)    | 1.00000             |           | -12742    | 5             |
|                                    | and the second second second             | and the stands              | CT IN I R WITH  |                 |               |                   |           | 93545               | 65000.1   | -10066    | e .           |
| LNLEN                              | ,0113e                                   | .10734                      | 2.23            | 02.50           | 26750         | .42555            | SEMIRICE  | +.27428             | 00665     | 1.0000    | 2             |
| THEORY                             | 100923*                                  | +21212                      | 1.95            | .05#4           | -,00068       | 104689            |           |                     |           |           |               |
| SHMDATCR                           | ,01100<br>,0100<br>,00913*<br>,22157**   | .00542                      | 2.12            | 10205           | .03416        | .40.097           |           |                     |           |           |               |
|                                    | Selov diegonal e                         | Lements of C                | holesky.        | matrix          |               |                   |           |                     |           |           |               |
| ILNA LUL                           | 4,06121*                                 | ,03557                      | -11,72          | .0563           | 13085         | ,00651            |           |                     |           |           |               |
|                                    | 08990                                    | ,10040                      | 55              | .5799           | \$3363        | ,28356            |           |                     |           |           |               |
| LING LNL                           |  |                             | and the second  | Videoli         | -, 53624      | -,20624           |           |                     |           |           |               |
| 1589 LUL<br>1989 LUL               | -,27126**                                | +19971                      |                 |                 |               |                   |           |                     |           |           |               |
| 15HV LHL                           | 27126**<br>Dispersion perso<br>.27460*** | ater for Her                | Biz dist        | isiBution       |               |                   |           |                     |           |           |               |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Three lane SPF Class Roadway Segments

| estricted<br>hi square<br>ignificar<br>cFadden S<br>stingtic<br>hf.Cr.All<br>odel esti<br>angle is<br>spatire b | variable<br>Abod function<br>1 log like/linco<br>es [ 6 d.f.]<br>pe lawel<br>Peedos P-squares<br>1 based of N =<br>1 = 930%.8 Å<br>mated: Jun 05,<br>2 pds and 2:<br>inneal regress | 4 -3303,12<br>\$608,46<br>.00<br>1 .4496<br>1006,1 -<br>1028,2128<br>1038,2128<br>1038,2128<br>1038,2128 | 601<br>248<br>200<br>201<br>10<br>005<br>124<br>41# |                 |            |                   |
|---|---|--|---|-----------------|------------|-------------------|
| 101112  |   | Standard<br>Error  |   | Fest.<br>(#1>2* |            | nfidense<br>armal |
|   | toncarible pacane   | ters   |   | *******         | ********** | ********          |
| Constanti   |   |  | 0.17035   | 00000           | >-12.19632 | -1010262          |
| ABOTTORA  | 00389***  | 000989   | -5.96   | _0001           |            | 00195             |
| BCVL  | 00088***  | 0001I  | -5.14   | .0000           | -,00582    | 00039             |
| NYWDINC)  |   |  | 3.64  | .0004           | .00725     | .02643            |
| REVERANT  |   |  | 0.01  | .0000           | ,00010     |                   |
|   | -13.1274**  |  |   | -0360           | -29.3354   |                   |
| 13  | leans for random  | TRIBUTATO .  |   |                 |            |                   |
| LULEH   | . #80008+++   | .054TE   | 15:52   | -0000           | .74275     | 0.25740           |
| LIGHT   | 1,37895***  | 07803  | 18.34   | .0000           | 1,22585    |                   |
| SWEDLT  | .85008***<br>1,37895***<br>04080***   | .01228   | -9.90   |                 | 06456      |                   |
| 11  | lagional element  | ts of Chiles   | by matrix   |                 |            |                   |
| LHLEN   | .91025***   | .05093   | 6.00  | .0000           | :20040     | .41004            |
| LIDATE  |   | 100001   |   |                 | .03787     |                   |
| SHNDLT  |   |  | 1.90  |                 | -,00120    | .02070            |
| 1212(1)114  | selow disconsi -  | lemente of   | Cholesky  | MATELN          |            |                   |
| LINE LUL  | 12511+++  | 1022.97  | -5.45   | -0000           | 17012      | -100009           |
| ISHW LNL!   | 01991   | 201405   | -1.42   | 1565            | 04748      | .00765            |
| 1.9997 1.0121   | ,01291  | .01252   | .90   | .3218           | 01210      | .00656            |
|   | Lopersing paras   | secer for De   |   |                 |            |                   |
| SculFarm)   |   |  | 15.74   |                 |            | .25464            |
|   |   |  |   |                 |            |                   |

Implied covariance matrix of candom parameters

| Comptiant | e pettin  |            |        |        |
|-----------|-----------|------------|--------|--------|
|           |           |            |        | ****** |
|           | LHLEN     | 1308.07    | ANNULT |        |
| ********  |           |            |        |        |
| 13(1E)    | .96262+01 | v salas an |        |        |

INEDT -.8881E-01 .1891E-01 SHNDLT -.6178E-03 .8500E-03 .6458E-03 Implied standard deviations of random parameters

| **** | 100.00 | 000000000000 |
|------|--------|--------------|
|      |        |              |
| 1.1  |        | -310223      |
|      |        |              |
|      | h ()   | 1201025      |

| Cor.Nat.                                |         |         |         |
|---|---------|---------|---------|
| 10 10 4 10 10 10 10 4 10 4 10 4 10 4 10 |         |         |         |
|   | 1,00000 |         |         |
| CHART                                   | +180944 | 1,00000 | 1,91174 |
| (TJCNEE)                                | ~.75342 | 101574  | 1.00000 |

### Random Parameter Negative Binomial Model of Total Crashes on Four lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Restricter<br>Chi squar<br>Significe<br>NoFedden S<br>Estimation<br>Inf.Cr.A20<br>Nodel ast<br>Sample is   | efficients Head<br>variable<br>librod function<br>d log likelihood<br>ed [ E.d.E.]<br>not level<br>Freudo F-squared<br>i bared on F =<br>C = 51178.5 AI<br>Lingted Jun 04.<br>2 pds and 144<br>hinomial regress | TOTAL<br>-25566.14<br>1 -65581.56<br>T4030.21<br>.00<br>1 .5979<br>25432, M =<br>2/H = 1.1<br>2016, 17:47<br>26 infividua | 157<br>178<br>253<br>200<br>255<br>500<br>118                   |   |   |  |
|--|---|---|---|---|---|--|
| TOTALACC   | Goeffloient   | Standard<br>Escos   |   | Frob.<br>(#)>2*   |   | mfidence<br>erval  |
|  | Voccandical permit-   | tere  |   |   |   |  |
| Contenants<br>LIFLEN<br>BERLIN<br>VOVPTSRB<br>VOVPTSRB<br>VOVT<br>SCARATS<br>RFV000000<br>VOVT<br>RFV000000<br>VOVT<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS<br>SCARATS | -6,1253***<br>81272***<br>00282**<br>-1.34201***<br>-03557***<br>-03557***<br>126-352***<br>-00058***<br>-20088***<br>-20088***<br>-20088***<br>-20088***   | 21609<br>01159<br>00096<br>07995<br>00764<br>00198<br>40225-05<br>00198<br>40,30723<br>84026<br>00297<br>02627<br>54026   | $\begin{array}{c} 31,1,2,0,6,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0$ | .0000<br>.0141<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000<br>.0000 | -7.14928<br>.78001<br>.00927<br>-1.39971<br>.02291<br>.02291<br>.780530-04<br>.00674<br>.00674<br>.00674<br>.00674<br>.00157<br>.00137<br>.002584<br>.00137 | -6.30323<br>.85842<br>.05438<br>-1.08830<br>.052563<br>.02742-05<br>.01484<br>265.356<br>-4.38128<br>00934<br>2.8906 |
|  | feans for rendor  | parameters  |   |   |   |  |
| UNADY :<br>VCEARSA:<br>BINDLY :  | .91110***<br>.05412***<br>05257***  | .02117<br>.00925<br>.00900  | 8,54  | .0000   | .06437<br>+.00023   | .05258<br>.10350<br>07649  |
| UCFARIA<br>SHOULT  | .04574***<br>.03154***<br>.00097***   | .00219<br>.00245<br>.00141  | 30.02<br>2.72<br>2.70   | .0002<br>.0002  | -06144<br>-01492<br>-00108  | .01008<br>.04917<br>.00485   |
| 100F LNA:<br>18HF LNA:<br>18HF VCF:  | Helov diagonal +<br>05760***<br>.04131***<br>02038***<br>Nispersion paras   | ,01029<br>,00911  | 13.26   | .0000.  | 01764<br>.08511<br>02483  | -,03788<br>,04730<br>-,01610   |
| ScalTern!  | .41313***   | .00754  | 54.54   | ,0000   | . 10034   | , 4285Z  |

Implied novariance matrix of random parameters

Coveringe metris

| 1001003           | LUGADE                | VERARIO         | ANNULT.   | ST (0) S = 100 S |
|-------------------|-----------------------|-----------------|-----------|------------------|
|                   |                       | THE PROPERTY OF | 1111111-1 |                  |
| LIGADT<br>OCTARIA | .4324E-02<br>0787E-02 | .43122-02       |           |                  |
| SHOULT            | .2710E-03             | +.301#E+02      | .21295-00 |                  |

Implied standard deviations of random parameters

| A.D_BetAi | terres i l |
|-----------|------------|
|           |            |
| 1.1       | .0457564   |
| 21        | .2466683   |
| - 16      | ,0461333   |

Implied correlation matrix of random parameters

| Ctiz, Mas. 1 | LIGHT     | VCPARIS. | SHULLT  |
|--------------|-----------|----------|---------|
| ********     |           |          |         |
| LIGADTI      | 1.00000.1 | 87708    | .00010  |
| VCELRMAI     | -187708   | 1,00000  |         |
| (TJC010.     | .19310    | -100542  | 1.00000 |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Four lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Hestriote<br>Chi squar<br>Aignifice<br>Mofedien<br>Estimatio<br>Inf.Cs.Al<br>Hodel est<br>Hample 18 | efficients Reg<br>variable<br>ihood function<br>o log likelibion<br>ed ( e d.r.)<br>not level<br>Preudo R-square<br>r based on N =<br>0 = 01006.9 Å<br>instel Out 04,<br>4 pde end 144<br>bicomial regredo | -20031.45<br>-41480.39<br>41513.05<br>.00<br>5 .3052<br>25432, 8 =<br>10/N = 1<br>2016, 13149<br>14 10057100 | 343<br>594<br>500<br>20<br>445<br>103 |         |                                       |            |
|---|--|--|---------------------------------------|---------|---------------------------------------|------------|
|   |  | Standard   |                                       | Fech.   | ata Ar                                | ofidence   |
| 1800  | Coefficient  | Error  | 1.0                                   | 11125*  |                                       | erval      |
|   |  | *********  |                                       | ******* |                                       | *********  |
|   | Sonrandon perane   |  | 100000                                | State 1 | · · · · · · · · · · · · · · · · · · · | Acres 6    |
|   |  | 124730   | -30.48                                | .0000   | -8.02147                              | -7,05204   |
| 192111  |  | -01396   | 62.26                                 | .0000   | 170331                                | .83300     |
| 08311   |  | +00928   | 1.85                                  | .0646   | +,000.94                              | /01288     |
| MCV111  |  | .36678   | +8.66                                 | .0000   | -6,09837                              |            |
| HCVL1H2   |  | .10391   | +10.91                                | .0000   | -1.32000                              |            |
| THINDDEC  | .01056***  | 100231   | 6.56                                  | .0000.  | ;00.002                               |            |
| VENPTORS  | -00214+++  | .00048   | 6.46                                  | .0000   | .00120                                |            |
| REVERSE   | .w7575D-04***  | #140D-08   | 8-30                                  | -0000   | .814250-04                            | .895890-04 |
| VOVEVCA1  | 00055++  | 00033  | -2.57                                 | 0102    | -;00180                               | -,00020    |
| VCPARKA   |  | 101177   | 7.553                                 | .0000   | .04124                                | 122339     |
| NOVSOLL   | -8.84521***  | -98452   | -6.37                                 | 00000   |                                       | -4.59286   |
| 1000116   | 1.49733+**   | .37741   | 5.97                                  | .0001   | .75762                                | 2.29704    |
|   | Means for cerdin   |  |                                       |         |                                       |            |
| LINADT  |  |  | 38.65                                 | .0000   | 20469                                 | 1,00126    |
| VERU  |  | 106003   | -2.00                                 | 10452   | 26956                                 |            |
| AND RT 1  | 00929+**   |  | +30.13                                | 10000   | 19379                                 |            |
|   | Disgunal element   |  |                                       |         |                                       |            |
|   | .05539+**  |  |                                       |         | .04537                                | 105972     |
| VCR   |  |  | 2.49                                  | 0127    | 06276                                 |            |
| SHORT   |  |  | 5.20                                  | +100.   | 00224                                 | 100939     |
|   | Below diagonal +   |  | Dunlesky                              |         | 100226                                | 100828     |
| INCH LINE   | secon undginks a   | ACCESSION AND ADDRESS  | -1.44                                 | 1812    |                                       | .07089     |
| L'UP_LRA  | 10587  | -19959   |                                       |         | -,43863                               |            |
| 1587 133A   | .03325***  | -03849   | 2.35                                  |         | .02242                                | .03633     |
| 1599_VCR(   |  |  | ~2.16                                 | -0000   | =,02970                               | ++21482    |
|   | Dispersion paras   |  |                                       |         | 197979                                | 41548      |
| ScalParn)   | -29467+++  | 100041   | 99.07                                 | .0000.  |                                       | 141240     |

Implied ordering matrix of random parameters

| Covariat | toe matrix |     |        |            |
|----------|------------|-----|--------|------------|
| -100210  | LIMOT      | VCK | SMVORT | 1000000000 |
| LNADT    | .3069E-01  |     |        |            |

| V 1.49. |           |            |           |  |
|---------|-----------|------------|-----------|--|
| 319/087 | .16105-01 | -,1135E-01 | _1255E-0I |  |

Implied standard deviations of unidos parameters

|    | - | - | 4 |   | - | - |   |   |   |
|----|---|---|---|---|---|---|---|---|---|
| 11 |   |   | b | ŝ | 5 | 5 | 5 |   | à |
| 21 |   |   | 2 | 3 | 6 | ŧ | ŝ | é | ä |
| 81 |   |   | ņ | ġ | ŝ | 4 | à | 1 | 1 |

| Cor.Net. | LIDAT   | VCH.  | TRUMPLE |
|----------|---------|-------|---------|
|          |         |       |         |
| CIGADT   | 1.00000 | 84433 |         |
| VEX      |         |       |         |
| SHOUT-   | .92575  | 90205 | 1.00000 |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Four lane SPF Class Roadway Segments

| Dependent<br>Log likels<br>Chi square<br>Signification<br>McFadden S<br>Estimation<br>Inf.Cr.All<br>Nodel ast:<br>Seeple is | efficiente Hegi<br>variable<br>hood function<br>i log likelihoot<br>di 6 d.f.<br>variab B-agiares<br>i Hared off H =<br>c = 21727.4 Al<br>matel: Jun 06,<br>2 pds and 14<br>inomial regress | P:<br>-10043.21<br>-16725.75<br>0765.07<br>-16725.05<br>000<br>1.000<br>1.0104<br>26432. K =<br>1078 =<br>2016.10142 | 610<br>190<br>104<br>21<br>164<br>137 |          |          |             |
|---|---|--|---------------------------------------|----------|----------|-------------|
| 1   |   | Standard   |                                       | Frob.    |          | nfidence.   |
| P(2267)   | Coefficient   | Lever  |                                       | (s)>2+   | Int      | 東田行曲工       |
|   | linrandon parate  |  |                                       |          |          |             |
|   | -8.23887***   |  |                                       | .0000    | -2.37115 |             |
| CONFCARE  | .76201+++   | 001010   |                                       |          | .72718   |             |
| HOVE1NE!  | -7-40865***   | 117653   |                                       | .0000    |          | -2.06248    |
| 5020  |   | .07754   | -8,25                                 | 0000     | 40345    | 09996       |
|   |   | .01072   | -2.78                                 | .0068    | 06030    |             |
|   | -576230-04***   | 12010-04   | 4148                                  |          |          |             |
|   |   |  |                                       | .0000    |          |             |
| DISTANCED 1   | 00943***  | .00051   | 6.64                                  | .0000    |          | .00442      |
| VCVEVCA   | -,002884++  | .00052   | -5.55                                 |          | 00382    |             |
|   | _20101B-04+++   |  | -5.35                                 |          |          | +.833530-03 |
| VEVILINE)   | 113.704***  | 14.41014   | 1.71                                  |          |          | 264,006     |
| The Paralle 1   | teace for tandor  |  |                                       | 1.00.000 |          |             |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   | .27224***   | parameters.  | 20.44                                 | 0000     | *****    | 1.04479     |
| VENTORAL  | .03449***   | .01063   | 2.26                                  | 0015     | .01385   | .05552      |
| awpocki   | 022388+++   | .008#1   |                                       | .0001    |          |             |
|   | lisgonal wiement  |  |                                       |          |          | -146500     |
| EMADEL  | .03345***   | 00299  | 11.04                                 | .8585    | .00668   | .09818      |
| VEVETORA!   | .03249***<br>.00291***  | 00038  | 35.7                                  |          | .00217   | .00385      |
| SHMDCRI   | .01126***   | 00454  | 1.55                                  | .0395    | .00272   |             |
| 11  | elow disgonal .   | Lenenzy of (   | tholesky.                             | BATCLE   |          |             |
| 1707 1104   |   | .00053   |                                       |          | -,00004  | -00188      |
|   | .06377***   |  |                                       | .0000    | .04860   |             |
| 1589 VCV  | .03170***   | 100400   |                                       | .0500    | .04978   |             |
|   | Lepersion paren   | seter for He-  |                                       |          |          | 1000        |
|   |   | .111100  |                                       |          | .10566   | .35183      |

|         |            | and the first the same |             |            |
|---------|------------|------------------------|-------------|------------|
| Implied | 2014212204 | ##121K 02              | 2 8 11 2010 | 2028051025 |

