STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

TECHNICAL REPORT DOCUMENTATION PAGE

TR0003 (REV 10/98)

Lock Data on Form

1. REPORT NUMBER
CA16-2446

2. GOVERNMENT ASSOCIATION NUMBER

3. RECIPIENT'S CATALOG NUMBER

4. TITLE AND SUBTITLE
Methods for Identifying High Collision Concentrations for Identifying Potential Safety Improvements: Development of Advanced Type 2 Safety Performance Functions

5. REPORT DATE
June 30, 2016

6. PERFORMING ORGANIZATION CODE

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8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

Institute of Transportation Studies
109 McLaughlin Hall
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10. WORK UNIT NUMBER

11. CONTRACT OR GRANT NUMBER
65A0508

12. SPONSORING AGENCY AND ADDRESS

California Department of Transportation
Division of Research and Innovation, MS-83
1227 O Street
Sacramento CA 95814

13. TYPE OF REPORT AND PERIOD COVERED
Final Report

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This research developed advanced type 2 safety performance functions (SPF) for roadway segments, intersections and ramps on the entire Caltrans network. The advanced type 2 SPFs included geometrics, traffic volume and hierarchical random effects, while including random parameters for the geometric and traffic volume effects. Hierarchical random effects for roadway segments included route class, district and county effects. Random parameters for highway geometrics typically included design speed, median width, and shoulder width effects. In the case of intersections, advanced type 2 SPFs included traffic control, ADT and roadway geometrics, with channelization, two-way flow, and lighting variables as random parameters, and SPF class, mainline, functional class, intersection type, lighting, left turn channelization, mainline flow hierarchies as random effects. For ramps, type 2 SPFs included variables related to metering, HOV lane presence and ramp configuration, with county, and route class and district as hierarchical random effects. Model selection was conducted on the basis of information criteria such as AIC and BIC, and a comparative assessment of the suitability of basic type 2 SPF versus advanced type 2 SPFs was completed. The assessment indicated that basic type 2 SPFs were preferred in general for rural road segments, while advanced type 2 SPFs were preferred for urban segments.

17. KEY WORDS

safety performance function, random parameters, hierarchical random effects, model selection, roadway segments, intersections, ramps

18. DISTRIBUTION STATEMENT

19. SECURITY CLASSIFICATION *(of this report)*	20. NUMBER OF PAGES	21. COST OF REPORT CHARGED
Unclassified	84	N/A

DISCLAIMER STATEMENT

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Introduction

This research report documents the findings from the development of advanced type 2 safety performance functions (SPF) for the California highway network. A prior study developed type 1 and basic type 2 SPFs (Shankar and Madanat 2015). The focus of this study is to expand the scope of modeling SPFs to include the effects of heterogeneity due to unobserved effects in roadway crash data. Advanced type 2 SPFs allow us to incorporate unobserved heterogeneity via parameters and the overdispersion parameter. Basic type 2 SPFs accommodate heterogeneity through the overdispersion parameter alone. Therefore, it is very likely that basic type 2 SPFs can overestimate the magnitude of the overdispersion parameter, and underestimate the variation of the geometric effects. The underestimation of variation in geometric effects can be due to the fact that geometric parameters are constrained to be the same across all observations. In reality, the effects of geometrics can vary across observation. This is primarily due to unobserved effects due to economic variations, geographic variations, variations in driving behavior and environmental effects (see for example, Mannering, Shankar and Bhat 2016; Venkataraman et al 2011; Venkataraman et al 2013). Some of the unobserved effects can be stratified by groups as well, such as by county, district or route, or divided highway, or rural, or functional class. The impact of this stratification is that estimation of geometric effect can be potentially more accurate after controlling for such group effects. The construction of the statistical model for predicting crash frequencies, accounting for such group effects requires that parameters be treated as potentially random, a notion that is not accommodated in basic type 2 SPFs. A general framework for building such models is discussed in detail in Venkataraman et al (2014a). The count model of crashes is then described as follows:

To begin with, a generalized representation of the conditional density function for crash counts y_{it} in the i-th road component (segment or intersection or ramp segment) in year t is as follows:

$$P(y_{it}|x_{it}, \beta_{it}, w) = g(\cdot),\ \forall i = 1, \dots, I; \forall t = 1, \dots, T; \tag{1}$$

where $g(\cdot)$ is the density function of the appropriate count distribution, β_{it} is a vector of estimable parameters, x_{it} is a vector of observed variables describing each road segment in each year, such as lighting, geometric, and traffic characteristics, and w is a vector of random effects that can be hierarchical such as counties, districts, and routes, in combination with other stratifiers such as divided versus undivided, rural versus urban, signalized versus unsignalized (for intersections), and metered versus unmetered (for ramps). The data and parameters vary with both time and space, thereby working to capture changes across road components and over time. In a negative binomial model this density is (Greene, 1997):

$$g(y_{it}|x_{it}, \beta_{it}, \theta) = \frac{\theta^{\theta}\lambda_{it}^{y_{it}}\Gamma(y_{it}+\theta)}{\Gamma(\theta)y_{it}!(\lambda_{it}+\theta)^{y_{it}+\theta}} \tag{2}$$

where the mean crash rate is $\lambda_{it} = \exp(\beta_{it}x_{it})$, θ is an overdispersion parameter. The random parameter negative binomial model is introduced by adding a heterogeneity term and a random term to the estimable parameters:

$$\beta_{it} = \beta + \Delta z_{it} + \Gamma\nu_{it}, \tag{3}$$

where the first term, β, is the mean of the random parameter, the second term introduces heterogeneity (z_i is a vector of observed variables inducing road component-specific heterogeneity and Δ are estimable parameters on the heterogeneity variables), and the third term is a random deviation from the mean (Γ is an estimable diagonal covariance matrix capturing spatial and temporal parameter correlations, ν_{it} are unobservable normally distributed random error terms with zero mean and variance one). The likelihood contribution of the i-th road component to the sample likelihood is conditioned on the unobserved random heterogeneity ν_{it} and denoted by:

$$L_i(\beta, \Delta, \Gamma, \theta | y_{i1}, \ldots, y_{iT}, x_{it}, z_{it}, \nu_{it}, w) = \prod_{t=1}^{T} g(\cdot). \quad (4)$$

The likelihood for the i-th road component takes a non-closed form and it is therefore necessary to approximate the resulting integral through simulation by drawing R Halton draws for the random heterogeneity. Each draw is denoted with an index r, ν_{itr}, and is inserted into the likelihood function and its value calculated. From the series of simulated likelihood values the expected value of the likelihood unconditioned on ν_it is found using the relationship (Greene, 2007),

$$\mathrm{E}(L_i(\beta, \Delta, \Gamma, \theta | y_{i1}, \ldots, y_{iT}, x_{it}, z_{it})) \approx \frac{1}{R} \sum_{r=1}^{R} L_{ir}(\beta, \Delta, \Gamma, \theta | y_{i1}, \ldots, y_{iT}, x_{it}, z_{it}, w, \nu_{itr}). \quad (5)$$

The above-mentioned procedure is useful for incorporating heterogeneity in the random parameter means as well, and is called simulated maximum likelihood estimation. Its accuracy relies on the number of Halton draws R, (see Venkataraman et al., 2014b, for a recent prior traffic safety application). In this study, we do not generalize to include heterogeneity in the random parameter means, but we account for heterogeneity in the geometric parameter through a random distribution, while also accounting for hierarchical random effects such as those due to county, district and route sources. Therefore, the models we develop here are partly hierarchical – they include hierarchical random effects, but not hierarchical random parameter means, where the parameter means are allowed to be heterogeneous due to observed factors.

Empirical Setting

The advanced type 2 models were developed for three distinct components of the California highway network – namely, roadway segments without intersections, intersections and ramp segments (with and without metering). The dataset is the same as that used for phase 1 basic type 2 models, with 2012 crash data being used for the development of the statistical analysis. The phase 1 report documents in great detail the different characteristics of the dataset, so to be brief, we describe the various components of the network briefly here. The roadway segment models were developed for ten classes of SPFs in addition to a single statewide model combining all SPF classes, a single statewide of intersections with varying type of traffic control, channelization and flow constraints, and a statewide set of metered and unmetered ramp segments. For each of these components, six types of outcomes were modeled – total crashes, property damage only (PDO), complain of pain, visible injury, severe injury and fatality. Therefore, in total, 84 different model types were considered in this study. The rest of this report documents the findings from this analysis.

Table 1a shows the observation samples for each of the ten SPF road segment classes. It must be mentioned here that the estimation of advanced type 2 SPFs is very time consuming due to the simulation based approach. It would be desirable to estimate multiple year models of the advanced type 2 framework, but when one considers 40,508 observations for estimating a statewide, single overall advanced type 2 model, the computational burden cannot be overcome, and the models were not estimable.

Table 1a. Number of observations for roadway segment advanced type 2 SPFs.

SPF Class	Observations
All-classes (AC)	40,458
Rural two-lane (R2L)	4,153
Rural four-lane (R4L)	9,149
Rural four-plus-lane (R4PL)	220
Rural multilane undivided (RMU)	115
Urban two-lane (U2L)	5,594
Urban four-lane (U4L)	7,184
Urban five, six-seven-lane (U567L)	4,265
Urban eight-plus (U8PL)	5,695
Urban multilane undivided (UMU)	844
Urban multilane divided (UMD)	3,239

The intersection and ramp datasets are also described in detail in the phase 1 report. The observation sample for intersections used in this study was 97,692 observations (6-year history), while the metered ramp dataset contained 12,264 observations (6-year history.

SPF Development

We discuss in the following section the findings of geometric and traffic volume variables in the various SPFs. We begin with a variable glossary for each component, and include summary tables which show which variables were significant in the appropriate SPF – for example, total crash SPF, property damage only, complaint of pain, visible injury, severe injury and fatal injury. The tables are organized by variable names in the first column, followed by the description of the variable, followed by the SPF in which it appears as a statistically significant effect. This last column is titled SPF Models, which indicates, which models contain the variable as a random parameter, and which contain the variable as a fixed parameter. The SPF Models column identifies the model by abbreviations that are as follows:

AC – all SPF classes

R2L – rural 2-lane

R4L – rural 4-lane

R4PL – rural 4-plus-lane

RMU – rural multilane undivided

U2L – urban 2-lane

U4L – urban 4-lane

U567L – urban 567-lane

U8PL – urban 8-plus-lane

UMD – urban multilane divided

UMU – urban multilane undivided

If the SPF Models column in Table 2 indicated the AC abbreviation in bold for the variable log(ADT), then, it means that the logarithm of ADT was a random parameter in the total crash model. If the indication in unbolded, then the logarithm of ADT a fixed parameter. Further, it should be noted that for each main table there is a corresponding random effects table that follows. For example, for table 2a which is the main table of geometric and traffic volume parameters, table 2b shows the statistically significant random effects in the all-classes total crash model. In this manner, each of the six crash outcomes have two tables associated per outcome, a main table containing the geometric and traffic volume parameter characteristics (random versus fixed), and a random effect table. The majority of random parameters are associated with: logarithm of ADT, logarithm of length, design speed, and to a degree of median width, and shoulder width. These are also continuous measures, and modeled as normal distribution in the random parameter, random effects, negative binomial model shown in equations 1-3. The randomness of parameters does not necessarily decrease across severity outcomes, while the number of parameters does however. This shows that once the unobserved heterogeneity is accounted for, the geometric effects influencing the higher severities tend to be diminish. In certain cases, the advanced type 2 model was inestimable, especially for higher severities and where sample size was low (for example, rural multilane undivided and urban multilane undivided). In such cases, it is recommended that the basic type 2 model be used as the default model for predictive purposes.

We present a series of tables below in the following portions of this report documenting the significant variables in the various SPFs, along with a comparative assessment of the basic and advanced type 2 SPFs. We also include tables that show the recommended SPFs for various components of the network by severity category.

One can notice that the types of variables influencing roadway segment analysis are different from those influencing intersection analysis or ramp analysis. While mainline geometry is available for intersection data, minor street geometry data is unavailable. Horizontal and vertical curvature data is not available for any of the components of the roadway network, and therefore, curvature variables are not evaluated in this study. One would expect these variables to produce an omitted variable effect (as noted in the published literature, see Venkataraman et al 2011;2013;2014a). As a result, it is likely that all of the SPFs developed in this study will be influenced by unobserved effects arising in part due to omitted variables. Developing future geometric databases to include curvature variables should be a goal for Caltrans. It is to be noted in this study that the use of advanced type 2 SPFs through random parameters random effects offsets in part the effects of the curvature variables omitted from the true model. However, it cannot be claimed that compensation is complete. In the absence of complete geometric data, all SPFs are in some sense incomplete, and not fully specified.

Table 2a. Variable glossary and significance in segment SPF models of total crashes.

Variable	Description	SPF Models
Cross-sectional		
ADT	Annual daily traffic	**AC**, **R2L**, **R4L**,R4PL,RMU,**U2L**,**U4L**,**U567L**,**U8PL**,**UMU**,**UMD**
LENGTH	Length of a segment in miles	**AC**, **R2L**, **R4L**,**R4PL**,RMU,U2L,**U4L**,**U567L**,**U8PL**,**UMU**,**UMD**
LT_OS_WI	Left shoulder width in increasing direction of milepost in feet	R2L,R4L,R4PL,U2L,U4L,U567L,UMD
RT_OS_WI	Right shoulder width in increasing direction of milepost in feet	R2L,**R4L**,U567L,UMU
RT_TR_WI	Traveled way width in direction of milepost in feet	AC,R4PL,U567L,U8PL
LT_IS_WI	Left shoulder width in decreasing direction of milepost in feet	**AC**,R4L,U567L,U8PL
RT_IS_WI	Right shoulder width in decreasing direction of milepost in feet	R4L,U2L,U4L,UMD
MED_WI	Median width in feet	AC,U2L,**U567L**,**U8PL**
DES_SP	Design speed in miles per hour	AC, **R2L**,**R4L**,**R4PL**,**U2L**,U4L,U567L,**UMU**,UMD
TOTLANES	Number of lanes	AC,UMU,UMD
RTLANES	Number of lanes in increasing direction of milepost	**RMU**,U567L,U8PL
LTLANES	Number of lanes in decreasing direction of milepost	U8PL,UMD
RLTR	Continuous left turn indicator; 1 if present in increasing direction of milepost, 0 otherwise	U567L
LLTR	Continuous left turn indicator; 1 if present in decreasing direction of milepost, 0 otherwise	AC,UMU
LAUXL	Auxiliary lane indicator; 1 if present in decreasing direction of milepost, 0 otherwise	AC,U8PL
LNOSPEC	Special structures indicator; 1 if no special structures are present in in decreasing direction of milepost, 0 otherwise	AC,UMU
Roadside		
METHRIE	Median thrie beam indicator;1 if present, 0 otherwise	AC,U4L,U567L
MECONC	Median barrier indicator; 1 if concrete barrier in increasing direction of milepost, 0 otherwise	AC,U4L
MEBEAM	Median barrier indicator; 1 if beam barrier, 0 otherwise	U4L
MESTRUC	Median type indicator; 1 if on divided roadway with separate structure	U4L
MESGR	Median type indicator;1 if divided roadway with separate grades, 0 otherwise	U4L
MENOBARR	Median type indicator; 1 if no barrier present, 0 otherwise	R4PL,U567L
MECONCB	Median barrier indicator; 1 if concrete beam barrier, 0 otherwise	U8PL
MEBRAIL	Median bridge rail indicator; 1 if median bridge rail present, 0 otherwise	AC
MEOTHER	Median type indicator; 1 if nonspecific median present, 0 otherwise	AC

** model in bold indicates it contains variable as a random parameter

Table 2a (continued). Variable glossary and significance in segment SPF models of total crashes.

Variable	Description	SPF Models
MECONCG	Median barrier indicator; 1 if concrete barrier with guard rail, 0 otherwise	AC
MEST	Median surface indicator; 1 if median is striped, 0 otherwise	AC
Route Indicator		
RT140	Route 140 indicator; 1 if segment is in route 140, 0 otherwise	R2L,U2L
RT79	Route 79 indicator; 1 if segment is in route 79, 0 otherwise	R2L
RT45	Route 45 indicator; 1 if segment is in route 45, 0 otherwise	R2L
RT3	Route 3 indicator; 1 if segment is in route 3, 0 otherwise	R2L
RT253	Route 253 indicator; 1 if segment is in route 253, 0 otherwise	R2L
RT40	Route 40 indicator; 1 if segment is in route 40, 0 otherwise	R4L
RT78	Route 78 indicator; 1 if segment is in route 78, 0 otherwise	R4L
RT198	Route 198 indicator; 1 if segment is in route 198, 0 otherwise	R4L
RT35	Route 135 indicator; 1 if segment is in route 135, 0 otherwise	R4L
RT4	Route 4 indicator; 1 if segment is in route 4, 0 otherwise	R4L
RT5	Route 5 indicator; 1 if segment is in route 5, 0 otherwise	R4PL,U567L
RT59	Route 59 indicator; 1 if segment is in route 59, 0 otherwise	U2L
RT88	Route 88 indicator; 1 if segment is in route 88, 0 otherwise	U2L
RT108	Route 108 indicator; 1 if segment is in route 108, 0 otherwise	AC,U2L
RT111	Route 111 indicator; 1 if segment is in route 111, 0 otherwise	U2L,UMU,UMD
RT18	Route 18 indicator; 1 if segment is in route 18, 0 otherwise	U2L
RT129	Route 129 indicator; 1 if segment is in route 129, 0 otherwise	U2L
RT73	Route 173 indicator; 1 if segment is in route 173, 0 otherwise	AC,U567L
RT120	Route 120 indicator; 1 if segment is in route 120, 0 otherwise	U4L
RT15	Route 15 indicator; 1 if segment is in route 15, 0therwise	U4L,U567L,U8PL
RT178	Route 178 indicator; 1 if segment is in route 178, 0 otherwise	U4L
RT2	Route 2 indicator; 1 if segment is in route 2, 0 otherwise	R4L
RT101	Route 101 indicator; 1 if segment is in route 101, 0 otherwise	U4L
RT215	Route 215 indicator; 1 if segment is in route 215, 0 otherwise	U567L,U8PL
RT241	Route 241 indicator; 1 if segment is in route 241, 0 otherwise	AC,U567L
RT12	Route 12 indicator; 1 if segment is in route 12, 0 otherwise	U4L
RT110	Route 110 indicator, if segment is in route 110, 0 otherwise	U567L,U8PL
RT180	Route 180 indicator; 1 if segment is in route 180, 0 otherwise	U567L
RT14	Route 14 indicator; 1 if segment is in route 14, 0 otherwise	U567L
RT680	Route 680 indicator; 1 if segment is in route 680, 0 otherwise	AC,U567L
RT80	Route 80 indicator; 1 if segment is in route 80, 0 otherwise	U567L,U8PL
RT405	Route 405 indicator; 1 if segment is in route 405, 0 otherwise	U8PL
RT210	Route 210 indicator; 1 if segment is in route 210, 0 otherwise	U8PL

Table 2a (continued). Variable glossary and significance in segment SPF models of total crashes.

Variable	Description	SPF Models
RT880	Route 880 indicator; 1 if segment is in route 880, 0 otherwise	U8PL
RT86	Route 86 indicator; 1 if segment is in route 86, 0 otherwise	UMD
RT174	Route 174 indicator; 1 if segment is in route 174, 0 otherwise	U567
RT187	Route 187 indicator; 1 if segment is in route 187, 0 otherwise	UMD
RT46	Route 46 indicator; 1 if segment is in route 46, 0 otherwise	UMD
RT51	Route 51 indicator; 1 if segment is in route 51, 0 otherwise	UMD
RT49	Route 49 indicator; 1 if segment is in route 49, 0 otherwise	UMD
RT18	Route 18 indicator; 1 if segment is in route 18, 0 otherwise	UMU
RT10	Route 10 indicator; 1 if segment is in route 10, 0 otherwise	U8PL
RT116	Route 116 indicator; 1 if segment is in route 116, 0 otherwise	U2L
RT193	Route 193 indicator; 1 if segment is in route 193, 0 otherwise	U2L
RT74	Route 74 indicator; 1 if segment is in route 74, 0 otherwise	UMD
RT41	Route 41 indicator; 1 if segment is in route 41, 0 otherwise	AC,U4L
RT24	Route 24 indicator; 1 if segment is in route 24, 0 otherwise	U8PL
RT200	Route 200 indicator; 1 if segment is in route 200, 0 otherwise	AC
RT53	Route 53 indicator; 1 if segment is in route 53, 0 otherwise	AC
RT166	Route 166 indicator; 1 if segment is in route 166, 0 otherwise	AC
RT129	Route 129 indicator; 1 if segment is in route 129, 0 otherwise	AC
RT236	Route 236 indicator; 1 if segment is in route 236, 0 otherwise	AC
County Indicator		
IMP	Imperial county indicator; 1 if segment is in Imperial county, 0 otherwise	U2L
VEN	Ventura county indicator; 1 if segment is in Ventura county, 0 otherwise	AC,R2L
MEN	Mendocino county indicator; 1 if segment is in Mendocino county, 0 otherwise	U2L
LA	Los Angeles county indicator; 1 if segment is in Los Angeles county, 0 otherwise	AC,U4L
SB	Santa Barbara county indicator; 1 if segment is in Santa Barbara county, 0 otherwise	U4L
SOL	Solano county indicator; 1 if segment is in Solano county, 0 otherwise	U4L,U567L,U8PL
ALA	Alameda county indicator; 1 if segment is in Alameda county, 0 otherwise	U4L,U8PL
YUB	Yuba county indicator; 1 if segment is in Yuba county, 0 otherwise	U4L
HUM	Humboldt county indicator; 1 if segment is in Humboldt county, 0 otherwise	U4L
SDIEGO	San Diego county indicator; 1 if segment is in San Diego county, 0 otherwise	U567L,U8PL
RIV	Riverside county indicator; 1 if segment is in Riverside county, 0 otherwise	U567L

Table 2a (continued). Variable glossary and significance in segment SPF models of total crashes.

Variable	Description	SPF Models
KER	Kern county indicator; 1 if segment is in Kern county, 0 otherwise	U567L
SCL	Santa Clara county indicator; 1 if segment is in Santa Clara county, 0 otherwise	U8PL
SAC	Sacramento county indicator; 1 if segment is in Sacramento county, 0 otherwise	U8PL
ALP	Alpine county indicator; 1 if segment is in Alpine county, 0 otherwise	AC
AMA	Amador county indicator; 1 if segment is in Amador county, 0 otherwise	AC
STA	Stanislaus county indicator; 1 if segment is in Stanislaus county, 0 otherwise	AC

Table 2b. Random effects significance in segment SPF total crashes models.

Random Effect	SPF Models
Route	AC,R2L,R4PL,U2L,U567L,U8PL,UMD
County	R2L,R4L,R4PL,U2L,U4L,U567L,U8PL,UMU,UMD
District	AC,R4L,RMU,U2L,U4L,U567L,U8PL,UMD
SPF Class	AC

Tables 2a and 2b show the random parameters and hierarchical random effects in segment SPFs for total crash outcomes. It is noted that the logarithm of ADT and length are random in multiple SPFs, indicating heterogeneity associated with volume and segmentation effects on property damage only outcomes. In addition to ADT and length, shoulder width, median width and design speed were found to be random. This demonstrates the heterogeneity of multiple geometric features in their impact on property damage outcomes. It is also noted that none of the indicator variables are random, given that a substantial number of the indicators are statistically significant. This demonstrates that as roadside effects become exhaustive, unobserved heterogeneity due to the roadside is mitigated indicating the importance of fully specified roadside variables in model estimation.

The random effects due to route are mainly urban, indicating that urban segments tend to have hierarchical unobserved effects at the route, county and district level. In the all-class models, SPF Class is a random effect, as well as the county and route effects. Rural hierarchical effects are primarily due to route class sources, indicating that property damage grouping by route class might be an effective way to identify low-societal cost collision corridors.

A large number of fixed parameters are found to be significant – including several route and county indicators, as well as numerous roadside indicators. This suggests the richness of the property damage only models across SPF classes, while emphasizing the importance of full specifications. When one considers that four hierarchical random effects were significant after an exhaustive specification of geometric, route and county indicators, this further underscores the importance of unobserved heterogeneity that resides in geographic, route level, county level, district level and functional class hierarchies.

Table 3a. Variable glossary and significance in segment SPF models of property damage only crashes.