Covariance matrix

LNADT VEVPTORA SENDCR LUADT VCVPTORA SHNDCR 10628-02 16168-04 20685-03 .87142-04 .12305-03 .51985-02

Implied standard deviations of random parameters

S.D\_Beta 1 .0324012 .00296202 .0720970 おおお

Implied correlation matrix of random parameters

| Dog_Mat.) | LINADT  | VEVVIGRA | SENDCR. |
|-----------|---------|----------|---------|
| ++        |         |          |         |
| CIGADE :  | 1.00000 | .14819   | .88445  |
| VCVFTORA: | .10018  | 1.00000  | .56213  |
| SENDCE    | 100010  | 188215   | 1.00000 |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Four lane SPF Class Roadway Segments

| Astricte<br>Di square<br>Niguifices<br>Astimation<br>Def.Cr.AC<br>Dobl art:<br>Neglit is<br>Neglit is | Variable<br>hood function<br>i log likelihood<br>ed [ 3 d.f.]<br>hoe level<br>resuld R-squared<br>h based no H =<br>1 = 11137.3 AJ<br>imated: Fur 06,<br>2 pis end 142<br>inonial regress | -6361.75<br>1038.17<br>.000<br>.0001<br>10432, X =<br>C/W =<br>2018, 17:16<br>16 individuo<br>ion model | 494<br>442<br>100<br>14<br>414<br>50 |          |          |           |
|---|---|---|--------------------------------------|----------|----------|-----------|
|   |   | Scandard  |                                      | Prob.    |          | nfiderice |
| EVI (   | Coefficient   | Erman   |                                      | 18152*   | Ent      | erval     |
|   | Fonsandom paxane  |   |                                      |          |          |           |
|   | -5.47814***   |   |                                      |          | -6.40524 | -4.55304  |
| THTEN   | .78013***   | 102245  | 34.75                                | .2005    | ,75613   |           |
| 05010   |   | .00801  | 2.14                                 | 10322    | ,00091   | ,02087    |
|   | -1-17497+++   | . 84743   | 2.14                                 | _0007    | -1,85630 | 49344     |
|   |   | 0008.016  | +2-08                                | _0279    | -55148.3 | -1125.8   |
| MCVL  | 0.46532++   | 1.86795   | 2.05                                 | .0379    |          | 8,73220   |
| UVPTOBA:  |   | .00061  | 3.46                                 | -0005    | 100092   | .00933    |
| LIBERHY'S   | -3,45335**  |   | +2.07                                | .0380    | -6.72839 | -,19107   |
|   | means for random  |   |                                      |          |          |           |
|   | +\$79298***   |   |                                      |          |          |           |
|   | +.00303+>+  |   |                                      |          | -10754D  | -,09187   |
|   | lieponal element  |   |                                      |          |          |           |
| LNBOT   | .00910***   | .00300  | 9.69                                 |          | 102324   |           |
|   | ,00933**  | 100173  | 1.42                                 |          | 100278   | 101404    |
|   | Selivy diagonal e   |   |                                      |          |          |           |
| HW_LHAT   | ,0±072***   | 15500.  | 2.61                                 | .0000    | 109244   | /06599    |
| -   | staperaton paras  | abar for Fey  | gin mist                             | ribution |          |           |
|   | .89568***   | Conclusion in the second  | 14.75                                | 0.000    | 144346   | .62970    |

| Cor.Mat. | LNADT   | SENTRE |
|----------|---------|--------|
| LHADT    | 1.00000 | .87621 |
| SEMDET   |         | -8762  |

### Random Parameter Negative Binomial Model of Serious Injury Crashes on Four lane SPF Class Roadway Segments

| Randon Cor<br>Dependent  | efficiente Meph                    | nReg Model        | niz.             | 5600000         |          |                   | Teplied of                |  | tris of random parameters   |
|--------------------------|------------------------------------|-------------------|------------------|-----------------|----------|-------------------|---------------------------|--|-----------------------------|
|                          | thood function                     | -1418.953         | 24               |                 |          |                   |                           | - INCLAS   |                             |
|                          | f log likelihood<br>ed ( ) 0.1.f.) | -1438.700         |                  |                 |          |                   |                           | 1104207  | INDCR                       |
| Significer<br>McTadden 1 |                                    | .000<br>.01378    | 00<br>53         |                 |          |                   | LNADT<br>SHREES           | .8254E-03<br>.1784E-02                                 | .41828-02                   |
| Int. Cr. AD              | 1 = 2859.9 AD<br>Imated: Jun 14.   | 0/1 + -1          | 01               |                 |          |                   | Implied at                | andatid devi   | stitus of random parameters |
| Sample is                | J pus and 142<br>binomial regress  | 16 Individua      |                  |                 |          |                   | 3.0_Detel                 |  | 1                           |
|                          |                                    |                   |                  |                 |          |                   |                           |  |                             |
| SINT (                   |                                    | Standard<br>Error | Ŧ                | Prob.<br>(s)>Z* | 954 00   | mfidence<br>erval | 21                        | .02676   | 0.0                         |
| 11                       | Ronranitiet marane                 | 1429              | *******          |                 |          |                   | Textion of the            | and a state of   | strim of random parameters  |
| CONSTANTI                |                                    | 1.105572          | 3-5-85           | 20000           | -7.93445 | -8185269          | entreader as              | 04 (0.00 A 10 (0.00 A 10 | dreaw or though Supercorded |
| 1,911,810 (              | .80728+++                          | .05285            | 19.28            | ,0300           | _70871   | .91005            |                           |  |                             |
| HCVLIHI!                 | -1.91408***                        | .60745            | -3,15            | 10016           | -3.10661 | -,72550           |                           |  | elementaria (               |
| REFERENCE                | 02220*                             | .01222            | -1,90            | .0575           | 04715    | _00074            | Cot.Net.1                 | LIGADT 5   | HVDCR                       |
| HCVIRKIEL                | .00099***                          | .00284            | 3.21             | .0012           | .00197   | .00501            | the local division of the |  | dram.mo.                    |
| 1.12                     | Seens for rendom                   | parameters        |                  |                 |          |                   | LINADT                    | 1.00000 .  | 94490                       |
| LISADT                   | 142262444                          | .10038            | 4,41             | ,0000           | _10295   | .45644            |                           | .34650. 1.   |                             |
| SM00C8)                  | 078314+4                           | .01705            | -4.53            | ,0000           | 11178    |                   |                           |  |                             |
|                          | Disgonal element                   | s of Cholesk      | y meticia        | 1199625         |          |                   |                           |  |                             |
| LHADTI                   | .02859***                          | .00540            | 8,88             | .0000           | .01819   | -02938            |                           |  |                             |
| SHUDCE                   |                                    | .01265            | 1.91             | .0468           | 00398    | .04632            |                           |  |                             |
| . 13                     | Selow disponal e                   | Lementes of C     | holesky          | matria          |          |                   |                           |  |                             |
| 188W 1344                | .06211***                          | 01180             | 8128             | .0000           | .03799   | 108421            |                           |  |                             |
|                          | Dispersion perso                   | eter dor Neg      | Din dist         | ribution        |          |                   |                           |  |                             |
| - 11                     |                                    | 121191            | COLUMN TRANSPORT | 10230           | -06701   | . 90402           |                           |  |                             |

# Random Parameter Negative Binomial Model of Fatal Injury Crashes on Four lane SPF Class Roadway Segments

| Associate<br>Chi squar<br>fignifice<br>UsFedden<br>Estimatio<br>Inf.Cr.AI<br>Updel est<br>Sample in | Veriable<br>ibidd finstion<br>d log likelihood<br>ed [ I d.f.]<br>noe level<br>Pawodo R-squared<br>n beset on H =<br>C = 1000.9 A2<br>imatei Jun 04,<br>2 pds and 142<br>hinosial yegrees | -35431,000<br>55833,050<br>.000<br>25432, M =<br>2/N = .0<br>2016, 13:21:<br>16 individue | 104<br>176<br>100<br>141<br>157<br>25 |                   |           |                   |
|---|---|---|---------------------------------------|-------------------|-----------|-------------------|
| FATAL   | CoeffLoiens   | Itaniard<br>Error   | . 4                                   | Frob.<br>(8)>5*   |           | nfidence<br>ervel |
| 1   | Sonrandom parake  | Cans  |                                       |                   |           |                   |
| Constant!   | =7.26959+++   | 1.00300   | -1.20                                 | ,0000             | -10.10790 | -3.05121          |
| 101.500   |   | -15722  |                                       |                   |           | 1.00465           |
| SEVERTCR  | .06715  | -05874  | 1.67                                  | -0622             | +.02250   | 125682            |
|   | 一五百,文作金有中   |   | -1.95                                 | .115.28           |           |                   |
| ACANKER !   | 5.28175***  |   |                                       |                   | 1.40513   | 9.11837           |
|   |   |   |                                       |                   |           |                   |
| VCVL15  | Neans for rendom  |   |                                       |                   |           |                   |
| VCVL15  |   |   |                                       | . 1.598           | .01841    | .45455            |
| VCVL15  |   | 117301  | 2.07                                  |                   |           | .45455            |
| VCVL15  | .35762**<br>Scale parameters  | 117301  | 2.07<br>of secon                      | II DAYADA         | 5818      |                   |
| VCVLIS<br>LNADI<br>LNADI  | .35762**<br>Scale parameters  | 17301<br>for dists.<br>.01220   | af 2.07<br>5.20                       | .0014             | C1327     |                   |
| VCVL15<br>LNADT   | .35752+*<br>Scale parameters<br>.03237+**   | 17301<br>for dists.<br>.01220   | 2:07<br>of succu<br>5:20<br>fbin diet | .0014<br>pibutint | C1327     |                   |

### Random Parameter Negative Binomial Model of Unknown Injury Crashes on Four lane SPF Class Roadway Segments

| Nestricte<br>Uni agiar<br>Significa<br>Nefeilian i<br>Retimetics<br>Inf.Cr.Ali<br>Hodel est<br>Sample is | Decido R-squaren<br>h Basel on H =<br>C = 2019.6 AJ<br>Unated: Jun 09,<br>2 pds and 142<br>hinomial regrass | 101000<br>-1027,735<br>1 -1090,863<br>46,237<br>100200<br>1 .02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.02200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.0200<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000<br>1.02000 | 99<br>20<br>00<br>92<br>22<br>73<br>24 |                 |                              |                   |
|--|---|--|--|-----------------|------------------------------|-------------------|
| UNITIACIAN   | Coefficient   | Standard<br>Errot  |  | Prob.<br>(#(52* | 2                            | nfidence<br>arval |
|  |   | 1990 - 104 S   |  |                 |                              |                   |
| Constant   | -8,15546***   | 1,82809  |  |                 | -9.15046<br>.43048<br>.00260 | -90492            |
| NCVL<br>SEMDET<br>SEMDET   | .00569***<br>00568***<br>09162***<br>04901***   | ,71250-04<br>.02068<br>.01866  | -8,40<br>-8,40<br>-2,64                | .0000           | 00063<br>13215<br>08538      | 00035             |
| 13   | leans for random  | parameters.  |  |                 |                              |                   |
| SHADBACK   | .18004+**<br>16556**  | 102197   | - FF249                                | .0131           | -30884                       |                   |
|  | Diaponal element  |  |  |                 |                              |                   |
|  | .01281**<br>.02835  | .02759   | 1,99                                   | 10642           | 01870                        |                   |
| JURNERFOR  |   | Langerig of L  |  |                 | 10000                        |                   |
| LINDRICK   | Selov diagonal *<br>.11651***<br>Dispersion paras   |  |  |                 |                              | 28791             |

Implied covariance matrix of random parameters

LINEDT SHFERTOR LINEDT SHFERTOR LINEDT .16412-03 SPECETOR .27452-02 .4745E-03 Employ standard deviations of random parameters 3.5\_Detail 1 Linedta Lined

11 (DI25007 21 -217914

Depiled correlation matrix of random parameters

| Cor.Net.1 |   | ì | 31 | à  | b | π |   | z | Ξ | N | ī | ġ | Ξ | ċ | 7 |
|-----------|---|---|----|----|---|---|---|---|---|---|---|---|---|---|---|
| ********  |   | ÷ | 2  | 1  | 4 | ų | 4 | - | - | ÷ |   | 4 | - |   |   |
| LHADT 1.  | ì | d |    | ic | à | Ó |   |   |   | i | ş | à | i | ä | 1 |
| SHEPRICE) | 2 | ÷ | ŝ  | 6  | 2 | ÷ |   |   | ż | ì | à | ā | ó | ŝ | ò |

### Random Parameter Negative Binomial Model of High Injury Crashes on Four lane SPF Class Roadway Segments

| Log likel:<br>Restricte:<br>Chi squar:<br>Sigmifiles<br>NoFadien i<br>Istimetic:<br>Inf.Cr.AI<br>Nodel est:<br>Schple is | Variance<br>ihood function<br>d log likelihood<br>at [ 3 d.f.]<br>hoe level<br>Pseudo R-squares<br>h based on H =<br>1 = 15158.4 at<br>imsted: Jun ON,<br>2 pps and 11<br>binomial regress | -6764,190<br>1 -7467,430<br>1428,680<br>.000<br>1 00850<br>1 00850 | 123<br>125<br>100<br>131<br>15<br>15<br>15 |                 |            |                    |
|--|--|---|--|-----------------|------------|--------------------|
| #11H/1   | Coefficient  | Standard<br>Erste   | ×.   | 0tob.<br> 81>0* |            | nfiderjoe<br>erwal |
| 11   | Sonrandom parama   | 1.023   |  | 1.5.5           | 0.55.0     | 2.00.000           |
| Constanti  | -6.95066***  | .82726  | -9.39                                      |                 | -5,98401   | -8.91725           |
| 1311.031   | .80083***  |   |  |                 | .70167     |                    |
| HOVE   | -,00013***   | 126580-08   |  | .0000           |            | -,00008            |
| HOTLDECK   | 42471++  | .18761  | -2.26                                      | -02.5E          | 78343      | 05700              |
| UNUDRICR   | .15114***  | .03790  | 3.95                                       |                 |            | .22558             |
| DEG11  | 21036++  | .00498  | 7.05                                       | -0372           | .00061     | .02012             |
|  |  |   | -10.0%                                     |                 |            | 04804              |
|  | .00315***  |   | 1.52                                       | .0000           | .00148     | .00431             |
|  | 10411D-04***   |   | -3.03                                      | .0025 -         | .519990-04 | +1652340-05        |
|  | Neans for random   | parameters  |  |                 |            |                    |
| LIGADE   |  |   |  |                 | 194042     | 100001             |
| SINGCRI  | *********  | .02082  | -3.85                                      | -000e           | 11159      | 03133              |
| 11   | Diagonal element   | a of Cholesi  | ty matrix                                  |                 |            |                    |
| LIGADE )   | .02878***  | .00315  | 13.57                                      | .2000           | 02456      | .03300             |
| SHRIDICR 1   | 101520+++  | .00455  | 3.14                                       | 10027           | .00571     | .02470             |
| 13   | Selow diagonal e   | tesents of t  | Writestow.                                 | matria          |            |                    |
| ANT WEEK   |  | 100433  | 111.06                                     | .0000           | 1,02631    | 105400             |
|  | Dispersion param   |   |  | ritorici        |            |                    |
|  | .72432***  |   | 12.57                                      |                 |            | 0.0000000          |
|  |  |   |  |                 |            |                    |
|  | nn,D-sa or D-sa<br>,,, Sij   |   |  |                 |            |                    |

| Coversance | HRITIK |       |
|------------|--------|-------|
|            |        | <br>- |
|            |        |       |

|        |           | 2000/04                                       |
|--------|-----------|---|
|        | .82818-05 | NATION AND AND AND AND AND AND AND AND AND AN |
| DENDER | .13428-02 | 24358-02                                      |

Implied standard deviations of random parameters

Inglish covariance matrix of random parameters

| S.D Betal | 4        |
|-----------|----------|
|           |          |
| 2.8       | .0287768 |
| 2.1       | .0420445 |

| Cor.Hat.y | LINART | SEMDCR  |
|-----------|--------|---------|
|           |        |         |
| LUMPT     | .00000 | .85973  |
| SHADCE    | .98013 | 1,00000 |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Four lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Deutificte<br>Chi sigiar<br>Significa<br>NoTadoen<br>Detiautio<br>Inf.Cr.81<br>Nodel est<br>Sample is   | efficients NegB<br>variable<br>insof function<br>d log likelihood<br>ed [ 3 d.f.]<br>feeddo B-squared<br>n baae8 oc R =<br>c = 13807.8 AJ<br>imared Jon 11,<br>3 pds and 142<br>binomial regress   | .0051<br>-6825.630<br>-6825.630<br>-000<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-17840<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-178400<br>-1 | 396<br>941<br>990<br>991<br>991<br>991<br>991<br>991<br>991<br>991<br>991<br>99 |                  |  |                          | Implied novaclaine matrix of random parameters Covariance matrix INADT SCHMUSTL INADT SCHMUSTL INADT SLODE-05 SCHMUSTL4154E-04 .1169E-04 Implied standard deviations of random parameters S.D_Beta) 1 |
|---|--|--|---|------------------|--|--------------------------|---|
| JUSTING   | Coefficient  | Standard<br>Error  | t.  | Fgoh.<br>(±1)/2* | 353 00   | efidence<br>ervel        | 1) .0176132<br>31 .0176139  |
| Constant<br>Iddien<br>SEMOCH<br>BHEDRICH<br>DEVI<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1<br>UCVL1 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1256+**<br>.00179++-<br>.01494**<br>.14926+*<br>.24926+*<br>.04926+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.001044+*<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+***<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+**<br>.00105+***<br>.00105+***<br>.00105+***<br>.00105+***<br>.00105+***<br>.00105+* | .51263<br>.00440<br>.05240<br>.05564<br>3.65576<br>2.00566<br>2.00566<br>2.00566<br>2.00566<br>2.00566<br>2.00566<br>2.00566<br>.00568<br>.00568<br>.00567<br>.00566<br>.00566<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567<br>.00567   | -3.90<br>18.00<br>8.99<br>Ry matrix<br>8.55                                     | .5000<br>.0000   | .70414<br>-17433<br>.09475<br>.00405<br>-24,3492<br>.25495<br>-2,32935<br>-1,46292<br>-06261<br>.00148<br>.00148<br>.00148 | 00025<br>.00909<br>00017 | Impiled ourselation matrix of rembum persmeters<br>Chr.Mat.) 18827 HOVESHEL<br>ISADT 1.0000069472<br>SCARKIEL69472 2.00000  |
| Doslears  | Delov diagonal *<br>00200***<br>Dispersion param<br>.30061***  | .00038<br>eses dos Nes<br>.01611   | -8.16<br>2016 diat<br>18.06   | .0000            | .26905   | 00163<br>.33215          |   |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Four lane SPF Class **Roadway Segments**

Ranima Coefficients SegBeFeg Model Dependent variable 10000 Log likelihood function - 10000.0704 Chi system ( 4 0.071 - 30000.11358 Significance level - 0.0000 Diradden Peedo R-squared - 0.0000 EstLimatica based on 5 = 30403, K = 34 Unif.Cr.RC = 44780.31CM = 1.374 Model serimated in 00, 2006, 2013500 Sample is 2 pds and 1472 influtuals Bagtive hinomial represent model States of the series of the second 01% Confidence Interval Error Fron. -E.73540 24512 -4.09106 7.83434 -07539 -01549 -00054 4.75522-4.00051 -11590 -11625.6 2.21951 -.00038 -7,67697 ,79290 -1,63049 4,09512 -,00550 -,00148 -,00148 -,00148 -,00148 -,00148 -,00148 -,00148 -,00148 -,00159 -,00590 23,995 01281 90299 90299 00291 Constant LRLEN HCVIXSEL HCVI SCHURT .00291 .00210 .6797D-04 .00032 .7564D-08 .00032 .01998 4767.392 .36704 .90118 -.03953 -.03953 .00245 1.01040 -.01253 .00437 ,03730 ,02947 -,02001 .04483 .08836 .00078 .00768 -.00740 -.008197 -.00819 -.00323 18779 42022

Inglied covariance matrix of random parameters

| Coveriance | e hatzia  |          |                              |
|------------|-----------|----------|------------------------------|
| 12000011   | LIRADT    | AMMOLICA | VZVETSAA                     |
| LNADT      | -16562-02 |          | **************************** |

VEVETGEA -.2752E-03 -.3268E-03 .5976E-04

Implied standard deviations of smidtm parameters

| .0_BetAl | a mari    |
|----------|-----------|
|          |           |
| 1        | 10810066  |
| 21       | 10003437  |
| 10.0     | .00773044 |

| Cop.Sat.        | LIMIT    | SHARTCH   | VEVITORIA |
|-----------------|----------|-----------|-----------|
| +               |          |           |           |
| LUADT           | 1.000000 | .47792    | -,81650   |
| SENDITCH.       | 47792    | 1.00000   | 00910     |
| Universities !! |          | - B10.076 | 1 111000  |

#### Random Parameter Negative Binomial Model of Total Crashes on Five lane SPF Class Roadway Segments Imp

| Dependent<br>Sog likel<br>Restilote<br>Chi squar<br>Significe<br>Nofadden<br>Istinutio<br>Inf.Cr.AJ<br>Nodel est<br>Semple is | efficience Shedd<br>variable<br>indoof fumstich<br>5 log lixelinoot<br>for lixelinoof for<br>livelinoof for<br>the level<br>freudo for squared<br>to based on H =<br>5 = 5482.7 Ad<br>2 phs and 23<br>binneli regress | TOTALA<br>-2500.335<br>-8567.403<br>12518.309<br>1001<br>-87222<br>2244, H =<br>1/W = 2.7<br>2014, 18180<br>23 1001/12008 | 00<br>21<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>21<br>21<br>21<br>21<br>21<br>20<br>21<br>21<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20 |          |            |   |
|---|---|---|--|----------|------------|---|
|   |   | Standard  |  | Prich.   | :958 Co    | nfidence                                |
| TOTALACCI   | Coefficient   | Error   | 1  | 12122*   | Int        | devia5                                  |
| +   |   |   |  |          |            | ***********                             |
| Company 1   | Punsendom parame<br>-0.02245***   | ters.   |  | inizian. |            |   |
| Laters  | .85001+++   | .03957  | 72.07  | 0.000    | 178182     | .32413                                  |
| HCVLIMT   |   |   |  |          |            | <ul> <li>C.S. (1971) 41</li> </ul>      |
| instantary (  | - Netdown   | Textual law   |  | 100.00   | - 0.00 A T |   |
| UPUT C  | 00039+++<br>.00591+++<br>.04079+++  | 00014   | -2.70  | 0055     | - 00047    | - babes                                 |
| (COLDING )  | .00891+++   | 00110   | 3.00   | .0022    |            | 10047                                   |
| SHUDLTCR  | .04079***   | 101000  | 2.55   | 0099     | 100001     | 07176                                   |
| HENNIKHI, L   | -5.35964++  | 2.43512   | +2.22  | 102'00   | -10.11260  | 58709                                   |
|   | Means for random  | DADADADADATA  |  |          |            |   |
| LUMDY :   | .90781+#*   | .06923  | 13.11  | 0000     | .77314     | 1.04348                                 |
| DISVOLT   | 01235+++  | 101855  | -s1.71   | 20002    | 11065      | 03411                                   |
| BCVCRAF!  | .00012+++   | .31070-04   | 3,90   | .0001    | :00004     | .,00018                                 |
| 1   | 07332+**<br>.00012+**<br>Diagonal element   | s of Cholesk  | y matrix   |          |            |   |
| LNADT   | **21670-  | 100507  | 15.61  | -0000    | 106921     | ,00909                                  |
| SHUDLT  | _03272***   | .00768  | 4.26   | .00000   |            | :04779                                  |
| HCVCRAR   | Disponal element<br>.07915***<br>.03272***<br>.42789D-04**  | _2078D-04   | 2.04   | .0594    | .397400-05 | 1034012-04                              |
| 1   | Selce disponal 4  | Lements of C  | holesky :  | xcriss   |            |   |
| INN_LIAL  | -06067***   | .01077  | ++-70  | .0000    | 102947     | 107547                                  |
| 1HOV LSR  | .\$1279D-04+*   | .1993D-04   | 2.04   | -9410    | .302350-25 | -109530-03                              |
| THCA_390.1  | 5elc# disponal *<br>_06087***<br>.81279D-04**<br>83950D-04**  | -26160-04   | -2.99  | 10168    | 116980-05  | 1125960-04                              |
| 20 Barriel  | Dispersion param  | eter for Neg  | (\$10. (\$195  | 11Du510  | 1          | 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - |
| SpalFarm)   |   | 108889  | 14.05  | -10000   |            | 179172                                  |
|   |   |   |  |          |            | ***********                             |
|   | th.D-as of D+sx   |   |  |          |            |   |
|   | , en, a may 210   |   |  |          |            |   |

| Consistance                | a marrie                            |                        |          |             |
|----------------------------|-------------------------------------|------------------------|----------|-------------|
|                            | LIMIT                               | 38902.7                | HCVCRAII |             |
| LHADT<br>SHWULT<br>HOVERAN | .6265E-02<br>.4002E-02<br>.6553E-05 | .38258-02<br>.20178-08 | 12825-09 | 00000000555 |

Imp 8-3

| S_Beta        | 1   |    |   |   |   |   |   |   |    |   | 2 |
|---------------|-----|----|---|---|---|---|---|---|----|---|---|
|               | +   | -  | - | - | - | - | - | - |    | - | - |
| · · · · · · · | 1   |    |   |   | ņ | à | ģ | 1 | ÷  | 9 | d |
| - 2           | ¥   |    |   |   | D | £ | ٥ | 2 | 3  | 5 | 1 |
| 3             | έ L | ÷. | ż | ł | 5 | è | ė | z | i. | Ð | à |

Implied correlation matrix of random parameters

| Cor.Nat.1 | LINAT   | SENDLT  | .ec/csail |
|-----------|---------|---------|-----------|
| LNADTI    | 1.00000 | .83955  | .72630    |
| STRUCT (  | .029955 | 1.00000 | .29927    |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Five lane SPF Class Roadway Segments

| Dependent<br>log likel<br>Sestilote<br>Chi squad<br>Significa<br>Hofadien<br>Estimatio<br>Inf.Cs.AI<br>Hodal est<br>Sample is | efficience Hegi<br>variable<br>incod function<br>d log lixelinco<br>ed [ 6 d.f.]<br>nce level<br>Taeudo X.square<br>n based on N =<br>C = 4696.0 a<br>interest Jun 11,<br>7 pds and 2<br>binnel regres | -1522,016<br>-5558,023<br>-5558,023<br>-6467-894<br>-2000<br>-19207<br>2246, H =<br>-<br>2016, J1:225<br>2016, J1:225<br>2016, J1:225 | 41<br>06<br>00<br>11<br>12<br>46<br>20 |                 |            |   |
|---|--|---|--|-----------------|------------|---|
| 200   | Coefficient  | Standard<br>Ercor   |  | Frab.<br>11:52* |            | nfidence<br>ernal                       |
|   | Sonrandon parate   |   |  |                 |            | +++++++++++++++++++++++++++++++++++++++ |
| Constant!   | -4.75525***  | .53577  | 20.49                                  | 0000            | .80829     | -5,10536                                |
| DES1  | -3.06545***  | .00564  | 8-01                                   | 0003            | .00592     |   |
| HOVLINE   | -1-39507***  | -43890  | -3.04                                  | 0024            |            | 47484                                   |
| 307152.1  | +,252020-04**  | 12490-04  | +2.02                                  | - 3640          | .406050-04 | 71040D-06                               |
| NCPARIAL<br>NCVPCCVA  | .11570***  | ,03645  | 5.33                                   | .0015           |            | .15714                                  |
| SHRDCR.   | -11038**<br>01284**  | 104576<br>100603  |  | 02107           | 02616      | 113618                                  |
|   | Means for random   | the local sector sector in the sector   |  |                 |            |   |
| EXTADT  <br>ENTENDED  |  | .07940  | 11.14                                  | .0000           | -,02584    |   |
| 19031   | 17196***<br>Disgonal element   | .01012  | -10.35                                 | 10000           | 10760      | -,10623                                 |
| LSADTI  | .04355***  | .03687  | 2.92                                   | .0035           | 01034      | 106264                                  |
| RMERCORC  | +++**  | .00170  | 3.38                                   | :0007           | 200242     | .00900                                  |
|   | Below disgonal e   |   |  |                 | -100488    | 100403                                  |
| LEATE LAL   | .00434   | 100490  |  | 19754           | -,00026    |   |
|   | -05827***  | .01226  | 4.75                                   | .0000           | .00424     | .09230                                  |
| 15HN LNA  |  |   |  | ribotion        |            |   |

Inglied covariance matrix of random parameters

Covariance Astria LIADT RHINDDEC SENDET LUADT .24595-02 RETURDEC .21148-03 .51398-04 SEMDRT .20005-02 .40185-03 .41325-02

Implies standard deviations of random parameters

| 1.1 Sets | j |       |   |   |   |   |      |   |   | ł |
|----------|---|-------|---|---|---|---|------|---|---|---|
|          | ÷ | <br>- | - | - | - | - | -    | - | - | - |
|          | ł |       | 2 | ż | ä | 5 | is i | 5 | 5 | 1 |
|          |   | ú     | ô | ā | 6 | i | i    | Ď | 5 | 1 |
|          | 1 |       | ì | ŝ | ŝ | 4 | ī    | i | 3 | 4 |

Ingiled purselation matrix of random parameters

| COX+MAS+ | LHADT   | PRANDORO BRAND | SHVDRD  |
|----------|---------|----------------|---------|
| LUGART   | 1:00000 | .60235         | .00004  |
| DIGINTER | .00235  | 1.00060        | . 58003 |
| SHNDRY   | .90006  | .84002         | 1.90000 |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Five lane SPF Class Roadway Segments

|   | efficients RegB  |  |                      | *******         |               |                    | Implied of                              |                               |                          | f random       | parameters          |  |
|---|--|--|----------------------|-----------------|---------------|--------------------|---|-------------------------------|--------------------------|----------------|---------------------|--|
| Log likels  | ibood function   | -1305.548                                | 45.                  |                 |               |                    |   |                               |                          |                |                     |  |
|   | d log likelihood<br>ed [ & d.f.]                                 |  |                      |                 |               |                    |   | 1.07                          |                          | NEDEC          | INDET               |  |
| Bignificar<br>Hofadden S<br>Estimation<br>Inf.Cr.AD | nce level<br>Feendo S-squared<br>n based no H =<br>C = 2703.5 AJ | .000<br>.07843<br>2244, K =<br>C/H = 1.2 | 90<br>72<br>14<br>04 |                 |               |                    | LMADT<br>REFYNDDEC<br>SENDRT            | (81978-<br>117898-<br>122098- | 06<br>04 .183<br>04 .413 | 08-08<br>75-03 | .11318-00           |  |
|   | imened: Jun 12,<br>2 pdb mid 11                                  |  |                      |                 |               |                    | INDITED %1                              | CANGARD I                     | Heva Ana Gane            | 01 1401        | ton parmieters      |  |
|   | tinonial regiese   |  |                      |                 |               |                    | A.D_Becal                               |                               | 4                        |                |                     |  |
| *190  |  | Stendard<br>Error                        | 10                   | Foub.<br>(0)>0* | 25% Co<br>215 | ofidative<br>ervel | 13<br>21                                | 2.00                          | 67890<br>38287<br>277747 |                |                     |  |
|   | Sonrandos parame   |  |                      |                 |               |                    | ्र तुर                                  | 3.53                          | 10000                    |                |                     |  |
|   | -8,17708***  |  | -5.87                | .0058           | -5.31143      | -1.04278           |   |                               |                          |                |                     |  |
| INTEN   | .82759***  | .05015                                   | 15.57                | .0000           | .72338        | .93170             |   |                               |                          |                | m pacamatacs        |  |
| D501 /  | .02238**   | .01029                                   | 2.17                 | .0296           | .00221        | 04254              |   |                               |                          |                |                     |  |
| ACVETCVA:   | .70182*  | .003.09                                  | 1.97                 | .0688           | -:00032       | ,00897             |   |                               |                          |                |                     |  |
| HUYL:   | 00040***   | 200052                                   | -3.20                | .0014           | 00064         | -:00018            | +++++++++++++++++++++++++++++++++++++++ |                               |                          |                | <ul> <li></li></ul> |  |
| PRYNDLINC   | <.01T08**  | .00817                                   | -2.29                | .0366           | +,03320       | 00108              | Coz.Met.                                | LMADT                         | RAYNDORC:                | 311408.3       | 5 C                 |  |
|   | Monney Yob kneed   | paraneters                               |                      |                 |               |                    | ******                                  |                               |                          |                |                     |  |
| 1348-075  | .90776***  |  | 8.37                 | .0000.          | 169017        | 1.12034            | LIGADT                                  | 1.00000                       | .44544                   | .116663        | É                   |  |
| RAYNDOCC  | 01863**  | .00791                                   | -2.36                | .0185           | 03413         | 00515              | BHF/WDDEC                               | 164346                        | 1.00000                  | 178523         | 6                   |  |
| 38ND071   |  |  | -5.25                | .0000           | 10010         | -,11403            | SHADEL                                  | 110003                        | ,76523                   | 1.00000        | 0                   |  |
| 11  | Diaponal element   | # of Cholesk                             | V PADELA             | 6               |               |                    |   |                               |                          |                |                     |  |
| 1355271   | .00560**   | ,00155                                   | 2.37                 | .0276           | .00064        | 20673              |   |                               |                          |                |                     |  |
| REVEDEC   | ,01019***  |  |                      |                 | .00583        | .01489             |   |                               |                          |                |                     |  |
| SHIDRI  |  |  |                      |                 | 100075        | .04391             |   |                               |                          |                |                     |  |
|   | Selow diegonal a   |  |                      |                 |               |                    |   |                               |                          |                |                     |  |
|   | 100879   |  |                      |                 | +100698       | 02884              |   |                               |                          |                |                     |  |
|   |  |  |                      | .5023           | 02764         | 04921              |   |                               |                          |                |                     |  |
| 1991T_LINAT   | .01070   |  |                      |                 |               |                    |   |                               |                          |                |                     |  |
|   |  |  |                      | .0005           | 102202        | 07055              |   |                               |                          |                |                     |  |
| 1997_LRA:<br>1988_LRA:<br>1988_RRY:                 |  | 105442                                   | 3,40                 |                 |               | .07025             |   |                               |                          |                |                     |  |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Five Iane SPF Class