Variable	Description	SPF Models
Cross-sectional		
Log(ADT)	Annual daily traffic	****AC,R2L**, R4L,R4PL,RMU,**U2L,U4L,U567L,U8PL,UMD,UMU**
Log (Length)	Length of a segment in miles	**AC, R2L, R4L**,R4PL,**RMU,**U2L,**U4L,U567L,U8PL,UMD,UMU**
LT_OS_WI	Left shoulder width in increasing direction of milepost in feet	R4PL
RT_OS_WI	Right shoulder width in increasing direction of milepost in feet	R4L,U567L,U8PL,UMU
RT_TR_WI	Traveled way width in direction of increasing milepost in feet	R4L,R4PL,U567L,U8PL
LT_TR_WI	Traveled way width in direction of decreasing milepost in feet	U567L
LT_IS_WI	Left shoulder width in decreasing direction of milepost in feet	U2L,U8PL
RT_IS_WI	Right shoulder width in decreasing direction of milepost in feet	**AC,**R2L,U4L,UMD
MED_WI	Median width in feet	AC,R4L,U2L,**U567L,U8PL**
DES_SP	Design speed in miles per hour	AC,**R2L,R4L,R4PL,U2L,**U4L,U567L,UMU
TOTLANES	Number of lanes	R4L
RTLANES	Number of lanes in increasing direction of milepost	U567L,U8PL
LTLANES	Number of lanes in decreasing direction of milepost	U8PL,UMD
RLTR	Continuous left turn indicator; 1 if present in increasing direction of milepost, 0 otherwise	U567L
LLTR	Continuous left turn indicator; 1 if present in decreasing direction of milepost, 0 otherwise	AC,U4L
LAUXL	Auxiliary lane indicator; 1 if present, 0 otherwise	U567L
LNOSPEC	Special structures indicator; 1 if no special structures are present in decreasing direction of milepost, 0 otherwise	AC,UMU
Roadside		
METHRIE	Median thrie beam indicator;1 if present, 0 otherwise	AC
MEBEAM	Median barrier indicator; 1 if beam barrier, 0 otherwise	U4L
MESTRUC	Median type indicator; 1 if on divided roadway with separate structure	U4L
MESGR	Median type indicator; 1 if divided with separate grades, 0 otherwise	U4L
MENOBARR	Median type indicator; 1 if no barrier present, 0 otherwise	R4PL
MECONCB	Median barrier indicator; 1 if concrete beam barrier present, 0 otherwise	U8PL
MECONCG	Median barrier indicator; 1 if concrete barrier guard rail present, 0 otherwise	AC,U8PL
MECONC	Median barrier indicator; 1 if concrete barrier present, 0 otherwise	AC
MEBRAIL	Median bridge rail indicator; 1 if median bridge rail present, 0 otherwise	AC,U8PL
METWTL	Median two-way turn lane indicator; 1 if present, 0 otherwise	UMD
MEOTHER	Median type indicator; 1 if nonspecific median present, 0 otherwise	AC
MEST	Median type indicator; 1 if striped median present, 0 otherwise	AC
RMEDHOV	Median HOV indicator; 1 if in increasing direction of milepost, 0 otherwise	U8PL

** model in bold indicates it contains variable as a random parameter

Table 3a (continued). Variable glossary and significance in segment SPF models of property damage only crashes.

Variable	Description	SPF Models
Route Indicator		
RT140	Route 140 indicator; 1 if segment is in route 140, 0 otherwise	R2L
RT79	Route 79 indicator; 1 if segment is in route 79, 0 otherwise	R2L
RT45	Route 45 indicator; 1 if segment is in route 45, 0 otherwise	R2L
RT3	Route 3 indicator; 1 if segment is in route 3, 0 otherwise	R2L
RT253	Route 253 indicator; 1 if segment is in route 253, 0 otherwise	R2L
RT40	Route 40 indicator; 1 if segment is in route 40, 0 otherwise	R4L
RT78	Route 78 indicator; 1 if segment is in route 78, 0 otherwise	R4L
RT168	Route 168 indicator; 1 if segment is in route 168, 0 otherwise	R4L
RT198	Route 198 indicator; 1 if segment is in route 198, 0 otherwise	R4L
RT32	Route 32 indicator; 1 if segment is in route 32, 0 otherwise	R4PL
RT4	Route 4 indicator; 1 if segment is in route 4, 0 otherwise	R4L
RT5	Route 5 indicator; 1 if segment is in route 5, 0 otherwise	R4PL,U567L
RT88	Route 88 indicator; 1 if segment is in route 88, 0 otherwise	U2L
RT111	Route 111 indicator; 1 if segment is in route 111, 0 otherwise	UMD,UMU
RT18	Route 18 indicator; 1 if segment is in route 18, 0 otherwise	U2L
RT129	Route 129 indicator; 1 if segment is in route 129, 0 otherwise	AC,U2L
RT73	Route 173 indicator; 1 if segment is in route 173, 0 otherwise	AC,U567L
RT15	Route 15 indicator; 1 if segment is in route 15, 0therwise	U4L,U567L
RT178	Route 178 indicator; 1 if segment is in route 178, 0 otherwise	U4L
RT101	Route 101 indicator; 1 if segment is in route 101, 0 otherwise	R4L,U4L
RT215	Route 215 indicator; 1 if segment is in route 215, 0 otherwise	U567L,U8PL
RT241	Route 241 indicator; 1 if segment is in route 241, 0 otherwise	AC,U567L
RT110	Route 110 indicator, if segment is in route 110, 0 otherwise	U8PL
RT680	Route 680 indicator; 1 if segment is in route 680, 0 otherwise	AC,U567L
RT80	Route 80 indicator; 1 if segment is in route 80, 0 otherwise	R4L,U8PL
RT210	Route 210 indicator; 1 if segment is in route 210, 0 otherwise	U8PL
RT86	Route 86 indicator; 1 if segment is in route 86, 0 otherwise	UMD
RT46	Route 46 indicator; 1 if segment is in route 46, 0 otherwise	UMD
RT51	Route 51 indicator; 1 if segment is in route 51, 0 otherwise	UMD
RT49	Route 49 indicator; 1 if segment is in route 49, 0 otherwise	UMD
RT10	Route 10 indicator; 1 if segment is in route 10, 0 otherwise	U8PL
RT116	Route 116 indicator; 1 if segment is in route 116, 0 otherwise	U2L
RT41	Route 41 indicator; 1 if segment is in route 41, 0 otherwise	AC,U4L

Table 3a (continued). Variable glossary and significance in segment SPF models of property damage only crashes.

Variable	Description	SPF Models
	Route Indicator	
RT24	Route 24 indicator; 1 if segment is in route 24, 0 otherwise	U8PL
RT1	Route 1 indicator; 1 if segment is in route 1, 0 otherwise	U567L
RT710	Route 710 indicator; 1 if segment is in route 710, 0 otherwise	U567L
RT76	Route 76 indicator; 1 if segment is in route 76, 0 otherwise	UMD
RT83	Route 83 indicator; 1 if segment is in route 83, 0 otherwise	UMD
RT200	Route 200 indicator; 1 if segment is in route 200, 0 otherwise	AC
RT53	Route 53 indicator; 1 if segment is in route 53, 0 otherwise	AC
RT166	Route 166 indicator; 1 if segment is in route 166, 0 otherwise	AC
RT236	Route 236 indicator; 1 if segment is in route 236, 0 otherwise	AC
County Indicator		
IMP	Imperial county indicator; 1 if segment is in Imperial county, 0 otherwise	U2L,UMD
VEN	Ventura county indicator; 1 if segment is in Ventura county, 0 otherwise	AC,R2L
LA	Los Angeles county indicator; 1 if segment is in Los Angeles county, 0 otherwise	AC,U4L
SB	Santa Barbara county indicator; 1 if segment is in Santa Barbara county, 0 otherwise	U4L
SOL	Solano county indicator; 1 if segment is in Solano county, 0 otherwise	U4L,U567L,U8PL
ALA	Alameda county indicator; 1 if segment is in Alameda county, 0 otherwise	U4L,U8PL
YUB	Yuba county indicator; 1 if segment is in Yuba county, 0 otherwise	U4L
HUM	Humboldt county indicator; 1 if segment is in Humboldt county, 0 otherwise	U4L
SDIEGO	San Diego county indicator; 1 if segment is in San Diego county, 0 otherwise	U4L,U567L
KER	Kern county indicator; 1 if segment is in Kern county, 0 otherwise	U567L
SCL	Santa Clara county indicator; 1 if segment is in Santa Clara county, 0 otherwise	U8PL,UMD
SAC	Sacramento county indicator; 1 if segment is in Sacramento county, 0 otherwise	U8PL
ORNG	Orange county indicator; 1 if segment is in Orange county, 0 otherwise	U4L
FRE	Fresno county indicator; 1 if segment is in Fresno county, 0 otherwise	U4L,U567L
SLO	San Luis Obispo county indicator; 1 if segment is in San Luis Obispo county, 0 otherwise	U4L
SON	Sonoma county indicator; 1 if segment is in Sonoma county, 0 otherwise	U4L
CC	Contra Costa county indicator; 1 if segment is in Contra Costa county, 0 otherwise	U567L
MON	Monterey county indicator; 1 if segment is in Monterey county, 0 otherwise	U567L
PLA	Placer county indicator; 1 if segment is in Placer county, 0 otherwise	U567L
SHA	Shasta county indicator; 1 if segment is in Shasta county, 0 otherwise	U567L

Table 3a (continued). Variable glossary and significance in segment SPF models of property damage only crashes.

Variable	Description	SPF Models
TUL	Tulane county indicator; 1 if segment is in Tulane county, 0 otherwise	UMD
ALP	Alpine county indicator; 1 if segment is in Alpine county, 0 otherwise	AC
AMA	Amador county indicator; 1 if segment is in Amador county, 0 otherwise	AC
STA	Stanislaus county indicator; 1 if segment is in Stanislaus county, 0 otherwise	AC

Table 3b. Random effects significance in segment SPF property damage only models.

Random Effect	SPF Models
Route	AC,R2L,R4L,R4PL,U2L,U4L,U567L,U8PL,UMD
County	AC,R4PL,U2L,U4L,U567L,U8PL,UMD,UMU
District	U4L,U567L,U8PL,UMD
SPF Class	AC

Tables 3a and 3b show the random parameters and hierarchical random effects in segment SPFs for property damage only outcomes. It is also noted that the logarithm of ADT and length are random in multiple SPFs, indicating heterogeneity associated with volume and segmentation effects on property damage only outcomes. In addition to ADT and length, shoulder width, median width and design speed were found to be random. This demonstrates the heterogeneity of multiple geometric features in their impact on property damage outcomes. It is also noted that none of the indicator variables are random, given that a substantial number of the indicators are statistically significant. This demonstrates that as roadside effects become exhaustive, unobserved heterogeneity due to the roadside is mitigated indicating the importance of fully specified roadside variables in model estimation.

The random effects due to route are mainly urban, indicating that urban segments tend to have hierarchical unobserved effects at the route, county and district level. In the all-class models, SPF Class is a random effect, as well as the county and route effects. Rural hierarchical effects are primarily due to route class sources, indicating that property damage grouping by route class might be an effective way to identify low-societal cost collision corridors.

A large number of fixed parameters are found to be significant – including several route and county indicators, as well as numerous roadside indicators. This suggests the richness of the property damage only models across SPF classes, while emphasizing the importance of full specifications. When one considers that four hierarchical random effects were significant after an exhaustive specification of geometric, route and county indicators, this further underscores the importance of unobserved heterogeneity that resides in geographic, route level, county level, district level and functional class hierarchies.

Table 4a. Variable glossary and significance in segment SPF models of complaint of pain crashes.

Variable	Description	SPF Models
Cross-sectional		
Log(ADT)	Annual daily traffic	****AC,R2L,R4L,R4PL,**U2L,**U4L,U567L,U8PL,UMD,UMU**
Log (Length)	Length of a segment in miles	**AC,**R2L,**R4L,**R4PL,**U2L,U4L,U567L,U8PL,UMD,**UMU
LT_OS_WI	Left shoulder width in increasing direction of milepost in feet	R4PL,U4L,**U567L,**UMD
RT_OS_WI	Right shoulder width in increasing direction of milepost in feet	R4L
RT_TR_WI	Traveled way width in direction of increasing milepost in feet	AC,R4PL,U567L,U8PL
LT_IS_WI	Left shoulder width in decreasing direction of milepost in feet	**AC,**U2L,U8PL
LLTR	Left turn indicator; 1 if present in decreasing direction of milepost, 0 otherwise	AC
MED_WI	Median width in feet	AC,U4L,U567L,**U8PL**
DES_SP	Design speed in miles per hour	AC,**R2L,**R4L,R4PL,**U2L,**U567L,**UMD**
TOTLANES	Number of lanes	UMD
RTLANES	Number of lanes in increasing direction of milepost	U4L,U567L,U8PL
RAUXL	Auxiliary lane indicator; 1 if present in increasing milepost direction, 0 otherwise	U567L
LNOSPEC	Special structures indicator; 1 if no special structures are present in decreasing direction of milepost, 0 otherwise	AC
Roadside		
METHRIE	Median barrier indicator; 1 if thrie beam barrier, 0 otherwise	AC,U567L
MEOTHER	Median type indicator; 1 if nonspecific median, 0 otherwise	AC
MESTRUC	Median type indicator; 1 if on divided roadway with separate structure	U4L
MESGR	Median type indicator; 1 if divided roadway with separate grades	U4L
MENOBARR	Median barrier indicator; 1 if no barrier present, 0 otherwise	U8PL
MEBEAMG	Median barrier indicator; 1 if beam guard rail present, 0 otherwise	U8PL
MEPAVE	Median condition indicator; 1 if median is paved, 0 otherwise	U4L
METWTL	Median two-way turn lane indicator; 1 if present, 0 otherwise	U2L,U567L
MEBRAIL	Median bridge rail indicator; 1 if median bridge rail present, 0 otherwise	AC
MECONC	Median barrier indicator; 1 if concrete barrier present, 0 otherwise	AC
MECONCG	Median barrier indicator; 1 if concrete barrier guard rail present, 0 otherwise	AC
MEST	Median type indicator; 1 if striped median present, 0 otherwise	AC
Route Indicator		
RT79	Route 79 indicator; 1 if segment is in route 79, 0 otherwise	R2L
RT5	Route 5 indicator; 1 if segment is in route 5, 0 otherwise	R4PL
RT18	Route 18 indicator; 1 if segment is in route 18, 0 otherwise	UMD
RT129	Route 129 indicator; 1 if segment is in route 129, 0 otherwise	AC,U2L
RT15	Route 15 indicator; 1 if segment is in route 15, 0therwise	U4L,U567L
RT101	Route 101 indicator; 1 if segment is in route 101, 0 otherwise	U4L

** model in bold indicates it contains variable as a random parameter

Table 4a (continued). Variable glossary and significance in segment SPF models of complaint of pain crashes.

Variable	Description	SPF Models
RT215	Route 215 indicator; 1 if segment is in route 215, 0 otherwise	U8PL
RT80	Route 80 indicator; 1 if segment is in route 80, 0 otherwise	R4L,U8PL
RT210	Route 210 indicator; 1 if segment is in route 210, 0 otherwise	U8PL
RT51	Route 51 indicator; 1 if segment is in route 51, 0 otherwise	UMD
RT24	Route 24 indicator; 1 if segment is in route 24, 0 otherwise	U8PL
Route Indicator		
RT1	Route 1 indicator; 1 if segment is in route 1, 0 otherwise	U4L
RT76	Route 76 indicator; 1 if segment is in route 76, 0 otherwise	UMD
RT150	Route 150 indicator; 1 if segment is in route 150, 0 otherwise	R2L
RT395	Route 395 indicator; 1 if segment is in route 395, 0 otherwise	R4L
RT29	Route 29 indicator; 1 if segment is in route 29, 0 otherwise	R4L
RT59	Route 59 indicator; 1 if segment is in route 59, 0 otherwise	U2L
RT108	Route 108 indicator; 1 if segment is in route 108, 0 otherwise	AC,U2L
RT12	Route 12 indicator; 1 if segment is in route 12, 0 otherwise	U4L
RT118	Route 118 indicator; 1 if segment is in route 118, 0 otherwise	U4L
RT8	Route 8 indicator; 1 if segment is in route 8, 0 otherwise	U567L
RT405	Route 405 indicator; 1 if segment is in route 405, 0 otherwise	U8PL
RT138	Route 138 indicator; 1 if segment is in route 138, 0 otherwise	UMD
RT123	Route 123 indicator; 1 if segment is in route 123, 0 otherwise	UMD
RT73	Route 73 indicator; 1 if segment is in route 73, 0 otherwise	AC
RT241	Route 241 indicator; 1 if segment is in route 241, 0 otherwise	AC
RT166	Route 166 indicator; 1 if segment is in route 166, 0 otherwise	AC
RT236	Route 236 indicator; 1 if segment is in route 236, 0 otherwise	AC
RT41	Route 41 indicator; 1 if segment is in route 41, 0 otherwise	AC
County Indicator		
SOL	Solano county indicator; 1 if segment is in Solano county, 0 otherwise	U567L,U8PL
ALA	Alameda county indicator; 1 if segment is in Alameda county, 0 otherwise	U4L,UMU
SDIEGO	San Diego county indicator; 1 if segment is in San Diego county, 0 otherwise	R4L,U8PL
ORNG	Orange county indicator; 1 if segment is in Orange county, 0 otherwise	UMD
SON	Sonoma county indicator; 1 if segment is in Sonoma county, 0 otherwise	U4L
CC	Contra Costa county indicator; 1 if segment is in Contra Costa county, 0 otherwise	U567L,U8PL
MON	Monterey county indicator; 1 if segment is in Monterey county, 0 otherwise	U4L
NAP	Napa county indicator; 1 if segment is in Napa county, 0 otherwise	R2L
SM	San Marino county indicator; 1 if segment is in San Marino county, 0 otherwise	U8PL
STA	Stanislaus county indicator; 1 if segment is in Stanislaus county, 0 otherwise	AC,UMD
LA	Los Angeles county indicator; 1 if segment is in Los Angeles county, 0 otherwise	AC
VEN	Ventura county indicator; 1 if segment is in Ventura county, 0 otherwise	AC
ALP	Alpine county indicator; 1 if segment is in Alpine county, 0 otherwise	AC
AMA	Amador county indicator; 1 if segment is in Amador county, 0 otherwise	AC

Table 4b. Random effects significance in segment SPF complaint of pain models.

Random Effect	SPF Models
Route	R2L,U8PL
County	R4L,R4PL,U4L,U567L,U8PL
District	AC,U2L,U8PL,UMD,UMU
SPF Class	AC

Tables 4a and 4b show the random parameters and hierarchical random effects in segment SPFs for complaint of pain injury. It is also noted that the logarithm of ADT and length are random in multiple SPFs, indicating heterogeneity associated with volume and segmentation effects on complaint of pain injuries. In addition to ADT and length, shoulder width, median width and design speed were found to be random. This demonstrates the heterogeneity of multiple geometric features in their impact on complain of pain injuries. It is also noted that none of the indicator variables are random, given that a substantial number of the indicators are statistically significant. This demonstrates that as roadside effects become exhaustive, unobserved heterogeneity due to the roadside is mitigated indicating the importance of fully specified roadside variables in model estimation.

The random effects due to route are mainly urban, indicating that urban segments tend to have hierarchical unobserved effects at the county and district level. In the all-class models, SPF Class is a random effect, as well as the district effect. Route class hierarchy being a significant random effect is an important finding since it indicates the potential for route groupings in terms of route propensities towards visible injury outcomes.

Table 5a. Variable glossary and significance in segment SPF models of visible injury crashes.

Variable	Description	SPF Models
Cross-sectional		
Log(ADT)	Annual daily traffic	**AC,**R2L, R4L,**R4PL,**U2L,U4L,**U567L,U8PL,UMD,UMU**
Log (Length)	Length of a segment in miles	****AC,R2L,R4L,**R4PL,U2L,**U4L,U567L,U8PL,**UMD,UMU
LT_OS_WI	Left shoulder width in increasing direction of milepost in feet	**U2L,**U4L
RT_OS_WI	Right shoulder width in increasing direction of milepost in feet	R2L,**R4L,**U567L
RT_TR_WI	Traveled way width in direction of increasing milepost in feet	AC,U567L,U8PL
LT_IS_WI	Left shoulder width in decreasing direction of milepost in feet	AC,U8PL
RT_IS_WI	Right shoulder width in decreasing direction of milepost in feet	R4PL,UMD
MED_WI	Median width in feet	AC,U4L,U8PL
DES_SP	Design speed in miles per hour	AC,R2L,R4PL,U567L
RTLANES	Number of lanes in increasing direction of milepost	U567L
LTLANES	Number of lanes in decreasing direction of milepost	UMD
LAUXL	Auxiliary lane indicator; 1 if present in decreasing milepost direction, 0 otherwise	U8PL
LNOSPEC	Special structures indicator; 1 if no special structures are present in decreasing direction of milepost, 0 otherwise	UMD
Roadside		
METHRIE	Median barrier indicator; 1 if thrie beam barrier, 0 otherwise	AC,U567L
MESTRUC	Median type indicator; 1 if on divided roadway with separate structure	U4L
MENOBARR	Median barrier indicator; 1 if no barrier present, 0 otherwise	R4L
METWTL	Median two-way turn lane indicator; 1 if present, 0 otherwise	U2L
MEBRAIL	Median bridge rail indicator; 1 if median bridge rail present, 0 otherwise	AC
MEST	Median type indicator; 1 if striped median present, 0 otherwise	AC
Route Indicator		
RT79	Route 79 indicator; 1 if segment is in route 79, 0 otherwise	R2L
RT101	Route 101 indicator; 1 if segment is in route 101, 0 otherwise	U4L
RT29	Route 29 indicator; 1 if segment is in route 29, 0 otherwise	R4L
RT108	Route 108 indicator; 1 if segment is in route 108, 0 otherwise	U2L,UMD
RT8	Route 8 indicator; 1 if segment is in route 8, 0 otherwise	U567L,U8PL
RT405	Route 405 indicator; 1 if segment is in route 405, 0 otherwise	U8PL
RT128	Route 128 indicator; 1 if segment is in route 128, 0 otherwise	R2L
RT94	Route 94 indicator; 1 if segment is in route 94, 0 otherwise	R4L
RT2	Route 2 indicator; 1 if segment is in route 2, 0 otherwise	R4L
RT50	Route 50 indicator; 1 if segment is in route 50, 0 otherwise	R4L
RT199	Route 199 indicator; 1 if segment is in route 199, 0 otherwise	U2L
RT58	Route 58 indicator; 1 if segment is in route 58, 0 otherwise	U4L

** model in bold indicates it contains variable as a random parameter

Table 5a (continued). Variable glossary and significance in segment SPF models of visible injury crashes.

Variable	Description	SPF Models
Route Indicator		
RT17	Route 17 indicator; 1 if segment is in route 17, 0 otherwise	U4L
RT22	Route 22 indicator; 1 if segment is in route 22, 0 otherwise	U567L
RT20	Route 20 indicator; 1 if segment is in route 20, 0 otherwise	U567L
RT132	Route 132 indicator; 1 if segment is in route 132, 0 otherwise	UMD
RT36	Route 36 indicator; 1 if segment is in route 36, 0 otherwise	UMU
RT73	Route 73 indicator; 1 if segment is in route 73, 0 otherwise	AC
RT241	Route 241 indicator; 1 if segment is in route 241, 0 otherwise	AC
RT200	Route 200 indicator; 1 if segment is in route 200, 0 otherwise	AC
RT53	Route 53 indicator; 1 if segment is in route 53, 0 otherwise	AC
RT680	Route 680 indicator; 1 if segment is in route 680, 0 otherwise	AC
RT166	Route 166 indicator; 1 if segment is in route 166, 0 otherwise	AC
RT129	Route 129 indicator; 1 if segment is in route 129, 0 otherwise	AC
RT236	Route 236 indicator; 1 if segment is in route 236, 0 otherwise	AC
RT41	Route 41 indicator; 1 if segment is in route 41, 0 otherwise	AC
County Indicator		
LA	Los Angeles county indicator; 1 if segment is in Los Angeles county, 0 otherwise	AC,U4L
SOL	Solano county indicator; 1 if segment is in Solano county, 0 otherwise	U8PL
ALA	Alameda county indicator; 1 if segment is in Alameda county, 0 otherwise	U4L
SAC	Sacramento county indicator; 1 if segment is in Sacramento county, 0 otherwise	U2L
ORNG	Orange county indicator; 1 if segment is in Orange county, 0 otherwise	
FRE	Fresno county indicator; 1 if segment is in Fresno county, 0 otherwise	U567L
CC	Contra Costa county indicator; 1 if segment is in Contra Costa county, 0 otherwise	U567L
TUL	Tulane county indicator; 1 if segment is in Tulane county, 0 otherwise	UMD
SM	San Marino county indicator; 1 if segment is in San Marino county, 0 otherwise	U8PL
SBD	San Bernadino county indicator; 1 if segment is in San Bernardino county, 0 otherwise	U2L
MRN	Marin county indicator; 1 if segment is in Marin county, 0 otherwise	U8PL
VEN	Ventura county indicator; 1 if segment is in Ventura county, 0 otherwise	AC
STA	Stanislaus county indicator; 1 if segment is in Stanislaus county, 0 otherwise	AC
AMAA	Amador county indicator; 1 if segment is in Amador county, 0 otherwise	AC
ALP	Alpine county indicator; 1 if segment is in Alpine county, 0 otherwise	AC

Table 5b. Random effects significance in segment SPF visible injury models.

Random Effect	SPF Models
Route	AC,R2L,U567L
County	R4L,U8PL,UMD
District	R4PL,U2L,U4L,UMU
SPF Class	AC

Tables 5a and 5b show the random parameters and hierarchical random effects in segment SPFs for visible injury. It is also noted that the logarithm of ADT and length are random in multiple SPFs, indicating heterogeneity associated with volume and segmentation effects on visible injuries. In addition to ADT and length, shoulder width was found to be random. This demonstrates the heterogeneity in the impact of shoulder width on rural 4-lane and urban 2-lane segments. For example, since shoulder width is assumed to be normally distributed, we find that 4% of U2L segments are expected to have a positive shoulder width coefficient, while 96% of segments are expected to have a negative shoulder width coefficient for visible injury occurrence. In words, this indicates that 4% of the segments will experience an increase in visible injuries with wider shoulders, while 96% will experience a decrease in visible injuries with wider shoulders. Similarly, we find that 84% of R4L segments are expected to have a positive shoulder width coefficient, while 16% of segments are expected to have a negative shoulder width coefficient. In words, this indicates that 16% of the segments will experience an increase in visible injuries with wider shoulders, while 84% will experience a decrease in visible injuries with wider shoulders. This runs counter to the conventional expectation that wider shoulders will result in decrease in crash frequencies.

The random effects due to route are mainly urban, indicating that urban segments tend to have hierarchical unobserved effects at the county and district level. In the all-class models, SPF Class is a random effect, as well as the route class effect. Route class hierarchy being a significant random effect is an important finding since it indicates the potential for route groupings in terms of route propensities towards visible injury outcomes.

Table 6a. Variable glossary and significance in segment SPF models of severe injury crashes.