### Roadway Segments

| Dependent<br>Log likel<br>Restricter<br>Chi squar<br>Signifina<br>Nofaden 1<br>Estimation<br>Inf.Cp.AD<br>Nodel est<br>Resple is<br>Resple is | efficients HegB<br>variable<br>dibod function<br>d Leg likelincod<br>es [ é d.f.]<br>Peedo R-squared<br>n based on N =<br>C = 2850.8 AI<br>immedi Jum 30,<br>g ds end 27<br>tinnenil regress | -1257.41<br>-1290.63<br>246.55<br>.00<br>.0956<br>2246.5 =<br>2016.2046<br>3016.2040<br>09 individu | EV1<br>402<br>997<br>180<br>000<br>16<br>16<br>471<br>245<br>418 |          |            |          |
|---|--|---|--|----------|------------|----------|
|   | Coefficient  | Brandant.   |  |          |            |          |
|   |  |   |  | 141>2+   | Int        | arval    |
|   | Noosanibim pasane  | and a second  |  | *******  | ********** |          |
| CONSTRACT   | .47946<br>-3.70270***<br>.00331**<br>-0.3923***<br>-6.94121***<br>-1.48828***<br>02362**   | 1.87858   | 2-30   | 001070   | -2760810   | 01647090 |
| HCVLINT (   | -3.70270***  | .04139  | -9.90  | .0000    | -5.35100   | -2.05360 |
| HCVNMSEL  | .00351**   | 00163   | 2.39   | 0168     | .00071     | ,00711   |
| ENTRECHC)   |  | ,00395  | -3.95  | .0001    | pseep      | -:01978  |
| VIVL121   | -8,94121++4  | 1,51474   | -5.76  | .0002    | =7,81809   | -2.38637 |
| BOFLDED   | -1,48818***  | .29544  | -8.74  | -0002    | -2.26888   | -,71814  |
| 0002  | 03362**  | .01013  | -2.30  | .0194    | 04044      | 00378    |
|   |  |   |  |          |            |          |
| LNAST   | 185584***  | ,09162  | 6.35   | .0000    | 198208     | 182022   |
| 3881931   | 35622***   | 101828  | -11,192  | .0000    |            | 10033    |
| LILLEN  | .84089***<br>15622***<br>.84143***   |   | 19:04  | .0000.   | 197284     | .95001   |
| - 13  | Dispiral element   | s of Choles   | ty matrix  |          |            |          |
|   | ,02563**   |   |  |          |            |          |
| SSMIDTI   | ·02312**   | 103333  | 2.02   | .0376    | ,00132     |          |
| THITH   | 105081***  | ,01898  | 2176   | 10057    | +82478     | .28634   |
|   | Balmy diagonal e<br>.03151*<br>09675*<br>.01280  | lamanza of :  | Tholesky.  | matrix   |            |          |
| SAME THE  | .03151+  | ,01,664   | 1.92   | .0553    | -,00071    | .06373   |
| 1110 106  | -,094754   | .05618  | +1.78  | .0501    | r.20088    | .01108   |
| 11107 8881  | 101100   | 184151  | -43  | .62.45   | ++24886    | 1.0代来乐乐  |
|   | Dispersion perso   | star for Har  | gin dist   | ribution |            |          |
| - 14  | 1.55567***   |   |  |          | .04330     |          |

Pote: mnnn.D-xx or D-xx => multiply by 10 to -xx or -xx. Note: \*\*\*, \*\*, \* => Significance at 14, 54, 104 level.

Implied covariance matrix of random parameters

| Covariat                 | estris wo                          |                       |           |          |
|--------------------------|------------------------------------|-----------------------|-----------|----------|
|                          | LINADT                             | SHADAL                | LATERA    |          |
| LNADT<br>SENDRJ<br>LNAEN | .91902-93<br>.90232-03<br>27135-02 | .15278-02<br>26908-02 | .11725-01 | 00000000 |

Implied standard devictions of random parameters

|          | S.D_Seta |
|----------|----------|
|          |          |
| .1228432 | 11       |
| .033052  | 21       |
| .10827   | 31       |

| ooz.Hat. | LHADT   | 0.69(087 | LHLRH   |
|----------|---------|----------|---------|
| LINADT   | 1.00000 | .20633   | 57500   |
| SHWDRT   | .00681  | 1,00000  | 65565   |
| SIL SIL  | +.87608 | -,63583  | 1.00000 |

Random Parameter Negative Binomial Model of Serious Injury Crashes on Five lane SPF Class Roadway Segments

| Dependent<br>Log likeli<br>Restricted<br>Thi square<br>Significan<br>Mofadden F<br>Estimation<br>Inf.C. AlC<br>Nodel esti<br>Sample 15   | hood function<br>  log isWellhood<br>  l d.f.]  | 51<br>-138,707<br>-148,909<br>12,545<br>.000<br>.04287<br>2245, E =<br>2/M = .1<br>2016, 16139<br>2016, 16139 | 92<br>40<br>76<br>97<br>80<br>97<br>8<br>32<br>22          |   |  |  |
|--|---|---|--|---|--|--|
| 5130)  | Coefficient   | Standard<br>Estor   |  | Prob.<br>(p)>Z*   |  | nfidence<br>soval                              |
|  |   |   |  |   |  |  |
| 11   | lobrandom parame  | ters  |  |   |  |  |
|  |   |   | 4.19   | .0000   | .54160   | 1,49203  |
|  | loheundos pacone  | +24246  | 2.12   | 10338   | .54140   | 1,49203  |
| Lingtant   | lohrmodom parame<br>1.01052***  | +29286  | 2.12   |   |  | .01246   |
| LINATE CONSTRUCT   | 00.rendom parane<br>1.01682***<br>.00443**  | +24246  | 2113   | .0333<br>.0145  | .00051   | .01244   |
| LINADT<br>LINADT<br>SHNDLT<br>SNNDRTUR   | 0.01002***<br>.01002***<br>.01003**<br>14501**  | 24246<br>00305<br>08526   | 2.13<br>-2.45<br>-1.65                                     | .0338<br>.0145<br>.0028   | .00051<br>-,26116                                | .01244   |
| Congtant)<br>LNRDT<br>8HNDLT<br>BHNDRTUR<br>BHNDLTCR   | 0.014024**<br>1.014024**<br>.00443**<br>14501**<br>20520  | .24246<br>.00305<br>.01626<br>.17348<br>.12881  | 2.13<br>-2.45<br>-1.65                                     | .0338<br>.0145<br>.0028   | .00051<br>-,26116<br>-,62363                     | .01244<br>02884<br>.05711                      |
| Congtant)<br>LNRDT<br>8HNDLT<br>BHNDRTUR<br>BHNDLTCR   | locraodom parane<br>1.01852***<br>.00443**<br>14501**<br>24528<br>.25960**                                  | .24246<br>.00305<br>.01626<br>.17348<br>.12881  | 2.15<br>-2.45<br>-1.65<br>2.02                             | .0338<br>.0145<br>.0028<br>.0495                                | .00051<br>26118<br>62369<br>.00772               | .01244<br>02884<br>.05712<br>.53147            |
| CONSTANT)<br>LINEDT<br>SHNDLT<br>SHNDRTCR<br>SHNDLTCR<br>SHNDLTCR<br>(S<br>LNLEN)  | 001100500 parameters<br>.00403**<br>-14601**<br>-20020<br>.20020<br>.20020<br>.00007***<br>toble parameters | 24246<br>.00305<br>.01926<br>.17365<br>.12881<br>permeters<br>.24033<br>Cor diete-                            | 2.13<br>-2.46<br>-1.45<br>2.02<br>3.96                     | .0338<br>.0149<br>.0028<br>.0499                                | .00051<br>26116<br>62363<br>.00773               | .01244<br>02884<br>.05712<br>.53147            |
| CONSTANT)<br>LINEDT<br>SHNDLT<br>SHNDRTCR<br>SHNDLTCR<br>SHNDLTCR<br>(S<br>LNLEN)  | 001100500 parameters<br>.00403**<br>-14601**<br>-20020<br>.20020<br>.20020<br>.00007***<br>toble parameters | .24246<br>.00305<br>.01926<br>.17365<br>.12881<br>parameters<br>.24033<br>Cor diote-                          | 2.13<br>-2.46<br>-1.45<br>2.02<br>3.96                     | .0333<br>.0144<br>.0029<br>.0494<br>.0494                       | .00051<br>26116<br>62363<br>.00773               | .01244<br>02884<br>.05712<br>.53147            |
| Constant)<br>LNRDT<br>SHROLT<br>SHROLT<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLTCR<br>SHROLT<br>SHROLTS<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHROLT<br>SHR | 001100500 parameters<br>.00403**<br>-14601**<br>-20020<br>.20020<br>.20020<br>.00007***<br>toble parameters | .24246<br>.00305<br>.04926<br>.17348<br>.12881<br>parameters<br>.24033<br>fos diete-<br>.04823                | 2.12<br>-2.45<br>-1.45<br>2.02<br>3.96<br>of rando<br>1.98 | .0333<br>.0145<br>.0028<br>.0495<br>.0001<br>m gataset<br>.0646 | .00051<br>-,26116<br>-,42363<br>.00772<br>.52483 | .01246<br>02888<br>.05712<br>.80147<br>1.94551 |

## Random Parameter Negative Binomial Model of Unknown Injury Crashes on Five lane SPF Class Roadway Segments

|   | efficients Pois;<br>variable   |   | 101                          |                          |                                    |                   |
|---|--|---|------------------------------|--------------------------|------------------------------------|-------------------|
| Loo likel   | thood function   | -53,550   | 93                           |                          |                                    |                   |
| Bestricts   | Variable<br>thood function<br>d log likelihood   | -2246.000   | 00                           |                          |                                    |                   |
| Chi Aquat   | ed [ ] 1.0.1.1   | 4334.378  | 14                           |                          |                                    |                   |
|   | nce level  |   | 00                           |                          |                                    |                   |
| Nofeddan.   | Ferrido S-squared  | .98266  | 31                           |                          |                                    |                   |
| Estimatio   | * It nu hered in   | 2248. R.#   |                              |                          |                                    |                   |
| Inf.Cr.Al   | ¢ = 175.7.410  | 0. = W10  | 19                           |                          |                                    |                   |
|   | the second second second second second second second second second second second second second second second s | 0018 S0-08-   | 51                           |                          |                                    |                   |
| 10041 890   | imated: Jun 12, 3  |   |                              |                          |                                    |                   |
| Sample is   | I pds and 112  |   |                              |                          |                                    |                   |
| Sample is   |  |   |                              |                          |                                    |                   |
| Sample is   | I pds and 112  | 73 individue  | 1.                           |                          |                                    | 1121100           |
| Sample is<br>BOIBBON 5  | 7 pds and 112<br>egression model   | 73 individua  | 1.                           | Peos.                    |                                    | nfidence          |
| Sample is<br>BOIBBON 5  | I pds and 112  | 73 individue  | 1.                           | Pcon.<br>(#)>2+          |                                    | nfidence<br>erval |
| Simple is<br>Bolssom s<br>Chrosomi  | 7 pds and 113<br>egression model<br>Confficient  | Itandard<br>Estor   | 1.                           |                          |                                    |                   |
| Sample is<br>BolBBOM s<br>CLOCSONN  | 7 pds and 112<br>egression model   | Itandard<br>Error   |                              | 12 >2+                   | Inc                                | favze             |
| Sample 18<br>BOISSON 2<br>CHOSONN   | I pds and 111<br>egression model<br>Coefficient<br>Nonrandom peramet   | Standard<br>Standard<br>Error<br>Sers                                     | 14<br>-1-43                  | +2<(2)                   | -3.84963                           | +rval<br>41001    |
| Sample is<br>BOISSON :<br>CHOSSONN<br>CHOSSONN<br>CONSTANT<br>SHOULT            | 7 pds and 111<br>egression model<br>Coefficient<br>Fotrandos geradet<br>-2.13864**                             | Standard<br>Standard<br>Stror<br>0025<br>.87747<br>.00028                 | 14<br>2<br>-1,43<br>-2,45    | +2<(2)                   | -3.84963                           | +rval<br>41001    |
| ChOSONN<br>CHOSONN<br>CHOSONN<br>CHOSONN<br>CHOSONN<br>CHOSONN                  | I pds and lij<br>egression model<br>Coefficient<br>Ponrados paramet<br>-1.13864**<br>14327**                   | Standard<br>Escor<br>   | 1x<br>x<br>-J.43<br>-2.45    | 18192+<br>.0182<br>.0192 | -3.84968<br>16755                  | 41003<br>03123    |
| Sample im<br>BOIDSON :<br>CHORSONN<br>CHORSONN<br>CHORSONN<br>CHORSONN<br>SHEER | I pds and lij<br>syression model<br>Coefficient<br>-2.12864**<br>-14327**<br>Deans for render                  | Standard<br>Standard<br>Estor<br>.87747<br>.00028<br>peremiters<br>.28976 | 14<br>-1.43<br>-2.45<br>2.65 | 12152*<br>.0152<br>.0152 | The<br>-3.84968<br>26785<br>-16664 | 41003<br>03123    |

### Random Parameter Negative Binomial Model of High Injury Crashes on Five lane SPF Class Roadway Segments

|   | efficients Hegh<br>variable<br>Dood function  |   | 82<br>81                         |                         |                             |                   |  | e matrix                                      |                                      |                |                            |
|---|---|---|----------------------------------|-------------------------|-----------------------------|-------------------|--|---|--------------------------------------|----------------|----------------------------|
| Restricter  | 5 log likelihood  | -814,385  | 66) - C                          |                         |                             |                   |  | 1958  | 8                                    | DIADT          | HOVINGEL                   |
| Significer<br>Mofesder J<br>Estimation<br>Inf.Gr.Alt<br>Model est:<br>Sample 14 | <pre>d [ 6 d.f.]<br/>nie lavel<br/>Pseudo R-squared<br/>0 Daaed on N =<br/>7 = 1491.6 Al<br/>matell Jun 12,<br/>3 pix and 11<br/>hinobial regress</pre> | .000<br>.13703<br>2246, K =<br>0/9 = .4<br>2016, 22:58)<br>23 individue | 00<br>68<br>53<br>91<br>04<br>1# |                         |                             |                   | LULES<br>LUNADT<br>HOVENBEL<br>Implied e | .3275E-0<br>1520E-0<br>.9633E-5<br>sendard de | 2<br>2 .128<br>9318<br>Vietions<br>1 | 48-02<br>48-03 | -4076X-54<br>Son parameter |
| H2282   | Coefficient   | Staniard<br>Ercor   | 14                               | Fridb.                  | 254 Co<br>201               | nfidence<br>srval | 11                                       | ,037  | 2244<br>3401                         |                |                            |
|   | Innandom parame   |   |                                  |                         |                             |                   |  | 10045   | 2287                                 |                |                            |
| SHOORT  | -7.83720***<br>07968***<br>00515***   | 1-37120   | -4,47                            | .0000                   | -10.82850<br>11450<br>00024 | 04472             | Inplaca o                                | orrelation                                    | matrix                               | of sands       | m parameters               |
|   | teans for random  |   |                                  |                         |                             |                   |  |   |                                      |                |                            |
| CHADO)  | .88830***<br>.94374++*<br>.0042744  | 112690  | 6.81                             | 20000                   | .71998                      | 1-11246<br>       | Cor.Nat.                                 | 1012162                                       | 130407                               | NOVYON DEL     | ð -                        |
|   | lispinal element  |   |                                  |                         |                             |                   |  | 1.00000                                       |                                      |                |                            |
| LICENT<br>LIGHTI<br>NCVICENT  | .08728<br>.02624**<br>.00219**<br>Malox diagonal #  | .08690<br>.01198<br>.00084  | 2.02<br>2.51<br>2.50             | .0394<br>.0205<br>.0200 | 06812<br>.00393<br>.00095   | .18781<br>06565   | LHEDT  <br>HCVHNSEL                      | 75544   | 1,00000                              | -,88714        | 6)                         |
| LESA LHL<br>LHCV_LHL<br>LHCV_LHL  | -,02657<br>.00635***<br>00129   | .02391<br>.00208<br>.00289  | +1.11<br>3.06<br>-1.02           | 2666<br>0022<br>9075    |                             | .010#2<br>.00174  |  |   |                                      |                |                            |
|   | 1.00039***  |   |                                  |                         |                             |                   |  |   |                                      |                |                            |
|   |   |   |                                  |                         |                             |                   |  |   |                                      |                |                            |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Five lane SPF Class

### Roadway Segments

| Dependent<br>Log likel:<br>Restricted<br>hi aguary<br>Lignificat<br>Dirodan 1<br>detimation<br>Letimation<br>Lot est<br>Sample 18 | <pre>efficients HegB<br/>variable<br/>inbod function<br/>H log intelincod<br/>ed [ 6 dif.]<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>intelevent<br/>in</pre> | -026.200<br>-026.200<br>404.210<br>404.211<br>.000<br>1.20080<br>2244, K =<br>2244, K =<br>2244, S =<br>2244, S =<br>2244, S = 2<br>2014, S = 2<br>201 | 30<br>14<br>00<br>91,<br>36<br>60<br>05 |          |          |          |
|---|--|---|---|----------|----------|----------|
|   |  | Standard  |   | Frab,    | 454 Co   | nflüence |
| 20211191  | Coefficient  | Seree   |   | (#)52*   |          | arval    |
|   |  |   | 10 10 10 10 10 10 10 10                 |          |          |          |
| in the second   | funrandos payane   | 1 41444   | 12222                                   | 1000 B   | -        |          |
| COLUMN DE LA COLUMN   | -0.04651***<br>-11.4440**<br>00035**   | 4 78400   | -21.24                                  | 01.00    |          | -1.0493  |
| ALCONTACION OF  | 0000844  | - T- 1956 -   | 1.24                                    | 10200    | 00145    | 00000    |
| and the second  |  | CONTRACT OF STREET  | -2.22                                   | 0.0.00   |          |          |
| 1020029-1   | 022229**<br>-2.22005<br>.00018***  | 101900  | 4100                                    | 0.000    |          | P-100355 |
| ALCONTRACTOR ACID.  | -8-22005   | 1.070.72  |   | 0.0074   | 11.76230 | 10220    |
| In Conner   | leans for rendom   | 110010-04   |   | . or and |          |          |
|   | .25161***  |   |   | dana.    |          | 1.00407  |
| LHADT   |  | 4 8 4 8 1   | 3.34                                    | 2000     |          | -94294   |
|   | ~.16205***   |   |   |          |          |          |
|   | Diagonal element   |   |   |          | -150008  | 1111204  |
|   | .24374***  |   |   |          | +0.000   | . 39328  |
| LIMANTI   |  | -97120  | 2.44                                    | .0000    | .00228   |          |
|   | -02787**   | -91277  | 4,13                                    | 10262    |          |          |
|   | Helow diagonal +   |   |   |          | .00174   | 205100   |
|   | Mach Habbillas 4   | LANDAULTS OF L  | DOTABLE.                                | 1001030  |          |          |
| Line Litt   | 05561+   |   | -4,00                                   | 10112    | 11605    | .00400   |
| DOM LNL   | 01015<br>.04722**  |   | 7/32                                    | 17832    | -,07085  |          |
|   | *04782**   | -9x360  | 31.88                                   | 10414    | -00097   | -08982   |
| Dow Trime I   | dispersion perso   | where for Heg   | pin dist                                | ribu610h | .40121   | 44300    |
| 0.000   | .+0960+++  |   |   |          |          |          |

Implied covariance matrix of random parameters

| Coverien                          | oe sisiris                        | 1981100000             | 22000 1 Hzri 1 001 002020 000 0 | 1921100000 |
|-----------------------------------|-----------------------------------|------------------------|---------------------------------|------------|
|                                   | 197283                            | LEADT                  | SHNDLT                          |            |
| LNLES<br>LNLES<br>LNLDT<br>SSNDLT | -99412-01<br>13452-01<br>24742-02 | .58352-02<br>.10512-02 | .30622-02                       |            |

implied standard deviations of raydom parameters

| 1.00.004 | tere: |      |
|----------|-------|------|
|          |       | <br> |

| D_Bete | 1        |
|--------|----------|
|        |          |
| - 11   | 1242136  |
| - 23   | .0819278 |
| 1.00   | 10965325 |

Deplies correlation metrim of random parameters

| Cox.Net. : | LIULEN  | 130,02  | 310052  |
|------------|---------|---------|---------|
| LNLEN      | 1.00000 | 09785   |         |
| LNADT      | 85795   | 2.00000 | ,83851  |
| SMOLT      | 15282   | ,33552  | 1,00000 |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Five lane SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Sastrictes<br>Chi aquasy<br>Significan<br>Kofadden I<br>Setimptics<br>Inf.Cr.Al<br>Nodel est:<br>Sample is<br>Nacorite  | afficients Negl<br>variable<br>hood function<br>d log likelihoo<br>d [ 6 d.f.]<br>fecto 8-equared<br>is based on 18 =<br>1 = 5076.7.8,<br>imated: Jun 13,<br>7 pds and 11<br>innumial request | 103<br>-3510.354<br>1-6666.354<br>1294.427<br>.000<br>2249. H =<br>1270 = 7.2<br>2010.15135<br>225 individua<br>100 model | 68<br>00<br>R5<br>20<br>60<br>15<br>18 |                 |               |                    | Depite<br>Covaci<br>LHURN<br>LHEAT<br>STRUCK<br>STRUCK<br>STRUCK   |
|--|---|---|--|-----------------|---------------|--------------------|--|
| roini  | Coefficient   | Standard<br>Error   |  | FEG8-<br>18152* | 964 CC<br>205 | ofidence<br>arrai  |  |
|  | A 10 - 10 - 20 - 10 - 10 - 10 - 10 - 10   |   |  |                 |               |                    |  |
| Deterant   | antennen perse  | atabi   | 10.00                                  | 0000            | -4.11111      |                    |  |
| RCUMPET 1  | - BUCKAA  | 0.04707   | -1.99                                  | 0480            | -0.44247      | -2,00000<br>.10067 |  |
|  |   |   |  |                 |               |                    |  |
| and the second   | - 01114**   | 07484   | 2                                      | 01.41           | - 02035       | 00224              | Translation of the last of the |
| 10000  | -1 0.2554++   | 61008   | St 22                                  | 0142            | -3 34033      | 2.2.2.2.1          | Implie   |
| CONTRACT.  | 01114**<br>-1.24594**<br>06747***<br>06752***<br>00011***   | 01000   |  | 00004           | - 108-19      |                    |  |
| ALCONG TO ALL  | 0.0170.00   | 06074   | 3.32                                   | 07.24           | . 00070       | 0.0232             |  |
| AND 11 1 1 1 1 1 1   | 07007000  | 0.000000  |  | ana.            | 1.1.1.1.1.1.1 |                    | ******   |
| And a real of the local of the   | A2.575.5444   | 811 PD 04   | 5 87                                   | 0004            | 0.0000        | 00000              | Cox.Na   |
| VEVPTGRET  |   | .00076  |  | 10001           | .00005        |                    |  |
|  | laang Top pandin  |   |  |                 |               | Contract Call Co   | 1.911  |
| 2.02.001   | 01.878.444  | .04474  | 20.72                                  | 00000           | 0.83004       | 12.005481          | 1.82   |
| T HER DIT 1  | .91675***<br>.02018***<br>.01627*   | 07908   | 10.95                                  | 0000            | 44480         | .97558             | 30947  |
| and all the second seco | 0.1.6   | 00000   | 1.40                                   | 05.20           | - 00087       |                    |  |
|  | Disconsi elebect  | · · · · · · · · · · · · · · · · · · ·   | (A) 100 F. M. C. M.                    |                 |               |                    |  |
| 5305,8381  | .02103***<br>.02103***  | -04438  | 6.45                                   | .00000          | 120112        | 37601              |  |
| CHADT!   | 02103+++  | 00472   | 4.63                                   | 0000            | .01259        | 03105              |  |
| 51900081   | .02296***   | 00543   | 2,50                                   | .0068           | 100632        | 03960              |  |
|  |   |   |  |                 |               |                    |  |
| LTHE AND   | 05016***<br>05608<br>.02828**   | .01755  | -0.02                                  | .0000           | 09290         | 00380              |  |
| LINE MAL   | 00608   | .01877  |  | .4590           | -,03897       | .02091             |  |
| LOON LOL   | .02825**  | .01088  | 2.54                                   | .0109           | .00454        | 04882              |  |
|  | CLEDEFALON DAIM   | WIAI ICE DAG  | NAL 1141                               | 170017500       |               |                    |  |
|  |   | A 4 10 10 10  | 10.0.00                                | 00.00           | 100000        | 19428              |  |
| ToslParni  | .70148***   | -04734  |  |                 |               |                    |  |

Implied suveriance matrix of condom personners

noe sectia LHLEM SHENDER LINDT .89098-01 -.16752-01 .98598-02 -.27512-02 .92722-03 .12588-02

standard deviations of random parameters

| Bet |   | £  |   |  |      |   |   |   |   |    |   |   |   |   | 1 |
|-----|---|----|---|--|------|---|---|---|---|----|---|---|---|---|---|
|     | - | 2  | • |  | <br> | + |   | , |   | ., |   |   | ÷ | ÷ | Ģ |
|     | 1 | 2  |   |  |      |   |   | 1 | 2 | i  | 5 | ż | ż | 2 | ĥ |
|     | 2 | i. |   |  |      |   | i | ģ | ę | ģ  | ź |   | ŝ | 3 | ł |
|     | 1 |    |   |  |      |   |   |   | 3 | 1  | Ĺ | 4 | 1 | 1 | 5 |

correlation matrix of random parameters

| Coy.Hat. | THEFT   | LIGADT  | SEMPCR  |
|----------|---------|---------|---------|
| LNLEN)   | 1,00000 |         | +117157 |
| LEADTI   | -,95619 | 1.00000 | 142241  |
| SINDCR)  | 17187   | 242245  | 1,00000 |

### Random Parameter Negative Binomial Model of Total Crashes on Six lane SPF Class Roadway Segments

| segmen   | 115                                     |                               |                           |                 |               |                                |  |  |
|--|---|-------------------------------|---------------------------|-----------------|---------------|--------------------------------|--|--|
|  | fficiente Negl                          |                               |                           |                 |               |                                | Covariance matrix  |  |
| Dependent<br>Log likels  | hood function                           | -6022.475                     |                           |                 |               |                                | LEADT SHMENT SHMELTCR  |  |
| Chit equate<br>Significar<br>HirFadden B   | ( log likelihoo:<br>d [                 | 899.19696<br>000.<br>16269, 1 | 868<br>100<br>111         |                 |               |                                | LBADT 2200E-01<br>THENDET -1167E-01 .7704E-03<br>SHULLTS .6024E-05 .1042E-03 .3096E-03 |  |
|  | based on 0 =<br>= 12097.0 al            |                               |                           |                 |               |                                | Implied standard deviations of random parameters                                       |  |
| Sample 14  | pated: Jun 15.<br>2 pds and - 2'        | téé individue                 |                           |                 |               |                                | A.S_Betai à  |  |
|  | incelal regree:                         |                               |                           |                 |               |                                | 11 .0489228  |  |
| TUTALACC   | Coefficient                             | Biandazi<br>Error             |                           | 810b.<br>(#)>Z* | 164 CC<br>Int | nfidence                       | 2  |  |
|  | corrandom param                         |                               |                           |                 |               |                                |  |  |
| Constant:<br>LHLEN   | -3.31823***<br>.91388***<br>-2.82927*** | 42547<br>(02003<br>-20492     | -11.29<br>45.65<br>-10.22 |                 | .47460        | -4.19916<br>.45307<br>-2.37083 | Implied correlation matrix of random parameters  |  |
|  | -83538D-04***                           | -19880-04                     | 6.26                      | 10000           |               | -114650-00                     |  |  |
| MOVILS   | -2.50170+++                             | .47905                        | -5.28                     | .0000           | -3,47238      |                                | Cor.Net.) 18407 SENDET SENDLICE  |  |
| VCEARMAN .   | .09202***                               | 101968                        | 4.48                      |                 | 105304        | .19097                         | POCIMEDI TURN SOUDEI SOUTEN  |  |
| 1220003511   | -20334***                               | 100074                        | 6.03                      | -9000           | ,00130        | 200479                         | 1MAD7  [.0000001811 .48517   |  |
| RHYNDDECT  |   | .00888                        | -6.03                     |                 | 一、公共会听之       | 010488                         |  |  |
| WCVL161  | 1,26527***                              | .10121                        | 2.73                      | .0045           | .55557        | 2.17816                        | 且相相如果T1 + 91871 1,00000 +,64871  |  |
| VCVL111  | 3.19912**                               | 11112040                      | 2137                      | 1017e           | 0.258772      | #125049                        | BHHDLICR( .4517764875 1.07000  |  |
| DEG1:  | +.01007+++                              | 100011                        | +2.65                     |                 | +_0172E       | +.00255                        |  |  |
| 3  | leans for random                        | aretenaters :                 |                           |                 |               |                                |  |  |
| 235ADT   | .94283***                               | .04003                        |                           |                 |               | 2102059                        |  |  |
| SHMDRT   | 12665***                                | .00402                        | -31.00                    |                 | 13826         | -,11465                        |  |  |
| ANNOLICR:  |   | 100784                        | -2.91                     |                 | 04014         |                                |  |  |
|  | istonal alement                         |                               |                           |                 |               |                                |  |  |
| LIGOT;   | -04592***                               | -00420                        |                           | _0000           | 1493768       | 2.599.64%                      |  |  |
| SHWDRT   | .01015+*                                | .00487                        |                           | 0320            | +00143        | .02070                         |  |  |
|  | .01306***                               | -00470                        |                           |                 | +00384        | .02326                         |  |  |
|  | elow disponal s                         |                               |                           |                 |               |                                |  |  |
| THE PARTY INTE P |   | 100704                        |                           |                 | 04821         | 01143                          |  |  |
| 732M THE   | .02411**                                | 00365                         |                           | -0142           | 100484        | -01333                         |  |  |
| TRHN_THRI  | -,94910***                              |                               | +5.79                     |                 |               | 03247                          |  |  |
|  | ispersion paras                         |                               |                           |                 |               |                                |  |  |
| ScalParm)  | .70456+++                               | .02883                        |                           |                 | 164332        | .76237                         |  |  |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Six lane SPF Class Roadway Segments

| Random Cov                           | efficience llegt  | Inded Model                         |                 |         |                     |                     | Implied o        | CUBELADOR  | natris :  | f Intde | E DAIMNETAIN  |
|--------------------------------------|---|-------------------------------------|-----------------|---------|---------------------|---------------------|------------------|------------|-----------|---------|---------------|
| Log linet:                           | Variable  | 1. 一定会会下,我让你                        | 270             |         |                     |                     | Cotablenc        |            |           |         |               |
| Thi square                           | i log likelihods<br>bó (    f. U.I.)  | 14264-821                           | 118             |         |                     |                     |                  | 2.104      | DT S      | TRENSE  | HC/HOKBEL     |
| iofedden 1<br>Sylingtio<br>Suf.Cr.AD | ore lavel<br>Presdo R-squared<br>based on N =<br>1 = 9195.1 AU<br>Unated, Zun 16, | 8 ,40293<br>2412, E +<br>12/E = 1.4 | 30<br>20<br>126 |         |                     |                     | 110ADT<br>SHNDRT |            | 03 .194   | \$0-33  | 41448-14      |
|                                      | I pus and I'  |                                     | 1.0             |         |                     |                     | Implied #        | tenderd d  | evistion: | of two  | dom parameter |
|                                      | ******  | Scandard                            |                 | Frob.   | 353 Cc              | mfidence            | B.D_Beta)        | 8          | ÷.        |         |               |
| \$D0(                                | Coefficient   | Error                               | +               | 12105+  | Int                 | aival .             | 11               | .08<br>.04 | 22910     |         |               |
| tonscant                             | ionrandom parama<br>-5.87502***   | ATBLS.                              | -12.46          | .0000   | -8.81014            |                     | 31               | -007       | 05124     |         |               |
| LHLEH)<br>HCVLSHI                    | -8,87102***<br>_89579***<br>-2,2644£***   | .02259                              | 40.07           | -0000   | .05230<br>-2.84499  | -1.60101            |                  |            |           |         |               |
| SUBSCR.                              | .62206D-04***<br>01085***   | +12400-04<br>.00901                 | 3.57            | .0008   | .26001D-04<br>01072 | .92541D-04<br>00209 | implied o        | OIDS18110  | C BRITLS  | of rand | on parameters |
| YCV521                               | -1-14085***   | +85283                              | -8.04           | -0524   | -7.85648            | -140524             |                  |            |           |         |               |
| VCFARIOL                             | .08111***   | -02004                              | 4.07            | -0505   | -04223              | .12078<br>02979     | Cor.Net.         |            |           |         |               |
| DE010                                | 01085***<br>-5.10085***<br>.08111***<br>08856***<br>00086**                       | 100498                              | -7.18<br>-2.28  | .0200   | +1001#1             | =,00011             | 0.001/045-1      |            |           |         |               |
|                                      | -,00011++   |                                     |                 | .0429   | 00182               | 00002               | LNADTI           | 1.20500    |           |         |               |
|                                      | Mans for candle   |                                     | -8103           | 10.14.0 |                     | -110008             | HEVIDESEL        |            |           |         |               |
| TRADT                                | .96975+++   | .04462                              | 22.18           | _0000   |                     | 1.07720             |                  |            |           |         | 5             |
| STRINT)                              | 12100444  |                                     |                 |         | 18449               | ++10010             |                  |            |           |         |               |
| RCVNOLBEL                            | .00269***   |                                     |                 |         | ,00154              | .00423              |                  |            |           |         |               |
|                                      | lisponal element  |                                     |                 |         |                     |                     |                  |            |           |         |               |
|                                      | .05325***   |                                     |                 |         | 109297              | 106309              |                  |            |           |         |               |
| INCRT:                               |   | ,00470                              |                 |         | 102487              |                     |                  |            |           |         |               |
| SCIOUSEL                             | 100055+   |                                     |                 | .0016   | ,00000,             | 0.1100:             |                  |            |           |         |               |
| 1                                    | Below diagonal e  | alamants of 0                       | Tiplesky        | MATTIN  |                     | an and              |                  |            |           |         |               |
| THEFT THE                            | 00426<br>00535***<br>.00672***  | .00729                              | 1.1.1.58        | . 5596  | 一、侍法部臣寺             | .01003              |                  |            |           |         |               |
| INCV LHRI                            | 00535***  | .00071                              | -1-34           | -0000   | -,00874             | 00396               |                  |            |           |         |               |
| SHEATSHND                            | 1008155444  | .00060                              | 11.28           | *0000   | ,00412              | .00672              |                  |            |           |         |               |
| ScalParm                             | Lapersion parm  | ortes fus Sec                       |                 |         |                     | 189620              |                  |            |           |         |               |
| a construction of the second         | (   |                                     |                 |         |                     |                     |                  |            |           |         |               |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Six lane SPF Class