Variable	Description	SPF Models
Cross-sectional		
Log(ADT)	Annual daily traffic	**AC**,R2L, R4L,R4PL,U2L,U4L,U567L,U8PL,**UMD**,UMU
Log (Length)	Length of a segment in miles	** **AC,R2L**,**R4L,R4PL**,**U2L,U4L,U567L,U8PL**,UMD,UMU
LT_OS_WI	Right shoulder width in decreasing direction of milepost in feet	**AC**
RT_OS_WI	Right shoulder width in increasing direction of milepost in feet	R4PL
LT_IS_WI	Left shoulder width in decreasing direction of milepost in feet	U4L
MED_WI	Median width in feet	AC,**U8PL**
DES_SP	Design speed in miles per hour	AC,R2L,R4L,U2L
TOTLANES	Number of lanes	**UMU**
RTLANES	Number of lanes in increasing direction of milepost	U4L
LNOSPEC	Special structures indicator; 1 if no special structures are present in decreasing direction of milepost, 0 otherwise	U567L
Roadside		
METHRIE	Median barrier indicator; 1 if thrie beam barrier, 0 otherwise	AC
MEST	Median type indicator; 1 if striped median present, 0 otherwise	AC
METWTL	Median two-way turn lane indicator; 1 if present, 0 otherwise	U4L
MEOTHER	Median type indicator; 1 if nonspecific median, 0 otherwise	AC
Route Indicator		
RT49	Route 49 indicator; 1 if segment is in route 49, 0 otherwise	UMD
RT10	Route 10 indicator; 1 if segment is in route 10, 0 otherwise	U8PL
RT76	Route 76 indicator; 1 if segment is in route 76, 0 otherwise	U2L
RT2	Route 2 indicator; 1 if segment is in route 2, 0 otherwise	R4L
RT20	Route 20 indicator; 1 if segment is in route 20, 0 otherwise	U567L
RT26	Route 26 indicator; 1 if segment is in route 26, 0 otherwise	U2L
RT120	Route 120 indicator; 1 if segment is in route 120, 0 otherwise	U4L
RT680	Route 680 indicator; 1 if segment is in route 680, 0 otherwise	AC
RT166	Route 166 indicator; 1 if segment is in route 166, 0 otherwise	AC
RT129	Route 129 indicator; 1 if segment is in route 129, 0 otherwise	AC
RT236	Route 236 indicator; 1 if segment is in route 236, 0 otherwise	AC
County Indicator		
VEN	Ventura county indicator; 1 if segment is in Ventura county, 0 otherwise	AC, R2L
SDIEGO	San Diego county indicator; 1 if segment is in San Diego county, 0 otherwise	U8PL
CC	Contra Costa county indicator; 1 if segment is in Contra Costa county, 0 otherwise	U567L
MRN	Marin county indicator; 1 if segment is in Marin county, 0 otherwise	U8PL
SCR	Santa Cruz county indicator; 1 if segment is in Santa Cruz county, 0 otherwise	U4L
STA	Stanislaus county indicator; 1 if segment is in Stanislaus county, 0 otherwise	AC
LA	Los Angeles county indicator; 1 if segment is in Los Angeles county, 0 otherwise	AC

** model in bold indicates it contains the variable as a random parameter

Table 6b. Random effects significance in segment SPF severe injury models.

Random Effect	SPF Models
Route	AC,R2L,R4PL,U2L,U8PL
County	R4L,U4L,U567L,UMD,UMU
SPF Class	AC

Tables 6a and 6b show the random parameters and hierarchical random effects in segment SPFs for severe injury. The vector of significant geometric parameters is smaller in dimension than visible injury severities. It is also noted that the logarithm of ADT is random in two SPFs (AC and UMD), while the logarithm of length is random in multiple rural and urban SPFs as well as the all-class (AC) SPF. The fact that multiple rural SPFs have length as a random parameter indicate unobserved heterogeneities associated with the length effect. This implies the effect of length is not necessarily the same across observations as has been assumed in the published literature. This may be due to the fact that both rural and urban areas have greater dynamics due to traffic flow effects that may not be constant across segments while exerting their influence on severe injury outcomes. In addition to ADT and length, design speed and median width were found to be random. This demonstrates the heterogeneity in the impact of median width on urban 8-plus lane (U8PL) severe injuries. Since median width is assumed to be normally distributed, we find that 13% of UMU segments are expected to have a positive design speed coefficient, while 87% of segments are expected to have a negative design speed coefficient. In words, this indicates that 13% of the segments will experience an increase in severe injuries with higher design speeds, while 87% will experience a decrease in severe injuries with higher design speeds.

The random effects due to route are mainly urban, indicating that urban segments tend to have hierarchical unobserved effects at the route and county level. In the all-class models, SPF Class is a random effect, as well as the route class effect. Route class hierarchy being a significant random effect is an important finding since it indicates the potential for route groupings in terms of route propensities towards severe injury outcomes.

Table 7a. Variable glossary and significance in segment SPF models of fatal injury crashes.

Variable	Description	SPF Models
Cross-sectional		
Log(ADT)	Annual daily traffic	AC,R2L**,** R4L**,** U2L,U4L**,**U567L**,**U8PL**,UMD,**UMU
Log (Length)	Length of a segment in miles	****R4L**,**U2L,U4L,U567L,U8PL,**UMD**,**UMU,**AC,**R2L
RT_OS_WI	Right shoulder width in increasing direction of milepost in feet	R4L,U4L
LT_OS_WI	Right shoulder width in decreasing direction of milepost in feet	AC
MED_WI	Median width in feet	U567L
DES_SP	Design speed in miles per hour	AC,**R2L**
RNOSPEC	Special structures indicator; 1 if no special structures are present in increasing direction of milepost, 0 otherwise	U8PL,UMD
MESTRUC	Median type indicator; 1 if on divided roadway with separate structure	U4L
MECONCG	Median barrier indicator; 1 if concrete barrier guard rail present, 0 otherwise	AC
METHRIE	Median barrier indicator; 1 if thrie beam barrier, 0 otherwise	AC
Route Indicator		
RT5	Route 5 indicator; 1 if segment is in route 5, 0 otherwise	U4L
RT101	Route 101 indicator; 1 if segment is in route 101, 0 otherwise	U8PL
RT76	Route 76 indicator; 1 if segment is in route 76, 0 otherwise	U2L
RT8	Route 8 indicator; 1 if segment is in route 8, 0 otherwise	U567L
RT2	Route 2 indicator; 1 if segment is in route 2, 0 otherwise	R4L
RT99	Route 99 indicator; 1 if segment is in route 99, 0 otherwise	U567L
RT80	Route 80 indicator; 1 if segment is in route 80, 0 otherwise	AC
County Indicator		
ALA	Alameda county indicator; 1 if segment is in Alameda county, 0 otherwise	U8PL
SBD	San Bernadino county indicator; 1 if segment is in San Bernardino county, 0 otherwise	U567L
RIV	Riverside county indicator; 1 if segment is in Riverside county, 0 otherwise	AC,U4L,UMD
INY	Inyo county indicator; 1 if segment is in Inyo county, 0 otherwise	AC

Table 7b. Random effects significance in segment SPF fatal injury models.

Random Effect	SPF Models
Route	R2L,R4L
County	U2L,U4L,U567L,U8PL
District	UMD
SPF Class	AC

Tables 7a and 7b show the random parameters and hierarchical random effects in segment SPFs for fatal injury. The vector of significant geometric parameters is smaller in dimension than other severities. It is also noted that the logarithm of ADT is random in one SPF (UMD), while the logarithm of length is random in multiple SPFs (R4L, U2L, U4L, U567L, U8PL). The fact that multiple urban SPFs have length as a random parameter indicate unobserved heterogeneities associated with the length effect. This implies the effect of length is not necessarily the same across observations as has been assumed in the published literature. In addition to ADT and length, design speed is found to be random in one SPF, namely, two-lane rural segments. This demonstrates the heterogeneity in the impact of design speed on two-lane rural fatalities. Since design speed is assumed to be normally distributed, we find that 1% of two-lane rural segments are expected to have a positive design speed coefficient, while 99% of segments are expected to have a negative design speed coefficient. In words, this indicates that 1% of the segments will experience an increase in fatalities with higher design speeds, while 99% will experience a decrease in fatalities with higher design speeds. The effect of design speed is not unanimous; furthermore, it appears that higher design speeds are productive in reducing fatalities on two-lane rural segments.

The random effects due to route are mainly rural, indicating that two-lane and four-lane rural segments tend to have hierarchical unobserved effects at the route level. Conversely, the county and district effects are mainly urban, indicating geographic hierarchy being a source of unobserved effects. In the all-class models, SPF Class is a random effect.

Model Selection for Roadway Segments, Intersections and Ramp Segments

Model selection is based on two information criteria, namely, the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The two criteria are related to each other, and operate principally on the notion that penalized likelihoods for models with more parameters can be used to find the preferred model among a class of models. In our case, the class of models being compared is the basic type 2 SPF and the advanced type 2 SPF. These models do not have to be nested for comparative evaluation, as is the case with a likelihood ratio test. The sample AIC for samples is calculated by the formula: $-2\ln L_c+2k$ (and as $-2\ln L_c-2\ln[k+1]/[n-k-1]$ for small samples), where L_c is the log likelihood at convergence, n is the number of observations and k is the number of parameters in the model. The BIC is calculated according to the formula: $-2\ln L_c+k[\ln(n)-\ln(2\pi)]$. The BIC is known to penalize the more complex model heavily compared to the AIC. As a general rule, one picks models with the smallest BIC and AIC. The reasoning behind this is the smallest calculated values represent the lower threshold of information loss in the estimated models compared to the true model. Table 8 shows the comparative assessment of the various roadway segment models.

Table 8. Comparative assessment of basic type 2 and advanced type 2 segment models.

		Basic Type 2						Advanced Type 2					
SPF Model		LL_c	Adj. ρ^2	AIC	N	K	BIC	LL_c	Adj. ρ^2	AIC	N	K	BIC
	Total Crashes	-1,764.12	0.023	3,552.20	4,153	14	**3,644.890**	-1,755.90	0.169	**3,545.80**	4,153	17	3,653.427
R2L	PDO	-1,342.19	0.019	**2,708.40**	4,153	12	**2,784.351**	-1,339.42	0.119	2710.8	4,153	16	2,812.141
	Complaint of Pain	-399.063	0.006	**814.1**	4,153	7	**856.447**	-398.615	0.024	819.2	4,153	11	888.877
	Visible	-453.376	0.003	**922.8**	4,153	8	973.405	-453.196	0.014	926.4	4,153	8	**973.045**
	Severe	-212.704	0.0009	**435.4**	4,153	5	**467.066**	-212.601	0.004	441.2	4,153	8	491.855
	Fatal	-180.732	0.008	**369.5**	4,153	4	**394.790**	-180.105	0.014	374.2	4,153	7	418.531
	Total Crashes	-6,070.48	0.053	12,169.00	9,149	14	12,268.658	-6,040.80	0.383	**12,121.60**	9,149	20	**12,264.034**
R4L	PDO	-4,947.34	0.04	9,926.70	9,149	16	10,040.616	-4,924.11	0.324	**9,886.20**	9,149	19	**10,021.525**
	Complaint of Pain	-1,426.70	0.01	2,873.40	9,149	10	**2,944.604**	-1,415.99	0.061	**2,858.00**	9,149	14	2,959.678
	Visible	-1,424.14	0.008	2,868.30	9,149	10	**2,939.488**	-1,420.99	0.06	**2,868.00**	9,149	14	2,969.688
	Severe	-659.583	0.002	**1,331.20**	9,149	6	**1,373.894**	-659.432	0.01	1,334.90	9,149	7	1,382.714
	Fatal	-532.438	0.0006	**1,076.90**	9,149	6	**1,119.604**	-532.258	0.005	1,080.50	9,149	8	1,137.487
R4PL	Total Crashes	-284.604	0.161	587.2	220	9	**617.751**	-278.53	0.631	**583.1**	220	13	627.177
	PDO	-254.321	0.122	**526.6**	220	9	**557.185**	-253.077	0.561	528.2	220	11	565.484
	Complaint of Pain	-83.568	0.111	**182.9**	220	8	**210.285**	-83.533	0.249	187.1	220	10	221.002
	Visible	-59.8	0.005	**131.6**	220	6	**151.962**	-59.736	0.07	135.5	220	7	157.227
	Severe	-30.165	0.007	**70.3**	220	5	**87.298**	-30.159	0.022	74.3	220	7	98.073
	Fatal												

Table 8 (continued). Comparative assessment of basic type 2 and advanced type 2 segment models.

		Basic Type 2						Advanced Type 2					
SPF Model		LL_c	Adj. ρ^2	AIC	N	K	BIC	LL_c	Adj. ρ^2	AIC	N	K	BIC
RMU	Total Crashes	-56.952	0.030	**121.1**	115	4	**132.884**	-56.407	0.178	126.8	115	4	146.028525
	PDO	-44.283	0.00002	**98.6**	115	5	**112.291**	-44.281	0.086	102.6	115	5	121.776525
	Complaint of Pain												
	Visible												
	Severe												
	Fatal												
U2L	Total Crashes	-4,167.403	0.092	8,378.8	5,594	22	8,524.654	-4,159.605	0.316	**8,373.2**	5,594	22	**8,370.987**
	PDO	-3,409.059	0.080	6,842.1	5,594	12	6,921.671	-3,390.365	0.251	**6,812.7**	5,594	12	**6,918.801**
	Complaint of Pain	-1,180.092	0.009	2,380.2	5,594	10	**2,446.479**	-1,176.236	0.041	**2,378.5**	5,594	10	2,464.655
	Visible	-891.210	0.009	**1,802.4**	5,594	10	**1,868.715**	-890.767	0.052	1,805.5	5,594	10	1,885.087
	Severe	-337.309	0.005	**688.6**	5,594	7	**735.024**	-337.272	0.016	692.5	5,594	7	752.209
	Fatal	-310.346	0.076	**630.3**	5,594	5	**663.839**	-310.25501	0.945	636.5	5,594	5	689.546
U4L	Total Crashes	-10,056.433	0.184	20,158.9	7,184	23	20,317.097	-9,917.150	0.709	**19,892.3**	7,184	23	**20,091.809**
	PDO	-8,806.601	0.157	17,665.2	7,184	26	17,844.072	-8,703.588	0.658	**17,469.2**	7,184	26	**17,700.203**
	Complaint of Pain	-3,710.063	0.040	7,456.1	7,184	18	7,579.959	-3,704.822	0.246	**7,451.6**	7,184	18	**7,507.320**
	Visible	-2,329.864	0.006	**4,675.7**	7,184	8	**4,730.765**	-2,328.412	0.101	4,684.8	7,184	8	4,781.139
	Severe	-847.998	0.0007	**1,713.0**	7,184	9	**1,775.913**	-847.789	0.015	1,717.6	7,184	9	1,793.254
	Fatal	-603.835	0.0006	**1,221.7**	7,184	7	**1,269.827**	-603.756	0.014	1,227.5	7,184	7	1,296.308

Table 8 (continued). Comparative assessment of basic type 2 and advanced type 2 segment models.

		Basic Type 2						Advanced Type 2					
SPF Model		LL_c	Adj. ρ^2	AIC	N	K	BIC	LL_c	Adj. ρ^2	AIC	N	K	BIC
U567L	Total Crashes	-8,263.403	0.241	16,580.8	4,265	27	16,752.478	-8,193.799	0.855	**16,455.6**	4,265	27	**16,671.777**
	PDO	-7,335.609	0.211	14,729.2	4,265	29	14,913.606	-7,272.076	0.824	**14,614.2**	4,265	29	**14,836.689**
	Complaint of Pain	-3,574.533	0.066	7,181.1	4,265	16	**7,282.797**	-3,562.429	0.464	**7,164.9**	4,265	16	7,292.022
	Visible	-2,251.507	0.018	4,531.0	4,265	14	**4,620.0288**	-2,248.201	0.231	**4,530.4**	4,265	14	4,638.491
	Severe	-748.334	0.0006	**1,506.7**	4,265	5	**1,538.459**	-747.703	0.033	1,513.4	4,265	5	1,570.630
	Fatal	-458.764	0.0002	**933.5**	4,265	8	**984.394**	-458.120	0.022	936.2	4,265	8	999.822
U8PL	Total Crashes	-15,483.817	0.361	30,997.6	5,695	15	**31,097.344**	-15,449.339	0.911	**30,946.7**	5,695	15	31,106.214
	PDO	-14,255.541	0.306	**28,361.1**	5,695	25	28,727.266	-14,180.369	0.890	28,422.7	5,695	25	**28,628.806**
	Complaint of Pain	-7,380.872	0.068	14,801.7	5,695	20	14,934.691	-7,353.569	0.276	**14,759.1**	5,695	20	**14,931.969**
	Visible	-4,426.059	0.008	8,880.1	5,695	14	**8,973.181**	-4,417.019	0.276	**8,870.0**	5,695	14	8,981.043
	Severe	-1,488.356	0.003	**2,992.7**	5,695	8	**3,045.891**	-1,487.727	0.049	2,997.5	5,695	8	3,070.575
	Fatal	-931.5510	0.001	1,877.1	5,695	7	**1,923.633**	-928.706	0.027	**1,875.4**	5,695	7	1,935.238
UMD	Total Crashes	-3,103.692	0.181	6,235.4	3,239	14	6,320.546	-3,079.323	0.519	**6,198.6**	3,239	14	**6,320.306**
	PDO	-2477.660	0.160	4,989.3	3,239	17	**5,092.731**	-2,460.785	0.454	**4,965.6**	3,239	17	5,099.396
	Complaint of Pain	-1,123.451	0.033	**2,274.9**	3,239	9	**2,319.649**	-1,122.700	0.187	2,281.4	3,239	9	2,390.894
	Visible	-629.369	0.021	**1278.7**	3,239	10	1,339.568	-628.938	0.082	1281.9	3,239	10	**1,354.872**
	Severe	-246.591	0.0004	**503.0**	3,239	5	**533.597**	-246.527	0.003	507.1	3,239	5	549.635
	Fatal	-135.697	0.007	**283.4**	3,239	6	**319.892**	-133.711	0.031	285.4	3,239	6	340.169

Table 8 (continued). Comparative assessment of basic type 2 and advanced type 2 segment models.

		Basic Type 2						Advanced Type 2					
SPF Model		LL_c	Adj. ρ^2	AIC	N	K	BIC	LL_c	Adj. ρ^2	AIC	N	K	BIC
UMU	Total Crashes	-674.981	0.108	1,364.0	844	8	**1403.867**	-671.489	0.278	**1,363.0**	844	8	1,410.360
	PDO	-550.632	0.088	**1,117.3**	844	3	**1121.478**	-549.978	0.217	1,122.0	844	3	1,180.814
	Complaint of Pain	-194.193	0.026	**398.4**	844	15	489.458	-194.109	0.055	402.2	844	15	401.694
	Visible	-128.629	0.026	**266.1**	844	5	**290.949**	-128.439	0.054	270.9	844	5	304.045
	Severe	-31.886	0.940	**71.8**	844	5	**97.463**	-31.837	0.962	77.7	844	5	110.841
	Fatal												

As seen in Table 8, there is substantial discrepancy between the AIC guided model, and the BIC guided model. In few cases, both the AIC and BIC favor the same model, but in many cases, they are divergent. This point of divergence has been debated in the statistical community as well (see for example, Yang 2005). The BIC is a consistent, yet, not asymptotically efficient criterion, and therefore, asymptotically will select the fitted candidate model having the correct structure with probability one. The AIC on the other hand is not consistent but asymptotically efficient, and therefore will select the fitted candidate model which minimizes the mean squared error of prediction. Burnham and Anderson (2002) argue that while the BIC was developed to identify the true dimension of the model, i.e., favoring a parsimonious structure, this reasoning is unsuitable in the traffic safety case where one has a large number of variables with non-zero effect sizes. (Recall that when comparing the AIC and BIC formulas, we find that for $k>=8$, $k*\ln(n) > 2k$). Therefore, it is much more common for the AIC to favor the rich models developed to mitigate unobserved heterogeneity as seen in traffic safety problems. To further support Burnham and Anderson's argument, in traffic safety contexts, it is often the case that few variables have substantial non-zero effect sizes, while many have smaller effect sizes, but all effect sizes are non-zero. The goal is to find out how many parameters are useful for prediction, and this objective is consistent with the AIC's operational principle of asymptotic efficiency – in that it will select the model with minimal prediction errors.

In summary, one has to evaluate alternative traffic safety models via the agreement of AIC and BIC as far as possible. Where there is agreement, it indicates that the model is both true in structure and a candidate for minimal predictive errors as well. If there is disagreement between the AIC and BIC, it is recommended that the model with the lower AIC be preferred, since the goal is to select models with potential for minimal predictive errors. There are cases in this study where the advanced type 2 model was not estimable – led to convergence issues. In this case, the basic type 2 model is recommended as the default SPF. Table 9 summarizes our conclusions on model selection. As can be seen in Table 9, the basic type 2 SPF was selected for 15 urban categories based on agreement between AIC and BIC, while, the advanced type 2 was selected for 9 urban categories. The advanced type 2 SPF was also selected for 8 urban categories due to disagreement between the AIC and BIC, while the basic type 2 SPF was selected for 3 urban categories. In total, out of the 35 urban models compared, 17 advanced type 2 SPFs were selected, and 18 basic type 2 SPFs were selected. This summary shows that 68.57% of the urban SPFs have both the appropriate structure and optimal predictive power (based on agreement between AIC and BIC). Out of this proportion, 25.71% was of advanced type 2 SPF form. This indicates that the urban environment has a non-trivial proportion of components where unobserved heterogeneity is statistically significant and plays an important role in predictive outcomes. The urban multilane undivided component is the only urban component that did not have an advanced type 2 SPF selected on the basis of agreement between the AIC and BIC. The basic type 2 SPF appears to be the preferred form for at least one severity category in every urban class. The rural class of SPFs is dominated by the basic type 2 SPF as the preferred form, with only two SPFs recommended for the advanced type 2 form on the basis of AIC and BIC agreement. This shows that the structure of unobserved heterogeneity and predictive accuracy is well captured by the basic type 2 SPF in general for rural highway classes. This is perhaps due to the minimal variation in traffic flow effects as well as interchange and intersection design complexities in rural areas.

Table 9. Recommended SPF type for rural and urban roadway segments.

SPF Class	Outcome Type	Recommended SPF	SPF Class	Outcome Type	Recommended SPF
R2L	Total Crashes	Advanced Type 2	U567L	Total Crashes	Advanced Type 2
	PDO	Basic Type 2		PDO	Advanced Type 2
	Complaint of Pain	Basic Type 2		Complaint of Pain	Advanced Type 2
	Visible	Basic Type 2		Visible	Advanced Type 2
	Severe	Basic Type 2		Severe	Basic Type 2
	Fatal	Basic Type 2		Fatal	Basic Type 2
R4L	Total Crashes	Advanced Type 2	U8PL	Total Crashes	Advanced Type 2
	PDO	Advanced Type 2		PDO	Basic Type 2
	Complaint of Pain	Advanced Type 2		Complaint of Pain	Advanced Type 2
	Visible	Advanced Type 2		Visible	Advanced Type 2
	Severe	Basic Type 2		Severe	Basic Type 2
	Fatal	Basic Type 2		Fatal	Advanced Type 2
R4PL	Total Crashes	Advanced Type 2	UMD	Total Crashes	Advanced Type 2
	PDO	Basic Type 2		PDO	Advanced Type 2
	Complaint of Pain	Basic Type 2		Complaint of Pain	Basic Type 2
	Visible	Basic Type 2		Visible	Basic Type 2
	Severe	Basic Type 2		Severe	Basic Type 2
	Fatal	Basic Type 2		Fatal	Basic Type 2
RMU	Total Crashes	Basic Type 2	UMU	Total Crashes	
	PDO	Basic Type 2		PDO	Basic Type 2
	Complaint of Pain	Basic Type 2		Complaint of Pain	Basic Type 2
	Visible	Basic Type 2		Visible	Basic Type 2
	Severe	Basic Type 2		Severe	Basic Type 2
	Fatal	Basic Type 2		Fatal	Advanced Type 2
U2L	Total Crashes	Advanced Type 2			
	PDO	Advanced Type 2			
	Complaint of Pain	Advanced Type 2			
	Visible	Basic Type 2			
	Severe	Basic Type 2			
	Fatal	Basic Type 2			
U4L	Total Crashes	Advanced Type 2			
	PDO	Advanced Type 2			
	Complaint of Pain	Advanced Type 2			
	Visible	Basic Type 2			
	Severe	Basic Type 2			
	Fatal	Basic Type 2			

Table 10. Variable glossary and significance in intersection SPF models.

Cross-sectional	**Description**	**Severity**
LNADTMI	Mainline ADT	**TC,PDO,Cpain,Visible,Severe,Fatal**
LNADTMA	Cross Street ADT	**TC,PDO,Cpain,Visible,Severe,Fatal**
NUMLANE	Number of intersection lanes	TC,PDO,Cpain,Visible,Severe,Fatal
Intersection type		
FOURLEG	Four-leg intersection indicator	TC,PDO,Cpain,Visible,Severe,Fatal
T_INTRS	T- intersection indicator	TC,PDO,Cpain,Visible,Severe,Fatal
Traffic Control		
STOMAIN	Stop signs on mainline only indicator	TC,PDO,Cpain,Visible,Severe,Fatal
FWYFSHX	Four-way flasher (red on cross street) indicator	TC,PDO,Cpain,Visible,Severe,Fatal
FWYFSHAL	Four-way flasher (red on all) indicator	TC,PDO,Cpain,Visible,Severe,Fatal
SGNL2P	Signals pre-timed (two-phase) indicator	TC,PDO,Cpain,Visible,Severe,Fatal
SGNLFL2	Signals full traffic actuated, two-phase indicator	TC,PDO,Cpain,Visible,Severe,Fatal
SGNLOTH	Other signal control type indicator	TC,PDO,Cpain,Visible,Severe,Fatal
MSTARM	Mainline mast arm indicator	TC,PDO,Cpain,Visible,Severe,Fatal
INTMAT	Intersection mast arm indicator	TC,PDO,Cpain,Visible,Severe,Fatal
INT2WPK	Intersection two-way traffic, left turn restricted during peak hours indicator	TC,PDO,Cpain,Visible,Severe,Fatal
INT2WLT	Intersection-two-way traffic, left turn permitted indicator	**TC,PDO,Cpain,Visible,Severe,Fatal**
Channelization		
INTRT	Intersection right turn channelization indicator	TC,PDO,Cpain,Visible,Severe,Fatal
MNORGHT	No right turn channelization indicator	**TC,PDO,Cpain,Visible,Severe,Fatal**
Illumination		
NOLIGHT	No lighting indicator	**TC,PDO,Cpain,Visible,Severe,Fatal**
Random Effects	Spfclass, Major-minor, functional class, intersection type, lighting type, mainline left turn channelization type, and mainline traffic flow type	

Table 10 shows the results of the advanced type 2 SPFs developed for the five severity outcomes as well as the total crash outcomes for intersections. The results show that ADT of the major and minor streets are random in all severity SPFs as well as the total crash SPF. The intersection two-way traffic indicator is also found to be random, as is no right turn channelization indicator and no lighting indicator. These indicators show that significant unobserved heterogeneity is captured in intersections where channelization geometry and illumination are lacking. The lack of illumination indicator may also indicate an association with unsignalized intersections. The hierarchical random effects include SPF class (that of the major road, major-minor classification, functional class, intersection type, lighting type, mainline left turn channelization type and mainline traffic flow type (such as two-way, one-way). These random effects show the need to further research intersection crash occurrence by these stratifications, since the random effects are significant.

A surprising finding is that intersection traffic control variables are found to be fixed parameters. This might be attributed to the fact that traffic control devices appear to induce a sufficient level of compliance among drivers that their effect sizes do not vary significantly across intersections. The challenge therefore to mitigating intersection crash occurrence primarily appears to stem from illumination and geometry of channelization of flow.

Table 11. Comparative assessment of basic type 2 and advanced type 2 intersection models.

SPF Model	Basic Type 2				Advanced Type 2			
	LL_c	Adj. ρ^2	AIC	BIC	LL_c	Adj. ρ^2	AIC	BIC
Total Crashes	-123,003.32	0.12	**246,046.6**	**246,236.4**	-120,649.30	0.51	247,067.0	247,380.2
PDO	-94,540.25	0.10	189,120.5	189,310.3	-93,245.18	0.39	**186,556.4**	**186,869.6**
Complaint of Pain	-56,103.63	0.04	112,247.3	112,437.1	-55,542.25	0.21	**111,150.5**	**111,463.6**
Visible	-37,484.43	0.01	75,008.9	75,198.7	-37,328.51	0.06	**74,723.0**	**75,036.2**
Severe	-13,112.82	0.002	**26,264.4**	**26,454.2**	-13,112.42	0.01	26,290.8	26,604.0
Fatal	-5,875.46	0.002	11,766.9	**11,842.8**	-5,858.16	0.005	**11,752.3**	11,923.1

Table 12. Recommended SPF type for intersection models.

Total Crashes	Basic Type 2
PDO	Advanced Type 2
Complaint of Pain	Advanced Type 2
Visible	Advanced Type 2
Severe	Basic Type 2
Fatal	Advanced Type 2

Tables 11 and 12 shows the results of the comparative analysis of basic and advanced type 2 intersection models for various severity outcomes. Similar to the analysis of segment models, we find that the AIC vs BIC analysis yields the recommended SPFs shown in Table 12. The total crash SPF appears to benefit from a basic type 2 SPF form, while the PDO, complaint of pain, visible injury and fatal injuries seem to benefit from advanced type 2 forms. Severe injury is the one severity outcome that appears to benefit from a basic type 2 form. This analysis shows that severity specific SPFs are capable of producing SPFs that can yield minimal prediction errors. In particular, three SPFS, namely, the PDO, complaint of pain and visible injury models show agreement between AIC and BIC criteria. This demonstrates that both structure and prediction are best produced using the advanced type 2 SPF functional form.

The significance of heterogeneity and hierarchical random effects merits further consideration in the detailed analysis of intersection crash occurrence. A type of model that we have not explored in this study is the heterogeneity in mean model, wherein the stratifiers as identified in the random effects may potentially play a role in causing the means of the subgroups to be different. This is a potential area of further research. The cost of estimating such models comes at the expense of model dimensionality and complexity. Model dimensionality in particular can impede the development of rich random parameter SPFs due to the computational burdens the simulation based estimation imposes on the analysis.

We now discuss the findings of the ramp segment advancted type 2 SPF analysis. First we present the significant variables in the various severity outcomes of the SPFs. We then discuss the AIC-BIC criterion analysis along with recommendations for the appropriate type 2 SPFs.

Table 13. Variable glossary and significance in ramp segment SPF models.

Cross-sectional	Description	Severity
LNADT	Ramp ADT	**TC,PDO,Cpain,Visible,Severe,Fatal**
LNLENGTH	Ramp shape length	**TC,PDO,Cpain,Visible,Severe,Fatal**
NLANE	Number of lanes	**TC,PDO,Cpain,Visible**
Ramp Direction		
NBDIR	Northbound direction indicator	TC,PDO,Cpain,Visible,Severe,Fatal
WBDIR	Westbound direction indicator	TC,PDO,Cpain,Visible,Severe,Fatal
Ramp Type		
ONRAMP	Four-leg intersection indicator	**TC,PDO,Cpain,Visible,Severe**
Ramp Shape		
LOOP	Loop ramp indicator	**TC**
SLIP	Slip ramp indicator	TC,PDO
Ramp Metering		
RMPMTR	Ramp metering indicator	TC,PDO
NOHOV	No HOV lane indicator	TC,PDO,Cpain
Ramp Design		
BHOOK	Button hook ramp indicator	TC,PDO,Cpain
DIAMOND	Diamond ramp indicator	TC,PDO,Cpain, Visible, Severe
DSDIRR	Direct/semi-direct connector (right) ramp indicator	TC, PDO, Cpain
LOOPLT	Loop ramp with left turn indicator	TC,PDO, Cpain
LOOPWLT	Loop ramp without left turn indicator	TC,PDO, Cpain
SPLIT	Split ramp indicator	TC,PDO, Cpain
District		
DISTRICT3	District 3 indicator	Fatal
DISTRICT6	District 6 indicator	TC,PDO, Cpain
DISTRICT11	District 11 indicator	TC,PDO,Cpain, Visibe, Severe
DISTRICT12	District 12 indicator	TC, Visible
County		
COUNTY18	Sacramento county indicator	TC, Cpain
COUNTY23	Alameda county indicator	TC, PDO, Cpain
COUNTY29	San Mateo county indicator	TC, PDO
Route		
RT5	Route 5 indicator	TC, PDO, Cpain, Visible, Severe
RT8	Route 8 indicator	TC, PDO
RT10	Route 10 indicator	TC, PDO, Cpain
RT50	Route 50 indicator	TC, PDO
RT60	Route 60 indicator	TC, PDO
RT78	Route 78 indicator	TC, PDO, Cpain
RT105	Route 105indicator	TC, Cpain, Visible, Fatal
RT210	Route 210 indicator	TC, PDO, Cpain, Visible, Severe
RT710	Route 710 indicator	TC, PDO
RT880	Route 880 indicator	TC, PDO, Cpain
Random Effects	District class, county class, route class, direction, metering class	

Table 13 shows the significant variables in the various severity outcomes for intersections. It can be seen that the variables in bold that represent random parameters are primarily volume, length, number of lanes, the on-ramp indicator and loop ramp shape indicator. The rest of the variables including ramp design indicators, district, route and county indicators are fixed parameters. Random effects include hierarchical effects due to geography and route, as well as direction and metering levels. The last two variables merit further investigation due to non-trivial variances.

Table 14. Comparative assessment of basic type 2 and advanced type 2 ramp segment models.

SPF Model	Basic Type 2				Advanced Type 2			
	LL_c	Adj. ρ^2	AIC	BIC	LL_c	Adj. ρ^2	AIC	BIC
Total Crashes	-22,412.583	0.056	44,893.2	45,145.3	-21,751.121	0.506	**43,590.2**	**43,916.4**
PDO	-19,042.804	0.041	38,147.6	38,377.4	-18,690.840	0.395	**37,463.7**	**37,767.7**
Complaint of Pain	-10,538.088	0.011	21,126.2	21,311.5	-10,448.107	0.133	**20,966.2**	**21,225.7**
Visible	-5,885.551	0.005	**11,797.1**	**11,893.5**	-5,885.040	0.043	11,816.1	11,986.6
Severe	-1,282.603	0.001	**2,585.2**	**2,659.3**	-1,277.278	0.009	2,586.6	2,705.2
Fatal	-486.138	0.0004	**986.3**	**1,104.1**	-485.651	0.003	993.3	1,074.8

Table 15. Recommended SPF type for ramp segment models.

Total Crashes	Advanced Type 2
PDO	Advanced Type 2
Complaint of Pain	Advanced Type 2
Visible	Basic Type 2
Severe	Basic Type 2
Fatal	Basic Type 2

Tables 14 and 15 show the results of the model selection analysis. The analyses show that the total crash, property damage and complain of pain SPFs benefit from advanced type 2 models, since the contribution to the likelihood is significant (see adjusted rho-squared improvements). For higher severities however, the improvement in likelihoods is not that substantial so as to merit the selection of advanced type 2 SPFs. Based on information theory and the amount of information loss compared to a "true" model, it appears the basic type 2 SPF suffices for visible, severe and fatal injury models.

Conclusions and Recommendations

We developed advanced type 2 SPFs for roadway segments, intersections and ramp segments in this study. We determined that several geometric effects such as median width, shoulder width, and design speed are random parameters in numerous roadway segment SPF classes. It was also determined that the heterogeneity due to ADT and length was substantial in several of the roadway segment models. Roadway segments without intersections SPFs included:

6 all-district/all class models comprised of total crashes, PDO, complaint of pain, visible, severe and fatal injury types; and 54 all-district/spf-class models comprised of total crashes, PDO, complaint of pain, visible, severe and fatal injury types. Intersection SPFs included: 6 all-district/all class models comprised of total crashes, PDO, complaint of pain, visible, severe and fatal injury types; while ramp segment SPFs included: 6 all-district/all class models comprised of total crashes, PDO, complaint of pain, visible, severe and fatal injury types for all ramp segments and metered ramp segments

In terms of general model performance, for all-district/all-class model groups, the total crash model has:

The best convergent likelihood and Akaike information criterion compared to their fixed-parameter NB baselines. For all-district/all-class model groups, visible and severe models have inferior likelihoods and Akaike information criteria compared to their fixed-parameter NB baselines. For all-district/all-class model groups, severe and fatal models have lowest McFadden pseudo R-squareds. For all-district/spf-class model groups, the urban multilane divided models have the lowest McFadden pseudo R-squared. For all-district/spf-class model groups, the rural 4+lane models have inferior Akaike information criteria compared to their fixed-parameter NB baselines. For all-district/spf-class model groups, the urban four-lane and urban eight plus-lane SPFs have superior convergent likelihoods and Akaike information criteria compared to their fixed-parameter NB baselines. The county variable has the highest random effect variance. It also has a significant random effect variance in all ten spf class models (rural two-lane, rural four-lane, rural four plus-lane, rural multi-lane undivided urban two-lane, urban four-lane, urban 5to7-lane, urban eight plus-lane, urban multi-lane divided, and urban multi-lane undivided).

The district variable has a significant random effect variance in five spf class models (rural four-lane, rural multi-lane undivided, urban two-lane, urban four-lane, and urban multi-lane divided). The route class variable has a significant random effect variance in three spf class models (rural four plus-lane, urban four-lane, and urban multi-lane divided). The district class variable has the lowest random effect variance. In terms of random parameters, the logarithms of ADT and length have consistent random parameter effects across SPFs. Median width, shoulder width and design speed are random parameters in a few SPFs. Right shoulder width in increasing and decreasing direction of milepost appears to have consistent negative fixed parameter effects in most SPFs.

In terms of intersection model performance, the mainline dummy has the highest random effect variance. The mainline dummy has a significant random effect variance in three models (total crashes, PDO, and visible). Random effect variances were very weak in both severe and fatal models. The mainline left turn channelization dummy has the lowest random effect variance. The mainline ADT, cross street ADT, no lighting, no right turn channelization, and intersection-two-way traffic left turn permitted have consistent random parameter effects. Random parameter effects were weak in both severe and fatal models. The T-intersection indicator has a consistent negative fixed parameter effects. As a final note, it should be noted that in all the SPFs inclusive of roadway segments and ramp segments, a large number of route and county indicators are significant, albeit as fixed parameters. District indicators are not as numerous. Yet, the significance of these indicators indicates substantial hierarchical unobserved effects that suggest differences in the mean of unobserved effects across routes and counties. It maybe that in some cases, certain geometric slopes are also different – an exhaustive analysis of interactions of the route and county dummies with geometric variables is required to make definitive conclusions on the extent of the differences in parameters across routes and counties. The county and route indicators were not evaluated for intersections since the information on the minor street was unknown (for example, route information, unincorporated county/city information). Further, minor street geometrics were not available to the same resolution as the mainline. These factors also contribute to unobserved heterogeneity in intersection analysis.

The random parameter findings show the need to further analyze the segments where the impact of the variable is of the positive sign and where variable impact is of the negative sign. This type of analysis goes beyond the aggregate assessment of the mean parameter magnitude and sign across all observations. Individualized analysis of segments may shed further light into the contextual basis for increasing crash occurrence propensities at certain locations, especially in the domains of severe outcomes. This will require estimation of parameters at the segment level with the appropriate standard errors in order to construct confidence intervals around the individual segment level parameters. This type of analysis merits further consideration due to the targeted insights it can provide for prioritized safety locations. The identification of hierarchical random effects in the roadway segment models underscores the need for stratified analysis along district, county and route class lines. The finding on the preferred models using the AIC and BIC criterions yielded recommendations on the preferred SPF type for road segments, intersections and ramp segments. The finding is that not all SPFs are unanimously of the basic type 2 SPF form; in the roadway segment case, for example, several urban areas merit the use of advanced type 2 SPFs. In the intersection domain, it appears that several of the severity specific analyses merit the use of advanced type 2 SPFs. In the domain of ramp segments, it appears that several of the severity specific outcomes, regardless of ramp metering presence merit the use of advanced type 2 SPFs. The summary import is that in areas where significant unobserved heterogeneity is suspected, the significant random effect indicators suggest deeper stratified analysis along hierarchical lines (such as district, county, route class, SPF class, intersection type, lighting type, traffic flow type, and metering levels). What this implies is that basic type 2 SPFs within these stratified categories may not suffice – as has been noticed in the published literature. Rather, it motivates the need for richer heterogeneity in means random parameters models within these stratified groups. This finding is corroborated by recent research by Mannering et al (2016) who completed an exhaustive study of methods to model unobserved heterogeneity in crash occurrence and severity. What the Mannering study did not show and what this particular study indicates is the strategic guidance offered by the AIC-BIC analysis that recommends where to pursue advanced type 2 SPFs, and within what stratified groups.

The richness of the ramp metering models indicates the need to further pursue targeted research in the ramp design domain. Ramp design variables appear to be random, which implies there is significant heterogeneity due to the shape of the ramp. The context within which this heterogeneity is observed requires further research. For example, it may be that loop shape ramp parameters are random due to the heterogeneity in the overall design of the interchange within which the ramp design is situated. No two loop ramp are identical in their conduct of traffic flow – and this study shows that the propensity for the effect of the loop design to vary across interchanges is non-trivial. Another interesting finding is the randomness of the on-ramp indicator, which suggests that unobserved heterogeneity in crash occurrence is significant in merging type segments, rather than diverging type segments (such as off ramps). The numerous variables that are statistically significant in the ramp metering models as fixed parameters further underscores the significance of the random parameters and random effects. In the presence of omitted variables in the model, the randomness of a parameter is more likely, which in this study is not the case due to the rich specifications arising the numerous fixed parameters. A final note of significance is that the constant term is noted to be random in several intersection and ramp metering models. What this suggests is that in addition to the basic random effects (due to a random constant), there appears to added unobserved heterogeneity that materializes in the form of random slopes and random effects. The constant was not found to be random in roadway segment models – this is a surprising finding but perhaps indicative of the impact of the roadside effects that were significant in the roadway segments models. The intersection models and ramp metering models did not contain roadside variables – emphasizing a future need to build advanced type 2 models that can incorporate roadside effects in intersection and ramp metering models.

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APPENDIX

Modeling Output

Random Coefficients NegBnReg Model
Dependent variable TOTALCR
Log likelihood function -50861.12298
Restricted log likelihood -292976.17343
Chi squared [6 d.f.] 484230.10091
Significance level .00000
McFadden Pseudo R-squared .8263984
Estimation based on N = 40508, K = 37
Inf.Cr.AIC = 101796.2 AIC/N = 2.513
Model estimated: Jun 24, 2016, 04:53:42
Sample is 1 pds and 40508 individuals
Negative binomial regression model
Simulation based on 100 Halton draws

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.000214
R.E.(02) = DCODE	.000177
R.E.(03) = RCLASS	.000673

All-Districts-All-Classes: Total Crash Model of Road Segments

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-6.56432***	.08248	-79.59	.0000	-6.72597	-6.40267
MED_WI	-.00323***	.00037	-8.64	.0000	-.00397	-.00250
MEBRAIL	-.41053***	.03235	-12.69	.0000	-.47394	-.34713
METHRIE	.15566***	.03425	4.54	.0000	.08853	.22279
MEOTHER	.58569***	.07981	7.34	.0000	.42926	.74212
MECONC	.09061***	.02402	3.77	.0002	.04353	.13769
MECONCG	.16124***	.03306	4.88	.0000	.09645	.22603
RT108	.28704**	.12512	2.29	.0218	.04180	.53227
RT73	-.52796***	.14541	-3.63	.0003	-.81296	-.24297
RT241	-.58376***	.15950	-3.66	.0003	-.89637	-.27115
RT200	1.34829**	.57261	2.35	.0185	.22598	2.47059
RT53	-1.43565***	.52474	-2.74	.0062	-2.46411	-.40718
RT680	-.28485***	.08372	-3.40	.0007	-.44893	-.12076
RT166	.67780***	.13065	5.19	.0000	.42173	.93388
RT129	.74124***	.15125	4.90	.0000	.44480	1.03767
RT236	1.54293***	.52621	2.93	.0034	.51158	2.57429
RT41	.20063***	.06193	3.24	.0012	.07925	.32202
DES_SP	-.01913***	.00095	-20.16	.0000	-.02099	-.01727
RT_TR_WI	.00194***	.00066	2.95	.0031	.00065	.00323
LA	.21243***	.02092	10.16	.0000	.17144	.25342
VEN	.31174***	.04791	6.51	.0000	.21784	.40563
ALP	-1.15922***	.14985	-7.74	.0000	-1.45291	-.86553
AMA	-.33823***	.10814	-3.13	.0018	-.55018	-.12627
STA	.23182***	.06749	3.43	.0006	.09954	.36410
LLTR	-.15091**	.06070	-2.49	.0129	-.26988	-.03194
LNOSPEC	-.07324***	.02347	-3.12	.0018	-.11924	-.02724
MEST	-.14247***	.02508	-5.68	.0000	-.19164	-.09331
	Means for random parameters					
LNADT	.93567***	.00696	134.42	.0000	.92202	.94931
LNLEN	.75446***	.00525	143.64	.0000	.74417	.76476
LT_IS_WI	-.01070***	.00230	-4.66	.0000	-.01520	-.00620
	Scale parameters for dists. of random parameters					
LNADT	.01460***	.00086	17.06	.0000	.01292	.01627
LNLEN	.04490***	.00303	14.81	.0000	.03896	.05084
LT_IS_WI	.00243**	.00114	2.13	.0334	.00019	.00466
	Standard Deviations of Random Effects					
R.E.(01)	.01462**	.00691	2.11	.0345	.00107	.02816
R.E.(02)	.01329*	.00699	1.95	.0572	-.00041	.02699
R.E.(03)	.02593***	.00685	3.78	.0002	.01250	.03937
	Dispersion parameter for NegBin distribution					
ScalParm	1.28070***	.02046	62.60	.0000	1.24060	1.32079

Random Coefficients NegBnReg Model
Dependent variable PDO
Log likelihood function -44524.48623
Restricted log likelihood -218491.63021
Chi squared [6 d.f.] 347934.28797
Significance level .00000
McFadden Pseudo R-squared .7962188
Estimation based on N = 40508, K = 36
Inf.Cr.AIC = 89121.0 AIC/N = 2.200
Model estimated: Jun 24, 2016, 19:35:58
Sample is 1 pds and 40508 individuals
Negative binomial regression model
Simulation based on 100 Halton draws

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.000287
R.E.(02) = CTY	.000046
R.E.(03) = RCLASS	.000178

All-Districts-All-Classes: PDO Model of Road Segments

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-7.45062***	.09199	-80.99	.0000	-7.63091	-7.27032
MED_WI	-.00337***	.00039	-8.66	.0000	-.00413	-.00261
MEBRAIL	-.33529***	.03532	-9.49	.0000	-.40452	-.26606
METHRIE	.18427***	.03574	5.16	.0000	.11421	.25432
MEOTHER	.62771***	.08031	7.82	.0000	.47030	.78512
MECONC	.09014***	.02461	3.66	.0002	.04191	.13837
MECONCG	.22024***	.03393	6.49	.0000	.15374	.28674
RT73	-.53665***	.14800	-3.63	.0003	-.82673	-.24657
RT241	-.57052***	.18292	-3.12	.0018	-.92904	-.21200
RT200	1.80046***	.57317	3.14	.0017	.67707	2.92384
RT53	-1.58218***	.60329	-2.62	.0087	-2.76460	-.39976
RT680	-.34058***	.08376	-4.07	.0000	-.50475	-.17641
RT166	.73390***	.13945	5.26	.0000	.46059	1.00722
RT129	.85657***	.16770	5.11	.0000	.52789	1.18525
RT236	1.75791***	.61985	2.84	.0046	.54303	2.97278
RT41	.27199***	.06729	4.04	.0001	.14011	.40386
DES_SP	-.01491***	.00104	-14.29	.0000	-.01696	-.01287
RT_TR_WI	.00115*	.00067	1.72	.0860	-.00016	.00247
LA	.17465***	.02145	8.14	.0000	.13261	.21669
VEN	.27628***	.05057	5.46	.0000	.17716	.37539
ALP	-.99547***	.17604	-5.65	.0000	-1.34050	-.65044
AMA	-.34307**	.13534	-2.53	.0113	-.60834	-.07780
STA	.24286***	.06803	3.57	.0004	.10953	.37620
LLTR	-.19299***	.06431	-3.00	.0027	-.31905	-.06694
LNOSPEC	-.08207***	.02426	-3.38	.0007	-.12962	-.03452
MEST	-.14701***	.02740	-5.37	.0000	-.20071	-.09330
	Means for random parameters					
LNADT	.97027***	.00774	125.30	.0000	.95509	.98545
LNLEN	.75316***	.00570	132.24	.0000	.74200	.76433
RT_IS_WI	-.01127***	.00245	-4.60	.0000	-.01607	-.00646
	Scale parameters for dists. of random parameters					
LNADT	.01591***	.00089	17.96	.0000	.01417	.01764
LNLEN	.04720***	.00330	14.29	.0000	.04072	.05367
RT_IS_WI	.00257**	.00122	2.11	.0350	.00018	.00497
	Standard Deviations of Random Effects					
R.E.(01)	.01353**	.00671	2.02	.0438	.00038	.02669
R.E.(02)	.01695***	.00653	2.60	.0095	.00415	.02975
R.E.(03)	.01333*	.00683	1.95	.0510	-.00006	.02672
	Dispersion parameter for NegBin distribution					
ScalParm	1.31461***	.02302	57.11	.0000	1.26949	1.35973

```
Random Coefficients  NegBnReg Model
Dependent variable              CPAIN
Log likelihood function    -50844.56310
Restricted log likelihood -292976.17343
Chi squared [   6 d.f.]    484263.22067
Significance level              .00000
McFadden Pseudo R-squared      .8264550
Estimation based on N =  40508, K =  33
Inf.Cr.AIC  = 101763.1 AIC/N =    2.512
Model estimated: Jun 24, 2016, 01:36:47
Sample is  1 pds and  40508 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
```

```
+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |    Variance  |
| R.E.(01) = SPFCLASS                        |      .000129 |
| R.E.(02) = DCODE                           |      .000233 |
+--------------------------------------------+--------------+
```

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-6.51322***	.08196	-79.47	.0000	-6.67386	-6.35257
MED_WI	-.00285***	.00037	-7.64	.0000	-.00358	-.00212
MEBRAIL	-.39739***	.03231	-12.30	.0000	-.46071	-.33406
METHRIE	.15341***	.03380	4.54	.0000	.08717	.21965
MEOTHER	.50328***	.07652	6.58	.0000	.35330	.65326
MECONC	.08710***	.02363	3.69	.0002	.04078	.13342
MECONCG	.21217***	.03314	6.40	.0000	.14722	.27712
RT108	.26949**	.12288	2.19	.0283	.02866	.51032
RT73	-.53398***	.14557	-3.67	.0002	-.81929	-.24866
RT241	-.59206***	.15869	-3.73	.0002	-.90309	-.28104
RT166	.67756***	.13078	5.18	.0000	.42123	.93389
RT129	.75126***	.15190	4.95	.0000	.45354	1.04897
RT236	1.52388***	.52113	2.92	.0035	.50248	2.54528
RT41	.24822***	.06269	3.96	.0001	.12536	.37108
DES_SP	-.01826***	.00094	-19.38	.0000	-.02011	-.01641
RT_TR_WI	.00248***	.00066	3.78	.0002	.00119	.00377
LA	.18615***	.02057	9.05	.0000	.14583	.22647
VEN	.27052***	.04660	5.81	.0000	.17919	.36186
ALP	-1.12178***	.15017	-7.47	.0000	-1.41610	-.82745
AMA	-.34319***	.10774	-3.19	.0014	-.55436	-.13202
STA	.21963***	.06679	3.29	.0010	.08873	.35054
LLTR	-.21926***	.05902	-3.72	.0002	-.33493	-.10359
LNOSPEC	-.09736***	.02340	-4.16	.0000	-.14322	-.05150
MEST	-.13594***	.02490	-5.46	.0000	-.18475	-.08714
	Means for random parameters					
LNADT	.92511***	.00695	133.14	.0000	.91149	.93872
LNLEN	.74743***	.00519	144.10	.0000	.73727	.75760
LT_IS_WI	-.01157***	.00227	-5.10	.0000	-.01602	-.00712
	Scale parameters for dists. of random parameters					
LNADT	.01459***	.00085	17.23	.0000	.01293	.01625
LNLEN	.04883***	.00303	16.12	.0000	.04289	.05476
LT_IS_WI	.00175	.00113	1.95	.0520	-.00047	.00396
	Standard Deviations of Random Effects					
R.E.(01)	.01136	.00694	2.64	.0017	-.00224	.02496
R.E.(02)	.01526**	.00695	2.20	.0280	.00165	.02888
	Dispersion parameter for NegBin distribution					
ScalParm	1.32517***	.02117	62.59	.0000	1.28367	1.36666