### Roadway Segments

| Dependent<br>Log likel<br>Nettricter<br>Chi squar<br>Signifina<br>Nofedden<br>Nofedden<br>Inf.Cr.A2<br>Nodel eet<br>Nodel eet | efficients Hegi<br>variable<br>thood function<br>d Log Hikelinog<br>ed [ 4 d.7.]<br>nos lavel<br>peodo R-squares<br>t babed of R =<br>C = 1203.5 &<br>imbods Jun 06,<br>3 pds and 37<br>tinned regress | 9<br>-10892.04<br>1 -15746.71<br>4727.60<br>-500<br>6415, 8<br>107/8 =<br>107/8 =<br>3026, 14101<br>00 instrume | 303<br>097<br>000<br>149<br>18<br>18<br>134 |        |           |            |
|---|--|---|---|--------|-----------|------------|
|   |  | Standard  |   | Prob-  |           | nfidence   |
| \$192)  | Coefficient  | Error   |   | 12/324 | Int       | sival      |
| 23  | timrandom param  | ecare.  |   | ****** |           | ********** |
| Constant  | -8,49880***  | 100041  | (+221)34                                    | .0000  | +81440041 | -7,88517   |
| LHLEN:  |  | .01946  |   | .0080  | .72191    | ,78424     |
| HINT ONT  |  | .46887  |   |        | -8.16231  |            |
|   | DOD47+++   | .24912-04   |   |        | 00064     |            |
| CVEX SEL  | ,00297###  |   | 8.00  |        | .00202    |            |
| SWIDCR  |  |   | -3.25                                       | .0052  | -,02488   |            |
| 13  | leans for random   |   |   |        |           |            |
|   | 5.008574++   |   | 26,00                                       | 10000  | 132668-   | 1100100    |
| CVFT098   | 100282***  | .00056  | 4.46  | .0000  | ,00151    | .00372     |
| 5890171   | *,20657***   | 100823  | -20.05                                      | .1000  | -,11513   | 00482      |
| 10121   | liaginal element   |   | C/ Hatris                                   |        |           |            |
| LHADT   | .00966***  | .0035#  | 11.05                                       | .0000. | 201248    | .04670     |
| CVPTGRE   | .00154***  | .00041  | 2.79  | :0002  | :00078    | .00234     |
| SHULL   | ***000101  | 100308  | 3.25  | 10012  | ,00356    | 101608     |
|   | Helov disgonal +   | elements of (   | Dunkeeky.                                   | BATILE |           |            |
|   | -+00009  |   | -1.81                                       |        | -:00197   | .0003.8    |
| SHU LNA   | ,01117+  | .00584  | 1.31  | 10560  | 00028     | .02262     |
| SHR VCV   | ++01418***   | 100423  | -2.33                                       | 10009  | -,02249   | -,00882    |
|   | lispersim pares  |   |   |        |           |            |
|   | 100507+++  | 101007  | 28.45                                       | 18000  | 28119     | 188094     |
| Ven1Ferm)   |  |   |   |        |           |            |

1 .0396603 .00178112 .0206183 1121

Implied covariance matrix of random parameters

LNADT .1573E-02 VIVETIES -35222-04 .5172E-03 SENDIT .412EE-03 -.5127E-05 .5108E-03 Implied standard deviations of random parameters

VEVELONE

SHUDLI

Covariance matrix

0.0\_Seta

LIFADT

Inglied operation matrix of random parameters

| Coy.Het.) |       | VEVETORB | SHUDLT  |
|-----------|-------|----------|---------|
| LHADT     |       | 43241    | .54150  |
| VCVPT0R91 | 49861 | 1.00000  | -,56826 |
| HHRDLT (  |       |          | 1,00000 |

### Random Parameter Negative Binomial Model of Evident Injury Crashes on Six lane SPF Class Roadway Segments

|   |   |                                     | ********                | ******          | **********  | *************                | Implied o                | GY8214108                    | natria o       | C (#100H | personters  |
|---|---|-------------------------------------|-------------------------|-----------------|-------------|------------------------------|--------------------------|------------------------------|----------------|----------|-------------|
| Sependent                                       | efficietts Hep<br>variable<br>ihood function<br>d log likelihood  | mang joodal                         | 272                     |                 |             |                              | Coverseno                | e satrix                     |                |          |             |
| Seattlicte<br>Chi sgoar                         | d log likelihood<br>ed ( = 0.5.)                                  | -1257.41<br>-1300.43<br>244.05      | 097                     |                 |             |                              |                          | LIFAI                        | й з            | TRUET    | LULES       |
| Significe<br>HoPadden<br>Estimatic<br>Inf.Cr.Al | dom level<br>Facudo K-algumred<br>n based on N =<br>C = 1550.0 Al | .00<br>.1944<br>6415, M =<br>10/W = | 000<br>716<br>18<br>471 |                 |             |                              | LHADT<br>SINDRT<br>LHLEN | .81968-<br>.9025E-<br>2713E- | 0<br>03        | 78-02    | .11728-01   |
| Sample is                                       | imated: Jun 30,<br>2 pds and 27<br>bindmial regress               | ohivibmi 901                        | #1#                     |                 |             |                              |                          |                              | Vistions       | of rank  | m paramets  |
|   | Dinomial regress  |                                     | 112011113               |                 | +           |                              | 5.0_Bets                 |                              | 1.1            |          |             |
|   | CoeffLoient   |                                     | 1                       | Frab.<br>(8)>d* | Int         | nfidence<br>crws)            | 11                       | 1025                         | 18321<br>10822 |          |             |
|   | Sonrandon parate  | tere .                              |                         |                 |             |                              | 3                        | -14                          | 6375           |          |             |
| Constant  | -5.54205***   | .74788                              | -T.91<br>-8.40          |                 |             | -8.37709                     |                          |                              |                |          |             |
|   | .00391++  |                                     |                         |                 | .00071      | .00711                       | Inglied o                | ostejetto                    | 841118         | of ranks | i pereveter |
| 9095131   |   | 3.31474                             | -3.76                   | .0002           |             | -2.36437                     |                          |                              |                |          |             |
|   | .997210-04+   |                                     |                         |                 | -,174100-08 |                              | 0.000                    |                              |                |          |             |
| MUPLOED:  | -1,488239***  | .39546                              | -3.76                   | 10003           | -2,24888    | 71814                        | Cor.Nat.                 | LEADT                        | DIMENT.        | LUCIU    |             |
| 20221   |   | .01012                              |                         | 0196            | -,26288     | -,00379                      |                          |                              |                |          |             |
|   | Heans for random  |                                     |                         |                 |             |                              |                          | 1,00000                      |                |          |             |
| LNADT   |   |                                     |                         | .0000           | 100208      |                              |                          | .80481                       |                |          |             |
| SITVORT   |   | .01321                              |                         | .0005           | 18212       |                              |                          | 07509                        |                |          |             |
| 1202101   |   |                                     |                         | .0000           | 177284      | + REOLL                      |                          |                              |                |          |             |
|   | Disgonal element  |                                     |                         |                 | 2222        | 1000                         |                          |                              |                |          |             |
| LNADT   |   |                                     | 2.13                    |                 |             |                              |                          |                              |                |          |             |
| SHVDAT  |   | .01112                              | 2,08                    |                 | .00132      | 109691                       |                          |                              |                |          |             |
| - LULER   |   |                                     | 2.76                    | .0057           | 200675      | 100654                       |                          |                              |                |          |             |
|   | Seice disponal e  |                                     |                         |                 |             | a construction of the second |                          |                              |                |          |             |
| LINE LNA  | -03151+   |                                     | 1.01                    |                 | -,00071     |                              |                          |                              |                |          |             |
|   |   |                                     | -1.75                   |                 | 10000       |                              |                          |                              |                |          |             |
|   |   | 103155                              |                         | .0595           | -/04585     | 107456                       |                          |                              |                |          |             |
| itat. Sevi                                      |   |                                     |                         |                 |             |                              |                          |                              |                |          |             |
| itst_sev  | Disperation param<br>1.88907***                                   | ster for He<br>.16488               |                         | rtburis         | . 64838     | A 107414                     |                          |                              |                |          |             |

Random Parameter Negative Binomial Model of Serious Injury Crashes on Six lane SPF Class Roadway Segments

| hi squar<br>lignifice<br>liFadden<br>lifice.Al<br>lidel ert<br>legal ert<br>legal v | s log likelihood<br>ed ( 1 d.f.)<br>noe level<br>Paeudo R-squared<br>n based on N =<br>C = 7%1/1 A2<br>(mated: 3/n 14,<br>I pds and IT<br>binomial regress | 1.667<br>.196<br>.00223<br>5415, E =<br>C/E + .1<br>2016, 191404<br>05 individua<br>101 madel | 63<br>60<br>44<br>37<br>64<br>15 |                    |               |                   |
|---|--|---|----------------------------------|--------------------|---------------|-------------------|
|   | Coefficient  | Standard<br>Error   |                                  | Pricts.<br>(11)>1* | 95% Co<br>201 | nfldence<br>ezval |
|   | loncandon perene   |   | 1000                             |                    |               |                   |
| unstant!  | -2.03925***  | .01485  | -2,61                            | -0085              | -,26565       | 01010             |
| 1311831   | .77846***  | .10048  | T.75                             | 10000              | .57951        | .97343            |
| SHMIDTI   | +.10165***<br>10065***<br>.02746*  | .05352  | 28127                            | .0000              | +,21122       | +,07827           |
| NAMBING!  | 10065***   | +0.947.8  | -8+07                            | 10051              | 一一行其何有限等      |                   |
| DEDGI   | 102740*  | .01836  | 1199                             | 10341              | 0014B         | 200762            |
|   | Deans for rendum   |   |                                  |                    |               |                   |
|   | -47600**   |   |                                  |                    |               | -35142            |
| LHADTY  | Scale parameters   |   |                                  |                    |               | 1000              |
| LHADTI  |  | 101 B03047.0  |                                  |                    |               | -04675            |
| LHADT   | .02625**   |   |                                  |                    |               |                   |
| LIADT   | .02625**<br>Dispersion perso<br>-2.55551*  |   |                                  |                    |               |                   |

Random Parameter Negative Binomial Model of Unknown Injury Crashes on Six lane SPF Class Roadway Segments

| Restribte<br>Chi squar<br>Significe<br>NoFedden<br>Estimation<br>Inf.Cr.AJ<br>Nodel est<br>Sample is | variable<br>thood function<br>i log likelihood<br>ed [ 1 5.5.]<br>too level<br>feetato R-squared<br>togaed on N =<br>7 = 50.2 AD<br>tmated: Jun 17,<br>2 pds and 17<br>(indexa) regrees | -261.691<br>3.134<br>.025<br>.00980<br>5418, X =<br>0/N = .0<br>2016, 15111<br>00 individue   | 48<br>35<br>44<br>10<br>10<br>22                            |  |  |  |
|--|---|---|---|--|--|--|
| +  |   | Standard  |   | Frob.  | 954 Co   | nfidence                                       |
| UNDORD)  | Coefficient   | Excur   | conditions  | 12:52*   | Int  | erval  |
|  | Colstille Derent  | 1414  |   |  |  |  |
|  | Colstille Derent  | 1414  |   |  |  |  |
| Constant  <br>LUADT  | Ronienikim perene<br>-4.21247<br>.51027**   | 1423<br>3.76751<br>.24035   | -1,40   | .0879<br>.0237   | -9.63591   | 1.21097  |
| Constant  <br>LUADT  | Ronienikim perene<br>-4.21247<br>.51027**   | 1423<br>3.76751<br>.24035   | -1,40   | .0879<br>.0237   | -9.63591   | 1.21097  |
| Constant  <br>LUADT  | Ronienikim perene<br>-4.21247<br>.51027**   | 1423<br>3.76751<br>.24035   | -1,40   | .0879<br>.0237   | -9.63591   | 1.21097  |
| Contertaint (<br>LUGADT)<br>LNCEM<br>SHWDRT  | Contatilia persit<br>+4.21247<br>.51027+*<br>1.01072***<br>11045***<br>Gens for radius  | 1419<br>3.7671)<br>.24035<br>.11513<br>.09181<br>parameters                                   | -1,80<br>2,12<br>8,73<br>-3,87                              | .0879<br>.0337<br>.0000<br>.0002                               | -0.68591<br>-03823<br>-79525<br>-,17724                    | 1.21097<br>.88155<br>1.22418<br>08879          |
| Contertaint (<br>LUGADT)<br>LNCEM<br>SHWDRT  | Sociation parame<br>-4.21347<br>.51027**<br>1.01072***<br>11649***  | 1419<br>3.7671)<br>.24035<br>.11513<br>.09181<br>parameters                                   | -1,80<br>2,12<br>8,73<br>-3,87                              | .0879<br>.0337<br>.0000<br>.0002                               | -0.68591<br>-03823<br>-79525<br>-,17724                    | 1.21097<br>.88155<br>1.22418<br>08879          |
| Constant<br>LUADT<br>LUADT<br>SHMDRT<br>SHMDRT   | Collective persons<br>-4.21247<br>.51027**<br>1.01072***<br>-11045***<br>Gene for radius  | 1413<br>J.76711<br>.24035<br>.11503<br>.03181<br>parameters<br>.02531                         | -1.60<br>2.12<br>8.73<br>-3.87<br>-2.45                     | .0879<br>.0337<br>.0000<br>.0002<br>.0142                      | -8.63591<br>.03923<br>.78929<br>17724<br>11171             | 1.21097<br>.88155<br>1.22418<br>08879          |
| Contertant (<br>LUADT)<br>LUADT)<br>SHRUBT<br>(<br>RRYNDENC)   | Solialdim parame<br>-4.21347<br>.51027+*<br>1.01072***<br>11045***<br>deans for random<br>08210**<br>Soale parameters   | 0423<br>3.16711<br>.24035<br>.11503<br>.03161<br>parameters<br>.03531<br>for dists.           | -1.80<br>2.12<br>8.73<br>-3.87<br>-2.45<br>of reside        | .0878<br>.0337<br>.0000<br>.0002<br>.0142                      | -0.63591<br>.03923<br>.78525<br>17724<br>11171             | 1.21097<br>.38131<br>1.23419<br>05879<br>01248 |
| Cunetant<br>LUSADT<br>LUSADT<br>SHIVERT<br>RHYMDINC  | Socianiim parame<br>-4.21247<br>.51027**<br>1.01072***<br>11040***<br>Gents for readum<br>08210**   | ters<br>J.76711<br>.54035<br>.11505<br>.03181<br>parameters<br>.03531<br>For Sister<br>.00542 | -1.40<br>3.12<br>8.73<br>-3.47<br>-2.45<br>of rando<br>2.52 | .0879<br>.0337<br>.0000<br>.0022<br>.0142<br>m perame<br>.0142 | -8.63591<br>.03923<br>.78525<br>+.17724<br>11171<br>.01171 | 1.21097<br>.38131<br>1.23419<br>05879<br>01248 |