All-Districts-All-Classes: Complaint of Pain Model of Road Segments

```
Random Coefficients  NegBnReg Model
Dependent variable            VISIBLE
Log likelihood function    -51075.18506
Restricted log likelihood -292976.17343
Chi squared [   5 d.f.]    483801.97675
Significance level              .00000
McFadden Pseudo R-squared      .8256678
Estimation based on N =  40508, K =  29
Inf.Cr.AIC  = 102222.4 AIC/N =    2.524
Model estimated: Jun 24, 2016, 17:56:35
Sample is  1 pds and  40508 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
```

```
+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |    Variance  |
| R.E.(01) = SPFCLASS                        |      .000077 |
| R.E.(03) = RCLASS                          |      .001140 |
+--------------------------------------------+--------------+
```

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-8.45796***	.08098	-104.45	.0000	-8.61667	-8.29925
LT_IS_WI	-.01602***	.00223	-7.20	.0000	-.02038	-.01166
MED_WI	-.00417***	.00036	-11.53	.0000	-.00488	-.00346
MEBRAIL	-.23093***	.03502	-6.59	.0000	-.29957	-.16229
METHRIE	.07862**	.03461	2.27	.0231	.01079	.14645
RT73	-.45992***	.14115	-3.26	.0011	-.73657	-.18327
RT241	-.56107***	.15302	-3.67	.0002	-.86098	-.26117
RT200	1.35561**	.58141	2.33	.0197	.21607	2.49515
RT53	-1.43308***	.52885	-2.71	.0067	-2.46960	-.39655
RT680	-.21210**	.08991	-2.36	.0183	-.38832	-.03588
RT166	.62951***	.12127	5.19	.0000	.39183	.86720
RT129	.73606***	.13851	5.31	.0000	.46459	1.00753
RT236	1.58491***	.53097	2.98	.0028	.54422	2.62560
RT41	.30696***	.06250	4.91	.0000	.18447	.42946
DES_SP	-.00971***	.00090	-10.79	.0000	-.01148	-.00795
RT_TR_WI	-.00131**	.00063	-2.10	.0360	-.00254	-.00009
LA	.12491***	.02072	6.03	.0000	.08431	.16552
VEN	.23027***	.04556	5.05	.0000	.14098	.31956
ALP	-1.30066***	.14641	-8.88	.0000	-1.58763	-1.01370
AMA	-.32746***	.10681	-3.07	.0022	-.53681	-.11811
STA	.21747***	.06581	3.30	.0010	.08848	.34647
MEST	.06706***	.02421	2.77	.0056	.01961	.11451
	Means for random parameters					
LNADT	1.06403***	.00692	153.77	.0000	1.05047	1.07760
LNLEN	.77456***	.00520	148.86	.0000	.76436	.78476
	Scale parameters for dists. of random parameters					
LNADT	.01562***	.00051	30.44	.0000	.01462	.01663
LNLEN	.01336***	.00257	5.20	.0000	.00832	.01839
	Standard Deviations of Random Effects					
R.E.(01)	.00875	.00681	1.98	.0689	-.00460	.02210
R.E.(03)	.03376***	.00674	5.01	.0000	.02055	.04696
	Dispersion parameter for NegBin distribution					
ScalParm	1.28483***	.02066	62.20	.0000	1.24434	1.32531

All-Districts-All-Classes: Visible Injury Model of Road Segments

All-Districts-All-Classes: Severe Injury Model of Road Segments

Random Coefficients NegBnReg Model
Dependent variable SEVERE
Log likelihood function -50851.37559
Restricted log likelihood -292976.17343
Chi squared [7 d.f.] 484249.59568
Significance level .00000
McFadden Pseudo R-squared .8264317
Estimation based on N = 40508, K = 22
Inf.Cr.AIC = 101778.8 AIC/N = 2.513
Model estimated: Jun 24, 2016, 02:13:50
Sample is 1 pds and 40508 individuals
Negative binomial regression model
Simulation based on 100 Halton draws

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-6.51916***	.08090	-80.58	.0000	-6.67772	-6.36061
MED_WI	-.00286***	.00037	-7.81	.0000	-.00358	-.00214
METHRIE	.18492***	.03371	5.49	.0000	.11885	.25099
MEOTHER	.56165***	.07670	7.32	.0000	.41131	.71199
RT680	-.27101***	.08104	-3.34	.0008	-.42984	-.11217
RT166	.67921***	.12833	5.29	.0000	.42768	.93074
RT129	.74813***	.14796	5.06	.0000	.45813	1.03813
RT236	1.53553***	.51628	2.97	.0029	.52365	2.54742
DES_SP	-.01716***	.00093	-8.54	.0000	-.01897	-.01534
LA	.21849***	.02028	6.77	.0000	.17875	.25824
VEN	.29057***	.04624	6.28	.0000	.19994	.38121
STA	.22646***	.06601	3.43	.0006	.09708	.35585
MEST	-.12822***	.02456	-5.22	.0000	-.17637	-.08008
	Means for random parameters					
LNADT	.91686***	.00686	13.75	.0000	.90343	.93030
LNLEN	.74700***	.00511	16.30	.0000	.73699	.75701
LT_OS_WI	-.00995***	.00224	-4.44	.0000	-.01435	-.00555
	Scale parameters for dists. of random parameters					
LNADT	.01471***	.00083	10.66	.0000	.01308	.01634
LNLEN	.04466***	.00297	11.04	.0000	.03884	.05048
LT_OS_WI	.00394***	.00112	3.53	.0004	.00175	.00613
	Standard Deviations of Random Effects					
R.E.(01)	.01153*	.00693	1.96	.0764	-.00206	.02511
R.E.(02)	.01491**	.00657	2.27	.0233	.00202	.02779
	Dispersion parameter for NegBin distribution					
ScalParm	1.35469***	.02153	62.93	.0000	1.31250	1.39688

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.000133
R.E.(04) = RCLASS	.000222

All-Districts-All-Classes: Fatal Model of Road Segments

Random Coefficients NegBnReg Model
Dependent variable FATAL
Log likelihood function -3262.54893
Restricted log likelihood -3311.75997
Chi squared [2 d.f.] 98.42207
Significance level .00000
McFadden Pseudo R-squared .0148595
Estimation based on N = 40508, K = 14
Inf.Cr.AIC = 6553.1 AIC/N = .162
Model estimated: Jun 24, 2016, 22:36:00
Sample is 1 pds and 40508 individuals
Negative binomial regression model
Simulation based on 2 Halton draws

FATAL	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-6.84413***	.30526	-22.42	.0000	-7.44242	-6.24584
LNADT	.50763***	.03548	14.31	.0000	.43809	.57717
LT_OS_WI	-.02090	.01548	-1.95	.0769	-.05124	.00944
RIV	.23228	.14467	1.91	.0584	-.05127	.51583
INY	-1.94700*	1.01854	-1.97	.0559	-3.94331	.04932
RT101	-.35861**	.14462	-2.48	.0132	-.64206	-.07516
METHRIE	.28886**	.12787	2.26	.0239	.03824	.53949
MECONCG	.27867**	.13526	2.06	.0394	.01356	.54378
RT80	-.35366	.25088	-2.01	.0486	-.84538	.13806
DES_SP	-.01130*	.00597	-1.99	.0483	-.02301	.00040
	Means for random parameters					
LNLEN	.89490***	.02670	33.52	.0000	.84257	.94722
	Scale parameters for dists. of random parameters					
LNLEN	.03459	.02370	1.96	.0744	-.01185	.08104
	Standard Deviations of Random Effects					
R.E.(01)	.25605**	.12387	2.07	.0387	.01327	.49883
	Dispersion parameter for NegBin distribution					
ScalParm	2.03135**	.84521	2.40	.0162	.37476	3.68793

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.000451

All-Districts: Rural Two-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-5.52643***	.55974	-9.87	.0000	-6.62349	-4.42937
RT_IS_WI	.60148**	.27786	2.16	.0304	.05688	1.14607
RT140	.88778***	.31895	2.78	.0054	.26264	1.51292
RT79	.68368***	.23655	2.89	.0039	.22005	1.14731
RT45	-1.26763**	.59338	-2.14	.0327	-2.43062	-.10463
RT3	-1.07053***	.36142	-2.96	.0031	-1.77890	-.36216
RT253	-.97251*	.50077	-1.94	.0521	-1.95400	.00899
VEN	.39060*	.22201	1.96	.0585	-.04452	.82573
	Means for random parameters					
LNADT	.77892***	.07336	10.62	.0000	.63514	.92270
LNLENGTH	.83264***	.03903	21.34	.0000	.75616	.90913
DES_SP	-.02573***	.00503	-5.11	.0000	-.03559	-.01587
	Scale parameters for dists. of random parameters					
LNADT	.01477**	.00644	2.29	.0218	.00215	.02738
LNLENGTH	.23452***	.02904	8.08	.0000	.17761	.29143
DES_SP	.00427***	.00090	4.76	.0000	.00251	.00602
	Standard Deviations of Random Effects					
R.E.(01)	.08293*	.04654	1.98	.0647	-.00828	.17414
	Dispersion parameter for NegBin distribution					
ScalParm	1.79439***	.43950	4.08	.0000	.93297	2.65580

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                      PDO
Log likelihood function     -1339.41750
Restricted log likelihood   -1520.70930
Chi squared [   4 d.f.]       362.58361
Significance level               .00000
McFadden Pseudo R-squared      .1192153
Estimation based on N =   4153, K =  16
Inf.Cr.AIC  =   2710.8 AIC/N =     .653
Model estimated: Feb 19, 2016, 15:46:24
Sample is  1 pds and   4153 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.006878

All-Districts: Rural Two-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts : Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-4.45566***	1.02404	-4.35	.0000	-6.46276	-2.44857
LNLENGTH	.76566***	.08161	9.38	.0000	.60571	.92560
RT79	.99154**	.50049	1.98	.0476	.01060	1.97248
RT150	1.45957**	.62076	2.35	.0187	.24290	2.67623
NAP	1.27714***	.46325	2.76	.0058	.36919	2.18510
	Means for random parameters					
DES_SP	-.03521***	.01213	-2.90	.0037	-.05898	-.01143
LNADT	.41472**	.16718	2.48	.0131	.08705	.74239
	Scale parameters for dists. of random parameters					
DES_SP	.01230***	.00208	5.90	.0000	.00821	.01638
LNADT	.04314***	.01457	2.96	.0031	.01458	.07169
	Standard Deviations of Random Effects					
R.E.(01)	.97021*	.51004	1.90	.0571	-.02946	1.96988
	Dispersion parameter for NegBin distribution					
ScalParm	1.42298**	.63927	2.23	.0260	.17003	2.67593

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                    CPAIN
Log likelihood function      -398.61539
Restricted log likelihood    -408.46080
Chi squared [   3 d.f.]        19.69082
Significance level               .00020
McFadden Pseudo R-squared      .0241037
Estimation based on N =   4153, K =  11
Inf.Cr.AIC  =    819.2 AIC/N =     .197
Model estimated: Feb 20, 2016, 19:09:44
Sample is  1 pds and   4153 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.000693

All-Districts: Rural Two-lane Advanced Type 2 Random Effects Model– Visible Collision Counts : Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-3.62014***	1.09725	-3.30	.0010	-5.77070	-1.46958
LNADT	.34964**	.16392	2.13	.0329	.02837	.67091
RT79	.92888**	.39146	2.37	.0177	.16163	1.69613
RT_OS_WI	-.09146**	.04284	-2.13	.0328	-.17543	-.00749
RT128	.76697**	.35761	2.14	.0320	.06607	1.46787
DES_SP	-.02630**	.01175	-2.24	.0252	-.04933	-.00327
	Means for random parameters					
LNLENGTH	.91056***	.07144	12.75	.0000	.77054	1.05057
	Scale parameters for dists. of random parameters					
LNLENGTH	.17867***	.06130	2.91	.0036	.05852	.29882
	Standard Deviations of Random Effects					
R.E.(01)	.06534*	.02493	1.99	.0769	-.00689	.14959
	Dispersion parameter for NegBin distribution					
ScalParm	1.01044	.79015	1.98	.0810	-.53823	2.55910

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	VISIBLE
Log likelihood function	-453.19580
Restricted log likelihood	-459.58295
Chi squared [2 d.f.]	12.77431
Significance level	.00168
McFadden Pseudo R-squared	.0138977
Estimation based on N = 4153, K = 10	
Inf.Cr.AIC = 926.4 AIC/N = .223	
Model estimated: Feb 29, 2016, 18:20:55	
Sample is 1 pds and 4153 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.005091

All-Districts: Rural Two-lane Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

SEVERE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-4.18684***	1.43908	-2.91	.0036	-7.00739	-1.36630
LNADT	.40618*	.21753	1.97	.0619	-.02017	.83253
DES_SP	-.05034***	.01573	-3.20	.0014	-.08116	-.01952
VEN	1.23253**	.54086	2.28	.0227	.17247	2.29260
	Means for random parameters					
LNLENGTH	.83933***	.11182	7.51	.0000	.62017	1.05850
	Scale parameters for dists. of random parameters					
LNLENGTH	.17814*	.10008	1.78	.0751	-.01801	.37429
	Standard Deviations of Random Effects					
R.E.(01)	.37460*	.20007	1.87	.0612	-.01754	.76674
	Dispersion parameter for NegBin distribution					
ScalParm	1.18875*	.61221	1.94	.0522	-.01116	2.38866

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	SEVERE
Log likelihood function	-212.60115
Restricted log likelihood	-213.39745
Chi squared [2 d.f.]	1.59259
Significance level	.45100
McFadden Pseudo R-squared	.0037315
Estimation based on N = 4153, K = 8	
Inf.Cr.AIC = 441.2 AIC/N = .106	
Model estimated: Mar 01, 2016, 14:07:58	
Sample is 1 pds and 4153 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.001177

All-Districts: Rural Two-lane Advanced Type 2 Random Effects Model– Fatal Collision Counts: Segments Without Intersections

FATAL	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-5.41690**	2.63796	-2.05	.0400	-10.58720	-.24659
LNADT	.35632	.33981	2.07	.0344	-.30970	1.02234
LNLENGTH	.87741***	.14471	6.06	.0000	.59378	1.16104
	Means for random parameters					
DES_SP	-.02179	.02118	-2.03	.1036	-.06331	.01973
	Scale parameters for dists. of random parameters					
DES_SP	.00808**	.00320	2.52	.0116	.00180	.01437
	Standard Deviations of Random Effects					
R.E.(01)	.35461	.23103	1.83	.1248	-.09820	.80741
	Dispersion parameter for NegBin distribution					
ScalParm	1.21071**	.54467	1.92	.1162	.14317	2.27825

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	FATAL
Log likelihood function	-180.10544
Restricted log likelihood	-182.65205
Chi squared [2 d.f.]	5.09323
Significance level	.07835
McFadden Pseudo R-squared	.0139424
Estimation based on N = 4153, K = 7	
Inf.Cr.AIC = 374.2 AIC/N =	.090
Model estimated: Mar 01, 2016, 19:11:19	
Sample is 1 pds and 4153 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.002152

All-Districts: Rural Four-lane Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-4.32216***	.23538	-18.36	.0000	-4.78349	-3.86083
RT40	-.35224***	.13674	-2.58	.0100	-.62024	-.08424
RT78	-.48687***	.11919	-4.08	.0000	-.72048	-.25326
RT2	.72100***	.18219	3.96	.0001	.36391	1.07809
RT198	.38098**	.16189	2.35	.0186	.06368	.69829
RT35	.37792**	.17138	2.21	.0274	.04202	.71381
RT4	-.47205***	.10852	-4.35	.0000	-.68474	-.25935
RT_IS_WI	-.03001*	.01663	-1.94	.0611	-.06261	.00258
LT_IS_WI	.05520***	.01660	3.32	.0009	.02266	.08774
	Means for random parameters					
LNADT	.63733***	.02773	22.98	.0000	.58298	.69169
LNLENGTH	.80080***	.01584	50.54	.0000	.76975	.83186
DES_SP	-.01708***	.00248	-6.87	.0000	-.02195	-.01221
RT_OS_WI	-.02259***	.00687	-3.29	.0010	-.03607	-.00912
	Scale parameters for dists. of random parameters					
LNADT	.00752***	.00239	3.15	.0016	.00284	.01220
LNLENGTH	.20566***	.01048	19.62	.0000	.18512	.22620
DES_SP	.00425***	.00036	11.96	.0000	.00355	.00494
RT_OS_WI	.02349***	.00276	8.52	.0000	.01809	.02890
	Standard Deviations of Random Effects					
R.E.(01)	.04227**	.02007	2.11	.0351	.00294	.08160
R.E.(02)	.08631***	.02060	4.19	.0000	.04592	.12669
	Dispersion parameter for NegBin distribution					
ScalParm	1.87395***	.14331	13.08	.0000	1.59308	2.15483

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	TOTALCR
Log likelihood function	-6040.80334
Restricted log likelihood	-9784.94686
Chi squared [6 d.f.]	7488.28705
Significance level	.00000
McFadden Pseudo R-squared	.3826432
Estimation based on N = 9149, K = 20	
Inf.Cr.AIC = 12121.6 AIC/N =	1.325
Model estimated: Dec 10, 2015, 16:59:16	
Sample is 1 pds and 9149 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.001787
R.E.(02) = CTY2	.007449

All-Districts: Rural Four-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-4.46842***	.30303	-14.75	.0000	-5.06235	-3.87449
LNADT	.64196***	.03464	18.53	.0000	.57407	.70986
RT_OS_WI	-.02620***	.00739	-3.54	.0004	-.04069	-.01171
RT40	-.38022**	.15772	-2.41	.0159	-.68934	-.07109
RT78	-.92403***	.19655	-4.70	.0000	-1.30926	-.53879
RT168	.59419***	.18140	3.28	.0011	.23865	.94973
RT80	.92805***	.12665	7.33	.0000	.67982	1.17629
RT101	.38081***	.09423	4.04	.0001	.19612	.56550
MED_WI	.00269**	.00122	2.21	.0273	.00030	.00507
RT_TR_WI	-.02154*	.01129	-1.95	.0564	-.04367	.00059
RT198	.53117***	.18996	2.80	.0052	.15885	.90348
RT4	-.48409***	.13548	-3.57	.0004	-.74963	-.21856
TOTLANES	.21006***	.07801	2.69	.0071	.05717	.36296
	Means for random parameters					
LNLENGTH	.79765***	.01930	41.33	.0000	.75983	.83548
DES_SP	-.02522***	.00311	-8.11	.0000	-.03131	-.01912
	Scale parameters for dists. of random parameters					
LNLENGTH	.22566***	.01225	18.41	.0000	.20164	.24968
DES_SP	.00112***	.00038	2.93	.0033	.00037	.00186
	Standard Deviations of Random Effects					
R.E.(01)	.05487**	.02384	2.30	.0214	.00814	.10161
	Dispersion parameter for NegBin distribution					
ScalParm	1.60110***	.15113	10.59	.0000	1.30489	1.89731

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	PDO
Log likelihood function	-4924.10943
Restricted log likelihood	-7279.97627
Chi squared [3 d.f.]	4711.73367
Significance level	.00000
McFadden Pseudo R-squared	.3236091
Estimation based on N = 9149, K = 19	
Inf.Cr.AIC = 9886.2 AIC/N = 1.081	
Model estimated: Mar 04, 2016, 16:01:39	
Sample is 1 pds and 9149 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.003011

All-Districts: Rural Four-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts : Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-5.70143***	.52345	-10.89	.0000	-6.72738	-4.67548
RT80	1.02287***	.22020	4.65	.0000	.59128	1.45446
RT395	-.45642*	.24976	-1.93	.0676	-.94595	.03311
RT29	.99125***	.23004	4.31	.0000	.54037	1.44212
SDIEGO	.97417***	.17561	5.55	.0000	.62999	1.31835
RT_OS_WI	.90622***	.24025	3.77	.0002	.43533	1.37710
DES_SP	-.02544***	.00632	-4.03	.0001	-.03782	-.01306
	Means for random parameters					
LNLENGTH	.84157***	.03727	22.58	.0000	.76853	.91461
LNADT	.56548***	.07257	7.79	.0000	.42325	.70772
	Scale parameters for dists. of random parameters					
LNLENGTH	.30537***	.02758	11.07	.0000	.25132	.35943
LNADT	.01679***	.00552	3.04	.0023	.00598	.02761
	Standard Deviations of Random Effects					
R.E.(01)	.09640*	.04995	1.96	.0536	-.00150	.19430
	Dispersion parameter for NegBin distribution					
ScalParm	2.62327**	1.08407	2.42	.0155	.49852	4.74801

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	CPAIN
Log likelihood function	-1415.98891
Restricted log likelihood	-1508.36753
Chi squared [3 d.f.]	184.75724
Significance level	.00000
McFadden Pseudo R-squared	.0612441
Estimation based on N = 9149, K = 13	
Inf.Cr.AIC = 2858.0 AIC/N = .312	
Model estimated: Mar 06, 2016, 20:49:42	
Sample is 1 pds and 9149 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.009293

All-Districts: Rural Four-lane Advanced Type 2 Random Effects Model– Visible Collision Counts : Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Nonrandom parameters						
Constant	-5.00012***	.65379	-7.65	.0000	-6.28152	-3.71872
LNADT	.41948***	.06728	6.24	.0000	.28763	.55134
RT94	1.48172***	.27313	5.42	.0000	.94639	2.01706
RT2	1.67900***	.30163	5.57	.0000	1.08781	2.27018
RT50	.95883***	.28965	3.31	.0009	.39112	1.52654
RT29	.66808**	.30608	2.18	.0291	.06817	1.26798
MENOBARR	-.52250**	.23532	-2.22	.0264	-.98371	-.06128
Means for random parameters						
LNLENGTH	.90767***	.03841	23.63	.0000	.83240	.98295
RT_OS_WI	-.05184***	.01636	-3.17	.0015	-.08390	-.01978
Scale parameters for dists. of random parameters						
LNLENGTH	.27154***	.02901	9.36	.0000	.21468	.32841
RT_OS_WI	.02909***	.00694	4.19	.0000	.01549	.04269
Standard Deviations of Random Effects						
R.E.(01)	.04762**	.02372	2.01	.0447	.00112	.09412
Dispersion parameter for NegBin distribution						
ScalParm	1.95645***	.73437	2.66	.0077	.51711	3.39579

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model

Dependent variable	VISIBLE
Log likelihood function	-1420.99426
Restricted log likelihood	-1507.59366
Chi squared [3 d.f.]	173.19880
Significance level	.00000
McFadden Pseudo R-squared	.0574421
Estimation based on N = 9149, K = 13	
Inf.Cr.AIC = 2868.0 AIC/N =	.313
Model estimated: Mar 07, 2016, 23:21:40	
Sample is 1 pds and 9149 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.002268

All-Districts: Rural Four-lane Advanced Type 2 Random Effects Model– Severe Collision Counts : Segments Without Intersections

SEVERE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Nonrandom parameters						
Constant	-5.34439***	.69852	-7.65	.0000	-6.71346	-3.97532
LNADT	.42392***	.10238	4.14	.0000	.22326	.62458
DES_SP	-.02399**	.01014	-2.37	.0180	-.04385	-.00412
RT2	1.23958**	.62080	2.00	.0459	.02284	2.45631
Means for random parameters						
LNLENGTH	.88651***	.06055	14.64	.0000	.76784	1.00518
Scale parameters for dists. of random parameters						
LNLENGTH	.17228***	.05160	3.34	.0008	.07114	.27341
Standard Deviations of Random Effects						
R.E.(01)	.00149	.08141	1.02	.2854	-.15807	.16106
Dispersion parameter for NegBin distribution						
ScalParm	1.64520	1.42646	1.15	.2488	-1.15060	4.44101

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model

Dependent variable	SEVERE
Log likelihood function	-659.43154
Restricted log likelihood	-668.81062
Chi squared [2 d.f.]	18.75817
Significance level	.00008
McFadden Pseudo R-squared	.0140235
Estimation based on N = 9149, K = 8	
Inf.Cr.AIC = 1334.9 AIC/N =	.146
Model estimated: Mar 08, 2016, 17:55:12	
Sample is 1 pds and 9149 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.001502

All-Districts: Rural Four-lane Advanced Type 2 Random Effects Model– Fatal Collision Counts : Segments Without Intersections

FATAL	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-7.42278***	1.07104	-6.93	.0000	-9.52197	-5.32359
LNADT	.51359***	.12969	3.96	.0001	.25941	.76777
RT2	2.06939***	.54129	3.82	.0001	1.00848	3.13029
RT_OS_WI	-.06578**	.03086	-2.13	.0331	-.12628	-.00529
	Means for random parameters					
LNLENGTH	.90363***	.06151	14.69	.0000	.78306	1.02419
	Scale parameters for dists. of random parameters					
LNLENGTH	.20534***	.05487	3.74	.0002	.09780	.31287
	Standard Deviations of Random Effects					
R.E.(01)	.02899	.09212	2.31	.0130	-.15157	.20954
	Dispersion parameter for NegBin distribution					
ScalParm	10.4968	69.79968	2.15	.0205	-126.3081	147.3016

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                   FATAL
Log likelihood function         -532.25827
Restricted log likelihood       -535.09560
Chi squared [   2 d.f.]            5.67466
Significance level                  .05858
McFadden Pseudo R-squared         .0053025
Estimation based on N =   9149, K =   8
Inf.Cr.AIC  =   1080.5 AIC/N =      .118
Model estimated: Mar 08, 2016, 23:27:29
Sample is  1 pds and   9149 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.001840

All-Districts: Rural Four Plus-lane Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-3.20467**	1.52033	-2.11	.0350	-6.18446	-.22489
LNADT	.35902***	.08690	4.13	.0000	.18870	.52934
RT5	-.82167***	.20844	-3.94	.0001	-1.23020	-.41315
MENOBARR	-.66807***	.22010	-3.04	.0024	-1.09946	-.23668
RT_TR_WI	.05785***	.00766	7.55	.0000	.04282	.07287
LT_OS_WI	.09636***	.03273	2.94	.0032	.03221	.16051
	Means for random parameters					
LNLENGTH	.89164***	.07920	11.26	.0000	.73641	1.04687
DES_SP	-.06477***	.01993	-3.25	.0012	-.10384	-.02569
	Scale parameters for dists. of random parameters					
LNLENGTH	.30434***	.04632	6.57	.0000	.21355	.39513
DES_SP	.00257**	.00123	2.09	.0363	.00016	.00498
	Standard Deviations of Random Effects					
R.E.(01)	.21983***	.07863	2.80	.0052	.06571	.37395
R.E.(02)	.09644	.07824	1.93	.0177	-.05690	.24978
	Dispersion parameter for NegBin distribution					
ScalParm	3.03601***	1.07460	2.83	.0047	.92984	5.14218

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 TOTALCR
Log likelihood function         -278.53041
Restricted log likelihood       -754.68743
Chi squared [   4 d.f.]          952.31405
Significance level                  .00000
McFadden Pseudo R-squared         .6309328
Estimation based on N =    220, K =  13
Inf.Cr.AIC  =    583.1 AIC/N =    2.650
Model estimated: Dec 10, 2015, 17:32:43
Sample is  1 pds and    220 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.048326
R.E.(02) = RCLASS2	.009302

All-Districts: Rural Four Plus-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	3.44395*	1.90635	1.81	.0708	-.29243	7.18033
LNADT	.30621***	.08328	3.68	.0002	.14298	.46945
LNLENGTH	.80594***	.08316	9.69	.0000	.64296	.96893
RT5	-.86088***	.24585	-3.50	.0005	-1.34273	-.37903
MENOBARR	-.75386***	.27098	-2.78	.0054	-1.28498	-.22274
RT_TR_WI	.05610***	.00903	6.21	.0000	.03840	.07379
LT_OS_WI	.09004**	.03999	2.25	.0244	.01165	.16843
	Means for random parameters					
DES_SP	-.07754***	.01788	-4.34	.0000	-.11259	-.04250
	Scale parameters for dists. of random parameters					
DES_SP	.00896***	.00154	5.83	.0000	.00595	.01197
	Standard Deviations of Random Effects					
R.E.(01)	.09642*	.05074	1.90	.0574	-.00302	.19586
	Dispersion parameter for NegBin distribution					
ScalParm	2.04290***	.72799	2.81	.0050	.61607	3.46974

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	PDO
Log likelihood function	-253.07691
Restricted log likelihood	-577.03854
Chi squared [2 d.f.]	647.92326
Significance level	.00000
McFadden Pseudo R-squared	.5614211
Estimation based on N = 220, K = 11	
Inf.Cr.AIC = 528.2 AIC/N = 2.401	
Model estimated: May 10, 2016, 17:37:42	
Sample is 1 pds and 220 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.004981

All-Districts: Rural Four Plus-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-1.11943	5.35544	-2.02	.9822	-10.61590	10.37705
LNLENGTH	.54077**	.24671	2.19	.0284	.05722	1.02431
DES_SP	-.11885*	.06375	-1.96	.0623	-.24379	.00609
RT5	-1.89960**	.78127	-2.43	.0150	-3.43086	-.36834
RT_TR_WI	.10010***	.02837	3.53	.0004	.04449	.15571
LT_OS_WI	.22141**	.09986	2.22	.0266	.02569	.41712
	Means for random parameters					
LNADT	.21981***	.08463	2.60	.0094	.05394	.38568
	Scale parameters for dists. of random parameters					
LNADT	.02690	.02508	2.07	.0135	-.02226	.07605
	Standard Deviations of Random Effects					
R.E.(01)	.00776**	.00359	2.16	.0309	.00071	.01480
	Dispersion parameter for NegBin distribution					
ScalParm	.46144*	.23665	1.95	.0512	-.00239	.92526

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	CPAIN
Log likelihood function	-83.53252
Restricted log likelihood	-111.21372
Chi squared [2 d.f.]	55.36240
Significance level	.00000
McFadden Pseudo R-squared	.2489010
Estimation based on N = 220, K = 10	
Inf.Cr.AIC = 187.1 AIC/N = .850	
Model estimated: May 10, 2016, 19:26:46	
Sample is 1 pds and 220 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.009744

All-Districts: Rural Four Plus-lane Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-11.2954**	4.75414	-2.38	.0175	-20.6134	-1.9775
LNLENGTH	.58824***	.15715	3.74	.0002	.28022	.89626
DES_SP	-.10229**	.04976	-2.06	.0398	-.19981	-.00478
RT_IS_WI	.84391	.61898	1.86	.1728	-.36928	2.05709
	Means for random parameters					
LNADT	1.66385***	.37885	4.39	.0000	.92133	2.40638
	Scale parameters for dists. of random parameters					
LNADT	.05505**	.02484	2.22	.0267	.00635	.10374
	Standard Deviations of Random Effects					
R.E.(01)	.97695**	.44617	2.19	.0285	.10248	1.85142
	Dispersion parameter for NegBin distribution					
ScalParm	1.03839**	.01849	2.08	.0379	.00214	.07464

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable               VISIBLE
Log likelihood function        -59.73584
Restricted log likelihood      -64.26237
Chi squared [   2 d.f.]          9.05306
Significance level                .01082
McFadden Pseudo R-squared       .0704382
Estimation based on N =    220, K =   8
Inf.Cr.AIC  =    135.5 AIC/N =     .616
Model estimated: May 10, 2016, 20:01:22
Sample is  1 pds and    220 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.000253

All-Districts: Rural Four Plus-lane Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

SEVERE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-11.8167*	6.47058	-1.83	.0978	-24.4988	.8654
LNADT	1.19958*	.70217	1.97	.0876	-.17664	2.57580
RT_OS_WI	-.21800*	.13229	-1.85	.0994	-.47728	.04128
	Means for random parameters					
LNLENGTH	1.03884***	.27239	3.81	.0001	.50495	1.57272
	Scale parameters for dists. of random parameters					
LNLENGTH	.98648*	.57433	1.92	.0859	-.13919	2.11214
	Standard Deviations of Random Effects					
R.E.(01)	.02602	.34627	.08	.9401	-.65266	.70470
	Dispersion parameter for NegBin distribution					
ScalParm	79.4729	9980.669	.01	.9936	-19482.2794	19641.2251

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                SEVERE
Log likelihood function        -30.15957
Restricted log likelihood      -30.83252
Chi squared [   2 d.f.]          1.34591
Significance level                .51020
McFadden Pseudo R-squared       .0218261
Estimation based on N =    220, K =   7
Inf.Cr.AIC  =     74.3 AIC/N =     .338
Model estimated: May 10, 2016, 20:22:02
Sample is  1 pds and    220 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.000677

All-Districts: Rural Multilane Undivided Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	1.02587	.69969	1.97	.0426	-.34550	2.39723
LNLEN	1.13875***	.30464	3.74	.0002	.54166	1.73584
LNADT	.04658*	.02421	1.92	.0544	-.00088	.09403
	Means for random parameters					
RTLANES	-1.06586**	.44598	-2.39	.0169	-1.93996	-.19177
	Scale parameters for dists. of random parameters					
RTLANES	.59139***	.16831	3.51	.0004	.26151	.92126
	Standard Deviations of Random Effects					
R.E.(01)	.90351**	.44735	2.02	.0434	.02672	1.78030
	Dispersion parameter for NegBin distribution					
ScalParm	.79695*	.42309	1.88	.0596	-.03229	1.62618

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 TOTALCR
Log likelihood function          -56.40742
Restricted log likelihood        -68.51666
Chi squared [   3 d.f.]           24.21849
Significance level                  .00002
McFadden Pseudo R-squared         .1767343
Estimation based on N =    115, K =   7
Inf.Cr.AIC  =    126.8 AIC/N =    1.103
Model estimated: Dec 10, 2015, 17:58:36
Sample is  1 pds and    115 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.001661

All-Districts: Rural Multilane Undivided Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-12.4878*	6.40595	-1.95	.0512	-25.0432	.0677
LNADT	1.53509*	.83112	1.95	.0647	-.09387	3.16404
RT32	1.79423	1.10079	1.93	.1031	-.36327	3.95173
	Means for random parameters					
LNLEN	1.03522***	.34327	3.02	.0026	.36241	1.70802
	Scale parameters for dists. of random parameters					
LNLEN	.97975**	.41612	2.35	.0185	.16417	1.79534
	Standard Deviations of Random Effects					
R.E.(01)	.21635	.25970	1.83	.0248	-.29265	.72535
	Dispersion parameter for NegBin distribution					
ScalParm	1.04035*	.53491	1.94	.0518	-.00805	2.08876

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                     PDO
Log likelihood function          -44.28120
Restricted log likelihood        -48.44240
Chi squared [   2 d.f.]            8.32240
Significance level                  .01559
McFadden Pseudo R-squared         .0859000
Estimation based on N =    115, K =   7
Inf.Cr.AIC  =    102.6 AIC/N =     .892
Model estimated: May 10, 2016, 22:46:59
Sample is  1 pds and    115 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.006796

All-Districts: Urban Two-lane Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-4.13566***	.44657	-9.26	.0000	-5.01093	-3.26040
LNLENGTH	.64768***	.02057	31.49	.0000	.60736	.68800
RT140	-.63121***	.21413	-2.95	.0032	-1.05089	-.21152
RT59	.57692***	.21977	2.63	.0087	.14617	1.00767
RT88	-.44809***	.16597	-2.70	.0069	-.77339	-.12279
RT108	.49373***	.18417	2.68	.0073	.13277	.85470
RT111	-.78618**	.36039	-2.18	.0291	-1.49252	-.07983
RT18	.50750***	.18384	2.76	.0058	.14718	.86781
RT129	.60800***	.20164	3.02	.0026	.21279	1.00321
RT116	-.41573**	.18965	-2.19	.0284	-.78743	-.04403
RT193	-.65046**	.27923	-2.33	.0198	-1.19774	-.10319
IMP	-1.26912***	.37725	-3.36	.0008	-2.00852	-.52971
MEN	-.81524**	.36351	-2.24	.0249	-1.52772	-.10276
RT_IS_WI	-.19761***	.06082	-3.25	.0012	-.31682	-.07841
MED_WI	.01163**	.00571	2.04	.0417	.00044	.02282
	Means for random parameters					
LNADT	.62598***	.04611	13.58	.0000	.53560	.71635
DES_SP	-.02116***	.00280	-7.57	.0000	-.02665	-.01568
	Scale parameters for dists. of random parameters					
LNADT	.03474***	.00307	11.33	.0000	.02873	.04076
DES_SP	.00773***	.00053	14.61	.0000	.00669	.00877
	Standard Deviations of Random Effects					
R.E.(01)	.05561**	.02699	2.06	.0393	.00272	.10851
R.E.(02)	.06518**	.02789	2.34	.0194	.01052	.11983
R.E.(03)	.06536**	.02680	2.44	.0147	.01283	.11789
	Dispersion parameter for NegBin distribution					
ScalParm	.95723***	.07267	13.17	.0000	.81480	1.09965

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 TOTALCR
Log likelihood function     -4159.60503
Restricted log likelihood   -6079.65701
Chi squared [   5 d.f.]      3840.10396
Significance level              .00000
McFadden Pseudo R-squared      .3158158
Estimation based on N =   5594, K =  27
Inf.Cr.AIC  =   8373.2 AIC/N =    1.497
Model estimated: Dec 10, 2015, 20:24:20
Sample is  1 pds and   5594 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.003093
R.E.(02) = CTY2	.004248
R.E.(03) = RCLASS2	.004272

All-Districts: Urban Two-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-4.54002***	.45547	-9.97	.0000	-5.43272	-3.64731
LNLENGTH	.65342***	.02165	30.18	.0000	.61099	.69586
RT88	-.53091**	.25339	-2.10	.0362	-1.02755	-.03427
RT18	.62224***	.18240	3.41	.0006	.26474	.97974
RT129	.77491***	.20906	3.71	.0002	.36516	1.18466
RT116	-.58130**	.23286	-2.50	.0125	-1.03771	-.12489
IMP	-1.65331***	.47513	-3.48	.0005	-2.58454	-.72208
LT_IS_WI	-.23200**	.09539	-2.43	.0150	-.41896	-.04504
MED_WI	.01905***	.00636	2.99	.0027	.00658	.03151
	Means for random parameters					
LNADT	.62040***	.04696	13.21	.0000	.52836	.71244
DES_SP	-.02303***	.00285	-8.07	.0000	-.02863	-.01744
	Scale parameters for dists. of random parameters					
LNADT	.09032***	.00341	26.52	.0000	.08364	.09700
DES_SP	.00331***	.00057	5.85	.0000	.00220	.00442
	Standard Deviations of Random Effects					
R.E.(01)	.05896**	.02957	1.99	.0462	.00100	.11691
R.E.(02)	.09657***	.02944	3.28	.0010	.03887	.15426
	Dispersion parameter for NegBin distribution					
ScalParm	1.70578***	.20701	8.24	.0000	1.30005	2.11151

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                     PDO
Log likelihood function     -3390.36489
Restricted log likelihood   -4523.81609
Chi squared [   4 d.f.]      2266.90241
Significance level              .00000
McFadden Pseudo R-squared      .2505520
Estimation based on N =   5594, K =  16
Inf.Cr.AIC  =   6812.7 AIC/N =    1.218
Model estimated: Mar 10, 2016, 22:51:36
Sample is  1 pds and   5594 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.003476
R.E.(02) = CTY2	.009325

All-Districts: Urban Two-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-7.36198***	.97543	-7.55	.0000	-9.27380	-5.45017
LNADT	.81733***	.09442	8.66	.0000	.63227	1.00239
LT_IS_WI	-.07668**	.03151	-2.43	.0150	-.13844	-.01491
RT59	.90793**	.36271	2.50	.0123	.19704	1.61882
RT108	.68853*	.35217	1.96	.0506	-.00170	1.37876
RT129	.89794**	.38573	2.33	.0199	.14193	1.65395
METWTL	.48076**	.23838	2.02	.0437	.01354	.94797
	Means for random parameters					
LNLENGTH	.73943***	.04541	16.28	.0000	.65043	.82842
DES_SP	-.01397**	.00612	-2.28	.0225	-.02596	-.00197
	Scale parameters for dists. of random parameters					
LNLENGTH	.29998***	.02463	12.18	.0000	.25170	.34826
DES_SP	.00503***	.00104	4.85	.0000	.00300	.00707
	Standard Deviations of Random Effects					
R.E.(01)	.02052	.01548	1.93	.0850	-.00982	.05087
	Dispersion parameter for NegBin distribution					
ScalParm	1.95257**	.89896	2.17	.0299	.19064	3.71450

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 CPAIN
Log likelihood function     -1176.23517
Restricted log likelihood   -1227.00537
Chi squared [   3 d.f.]       101.54039
Significance level               .00000
McFadden Pseudo R-squared      .0413773
Estimation based on N =   5594, K =  13
Inf.Cr.AIC  =   2378.5 AIC/N =     .425
Model estimated: Mar 09, 2016, 23:19:20
Sample is  1 pds and   5594 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.000421

All-Districts: Urban Two-lane Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-8.06593***	.97897	-8.24	.0000	-9.98468	-6.14719
LNADT	.75809***	.10758	7.05	.0000	.54724	.96895
LNLENGTH	.81191***	.04073	19.93	.0000	.73207	.89175
RT108	1.14435***	.42526	2.69	.0071	.31087	1.97784
RT199	1.38564***	.37144	3.73	.0002	.65763	2.11365
SBD	.71077***	.21130	3.36	.0008	.29662	1.12491
SAC	.80514**	.31645	2.54	.0110	.18491	1.42538
METWTL	1.11255***	.25602	4.35	.0000	.61076	1.61435
	Means for random parameters					
LT_OS_WI	-.12186***	.02218	-5.49	.0000	-.16534	-.07839
	Scale parameters for dists. of random parameters					
LT_OS_WI	.06292***	.01120	5.62	.0000	.04097	.08488
	Standard Deviations of Random Effects					
R.E.(01)	.05843**	.02686	2.17	.0296	.00577	.11108
	Dispersion parameter for NegBin distribution					
ScalParm	1.56786**	.69666	2.25	.0244	.20243	2.93330

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable               VISIBLE
Log likelihood function      -890.76741
Restricted log likelihood    -939.41713
Chi squared [   2 d.f.]        97.29944
Significance level               .00000
McFadden Pseudo R-squared      .0517871
Estimation based on N =   5594, K =  12
Inf.Cr.AIC  =   1805.5 AIC/N =     .323
Model estimated: Mar 10, 2016, 20:13:30
Sample is  1 pds and   5594 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.003414

All-Districts: Urban Two-lane Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
  SEVERE|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -5.37540***    2.00994    -2.67  .0075    -9.31481  -1.43600
   LNADT|     .54286**      .21961     2.47  .0134      .11242    .97329
  DES_SP|    -.04521***     .01318    -3.43  .0006     -.07104   -.01937
    RT76|    1.02701*       .52797     1.95  .0518     -.00779   2.06180
    RT26|    1.45594***     .51468     2.83  .0047      .44718   2.46471
        |Means for random parameters
LNLENGTH|     .87039***     .08339    10.44  .0000      .70694   1.03384
        |Scale parameters for dists. of random parameters
LNLENGTH|     .13367**      .06304     2.12  .0340      .01011    .25724
        |Standard Deviations of Random Effects
R.E.(01)|     .11819*       .06304     1.87  .0608     -.00537    .24176
        |Dispersion parameter for NegBin distribution
ScalParm|     .93511        .91747     2.02  .0281     -.86309   2.73331
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                    SEVERE
Log likelihood function      -337.27239
Restricted log likelihood    -342.60398
Chi squared [   2 d.f.]        10.66319
Significance level                .00484
McFadden Pseudo R-squared      .0155620
Estimation based on N =   5594, K =   9
Inf.Cr.AIC  =    692.5 AIC/N =     .124
Model estimated: Mar 13, 2016, 16:04:40
Sample is  1 pds and   5594 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = RCLASS2                         |      .002037 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Two-lane Advanced Type 2 Random Effects Model– Fatal Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
   FATAL|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -10.2646***    1.75623    -5.84  .0000    -13.7068   -6.8224
   LNADT|     .79629***     .19443     4.10  .0000      .41522   1.17735
    RT76|    1.14680**      .45010     2.55  .0108      .26462   2.02898
        |Means for random parameters
LNLENGTH|     .76237***     .10294     7.41  .0000      .56061    .96413
        |Scale parameters for dists. of random parameters
LNLENGTH|     .11109*       .06643     1.97  .0745     -.01911    .24128
        |Standard Deviations of Random Effects
R.E.(01)|     .14509        .12741     1.74  .1548     -.10463    .39480
        |Dispersion parameter for NegBin distribution
ScalParm|    12.9246      193.1846     2.07  .0467   -365.7102  391.5595
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                     FATAL
Log likelihood function      -310.25501
Restricted log likelihood   -5593.99999
Chi squared [   2 d.f.]     10567.48996
Significance level                .00000
McFadden Pseudo R-squared      .9445379
Estimation based on N =   5594, K =   8
Inf.Cr.AIC  =    636.5 AIC/N =     .114
Model estimated: Mar 12, 2016, 14:51:09
Sample is  1 pds and   5594 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
+--------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTY2                            |      .021050 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Four-lane Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-8.73502***	.33098	-26.39	.0000	-9.38373	-8.08631
RT120	.42088**	.16709	2.52	.0118	.09339	.74837
RT15	-.45410***	.16891	-2.69	.0072	-.78516	-.12305
RT178	-.68780***	.18913	-3.64	.0003	-1.05849	-.31710
RT41	.35029***	.10050	3.49	.0005	.15332	.54727
RT12	.36832***	.09710	3.79	.0001	.17801	.55863
RT101	-.20487***	.04827	-4.24	.0000	-.29948	-.11025
LA	.19745***	.06360	3.10	.0019	.07280	.32211
SB	.33761***	.06369	5.30	.0000	.21278	.46244
SOL	-.54035***	.13245	-4.08	.0000	-.79994	-.28077
ALA	-.63081***	.09484	-6.65	.0000	-.81669	-.44492
YUB	-.67065***	.18010	-3.72	.0002	-1.02364	-.31766
HUM	.36731***	.13632	2.69	.0071	.10012	.63450
METHRIE	.23957***	.06967	3.44	.0006	.10303	.37612
MECONC	.19606***	.06584	2.98	.0029	.06702	.32510
MEBEAM	.64594***	.13254	4.87	.0000	.38618	.90570
MESTRUC	-.86927***	.08376	-10.38	.0000	-1.03343	-.70511
MESGR	-.31902***	.11720	-2.72	.0065	-.54873	-.08932
RT_IS_WI	-.01937***	.00570	-3.40	.0007	-.03055	-.00820
DES_SP	-.00772***	.00219	-3.53	.0004	-.01200	-.00343
	Means for random parameters					
LNADT	1.06476***	.02879	36.98	.0000	1.00833	1.12119
LNLENGTH	.83569***	.01364	61.25	.0000	.80895	.86243
	Scale parameters for dists. of random parameters					
LNADT	.00681***	.00152	4.47	.0000	.00382	.00979
LNLENGTH	.31223***	.00746	41.86	.0000	.29761	.32686
	Standard Deviations of Random Effects					
R.E.(01)	.03346*	.01752	1.94	.0561	-.00087	.06779
R.E.(02)	.04800***	.01532	3.13	.0017	.01797	.07803
	Dispersion parameter for NegBin distribution					
ScalParm	1.91589***	.07846	24.42	.0000	1.76210	2.06967

```
Random Coefficients  NegBnReg Model
Dependent variable                  TOTALCR
Log likelihood function     -9917.14965
Restricted log likelihood  -34161.36217
Chi squared [   4 d.f.]     48488.42505
Significance level               .00000
McFadden Pseudo R-squared      .7096969
Estimation based on N =   7184, K =  29
Inf.Cr.AIC  =  19892.3 AIC/N =    2.769
Model estimated: Dec 10, 2015, 22:32:37
Sample is  1 pds and   7184 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.001120
R.E.(02) = CTY2	.002304

All-Districts: Urban Four-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-9.90103***	.30916	-32.03	.0000	-10.50696	-9.29509
RT15	-.52977***	.16877	-3.14	.0017	-.86054	-.19899
RT178	-1.37505***	.24016	-5.73	.0000	-1.84576	-.90434
RT41	.48919***	.12188	4.01	.0001	.25031	.72808
ORNG	-.50642***	.09892	-5.12	.0000	-.70031	-.31254
SDIEGO	-.16091**	.06921	-2.33	.0201	-.29655	-.02526
FRE	-.46425***	.12664	-3.67	.0002	-.71247	-.21604
SLO	.28086***	.09524	2.95	.0032	.09420	.46752
SON	.29043***	.08734	3.33	.0009	.11924	.46162
MESGR	-.28979**	.12699	-2.28	.0225	-.53867	-.04090
LLTR	-.31376**	.14566	-2.15	.0312	-.59924	-.02827
RT101	-.29574***	.05901	-5.01	.0000	-.41139	-.18008
LA	.13135*	.06960	1.99	.0592	-.00507	.26776
SB	.42052***	.07617	5.52	.0000	.27122	.56982
SOL	-.39566***	.13741	-2.88	.0040	-.66499	-.12634
ALA	-.80381***	.10723	-7.50	.0000	-1.01398	-.59365
YUB	-.76051***	.21521	-3.53	.0004	-1.18231	-.33870
HUM	.60741***	.14824	4.10	.0000	.31686	.89796
MEBEAM	.73408***	.13815	5.31	.0000	.46330	1.00485
TOTLANES	-.62084***	.14383	-4.32	.0000	-.90273	-.33895
MESTRUC	-.85529***	.08127	-10.52	.0000	-1.01458	-.69599
RT_IS_WI	-.01821***	.00617	-2.95	.0032	-.03031	-.00610
DES_SP	-.00833***	.00232	-3.60	.0003	-.01287	-.00380
	Means for random parameters					
LNADT	1.15272***	.02969	38.83	.0000	1.09453	1.21090
LNLENGTH	.80711***	.01526	52.90	.0000	.77721	.83701
	Scale parameters for dists. of random parameters					
LNADT	.01870***	.00162	11.55	.0000	.01553	.02187
LNLENGTH	.28371***	.00806	35.21	.0000	.26792	.29951
	Standard Deviations of Random Effects					
R.E.(01)	.10288***	.01677	6.14	.0000	.07001	.13574
R.E.(02)	.15642***	.01663	9.40	.0000	.12382	.18902
R.E.(03)	.13722***	.01666	8.24	.0000	.10457	.16987
	Dispersion parameter for NegBin distribution					
ScalParm	1.84288***	.08868	20.78	.0000	1.66906	2.01669