### Random Parameter Negative Binomial Model of High Injury Crashes on Six lane SPF Class Roadway Segments

|           |          | - 01 |             |           |
|-----------|----------|------|-------------|-----------|
|           |          |      |             |           |
| Darities. | CARPELAN |      | Tenthe Law. | The state |

| estricted<br>hi square<br>ignificer<br>ofådden f | variable<br>hood function<br>i log likelihood<br>uf [ & d.f.]<br>pe level<br>"reudi 8-squaped<br>i based on 3 = | -1919-803<br>545.442<br>,000<br>1. ,14238 | 94<br>94<br>36 |            |                                 |          |
|--|---|---|----------------|------------|---------------------------------|----------|
| hf.Cr.ADD  | = 3320.2 33   | 12/31 =                                   | 6,13           |            |                                 |          |
|  | mated: Jun 19,  |   |                |            |                                 |          |
|  | 2 pde mid 27<br>inimial represe   |   | 10             |            |                                 |          |
|  |   | Standard                                  |                |            |                                 | ofidence |
|  | Confidence  |   |                | Frich_     |                                 | erval.   |
|  | Coefficient   |   |                | 14174      |                                 |          |
| 10   | -5.75413***   | CHUR .                                    |                |            |                                 |          |
| Constant -                                       | -5.75413***   | .77844                                    | -8-70          | .0000      | -8.91180                        | -5.23643 |
| HCVLINI (  | -1:03352***   | .29031                                    | -2.45          | .0081      | -1,79990                        | 10003    |
| #HMDHT:  | 08727***  | 121214                                    | -711#          | -2010      |                                 | 06544    |
| VCVLLE   | -2.81788***<br>8.08877***<br>02888***<br>3.83928***   | .77924                                    | -2.92          | .0005      | -1,79090<br>-,11110<br>+4,04517 | -2,29052 |
| VCVILLEI   | 3.05877***  | .87085                                    | 3.95           | -0054      | 5+88240                         | 4,76453  |
| 101100100  | 02059+++  | .00748                                    | 一道,道文          | 10001      | 04365                           | 01410    |
| VCVL12   | 3,83428***  | 1.43320                                   | 2.70           | .0070      | 1.04479                         | 6,62172  |
| 1.13   | teans for familie<br>.81445***<br>04425***  | parameters.                               |                |            |                                 |          |
| THTEN  | 282445***   | .01882                                    | 33.47          | .0050      | .74404                          |          |
| NUMBRICE   | +.08423+**  | .01525                                    | -2.90          |            | →.07612                         | 01424    |
| LMADT  | 101773+++   | 107524                                    | 10.45          | .0000      | ,66638                          | .971.05  |
| 1.11   | liagonal elament  | a of Cholese                              | ty matrix      | R113172-14 |                                 |          |
| LHLEN  | .04350<br>.04720***<br>.00043**   | 103012                                    | 1.98           | .0678      | -101351                         | 114174   |
| HHIDRICK   | 104720***   | 101404                                    | 2189           | ,0059      | 201814                          |          |
| LHADT  | .00043**  | 100428                                    | 2.22           |            | .00110                          | 201714   |
| 12   | eire disgonal e   | lements of 0                              | holesky        | MATCIN.    |                                 |          |
|  | 0929899   | 102077                                    | 2.94           | -0108      | 105228                          | :22364   |
| SHW_LOL  | 00608   | .01940                                    | 1.48           | -4499      | 09299                           | .02011   |
| SHP_LOL<br>LOL_LOL                               |   |   | - 1 · 4 ·      | .0957      | ~.02655                         |          |
| LNR_LNL<br>LNR_LNL<br>LNR_SHN                    | 01130*  | .00677                                    |                |            |                                 |          |
| 13<br>1389 1311<br>1381 1381<br>1383 1388        | 01130*<br>hispersion paras<br>1.08613***  | withi for Dep                             | din diet       | 212105105  |                                 |          |

Implied covariance matrix of random parameters

| CDT81'LBDO        | e motrix    |           |                 |  |
|-------------------|-------------|-----------|-----------------|--|
|                   |             |           | *************** |  |
|                   | 111123      | SHIDRICR. | LUADT           |  |
|                   | *********** |           | *******         |  |
| LNLEN<br>SHUDRTIR | .4001E-02   | 100025-03 |                 |  |

|                                   | 1111111111111 | +338.46-02 | 100358-05 |           |
|-----------------------------------|---------------|------------|-----------|-----------|
| LHADT 1994E-03 2044E-03 .2021E-03 | LIMPL         | 0004E-03   | 00445-03  | .29215-03 |

Implies standard deviations of ratios parameters

| J.D Sets) |          |
|-----------|----------|
|           |          |
| 2)        | .0630041 |
| 2         | 10703349 |
| 3.1       | .0158094 |

| Cor State | INTER   | SEMDERCE | LSIADT  |
|-----------|---------|----------|---------|
| 1.011.011 | 1.00000 | .74623   |         |
| SHWERTER  | .74653  | 1.00000  | +.75508 |
| LIMADT    | +.35211 | -,75708  | 1.00000 |

### Random Parameter Negative Binomial Model of Just Injury Crashes on Six lane SPF Class Roadway Segments

05% Confidence Interval

-8,10487 92879 -2,49493 -,17719 -,04289 -,00289 -,00082 ,30721 .00022 ,08006

.00744 -.02058 1.32555

.00662 .06786 .01786

.02568 -.01430 .04208

1.01949

+10.00254 .76002 -2.42200 -.2444E -.07418 -.00257 -4.00257 -4.00101 .00002 .72438

.00162 -.05422 .05526 .00247 .00342 .00182

-,01809 -,05160 -,01760

. 19624

910b. 12152\*

4

| Random Confficience Heging   | eg Model     |
|------------------------------|--------------|
|                              | 3051187      |
| Log likelshood function      |              |
| Sestricted log likelihood    | ~2106.14106  |
| Chi squared [ 6 d.f.]        | 016.45386    |
| Significance level           | .00000       |
| NoFedden Freudo R-squated    | .2220431     |
| Estimation based on H = 5    |              |
| Inf.Cr.310 - 3457.6 &20/1    | 415. + 1     |
| Model estimated: Jun 20, 20  | 14, 20105114 |
| Sample is 2 phs and 2709     | andsvibials. |
| Segetive binumial regression |              |
|                              |              |

Coefficient

(Sonzalidos párase

JUSTINI)

Standard Extor

1.01755 .04101 .74975 .01769 .00797

Note: minim.D-ax of D-ax we multiply by 10 to -ax of -ax. Note: \*\*\*, \*\*, \* web Significance at 10, 50, 100 layel.

Implied opvariance matrix of random parameters

Covariance matrix

|           | HONDOSEL                          | SHNDCR   | LEADT    |  |
|-----------|-----------------------------------|----------|----------|--|
|           | designed in party in the property |          |          |  |
| HOVMOREL. | .2064E-04                         |          |          |  |
| ANNOCA    | .1734E-04                         | 33522-01 |          |  |
| 1912/07   |                                   | 1987E-02 | 10107-01 |  |

+.1497E-03 .1397E-03 .3070E-03 Implies standard deviations of random parameters

| 1.1   | 3211 |     |    |   |   |   |   |   |   |   |
|-------|------|-----|----|---|---|---|---|---|---|---|
| 3.2.3 | eca. | 110 | 2  |   | 2 |   | 2 | 1 | 1 | 1 |
|       | 11   | 113 |    |   | 1 |   |   |   |   |   |
|       | 21   |     | ١, | Ċ | 0 | Ċ | 1 | 1 | 3 | 1 |
|       | 81   |     | 5  | 0 | 4 | s | 4 | Q | 5 | 1 |

Emplied vorrelation matrix of random parameters

| Cor.Net.  | 13530776 | SHADCE  | LINADT  |
|-----------|----------|---------|---------|
|           | ******** |         |         |
| ACTIONAL) | 1.00000  | .07468  |         |
| 201005    | 107468   | 1.00000 | .59910  |
| LINADT    | 12422    | . 50005 | 1.00900 |

| Random Parameter Negative | Binomial Model of Low Injury Crashes on Six lane SPF Cla | ass |
|---------------------------|--|-----|
|                           |  |     |

### Roadway Segments

| Dependent<br>Log ilkeli<br>Restricter<br>Significer<br>Nofeoden I<br>Estimation<br>Inf.Cr.AJ<br>Nodel esti<br>Sample Lo | efficients Hegi<br>variable<br>incod function<br>5 log lixelihoos<br>td [ 6 d.f.]<br>cre level<br>frendo R-square<br>1 based or N =<br>1 based or N =<br>2 = 10865.4 Al<br>imated: Jun J0,<br>3 pose and 2<br>kinckial regress | 10<br>-6014.02<br>2 -10160.07<br>10602.51<br>.007<br>2 .0404<br>5413. W =<br>10/W = 1.1<br>2016.00.43<br>W09 individu | 1972<br>174<br>175<br>175<br>175<br>175<br>175<br>175<br>175<br>175<br>175<br>175 |                               |                                |                   |
|---|--|---|---|-------------------------------|--------------------------------|-------------------|
| LOINT   | Coefficient  | Standard<br>Error   |   | Frob.                         |                                | nfidence<br>erval |
| 15  | Ronzandom parame   |   |   |                               |                                |                   |
| Constanti   | -2.55524***  | 04005   | -2.99   | .0026                         | -4:20412                       | 87236             |
| LSADII  | _37376***  | -04500  | 22.35   | .0000                         | .10019                         | 1.04134           |
| HOULINE (   | -2.46262+++  |   |   |                               | -2.03626                       | -1.80095          |
| SHIDCR)   | 00919**  | 100392  | +2:34   | .02.02                        | -,01655<br>-,05405<br>-3,43177 | 00180             |
| INWEETSIC   | 04431+++   | 100496  | -0.90   | .0000                         | -,05400                        | 03459             |
| VCV513  | -2.20541+++  | .62473  | -3.52   | .0004                         | -3143177                       | 97534             |
| MOVERAILY .   | 00919**<br>04431***<br>-2.2034***<br>-1.00387***<br>79658***<br>.04129***<br>004129***   | -1813D-04   | 8.70  | .0003                         | 1111430-14                     | .102630-08        |
| VCV2.181  | -1.00387***  | -34575  | -2.95   | -0557                         | -1,88148<br>-1,24058           | -,32626           |
| MOFLDEC)  | 79653***   | 一边装饰中形  | -3.52   | -0004                         | -1,24058                       | -,35240           |
| VCDANSA1  | .04129***  | -01502  | 2:75  | 03060                         | .01165                         | 107075            |
| 6   | teshs for randos   | parameters.   |   |                               |                                |                   |
| ILIBERSONDS   | .00714***  | .00070  | .3.04   | 10024                         | :00076                         | .00352            |
| ANVORT  | 15165***   | .00697  | -21.76  | .0000                         | 16533                          |                   |
| LINE #181   | 15165***<br>.92129***  | 102246  | 43.69   | .0000                         |                                | 1,02531           |
|   | Districts 1 + Deletric   | a of Christen   | N: 001233   |                               |                                |                   |
| (CONCRET.)  | _00206+++  | .00053  | 4.05  | 10001                         | .00104                         | 100306            |
| 2000021   | .01925+**  | 00564   | 2.24  | .0052                         | .00729                         | ,02980            |
| - COTERS  | .01710***  | 100648  | 2.64  | .0593                         | .00440                         | ,02980            |
| - 18  | below diapowal e   | lemetre of (  | Cholesgy  | 640118                        |                                |                   |
| 17738_1012L   | 01722***   | 100666  | -2.55   | 10097                         | -,00028                        | P.00416           |
|   | .06856+**  | -01721  | 3.87  | .0001                         | 100284                         | 120029            |
| 1002_0071   | .14275***  | -01365  | 10.44   | .0000                         | .11597                         | 116960            |
| LNT. SHWI   |  |   | Marine Laboration   | the part of the second second | 1.1.1.0                        |                   |
|   | Dispersion parks   | metes for Se  | 12110 GT 91   |                               | .70438                         | . \$4401          |

implied covariance matrix of random parameters

| COVALLAND        | THE DESIGNATION       |           |            |  |
|------------------|-----------------------|-----------|------------|--|
|                  | HOWIGHT               | STNDAT    | 1311.011   |  |
| SCONCEL<br>SHEET | .42308-06<br>2542E-04 | .62962-01 |            |  |
| THURH            | .13692-03             | -14598-02 | 10-1111-01 |  |
|                  |                       |           |            |  |

Implied standard deviations of random parameters

|   | а. | <br> |   |     |    |     |    |    |
|---|----|------|---|-----|----|-----|----|----|
| - |    |      | 2 | 7   | Ξ  | Ζ   |    |    |
| - | 2  |      |   | z   |    | 2   | 87 | ۴. |
|   | κ. |      |   | is. | e. | 'n. | 44 | -  |

teplast correlation matrix of random parameters

| Cdr.Mas. 1 | SCVIDISEL. | SHVORT   | LNLED   |
|------------|------------|----------|---------|
| ********   |            | ******** |         |
| NOVAGET.   | 1,00000    | -,61427  | 142003  |
| DRIVERT    | 68617      | 1.05000  | .36691  |
| LHLEN      | .42025     | .06628   | 1.00000 |
|            |            |          |         |

### Random Parameter Negative Binomial Model of Total Crashes on Seven lane SPF Class Roadway Segments

| Dependent<br>Ing likeli<br>Amstrinted<br>Chi square<br>Highificen I<br>Erimation<br>Infection I<br>Nobel exti<br>Ample in<br>Hepative t | fficients Negl<br>veriable<br>incod function<br>i log livelihood<br>d [ 6 d.f.]<br>Studt F-squares<br>based on I =<br>1 = 2721.8 Å<br>mated Jun 18,<br>2 pos and 1<br>incodi repres | TOTALS<br>-1215.004<br>8 -1485.409<br>8 1554.024<br>.000<br>8 .78244<br>1160.8 =<br>10/8 = 2.5<br>2014.11146.<br>840 individua<br>sim Wedel | 00<br>00<br>00<br>20<br>20<br>20<br>10<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20 |                 |                    |                   | Covariance matrix<br><u>IMADT 19908-00</u><br>UMADT .25908-00<br>IMADT .5908-00<br>IMADT .5908-00<br>IMADT .25908-00<br>IMADT .22008-00<br>PCVPTCNA .10055-05 .22008-04<br>IMADT .200820 Bevietions of random parameters |
|---|---|---|--|-----------------|--------------------|-------------------|--|
| TOTALACC  | Doefficient   | Standard<br>Error   | I  | Prob.<br>(#152* | 954 Co<br>Int      | nfidence<br>erval | <u>3.0_Beze</u> ) 1<br>2.1 .0259046  |
|   | lunzandon pasare  | eters   | ******   |                 |                    |                   | 1/ .0150066<br>2/ .0406208<br>8/ .00150505   |
| Constant(<br>LULES)   | -8.13504***<br>.91344***<br>-1.01417**  | .75475  | -5.15  | .0000           | -7,61722           | -4.65264          | 23 .00150505   |
| ADDRESS, L. J.  | -348.704+4  | 123.4455  |  | .0100           | -649.300<br>.05200 | +88,008           | Implied correlation matrix of rabdum parameters  |
| IMAGLICS)   | 05407***  | .01525  | -5.50  | 10187           | 54494              | 00408             |  |
| ENGINE CONTRACT   | 05407***<br>02451**<br>.00805<br>.04666***  | .00423  | 1.00   | .0524           | 00332              | .03310            | DEC.Nami.) LHADT SHMERT MCVFTCVA<br>LHADT: 1.010005690415400   |
| 207784  | -,00018***  | +33910-04   | 二、二角と奇ない   | +0000           | -+00022            | 00009             | LELET: 1.000000000415630   |
| VCVL/   | .06920++  | .02711  | 2,55   | 10101           | .01607             | .12234            | SHNDRT1 5500# 1.00000 57432  |
| 12  | leans for random  | - DAINTALACE  |  |                 |                    |                   | SCVFTCVR: -,13638 -,87432 1,00000  |
| SHADTI  | .04567**<br>.00442***   | .05014  | 37-38  | +9999           | ,76299             | .96961            |  |
| SHUDRE)   | -,04567**   | -22627  | -2,80  | 10124           | -,16148            | -,0098E           |  |
| SCOTCOM!  | :00#42***   | .000353   | 4478   | .0000           | .80240             | .00824            |  |
| 11  | laconal element   | ta of Cholese   | N. 1007123   |                 |                    |                   |  |
| LHADTI  | .01591*<br>.02274***<br>.00128**  | -00565  | 14484  | 10644           | +.00187            | -0#83#            |  |
| 1920BL  | .52274***   | -00524  | 5.61   | +0000           | .02530             | .04419            |  |
| SCALCOVI  | -00128**  | .90081  | 2.42   | .0388           | -10055             | -90222            |  |
| 12  | Selew disgonal e  | elements of C   | Notesty  | matris.         |                    |                   |  |
| 1000,100,   |   | -01584  | -2102  | +2437           |                    | 0.0061            |  |
| LHCV LML  | 02307**<br>+.00021<br>00025*  | -00071  | 1.18   | + 11110         |                    | -00112            |  |
| THCA THE  | 000085*   | 18000.  | -4.97  | .0154           | 00184              | -00012            |  |
|   | Lugerdion parmi<br>I.53851***   |   |  |                 |                    |                   |  |
|   |   |   |  |                 | 1.20212            |                   |  |