```
Random Coefficients  NegBnReg Model
Dependent variable                      PDO
Log likelihood function     -8703.58757
Restricted log likelihood  -25343.17523
Chi squared [   5 d.f.]     33279.17531
Significance level               .00000
McFadden Pseudo R-squared      .6565708
Estimation based on N =   7184, K =  31
Inf.Cr.AIC  =  17469.2 AIC/N =    2.432
Model estimated: Mar 14, 2016, 20:47:19
Sample is  1 pds and   7184 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.010583
R.E.(02) = CTY2	.024467
R.E.(03) = RCLASS2	.018830

All-Districts: Urban Four-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-12.7711***	.52368	-24.39	.0000	-13.7975	-11.7447
RT15	-.49232**	.24188	-2.04	.0418	-.96640	-.01824
RT12	.45910***	.17184	2.67	.0075	.12231	.79589
RT101	-.38254***	.09657	-3.96	.0001	-.57181	-.19327
ALA	-.38237**	.19152	-2.00	.0459	-.75774	-.00699
RT118	.53557**	.23206	2.31	.0210	.08074	.99039
RT1	.38959**	.17082	2.28	.0226	.05478	.72439
MON	-.32254**	.14758	-2.19	.0288	-.61179	-.03329
SON	.43671***	.14695	2.97	.0030	.14871	.72472
RTLANES	.42164***	.09698	4.35	.0000	.23157	.61172
LT_OS_WI	.04589***	.01174	3.91	.0001	.02287	.06890
MESTRUC	-.74301***	.17518	-4.24	.0000	-1.08636	-.39967
MESGR	-.52148***	.18871	-2.76	.0057	-.89135	-.15161
MEPAVE	-.29379***	.08153	-3.60	.0003	-.45358	-.13399
MED_WI	-.01185***	.00151	-7.85	.0000	-.01482	-.00889
	Means for random parameters					
LNADT	1.13369***	.04962	22.85	.0000	1.03642	1.23095
LNLENGTH	.70109***	.02464	28.46	.0000	.65280	.74938
	Scale parameters for dists. of random parameters					
LNADT	.03289***	.00279	11.77	.0000	.02741	.03837
LNLENGTH	.17341***	.01319	13.15	.0000	.14756	.19926
	Standard Deviations of Random Effects					
R.E.(01)	.19843***	.02909	6.82	.0000	.14142	.25544
	Dispersion parameter for NegBin distribution					
ScalParm	1.32025***	.13795	9.57	.0000	1.04988	1.59062

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	CPAIN
Log likelihood function	-3704.82241
Restricted log likelihood	-4912.51296
Chi squared [3 d.f.]	2415.38110
Significance level	.00000
McFadden Pseudo R-squared	.2458397
Estimation based on N = 7184, K = 21	
Inf.Cr.AIC = 7451.6 AIC/N =	1.037
Model estimated: Mar 14, 2016, 18:41:24	
Sample is 1 pds and 7184 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.039373

All-Districts: Urban Four-lane Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-9.11241***	.66408	-13.72	.0000	-10.41397	-7.81084
LNADT	.79439***	.06432	12.35	.0000	.66832	.92045
RT101	-.30526***	.10254	-2.98	.0029	-.50624	-.10428
LA	.35560***	.13662	2.60	.0092	.08783	.62337
ALA	-.51073**	.23346	-2.19	.0287	-.96830	-.05317
RT58	-.52966	.32594	-1.93	.1042	-1.16849	.10917
RT17	.48750**	.20928	2.33	.0198	.07731	.89768
MESTRUC	-.46013**	.21642	-2.13	.0335	-.88430	-.03596
LT_OS_WI	.03190**	.01550	2.06	.0396	.00152	.06229
MED_WI	-.00351**	.00162	-2.17	.0303	-.00669	-.00033
	Means for random parameters					
LNLENGTH	.79826***	.03040	26.26	.0000	.73868	.85784
	Scale parameters for dists. of random parameters					
LNLENGTH	.07813***	.02053	3.80	.0001	.03788	.11837
	Standard Deviations of Random Effects					
R.E.(01)	.05846	.03686	1.99	.1028	-.01379	.13071
	Dispersion parameter for NegBin distribution					
ScalParm	1.66285***	.33291	4.99	.0000	1.01035	2.31534

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	VISIBLE
Log likelihood function	-2328.41222
Restricted log likelihood	-2591.02812
Chi squared [2 d.f.]	525.23181
Significance level	.00000
McFadden Pseudo R-squared	.1013559
Estimation based on N = 7184, K = 14	
Inf.Cr.AIC = 4684.8 AIC/N =	.652
Model estimated: Mar 15, 2016, 19:49:06	
Sample is 1 pds and 7184 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.003417

All-Districts: Urban Four-lane Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
  SEVERE|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -8.69223***    1.20149    -7.23  .0000   -11.04711  -6.33736
   LNADT|     .67044***     .11390     5.89  .0000      .44720    .89368
 RTLANES|    -.44103**      .19385    -2.28  .0229     -.82096   -.06110
LT_IS_WI|     .05163**      .02209     2.34  .0194      .00833    .09494
   RT120|    1.21074***     .46537     2.60  .0093      .29863   2.12286
     SCR|     .99245***     .30914     3.21  .0013      .38654   1.59837
  METWTL|     .91577**      .38345     2.39  .0169      .16421   1.66732
        |Means for random parameters
LNLENGTH|     .78374***     .05401    14.51  .0000      .67788    .88959
        |Scale parameters for dists. of random parameters
LNLENGTH|     .13991***     .03827     3.66  .0003      .06490    .21491
        |Standard Deviations of Random Effects
R.E.(01)|     .05989**      .02817     2.13  .0335      .00467    .11511
        |Dispersion parameter for NegBin distribution
ScalParm|    1.07098*       .56395     1.90  .0576     -.03434   2.17631
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                 SEVERE
Log likelihood function      -847.78981
Restricted log likelihood    -860.93878
Chi squared [   2 d.f.]        26.29795
Significance level               .00000
McFadden Pseudo R-squared      .0152728
Estimation based on N =   7184, K =  11
Inf.Cr.AIC  =   1717.6 AIC/N =     .239
Model estimated: Mar 16, 2016, 21:39:35
Sample is  1 pds and   7184 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.     |     Variance |
| R.E.(01) = CTY2                           |      .003587 |
+------------------------------------------+--------------+
```

All-Districts: Urban Four-lane Advanced Type 2 Random Effects Model– Fatal Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
   FATAL|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -8.55390***    1.55924    -5.49  .0000   -11.60995  -5.49785
   LNADT|     .52491***     .14868     3.53  .0004      .23350    .81632
     RT5|     .73985**      .32349     2.29  .0222      .10583   1.37386
     RIV|     .91927**      .38258     2.40  .0163      .16943   1.66912
 MESTRUC|   -1.76001       1.08364    -1.62  .1043    -3.88390    .36389
RT_OS_WI|     .54500*       .28072     1.94  .0522     -.00520   1.09519
        |Means for random parameters
LNLENGTH|     .77543***     .06589    11.77  .0000      .64629    .90458
        |Scale parameters for dists. of random parameters
LNLENGTH|     .11676**      .05282     2.21  .0271      .01323    .22029
        |Standard Deviations of Random Effects
R.E.(01)|     .10031        .08434     1.59  .2343     -.06500    .26562
        |Dispersion parameter for NegBin distribution
ScalParm|    1.03769*       .02228     1.99  .0907     -.00598    .08137
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                  FATAL
Log likelihood function      -603.75622
Restricted log likelihood    -612.15731
Chi squared [   2 d.f.]        16.80220
Significance level               .00022
McFadden Pseudo R-squared      .0137238
Estimation based on N =   7184, K =  10
Inf.Cr.AIC  =   1227.5 AIC/N =     .171
Model estimated: Mar 18, 2016, 16:20:19
Sample is  1 pds and   7184 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
+------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.     |     Variance |
| R.E.(01) = CTY2                           |      .010062 |
+------------------------------------------+--------------+
```

All-Districts: Urban Five, Six, and Seven-lane Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-10.4578***	.38438	-27.21	.0000	-11.2111	-9.7044
LT_OS_WI	-.02141***	.00542	-3.95	.0001	-.03202	-.01079
LT_IS_WI	-.01210***	.00439	-2.76	.0059	-.02070	-.00349
RT241	-.72434***	.17252	-4.20	.0000	-1.06248	-.38620
RT73	-.60944***	.15575	-3.91	.0001	-.91469	-.30418
RT215	.51632***	.11542	4.47	.0000	.29011	.74254
RT15	-.24145***	.08391	-2.88	.0040	-.40592	-.07698
RT110	.37712***	.13739	2.74	.0061	.10784	.64639
RT14	-.27196**	.12784	-2.13	.0334	-.52252	-.02141
RT180	.53632***	.18164	2.95	.0032	.18030	.89234
RT680	-.42045***	.12508	-3.36	.0008	-.66560	-.17530
RT80	-.20625**	.09090	-2.27	.0233	-.38441	-.02809
RT5	-.29960***	.08197	-3.66	.0003	-.46025	-.13894
SDIEGO	-.19157***	.06628	-2.89	.0038	-.32148	-.06166
RIV	-.17262**	.08287	-2.08	.0372	-.33504	-.01021
KER	.27068***	.10248	2.64	.0083	.06983	.47153
SOL	-.30037**	.14041	-2.14	.0324	-.57556	-.02517
MENOBARR	.12985***	.04856	2.67	.0075	.03466	.22503
METHRIE	.21196***	.05691	3.72	.0002	.10042	.32349
RLTR	.19731*	.10296	1.96	.0553	-.00448	.39910
RT_TR_WI	-.02843***	.00525	-5.41	.0000	-.03872	-.01813
RTLANES	.28741***	.07115	4.04	.0001	.14796	.42686
DES_SP	.01378***	.00267	5.15	.0000	.00854	.01902
	Means for random parameters					
LNADT	1.16106***	.03357	34.58	.0000	1.09526	1.22686
LNLENGTH	.98387***	.01570	62.67	.0000	.95310	1.01463
MED_WI	-.00586***	.00079	-7.42	.0000	-.00741	-.00431
	Scale parameters for dists. of random parameters					
LNADT	.01515***	.00153	9.91	.0000	.01215	.01815
LNLENGTH	.20279***	.00683	29.67	.0000	.18940	.21619
MED_WI	.00266***	.00035	7.66	.0000	.00198	.00334
	Standard Deviations of Random Effects					
R.E.(01)	.06425***	.01682	3.82	.0001	.03128	.09722
R.E.(02)	.05648***	.01684	3.35	.0008	.02347	.08948
R.E.(03)	.02402	.01657	1.95	.0471	-.00845	.05649
	Dispersion parameter for NegBin distribution					
ScalParm	2.03568***	.08756	23.25	.0000	1.86407	2.20729

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 TOTALCR
Log likelihood function     -8193.79960
Restricted log likelihood  -56593.16760
Chi squared [   6 d.f.]     96798.73599
Significance level               .00000
McFadden Pseudo R-squared      .8552157
Estimation based on N =   4265, K =  34
Inf.Cr.AIC  =  16455.6 AIC/N =    3.858
Model estimated: Dec 11, 2015, 10:15:14
Sample is  1 pds and   4265 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.004128
R.E.(02) = CTY2	.003190
R.E.(03) = RCLASS2	.000577

All-Districts: Urban Five, Six, and Seven-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-11.0078***	.37715	-29.19	.0000	-11.7470	-10.2686
RT_OS_WI	-.02018***	.00598	-3.37	.0007	-.03191	-.00846
RT241	-.63726***	.18481	-3.45	.0006	-.99947	-.27504
RT73	-.52738***	.14724	-3.58	.0003	-.81597	-.23879
RT215	.59820***	.11798	5.07	.0000	.36697	.82943
RT15	-.26218***	.07970	-3.29	.0010	-.41838	-.10598
RT680	-.48322***	.11243	-4.30	.0000	-.70359	-.26286
RT1	-.42019***	.08641	-4.86	.0000	-.58955	-.25083
CC	-.26053***	.08963	-2.91	.0037	-.43620	-.08486
LT_TR_WI	-.00856***	.00322	-2.66	.0078	-.01486	-.00225
SDIEGO	-.35261***	.07143	-4.94	.0000	-.49261	-.21260
KER	.25908***	.09620	2.69	.0071	.07053	.44763
LAUXL	.30245***	.08417	3.59	.0003	.13747	.46742
RLTR	.28282**	.11532	2.45	.0142	.05680	.50883
RT_TR_WI	-.02741***	.00581	-4.72	.0000	-.03879	-.01602
RTLANES	.26703***	.08157	3.27	.0011	.10715	.42691
RT710	.72369***	.15431	4.69	.0000	.42126	1.02613
RT5	-.20382**	.08008	-2.55	.0109	-.36078	-.04685
FRE	.35299***	.09811	3.60	.0003	.16069	.54528
MON	.54520***	.17281	3.15	.0016	.20650	.88389
SOL	-.42654***	.13633	-3.13	.0018	-.69374	-.15935
PLA	-.35319**	.16163	-2.19	.0289	-.66999	-.03640
SHA	1.24881***	.21540	5.80	.0000	.82663	1.67098
METHRIE	.15788***	.05519	2.86	.0042	.04970	.26605
DES_SP	.00804**	.00312	2.58	.0100	.00192	.01415
	Means for random parameters					
LNADT	1.23815***	.03551	34.87	.0000	1.16855	1.30774
LNLENGTH	.94641***	.01559	60.69	.0000	.91584	.97697
MED_WI	-.00595***	.00076	-7.83	.0000	-.00744	-.00446
	Scale parameters for dists. of random parameters					
LNADT	.00672***	.00149	4.51	.0000	.00380	.00964
LNLENGTH	.22486***	.00758	29.65	.0000	.21000	.23972
MED_WI	.00917***	.00297	3.09	.0020	.00335	.01499
	Standard Deviations of Random Effects					
R.E.(01)	.06998***	.01715	4.08	.0000	.03636	.10359
R.E.(02)	.03424**	.01647	2.08	.0376	-.00197	.06652
R.E.(03)	.04160**	.01719	2.42	.0155	.00790	.07530
	Dispersion parameter for NegBin distribution					
ScalParm	2.18490***	.10244	21.33	.0000	1.98412	2.38568

```
Random Coefficients  NegBnReg Model
Dependent variable                     PDO
Log likelihood function     -7272.07569
Restricted log likelihood  -41427.90203
Chi squared [   6 d.f.]     68311.65270
Significance level               .00000
McFadden Pseudo R-squared      .8244643
Estimation based on N =   4265, K =  35
Inf.Cr.AIC  =  14614.2 AIC/N =    3.427
Model estimated: Apr 04, 2016, 15:44:38
Sample is  1 pds and   4265 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.004897
R.E.(02) = CTY2	.001173
R.E.(03) = RCLASS2	.001731

All-Districts: Urban Five, Six, and Seven-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-10.8587***	.55378	-19.61	.0000	-11.9441	-9.7733
CC	-.39831***	.13831	-2.88	.0040	-.66941	-.12722
METWTL	.66646***	.25751	2.59	.0097	.16174	1.17117
RT_TR_WI	-.04532***	.01086	-4.17	.0000	-.06660	-.02405
MED_WI	-.00705***	.00116	-6.06	.0000	-.00933	-.00477
RTLANES	.46672***	.13914	3.35	.0008	.19401	.73944
RAUXL	.35452**	.13819	2.57	.0103	.08366	.62538
SOL	-.54941***	.20528	-2.68	.0074	-.95175	-.14706
METHRIE	.20096***	.07739	2.60	.0094	.04927	.35265
RT8	.76825***	.22140	3.47	.0005	.33432	1.20218
RT15	-.45127***	.12669	-3.56	.0004	-.69958	-.20297
DES_SP	-.01481***	.00485	-3.06	.0022	-.02431	-.00531
	Means for random parameters					
LNADT	1.20808***	.05394	22.40	.0000	1.10236	1.31379
LNLENGTH	.93699***	.02305	40.65	.0000	.89182	.98217
LT_OS_WI	-.03846***	.00816	-4.71	.0000	-.05445	-.02247
	Scale parameters for dists. of random parameters					
LNADT	.00529**	.00221	2.39	.0166	.00096	.00962
LNLENGTH	.24643***	.01337	18.44	.0000	.22023	.27263
LT_OS_WI	.01210***	.00273	4.44	.0000	.00676	.01745
	Standard Deviations of Random Effects					
R.E.(01)	.04968*	.02554	1.95	.0517	-.00036	.09973
	Dispersion parameter for NegBin distribution					
ScalParm	2.21370***	.21010	10.54	.0000	1.80192	2.62548

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                   CPAIN
Log likelihood function     -3562.42879
Restricted log likelihood   -6645.25204
Chi squared [   4 d.f.]      6165.64649
Significance level               .00000
McFadden Pseudo R-squared      .4639137
Estimation based on N =   4265, K =  20
Inf.Cr.AIC  =   7164.9 AIC/N =    1.680
Model estimated: Apr 21, 2016, 12:08:22
Sample is  1 pds and   4265 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.002469

All-Districts: Urban Five, Six, and Seven-lane Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-10.6353***	.79068	-13.45	.0000	-12.1850	-9.0856
RT_OS_WI	-.03982***	.01058	-3.76	.0002	-.06056	-.01908
CC	-.51935**	.21408	-2.43	.0153	-.93894	-.09976
RT_TR_WI	-.05479***	.01529	-3.58	.0003	-.08477	-.02482
MED_WI	-.00464***	.00150	-3.10	.0019	-.00758	-.00171
RTLANES	.61091***	.19758	3.09	.0020	.22366	.99817
FRE	.51771***	.15719	3.29	.0010	.20962	.82580
METHRIE	.26916***	.08717	3.09	.0020	.09830	.44002
RT8	1.04158***	.39823	2.62	.0089	.26107	1.82209
RT22	.51015***	.18541	2.75	.0059	.14675	.87356
RT20	1.14975***	.40133	2.86	.0042	.36316	1.93634
	Means for random parameters					
LNADT	.99999***	.06804	14.70	.0000	.86663	1.13336
LNLENGTH	.87233***	.02617	33.33	.0000	.82103	.92363
	Scale parameters for dists. of random parameters					
LNADT	.01892***	.00275	6.88	.0000	.01353	.02431
LNLENGTH	.20769***	.01761	11.80	.0000	.17318	.24220
	Standard Deviations of Random Effects					
R.E.(01)	.03568*	.01837	1.94	.0522	-.00034	.07169
	Dispersion parameter for NegBin distribution					
ScalParm	3.79963***	.78559	4.84	.0000	2.25990	5.33936

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 VISIBLE
Log likelihood function     -2248.20053
Restricted log likelihood   -2923.55260
Chi squared [   3 d.f.]      1350.70415
Significance level               .00000
McFadden Pseudo R-squared      .2310039
Estimation based on N =   4265, K =  17
Inf.Cr.AIC  =   4530.4 AIC/N =    1.062
Model estimated: Apr 05, 2016, 20:05:49
Sample is  1 pds and   4265 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.001273

All-Districts: Urban Five, Six, and Seven-lane Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
  SEVERE|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -10.9880***     1.52274    -7.22  .0000    -13.9725    -8.0035
   LNADT|      .87884***     .13100     6.71  .0000      .62209    1.13559
      CC|   -1.26029**       .57478    -2.19  .0283    -2.38684    -.13374
    RT20|    2.38732***      .77118     3.10  .0020      .87583    3.89881
 LNOSPEC|    -.49544**       .20093    -2.47  .0137     -.88924    -.10163
        |Means for random parameters
LNLENGTH|      .88944***     .05787    15.37  .0000      .77602    1.00286
        |Scale parameters for dists. of random parameters
LNLENGTH|      .29643*       .15966     1.86  .0634     -.01651     .60936
        |Standard Deviations of Random Effects
R.E.(01)|      .35308        .26781     1.32  .1874     -.17183     .87798
        |Dispersion parameter for NegBin distribution
ScalParm|     1.76349*      1.02403     1.72  .0851     -.24358    3.77056
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                 SEVERE
Log likelihood function      -747.70326
Restricted log likelihood    -773.38014
Chi squared [   2 d.f.]        51.35377
Significance level               .00000
McFadden Pseudo R-squared      .0332009
Estimation based on N =   4265, K =   9
Inf.Cr.AIC  =   1513.4 AIC/N =     .355
Model estimated: May 01, 2016, 12:53:12
Sample is  1 pds and   4265 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTY2                            |      .001760 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Five, Six, and Seven-lane Advanced Type 2 Random Effects Model– Fatal Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
   FATAL|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -6.92712***     2.25867    -3.07  .0022   -11.35404  -2.50020
   LNADT|     .43950**       .19468     2.26  .0240      .05792    .82107
     RT8|    1.64955**       .72525     2.27  .0229      .22809   3.07102
    RT99|     .61208**       .27181     2.25  .0243      .07934   1.14481
     SBD|     .72403**       .29164     2.48  .0130      .15242   1.29564
  MED_WI|    -.00815*        .00420    -1.94  .0521     -.01638    .00008
        |Means for random parameters
LNLENGTH|     .99603***      .07976    12.49  .0000      .83970   1.15236
        |Scale parameters for dists. of random parameters
LNLENGTH|     .30365***      .05368     5.66  .0000      .19843    .40887
        |Standard Deviations of Random Effects
R.E.(01)|     .09317         .09267     1.01  .3147     -.08845    .27479
        |Dispersion parameter for NegBin distribution
ScalParm|    1.57006         .39413     1.45  .1481     -.20242   1.34253
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                  FATAL
Log likelihood function      -458.12036
Restricted log likelihood    -468.28677
Chi squared [   2 d.f.]        20.33281
Significance level               .00004
McFadden Pseudo R-squared      .0217098
Estimation based on N =   4265, K =  10
Inf.Cr.AIC  =    936.2 AIC/N =     .220
Model estimated: May 02, 2016, 15:46:24
Sample is  1 pds and   4265 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTY2                            |      .008681 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Eight Plus-lane Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Nonrandom parameters						
Constant	-12.1077***	.39022	-31.03	.0000	-12.8725	-11.3429
RT15	-.16453***	.05902	-2.79	.0053	-.28021	-.04885
RT405	-.16082***	.06137	-2.62	.0088	-.28111	-.04054
RT210	-.36439***	.09046	-4.03	.0001	-.54168	-.18709
RT110	.33632***	.07807	4.31	.0000	.18330	.48934
RT10	.29663***	.05490	5.40	.0000	.18903	.40423
RT880	.25173***	.07924	3.18	.0015	.09642	.40703
RT80	.22763***	.05982	3.81	.0001	.11039	.34487
LAUXL	.11904**	.05487	2.17	.0301	.01149	.22660
LT_IS_WI	-.02676***	.00296	-9.05	.0000	-.03256	-.02096
RTLANES	-.06732***	.01027	-6.55	.0000	-.08746	-.04718
Means for random parameters						
LNADT	1.36503***	.03241	42.12	.0000	1.30151	1.42856
LNLENGTH	.91174***	.01208	75.45	.0000	.88806	.93543
MED_WI	-.00506***	.00082	-6.18	.0000	-.00666	-.00345
Scale parameters for dists. of random parameters						
LNADT	.00369***	.00107	3.44	.0006	.00159	.00579
LNLENGTH	.11247***	.00521	21.58	.0000	.10225	.12269
MED_WI	.00447***	.00033	13.51	.0000	.00382	.00511
Standard Deviations of Random Effects						
R.E.(01)	.03170**	.01295	2.45	.0144	.00632	.05709
R.E.(02)	.06421***	.01321	4.86	.0000	.03832	.09010
Dispersion parameter for NegBin distribution						
ScalParm	1.61178***	.04779	33.73	.0000	1.51812	1.70544

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                  TOTALCR
Log likelihood function    -15449.33954
Restricted log likelihood -173084.73163
Chi squared [   6 d.f.]    315270.78417
Significance level                .00000
McFadden Pseudo R-squared      .9107412
Estimation based on N =   5695, K =  24
Inf.Cr.AIC  =  30946.7 AIC/N =    5.434
Model estimated: Dec 11, 2015, 02:09:33
Sample is  1 pds and   5695 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.001005
R.E.(02) = RCLASS2	.004123

All-Districts: Urban Eight Plus-lane Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Nonrandom parameters						
Constant	-12.6300***	.40679	-31.05	.0000	-13.4272	-11.8327
RT210	-.18734*	.09936	-1.99	.0594	-.38208	.00740
RT110	.19582**	.07615	2.57	.0101	.04658	.34507
RT10	.30339***	.05465	5.55	.0000	.19628	.41051
RT80	.34387***	.08702	3.95	.0001	.17333	.51442
LT_IS_WI	-.01682***	.00330	-5.09	.0000	-.02329	-.01034
RT215	.72154***	.13157	5.48	.0000	.46368	.97941
RT24	-.72782***	.12291	-5.92	.0000	-.96873	-.48692
SDIEGO	-.52019***	.04996	-10.41	.0000	-.61811	-.42228
SOL	-.58165***	.12957	-4.49	.0000	-.83559	-.32770
MECONCB	.19685***	.06985	2.82	.0048	.05994	.33376
RMEDHOV	-.16841***	.03584	-4.70	.0000	-.23867	-.09816
RT_TR_WI	-.01678***	.00209	-8.04	.0000	-.02087	-.01269
LTLANES	.04033***	.01360	2.97	.0030	.01368	.06699
ALA	.34316***	.05724	6.00	.0000	.23097	.45535
SCL	.26581***	.05789	4.59	.0000	.15235	.37927
SAC	.22598***	.06810	3.32	.0009	.09251	.35945
MECONCG	.07929**	.03897	2.03	.0419	.00291	.15567
MEBRAIL	-.27939***	.06841	-4.08	.0000	-.41348	-.14531
RT_OS_WI	-.01052*	.00580	-1.91	.0697	-.02189	.00085
RTLANES	.10012***	.02366	4.23	.0000	.05375	.14649
Means for random parameters						
LNADT	1.38417***	.03495	39.60	.0000	1.31567	1.45268
LNLENGTH	.87543***	.01259	69.51	.0000	.85075	.90012
MED_WI	-.00409***	.00072	-5.65	.0000	-.00551	-.00267
Scale parameters for dists. of random parameters						
LNADT	.00905***	.00113	7.98	.0000	.00682	.01127
LNLENGTH	.06122***	.00553	11.08	.0000	.05039	.07206
MED_WI	.00255***	.00034	7.40	.0000	.00187	.00322
Standard Deviations of Random Effects						
R.E.(01)	.06502***	.01357	4.79	.0000	.03843	.09162
R.E.(02)	.09569***	.01366	7.01	.0000	.06892	.12246
R.E.(03)	.02574**	.01068	2.41	.0159	.00482	.04666
Dispersion parameter for NegBin distribution						
ScalParm	1.57202***	.04877	32.23	.0000	1.47643	1.66761