### Random Parameter Negative Binomial Model of Property Damage Only Crashes on Seven lane SPF Class Roadway Segments

| Log likelihood function -1131,00857<br>Fearriteta Log Likelihood -3425,11795<br>Chi Fquarto 1 3 d.f. 1 4384,37376<br>Significance Level .00000<br>NeFadden Fawide F-equared .4477140<br>Estimation based on N = 1160, E = 15<br>Inf.CriATC = 2133,9 A2C/9 = 1.577<br>Noofi estimates Jun 28, 2014, 12/03/05<br>Seeple is 2 pds and 50 Logivalais<br>Seeple is 2 pds and 50 Logivalais |  |  |  |   |   | - 10945598        |   |  |  |  |  |
|---|--|--|--|---|---|-------------------|---|--|--|--|--|
| 1001  |  | Standard<br>Error  | x :  | Brisb:<br>(8)>0*  | 354 Cc<br>115   | nfidence<br>EFV61 | 2) .0133272   |  |  |  |  |
| I<br>Dunationit<br>HVVL2NI<br>SHEDDY<br>SHEDDY<br>HEDDY<br>HEDDY<br>DEDI<br>DEDI<br>TOP<br>VVVL<br>VVVL<br>VVVL<br>UNADY<br>SHLEDI<br>LINADY<br>SHLEDI<br>SHLEDI  | Hinrandon parama<br>-0.19057***<br>-0.20094***<br>01951<br>04112***<br>.00251*** | 1823<br>.32674<br>.7733<br>.01082<br>.00744<br>.00075<br>.01095<br>.12450-04<br>.53100<br>.00013<br>.00013<br>.00013<br>.04500<br>.04555<br>a of Choless<br>.02949 | -11.78<br>-4.28<br>-5.53<br>5.12<br>-5.65<br>-2.65<br>-1.94<br>90.48<br>15.22<br>V MATCH<br>5.22<br>V MATCH<br>5.22<br>V MATCH | .3000<br>.0000<br>.0476<br>.0000<br>.0818<br>.0003<br>.0003<br>.0079<br>.0519<br>.0000<br>.0000 | -7,22297<br>-4,20270<br>-0.0823<br>-0.0825<br>-0.08056<br>-0.00066<br>-2,81302<br>-00048<br>.79545<br>.79545<br>.00997<br>00844 | -8.15517          | Implied correlation matrix of random parameters<br>Corr.Mat.( INTER IDADT<br>INTER: 2.00000 .42724<br>INADT: .41114 1.00000 |  |  |  |  |
| and the second  | Lapersin peren<br>1.80076***   | star for Hag   |  | .0000   | 1,32556   | 2.22232           |   |  |  |  |  |

### Random Parameter Negative Binomial Model of Possible Injury Crashes on Seven lane SPF Class Roadway Segments

| Mandom Coefficiants HegEnReg Nodel<br>Dependent weinkole PTH7<br>Log LAWeilhood function -624.14566<br>Restricted Ing LaWeilhood -1124.5853<br>Chi separed j 3 d.f.; 1000.76584<br>Significione level .00000<br>McFadden Peeds A-egisted .4449713<br>Tatismision based on H = 1140, E = 15<br>Inf.Cr.ATC = 1175.5 AIC/W = 1.100<br>Model estimated .41, 2, 2014. 2.112/BB<br>Sample is 2 pds end .500 individuals<br>Megative Minemial regression model<br>Toth Confidence |                  |           |        |        |               |                   | Deplet coverience matrix of rendem parameters<br>Coverience matrix<br>INTER VEVETORS<br>INTER VEVETORS<br>INTER .1874E-01<br>VEVETORS .874E-02<br>VEVETORS .874E-02<br>Implied standard devietions of random parameters<br>3-0_Bets( 1 1 |  |  |  |  |  |
|--|------------------|-----------|--------|--------|---------------|-------------------|--|--|--|--|--|--|
| P2107  | Coefficiess      | Econo.    |        | Froh.  | oth Co<br>Int | ndidence<br>esval | 11 .16933<br>21 .50450450  |  |  |  |  |  |
|  | Honrandom parame |           | 199    |        |               | 192236277         | Implied correlation matrix of random parameters  |  |  |  |  |  |
| Constant   | =11.9189***      |           | +11.39 | .,0000 | 413.9629      | -3.8676           |  |  |  |  |  |  |
| 10401  | 1,18753+++       | ,00781    | 14.66  | .0000  | 1.11522       | 1,43993           |  |  |  |  |  |  |
| HCV11R2  | 一张,应该将20月4年年     | 1/107722  | 12.75  | +0000  | -2,30740      |                   | Commence of a generative statement of a  |  |  |  |  |  |
| IMMDCR   |                  | .01044    | -4.23  | .000E  |               |                   | Cox.Sist.1 INLES VOVFISES  |  |  |  |  |  |
| VCERBICK   |                  | +05801    | 1.95   | ,0824  | 00D#8         | +22675            | 2  |  |  |  |  |  |
| SC//CRASI  | ·00025***        | 15402D-04 | 8.97   | 10000  | 190017        | .00039            | LULEN; 1.00000 .31925  |  |  |  |  |  |
| - AGAP   | -,00086**        | -00022    | -2,05  | .0409  | 00090         | -100005           | VCVPTURE: .81998 1,00000   |  |  |  |  |  |
| TOVFIGRA.  | 09059**          | .0.971.0  |        | .0304  | -,19326       | 00155             |  |  |  |  |  |  |
| SCUMMERL)  | .00581***        | .00122    | 2.25   | .0012  | .00334        | .00948            |  |  |  |  |  |  |
|  | Neach for sendor |           | -      |        | 1.000         | 10.0000000        |  |  |  |  |  |  |
| TNT&31   | .82827***        | -04389    |        | .0005  | .90346        | 2124444           |  |  |  |  |  |  |
| YC+723R5   | .00136**         | 103714    |        | 1.0288 | ,00857        | 128410            |  |  |  |  |  |  |
|  | Disponel element |           |        |        |               | Same              |  |  |  |  |  |  |
| LHLES  |                  | .02341    |        |        | .11743        | .20939            |  |  |  |  |  |  |
| CALCULATERS  | .00177*          | .00091    |        | .0526  | -:00002       | 100585            |  |  |  |  |  |  |
|  | Below diagonal + |           |        |        | .00342        | dates             |  |  |  |  |  |  |
| IVCV LHL   |                  | .00088    |        | ,0000  |               | .00581            |  |  |  |  |  |  |
|  | Dispersion peres | .80389    |        | .000€  | 1718871       | 9.33002           |  |  |  |  |  |  |
| ScelPerni  | 2,76131+++       |           |        |        |               |                   |  |  |  |  |  |  |

# Random Parameter Negative Binomial Model of Evident Injury Crashes on Seven lane SPF Class Roadway Segments

| Randow Coefficients HegBRARD Stodel<br>Degendant Waitable Evi<br>Log Likelihood function -400.08714<br>Restricted log Likelihood -517.73837<br>Chi aquated ( 3 s.f.] 120.78481<br>dignificance Level |  |                   |          |                     |                    |                    | Sepled covariance matrix of vendim parameters         Covariance matrix         LHLEN       SSMDCR         LHCEN       .7797e-02         SHNDCR       .4404E-02       .3833E-03         Smpled standard deviations of rendom parameters       S.O.Bets)       .3 |  |  |  |  |  |
|--|--|-------------------|----------|---------------------|--------------------|--------------------|--|--|--|--|--|--|
| IVI  |  | Standard<br>Error |          | Exclusion ( ) > C * | 95% Ch<br>305      | nfidence<br>esval  | 21 .062942<br>21 .0619219  |  |  |  |  |  |
|  | Sonrandon parane                         |                   |          | -<br>               | 01.57.54           | 22.12.14           | Implied correlation matrix of random parameters  |  |  |  |  |  |
| Constant  <br>LSADT  | -8.19523***<br>.96706***                 |                   |          |                     | -2.75083<br>.51706 | -3.20400<br>.01707 | isplied correlation matrix of random parameters  |  |  |  |  |  |
| NCVLIME  |  | 1.02420           | -2.08    |                     | -0.50732           | 13274              |  |  |  |  |  |  |
| ROVORM1  | .00021**                                 |                   |          | ,02.57              | _05503             | .0005#             |  |  |  |  |  |  |
| BWYNDDECT  | .01508                                   | .01130            | 1,90     | 11053               | 00724              | .02740             | CossiNet.   LALEN SHMDCR   |  |  |  |  |  |
| VEVPTORAL  | +.00375                                  | .03234            | -2.00    | ,0095               | 00865              | .00085             |  |  |  |  |  |  |
| 11   | Seans for rendor                         | parameters        |          |                     |                    |                    | LALLEN 1.0200004298  |  |  |  |  |  |
| LILEN  |  | .08959            | 6.54     | .0000               | .71829             | 1.08530            | SHADCBI84298 1.00000   |  |  |  |  |  |
| SINDCB1  |  | .02212            | -2.94    | .0034               | -120775            | 02101              |  |  |  |  |  |  |
| 110  | Disgonal element                         | ts of Chulask     | y matrix |                     |                    |                    |  |  |  |  |  |  |
| 1.012.011  | ,0552 (***                               | .02112            | 2.58     | ,0064               | .01715             | .14024             |  |  |  |  |  |  |
| - 5HWDCR.)   | +03355**                                 | 01533             |          | 10304               | .00318             | 106368             |  |  |  |  |  |  |
|  | Below diagonal a                         |                   |          |                     |                    |                    |  |  |  |  |  |  |
|  |  | .01331            | -3,95    |                     |                    | 02830              |  |  |  |  |  |  |
| 1222 1222  | 05218***                                 |                   |          |                     |                    |                    |  |  |  |  |  |  |
| LEASE CALL   | 05218***<br>Dispersion paras<br>1.02299* | atteb for Neg     |          |                     |                    | *.11060            |  |  |  |  |  |  |

Random Parameter Negative Binomial Model of High Injury Crashes on Seven lane SPF Class Roadway Segments

Random Coefficients MedRinkeg Model Tepicostil Variania Milik Tepicostil Variania Milik Remained Statistics Milik Remained Statistics Milik Remained Statistics Milik Milik Milikania Milikani Milikania

#### Random Parameter Negative Binomial Model of Just Injury Crashes on Seven lane SPF Class Roadway Segments

| Dependent<br>Log likel:<br>Restricter<br>Chi square<br>Significau<br>NoFedden<br>Estimation<br>Juf.Cr.AJ<br>Nodel est:<br>Sample is | efficients Neg<br>Variable<br>Lood function<br>i log likelihood<br>di [ 3 d.f.]<br>needd: 3-square<br>i based on N =<br>[ - 743.8 A<br>mateel: Jun JS,<br>2 gde and<br>intennil regress | 2017)<br>-357,449<br>1-455,255<br>191,656<br>(000<br>1-21197)<br>1160, K =<br>107N = .6<br>2016, 147021<br>H0 Instructure | 20<br>92<br>00<br>91<br>13<br>42<br>04 |                 |          |           |
|---|---|---|--|-----------------|----------|-----------|
| JUNTINA   | Coeffloient   | Stendard<br>Rxtor   |  | Frob.<br>(2)>2* |          | fidence - |
|   | Foncendor berete  |   |  |                 |          |           |
|   | -11.1783***   |   | +7.72                                  | .0000           | -14,1412 | -1.4184   |
| toten:  |   | 108715  | 11.00                                  |                 | .66098   |           |
| SMOCK:  | -,06110***<br>.00023***<br>-,00058**  | .01486  | -1.12                                  |                 | -,08031  |           |
| BOUCEAN   | .05023***   | -61972-04   | 3.19                                   | .0007           | _00010   |           |
| VEVA  | +100058++   | .00024  | -2.28                                  | .0225           | 00103    |           |
| INVESTIGATION OF  | 1121 5.4+++   | 00100   |  |                 |          | 01180     |
| VCPARMA (   | .82912***   | 0.04434   |  |                 | .18965   |           |
| VEVENS  | -10.4034**  | 4,11010   | -2.52                                  |                 | -18.1070 | -2.2024   |
| SENDET  | -100100   | 101607  | -Z.55                                  | .0107           | +.07252  | 00924     |
|   | teans for randos  |   |  |                 |          |           |
|   |   |   |  |                 | .96282   | 1.45727   |
| WOULDN'T 1  | 5.21004***  | 2.32416   | -2.65                                  | .0082           | -8.10188 | 01858     |
|   | linginal element  | ts of thinlask  | ry matrix                              |                 |          |           |
| LISADT  |   | .00431  |  |                 | .02372   | ,04547    |
|   |   |   |  |                 | -11000   | 1.248800  |
| 80711911  |   | Teslerits of t  |  |                 |          |           |
|   |   |   |  |                 | -01977   | 17994     |
|   | 07754++   | .03148  | -2.46                                  |                 |          |           |
| men mer   |   | tetar for Neg   | din dist                               | tibutim.        |          | -11004    |

Note: mnnn.D-we or D-we => multiply by 10 to -we or \*ee. Note: \*\*\*, \*\*, \* ==> Significance at 14, 14, 104 level.

# Coverlance matrix IMAGE NUMILIE INAGE 13008-02 NUMION 13008-02 SCULINE 13008-02 Implied standard deviations of familie parameters Stylets/ 1 11 0340088 2) 1.05467 Implied correlation matrix of random parameters

8 8

implied covariance matrix of random parameters

|    |       | -  | -1  | Ī | ï | 1 | ī | i | 1 | ī | ą | 7 | 1 | 2 | ç | ī | ī | 4 | i | p |
|----|-------|----|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -  |       | ÷  |     | 4 | - | - | - | ÷ | - | ÷ | - |   | - | ÷ | 4 | 2 | 4 | ÷ | - |   |
|    | 234   | đ  | Ť1  |   | ż | ŝ | ċ | ó | Ó | à | ò |   |   |   |   | 5 | ė | 6 | t | d |
| 귀는 | 571.3 | Эł | żł. |   | ÷ | 1 | 3 | 4 | ŝ | ż | ŝ |   |   |   | 2 | ó | 0 | ø | b |   |

### Random Parameter Negative Binomial Model of Low Injury Crashes on Seven lane SPF Class Roadway Segments

| Dependent<br>Log likel<br>Restricte<br>Chi squar<br>dignifice<br>MoFadden<br>Estimatio<br>Inf.C:,AI<br>Npdel est<br>dample is | efficience Hegi<br>Variable<br>Lhood function<br>d log inkelihood<br>wd [ 3 d.f.]<br>net level<br>Pasuda K-square<br>D seed on N =<br>C = 2005.5 Ål<br>Hartes Jun 26.<br>Lipotal Jegreen | 10<br>-1211.64<br>: -4457.75<br>: 6052.29<br>.00<br>: .7201<br>1160, 2 =<br>10/9 = 2.<br>2014.19:15<br>000 10012/du | 145<br>(11<br>000<br>14<br>14<br>15<br>(50 |                 |          |                   |
|---|--|---|--|-----------------|----------|-------------------|
| LODAL   | Cuefficient  | Standard<br>Story   | 1  | Freb.<br>191>Z* |          | ofidence<br>écval |
|   | Sonrandon parame   | ters  |  |                 |          | ********          |
| Constant!   | -5.05555***  | -94719  | -10.39                                     | .0000           | -8.15702 | -8.61207          |
| LSADT   |  | -04797  | 自然之情是                                      | .0000           | .70248   | 194234            |
| HOVLING   |  | .75395  | -8.72                                      | .0000           | +8,02888 | -2,07826          |
| SHUDCK  | 04917+**<br>.00015***  | .00725  | -6.82                                      | .0000           | 06990    | -,09504           |
| <b>BOVCRAIN</b>   | .00013***  | .00721<br>4381D-04  | 3.05                                       | .0023           | .000005  | .00022            |
| VCVL  | +.00078+++   |   | -3.92                                      | .0000           | -;00109  | -,00055           |
| VCFLRMA   | -10555++   | 104114  | 2.52                                       | .0114           | 102.828  | 1584#1            |
| 7075111   | -12.0547++   | 9.98027   | -2.15                                      | .0316           | -2418788 | -1.12036          |
| DEGLI   | 04325***   | .01075  | +4.03                                      | .0001           | -,06625  | 02221             |
| 1/01/19/1A  | .05138**   | 100068  | 2.16                                       | .0310           | .00018   | 100263            |
| 1000  | Heats for candle   | parameters.   |  |                 |          |                   |
| LINCENT   | .91865***  | 01201   | 21.76                                      | .0000           | .53220   | .99706            |
| ACCIMINENT.   | .00791+**  | 100156  | 6.24                                       | .0000           | 200450   | .01048            |
| 1   | Disgonal element   | a of Choles   | ty matrix                                  | rs.             |          |                   |
| 105234  | .05590***  | .01654  | 3.26                                       | 10011           | 02145    | 108632            |
| 807003811   | .00207444  | .00081  | 5.84                                       | .0009           | ,00296   | 100318            |
|   | Below disponal 4   |   |  |                 |          |                   |
|   | 00126*   |   |  |                 | -;00268  | .00011            |
| 18CV LHL  |  |   |  |                 |          |                   |
| 18CV LHL  | Dispersion pains   |   |  |                 | 1.15438  | 1.98551           |

Implied ouverlance matrix of sandom parameters

Covariance mateix LHLEH NCVIKSEL

LHERN .29058-02 BCTMCERE -.60018-04 .18622-05

Deglied standard deviations of random parameters

S.D\_Bets) 1 .0156992 .00242115

|                            |         | 4      | .011   | 1092   |           |            |  |
|----------------------------|---------|--------|--------|--------|-----------|------------|--|
| Confidence<br>Interval     |         |        | .0024  | 1115   |           |            |  |
| 702 -4.61207<br>248 .94936 | Implied | corre. | lation | Dettis | of random | parameters |  |

Cor.Mat.: LHLEN HUNNESEL INLEN 1.00000 -.52145 SUNNESEL -.81145 1.0000d

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