```
Random Coefficients  NegBnReg Model
Dependent variable                      PDO
Log likelihood function    -14180.36961
Restricted log likelihood -128979.55496
Chi squared [   6 d.f.]    229598.37070
Significance level                .00000
McFadden Pseudo R-squared      .8900572
Estimation based on N =   5695, K =  31
Inf.Cr.AIC  =  28422.7 AIC/N =    4.990
Model estimated: Mar 23, 2016, 20:24:52
Sample is  1 pds and   5696 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.004228
R.E.(02) = CTY2	.009157
R.E.(03) = RCLASS2	.000663

All-Districts: Urban Eight Plus-lane Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-14.4728***	.59584	-24.29	.0000	-15.6407	-13.3050
RT210	-.26418***	.08903	-2.97	.0030	-.43868	-.08968
RT80	.48322***	.10164	4.75	.0000	.28402	.68243
LT_IS_WI	-.01233***	.00381	-3.23	.0012	-.01981	-.00486
RT215	.47892***	.18092	2.65	.0081	.12433	.83351
RT24	-.13995**	.06431	-2.18	.0296	-.26599	-.01390
RT405	-.33116***	.06500	-5.09	.0000	-.45855	-.20376
SDIEGO	-.18828***	.05135	-3.67	.0002	-.28893	-.08763
SOL	-.95454***	.17209	-5.55	.0000	-1.29182	-.61726
MENOBARR	.18922**	.08130	2.33	.0199	.02988	.34855
RT_TR_WI	-.01415***	.00304	-4.66	.0000	-.02011	-.00820
RTLANES	.10182***	.03745	2.72	.0066	.02841	.17523
SCL	.19058***	.06756	2.82	.0048	.05816	.32300
SM	-.38639***	.07731	-5.00	.0000	-.53792	-.23487
CC	-.39879***	.11266	-3.54	.0004	-.61961	-.17797
MEBEAMG	-.21420**	.08424	-2.54	.0110	-.37931	-.04910
	Means for random parameters					
LNADT	1.40316***	.05072	27.67	.0000	1.30376	1.50257
LNLENGTH	.95806***	.01538	62.29	.0000	.92792	.98821
MED_WI	-.00760***	.00097	-7.84	.0000	-.00951	-.00570
	Scale parameters for dists. of random parameters					
LNADT	.00834***	.00123	6.76	.0000	.00592	.01075
LNLENGTH	.21577***	.00855	25.24	.0000	.19902	.23253
MED_WI	.00568***	.00045	12.59	.0000	.00479	.00656
	Standard Deviations of Random Effects					
R.E.(01)	.03908***	.01492	2.62	.0088	.00983	.06833
R.E.(02)	.06422***	.01508	4.26	.0000	.03466	.09379
R.E.(03)	.02949**	.01502	1.96	.0497	.00004	.05894
	Dispersion parameter for NegBin distribution					
ScalParm	3.48426***	.23620	14.75	.0000	3.02133	3.94720

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 CPAIN
Log likelihood function     -7353.56871
Restricted log likelihood  -17325.02472
Chi squared [   6 d.f.]     19942.91200
Significance level               .00000
McFadden Pseudo R-squared      .5755522
Estimation based on N =   5695, K =  26
Inf.Cr.AIC  =  14759.1 AIC/N =    2.591
Model estimated: Mar 21, 2016, 15:57:55
Sample is  1 pds and   5696 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.001527
R.E.(02) = CTY2	.004125
R.E.(03) = RCLASS2	.000870

All-Districts: Urban Eight Plus-lane Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-11.2426***	.84860	-13.25	.0000	-12.9058	-9.5793
LT_IS_WI	-.01378***	.00531	-2.59	.0095	-.02419	-.00336
RT405	-.20957**	.08318	-2.52	.0118	-.37260	-.04654
SDIEGO	-.16434**	.06638	-2.48	.0133	-.29443	-.03424
SOL	-.35463**	.14980	-2.37	.0179	-.64822	-.06103
RT_TR_WI	-.00724***	.00212	-3.42	.0006	-.01140	-.00309
SM	-.49943***	.11016	-4.53	.0000	-.71534	-.28351
RT8	.56625***	.16968	3.34	.0008	.23368	.89883
MRN	-.49293**	.22254	-2.22	.0268	-.92910	-.05676
LAUXL	.16699**	.08414	1.98	.0472	.00208	.33190
	Means for random parameters					
LNADT	1.05445***	.07189	14.67	.0000	.91355	1.19535
LNLENGTH	.96102***	.02050	46.89	.0000	.92084	1.00119
MED_WI	-.00388***	.00113	-3.42	.0006	-.00609	-.00166
	Scale parameters for dists. of random parameters					
LNADT	.00344**	.00161	2.14	.0324	.00029	.00660
LNLENGTH	.19785***	.01221	16.21	.0000	.17393	.22178
MED_WI	.00463***	.00058	7.96	.0000	.00349	.00577
	Standard Deviations of Random Effects					
R.E.(01)	.04279**	.02069	2.07	.0386	.00224	.08333
	Dispersion parameter for NegBin distribution					
ScalParm	6.11314***	1.19481	5.12	.0000	3.77135	8.45493

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable               VISIBLE
Log likelihood function     -4417.01933
Restricted log likelihood   -6104.30044
Chi squared [   4 d.f.]      3374.56220
Significance level               .00000
McFadden Pseudo R-squared      .2764086
Estimation based on N =   5695, K =  18
Inf.Cr.AIC  =   8870.0 AIC/N =    1.557
Model estimated: Mar 24, 2016, 12:35:00
Sample is  1 pds and   5696 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.001831

All-Districts: Urban Eight Plus-lane Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

SEVERE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Nonrandom parameters						
Constant	-9.49504***	1.86396	-5.09	.0000	-13.14834	-5.84175
LNADT	.71570***	.15158	4.72	.0000	.41861	1.01279
RT10	.29286*	.16287	1.90	.0722	-.02637	.61209
MRN	.93824***	.33294	2.82	.0048	.28569	1.59080
SDIEGO	.29056**	.14102	2.06	.0394	.01417	.56695
Means for random parameters						
LNLENGTH	.94649***	.04129	22.93	.0000	.86557	1.02741
MED_WI	-.00694***	.00256	-2.71	.0067	-.01196	-.00192
Scale parameters for dists. of random parameters						
LNLENGTH	.18796***	.02915	6.45	.0000	.13082	.24510
MED_WI	.00567***	.00135	4.20	.0000	.00303	.00831
Standard Deviations of Random Effects						
R.E.(01)	.03732*	.01994	1.87	.0612	-.00176	.07641
Dispersion parameter for NegBin distribution						
ScalParm	3.31983**	1.67599	1.98	.0476	.03495	6.60472

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                SEVERE
Log likelihood function     -1487.72706
Restricted log likelihood   -1564.08448
Chi squared [   3 d.f.]       152.71484
Significance level               .00000
McFadden Pseudo R-squared      .0488192
Estimation based on N =   5695, K =  11
Inf.Cr.AIC  =   2997.5 AIC/N =     .526
Model estimated: Mar 25, 2016, 20:59:11
Sample is  1 pds and   5696 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = RCLASS2	.001393

All-Districts: Urban Eight Plus-lane Advanced Type 2 Random Effects Model– Fatal Collision Counts: Segments Without Intersections

FATAL	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
Nonrandom parameters						
Constant	-12.0709***	2.39635	-5.04	.0000	-16.7677	-7.3741
LNADT	.86729***	.19573	4.43	.0000	.48367	1.25091
RT101	-.82362***	.30763	-2.68	.0074	-1.42657	-.22067
ALA	-.84922**	.34320	-2.47	.0133	-1.52189	-.17656
RNOSPEC	.34767**	.14976	2.32	.0203	.05415	.64119
Means for random parameters						
LNLENGTH	1.11820***	.06474	17.27	.0000	.99131	1.24508
Scale parameters for dists. of random parameters						
LNLENGTH	.31365***	.03581	8.76	.0000	.24346	.38384
Standard Deviations of Random Effects						
R.E.(01)	.13312**	.06125	2.17	.0297	.01308	.25317
Dispersion parameter for NegBin distribution						
ScalParm	4.42817	4.28004	2.03	.0309	-3.96056	12.81689

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 FATAL
Log likelihood function      -928.70593
Restricted log likelihood    -954.28820
Chi squared [   2 d.f.]        51.16454
Significance level               .00000
McFadden Pseudo R-squared      .0268077
Estimation based on N =   5695, K =   9
Inf.Cr.AIC  =   1875.4 AIC/N =     .329
Model estimated: Mar 30, 2016, 18:19:42
Sample is  1 pds and   5695 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.017722

All-Districts: Urban Multilane Divided Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

TOTALCR	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-5.77843***	.69055	-8.37	.0000	-7.13189	-4.42497
TOTLANES	.12215***	.04225	2.89	.0038	.03934	.20496
RT111	-.60041***	.15865	-3.78	.0002	-.91136	-.28945
RT86	-.96382***	.19004	-5.07	.0000	-1.33630	-.59135
RT74	-.48447**	.19168	-2.53	.0115	-.86015	-.10880
RT187	-2.55758***	.83733	-3.05	.0023	-4.19872	-.91644
RT46	-1.94178***	.69019	-2.81	.0049	-3.29453	-.58902
RT51	.87048***	.22930	3.80	.0001	.42107	1.31989
RT49	.33889**	.14272	2.37	.0176	.05916	.61861
RT_IS_WI	-.03959**	.01615	-2.45	.0142	-.07125	-.00794
	Means for random parameters					
LNADT	.67643***	.06919	9.78	.0000	.54082	.81204
LNLEN	.55990***	.02847	19.67	.0000	.50410	.61570
DES_SP	-.01146***	.00383	-3.00	.0027	-.01896	-.00396
	Scale parameters for dists. of random parameters					
LNADT	.01023***	.00335	3.05	.0023	.00366	.01681
LNLEN	.10999***	.01114	9.87	.0000	.08816	.13183
DES_SP	.01343***	.00063	21.45	.0000	.01221	.01466
	Standard Deviations of Random Effects					
R.E.(01)	.09150**	.03734	2.45	.0143	.01832	.16468
	Dispersion parameter for NegBin distribution					
ScalParm	.97533***	.07451	13.09	.0000	.82930	1.12136

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                 TOTALCR
Log likelihood function     -3079.32305
Restricted log likelihood   -6405.81107
Chi squared [   6 d.f.]      6652.97605
Significance level              .00000
McFadden Pseudo R-squared      .5192922
Estimation based on N =   3239, K =  20
Inf.Cr.AIC  =   6198.6 AIC/N =    1.914
Model estimated: Dec 11, 2015, 12:59:38
Sample is  1 pds and   3239 individuals
Negative binomial regression model
Simulation based on     100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.008372

All-Districts: Urban Multilane Divided Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-5.74204***	.87089	-6.59	.0000	-7.44894	-4.03513
LTLANES	.23450**	.10528	2.23	.0259	.02815	.44084
RT111	-.80020**	.31811	-2.52	.0119	-1.42368	-.17672
RT86	-1.84215***	.34339	-5.36	.0000	-2.51519	-1.16912
RT76	-.56122	.34880	-1.91	.0176	-1.24485	.12242
RT83	.65613***	.23961	2.74	.0062	.18651	1.12575
IMP	.66087**	.32016	2.06	.0390	.03337	1.28838
TUL	1.04469***	.25817	4.05	.0001	.53868	1.55070
SCL	-.59602***	.16610	-3.59	.0003	-.92156	-.27048
METWTL	-.34265***	.12742	-2.69	.0072	-.59240	-.09290
RT46	-1.61730**	.77447	-2.09	.0368	-3.13524	-.09936
RT51	.87778**	.35654	2.46	.0138	.17897	1.57659
RT49	.52226***	.19409	2.69	.0071	.14185	.90267
RT_IS_WI	-.04710**	.01892	-2.49	.0128	-.08418	-.01002
	Means for random parameters					
LNADT	.61291***	.09257	6.62	.0000	.43148	.79434
LNLEN	.60751***	.03767	16.13	.0000	.53368	.68133
	Scale parameters for dists. of random parameters					
LNADT	.00775**	.00383	2.02	.0432	.00024	.01526
LNLEN	.17288***	.01372	12.60	.0000	.14599	.19977
	Standard Deviations of Random Effects					
R.E.(01)	.08636**	.04199	2.06	.0397	.00406	.16865
R.E.(02)	.17515***	.04235	4.14	.0000	.09215	.25814
R.E.(03)	.11861***	.04182	2.84	.0046	.03665	.20057
	Dispersion parameter for NegBin distribution					
ScalParm	.51138***	.04213	12.14	.0000	.42882	.59395

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                     PDO
Log likelihood function     -2460.78465
Restricted log likelihood   -4508.39295
Chi squared [   5 d.f.]      4095.21660
Significance level              .00000
McFadden Pseudo R-squared      .4541770
Estimation based on N =   3239, K =  22
Inf.Cr.AIC  =   4965.6 AIC/N =    1.533
Model estimated: May 02, 2016, 21:25:14
Sample is  1 pds and   3239 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.007457
R.E.(02) = CTY2	.030676
R.E.(03) = RCLASS2	.014067

All-Districts: Urban Multilane Divided Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
   CPAIN|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -9.70146***     1.30044    -7.46  .0000   -12.25028  -7.15265
TOTLANES|     .23539***      .08065     2.92  .0035      .07732    .39347
   RT138|    1.68959***      .24529     6.89  .0000     1.20882   2.17035
    RT18|    1.08203***      .30693     3.53  .0004      .48047   1.68359
   RT123|     .81064***      .30115     2.69  .0071      .22040   1.40088
    RT51|     .73820**       .34261     2.15  .0312      .06670   1.40970
    ORNG|     .73693***      .25350     2.91  .0036      .24009   1.23378
     STA|    1.18064***      .34246     3.45  .0006      .50942   1.85185
    RT76|    1.04214***      .27922     3.73  .0002      .49488   1.58939
LT_OS_WI|     .02790         .02042     1.97  .0718     -.01212    .06793
        |Means for random parameters
   LNADT|     .92678***      .11934     7.77  .0000      .69288   1.16069
   LNLEN|     .63964***      .05101    12.54  .0000      .53965    .73962
  DES_SP|    -.02919***      .00779    -3.75  .0002     -.04445   -.01392
        |Scale parameters for dists. of random parameters
   LNADT|     .98796**       .46047     2.15  .0319      .08545   1.89046
   LNLEN|     .07561***      .01947     3.88  .0001      .03746    .11377
  DES_SP|     .00443***      .00104     4.27  .0000      .00240    .00645
        |Standard Deviations of Random Effects
R.E.(01)|     .14305**       .05616     2.55  .0109      .03298    .25312
        |Dispersion parameter for NegBin distribution
ScalParm|     .91171***      .19246     4.74  .0000      .53450   1.28892
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                   CPAIN
Log likelihood function     -1122.70035
Restricted log likelihood   -1380.77552
Chi squared [   4 d.f.]       516.15034
Significance level               .00000
McFadden Pseudo R-squared      .1869060
Estimation based on N =   3239, K =  18
Inf.Cr.AIC  =   2281.4 AIC/N =     .704
Model estimated: May 02, 2016, 22:44:31
Sample is  1 pds and   3239 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = DCODE2                          |      .020464 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Multilane Divided Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
 VISIBLE|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -12.8614***     1.53641    -8.37  .0000    -15.8727   -9.8501
   LNLEN|     .77049***      .06344    12.14  .0000      .64615    .89484
 LTLANES|     .64677***      .20798     3.11  .0019      .23914   1.05441
     TUL|    1.35894***      .35505     3.83  .0001      .66305   2.05482
   RT108|    1.43637***      .48016     2.99  .0028      .49528   2.37746
   RT132|    1.88180***      .44230     4.25  .0000     1.01490   2.74870
 LNOSPEC|    1.47602**       .63771     2.31  .0206      .22614   2.72590
RT_IS_WI|    -.06920**       .02963    -2.34  .0195     -.12727   -.01113
        |Means for random parameters
   LNADT|     .89609***      .16645     5.38  .0000      .56984   1.22233
        |Scale parameters for dists. of random parameters
   LNADT|     .04927***      .00792     6.22  .0000      .03375    .06478
        |Standard Deviations of Random Effects
R.E.(01)|     .08068**       .03828     2.11  .0350      .00566    .15570
        |Dispersion parameter for NegBin distribution
ScalParm|     .91697***      .32077     2.86  .0043      .28828   1.54566
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                 VISIBLE
Log likelihood function      -628.93828
Restricted log likelihood    -684.86714
Chi squared [   2 d.f.]       111.85771
Significance level               .00000
McFadden Pseudo R-squared      .0816638
Estimation based on N =   3239, K =  12
Inf.Cr.AIC  =   1281.9 AIC/N =     .396
Model estimated: May 03, 2016, 20:29:48
Sample is  1 pds and   3239 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTY2                            |      .006509 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Multilane Divided Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
  SEVERE|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -8.24019***    1.75364    -4.70  .0000   -11.67726  -4.80312
   LNLEN|     .72565***     .10239     7.09  .0000      .52496    .92634
    RT49|    1.34436***     .43447     3.09  .0020      .49282   2.19590
        |Means for random parameters
   LNADT|     .58943***     .17365     3.39  .0007      .24909    .92977
        |Scale parameters for dists. of random parameters
   LNADT|     .04151*       .02145     1.94  .0530     -.00053    .08354
        |Standard Deviations of Random Effects
R.E.(01)|     .06652        .04739     1.40  .1604     -.02637    .15942
        |Dispersion parameter for NegBin distribution
ScalParm|    15.1190      320.5306     1.05  .1624   -613.1093  643.3474
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                 SEVERE
Log likelihood function      -246.52726
Restricted log likelihood    -247.19351
Chi squared [   2 d.f.]         1.33250
Significance level               .51363
McFadden Pseudo R-squared      .0026953
Estimation based on N =   3239, K =   7
Inf.Cr.AIC  =    507.1 AIC/N =     .157
Model estimated: May 09, 2016, 19:49:03
Sample is  1 pds and   3239 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
+------------------------------------------+--------------+
| Random effects in the model are based on |Random Effect |
| these expanded qualitative variables.    |     Variance |
| R.E.(01) = CTY2                          |      .000434 |
+------------------------------------------+--------------+
```

All-Districts: Urban Multilane Divided Advanced Type 2 Random Effects Model– Fatal Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
   FATAL|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -6.09031*      3.52132    -1.93  .0737   -12.99198    .81135
     RIV|    1.37688***     .48297     2.85  .0044      .43027   2.32349
 RNOSPEC|   -1.42289**      .56627    -2.51  .0120    -2.53276   -.31302
        |Means for random parameters
   LNLEN|     .95548***     .15189     6.29  .0000      .65779   1.25317
   LNADT|     .09513**      .04750     2.00  .0452      .00202    .18823
        |Scale parameters for dists. of random parameters
   LNLEN|     .42914***     .08511     5.04  .0000      .26232    .59595
   LNADT|     .07616***     .02311     3.30  .0010      .03086    .12145
        |Standard Deviations of Random Effects
R.E.(01)|     .06275        .20319     1.31  .1574     -.33549    .46099
        |Dispersion parameter for NegBin distribution
ScalParm|    2.35490       8.28706     1.28  .1763   -13.88744  18.59725
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                  FATAL
Log likelihood function      -133.71075
Restricted log likelihood    -138.04193
Chi squared [   3 d.f.]         8.66236
Significance level               .03413
McFadden Pseudo R-squared      .0313758
Estimation based on N =   3239, K =   9
Inf.Cr.AIC  =    285.4 AIC/N =     .088
Model estimated: May 04, 2016, 13:43:02
Sample is  1 pds and   3239 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+------------------------------------------+--------------+
| Random effects in the model are based on |Random Effect |
| these expanded qualitative variables.    |     Variance |
| R.E.(01) = DCODE2                        |      .003938 |
+------------------------------------------+--------------+
```

All-Districts: Urban Multilane Undivided Advanced Type 2 Random Effects Model– Total Crashes: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
 TOTALCR|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -4.84237***     1.40859    -3.44  .0006    -7.60315  -2.08159
    RT18|    1.50719***      .47655     3.16  .0016      .57316   2.44122
    LLTR|   -2.52213**      1.06744    -2.36  .0181    -4.61428   -.42998
  DES_SP|    -.01746**       .00727    -2.40  .0162     -.03170   -.00322
        |Means for random parameters
   LNLEN|     .52256***      .06102     8.56  .0000      .40297    .64214
   LNADT|     .65110***      .14092     4.62  .0000      .37491    .92730
        |Scale parameters for dists. of random parameters
   LNLEN|     .18778***      .02785     6.74  .0000      .13318    .24237
   LNADT|     .03571***      .00798     4.48  .0000      .02007    .05134
        |Standard Deviations of Random Effects
R.E.(01)|     .24535**       .09660     2.54  .0111      .05601    .43469
        |Dispersion parameter for NegBin distribution
ScalParm|     .76485***      .13717     5.58  .0000      .49601   1.03370
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                 TOTALCR
Log likelihood function      -671.48970
Restricted log likelihood    -930.17421
Chi squared [   3 d.f.]       517.36902
Significance level               .00000
McFadden Pseudo R-squared      .2781033
Estimation based on N =    844, K =  10
Inf.Cr.AIC  =   1363.0 AIC/N =    1.615
Model estimated: Dec 11, 2015, 11:08:13
Sample is  1 pds and    844 individuals
Negative binomial regression model
Simulation based on     100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTY2                            |      .006099 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Multilane Undivided Advanced Type 2 Random Effects Model– Property Damage Only Collision Counts: Segments Without Intersections

```
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
     PDO|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
Constant|   -5.31324***     1.65580    -3.21  .0013    -8.55856  -2.06792
 LNOSPEC|     .94174***      .32387     2.91  .0036      .30697   1.57652
RT_OS_WI|     .03640         .02472     1.97  .0489     -.01205    .08486
   RT111|    -.93100**       .42275    -2.20  .0276    -1.75958   -.10243
  DES_SP|    -.01613**       .00813    -1.98  .0474     -.03207   -.00019
        |Means for random parameters
   LNLEN|     .58535***      .08145     7.19  .0000      .42572    .74498
   LNADT|     .56992***      .16486     3.46  .0005      .24679    .89304
        |Scale parameters for dists. of random parameters
   LNLEN|     .15726***      .03070     5.12  .0000      .09708    .21744
   LNADT|     .02460***      .00891     2.76  .0058      .00713    .04206
        |Standard Deviations of Random Effects
R.E.(01)|     .47005**       .21372     2.20  .0279      .05117    .88893
        |Dispersion parameter for NegBin distribution
ScalParm|     .56711***      .11829     4.79  .0000      .33526    .79895
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                     PDO
Log likelihood function      -549.97759
Restricted log likelihood    -702.23073
Chi squared [   3 d.f.]       304.50629
Significance level               .00000
McFadden Pseudo R-squared      .2168136
Estimation based on N =    844, K =  11
Inf.Cr.AIC  =   1122.0 AIC/N =    1.329
Model estimated: May 05, 2016, 15:26:32
Sample is  1 pds and    844 individuals
Negative binomial regression model
Simulation based on    100 Halton draws

+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTY2                            |      .001048 |
+--------------------------------------------+--------------+
```

All-Districts: Urban Multilane Undivided Advanced Type 2 Random Effects Model– Complaint of Pain Collision Counts: Segments Without Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-7.53711***	2.84149	-2.65	.0080	-13.10634	-1.96789
LNLEN	.20584	.14713	1.90	.1618	-.08253	.49420
ALA	1.79891***	.64307	2.80	.0052	.53852	3.05931
	Means for random parameters					
LNADT	.54662*	.29468	1.96	.0636	-.03093	1.12418
	Scale parameters for dists. of random parameters					
LNADT	.04499***	.01609	2.80	.0052	.01345	.07653
	Standard Deviations of Random Effects					
R.E.(01)	.17003*	.09798	1.94	.0827	-.02202	.36207
	Dispersion parameter for NegBin distribution					
ScalParm	.41361*	.24277	1.90	.1584	-.06221	.88942

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	CPAIN
Log likelihood function	-194.10856
Restricted log likelihood	-205.33298
Chi squared [2 d.f.]	22.44884
Significance level	.00001
McFadden Pseudo R-squared	.0546645
Estimation based on N = 844, K = 7	
Inf.Cr.AIC = 402.2 AIC/N =	.477
Model estimated: May 06, 2016, 21:22:28	
Sample is 1 pds and 844 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.001169

All-Districts: Urban Multilane Undivided Advanced Type 2 Random Effects Model– Visible Collision Counts: Segments Without Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-9.51536**	3.97418	-2.39	.0167	-17.30462	-1.72610
LNLEN	.61385***	.14151	4.34	.0000	.33649	.89120
RT36	1.54006**	.64799	2.38	.0175	.27003	2.81010
	Means for random parameters					
LNADT	.79932**	.40661	1.97	.0493	.00238	1.59626
	Scale parameters for dists. of random parameters					
LNADT	.06177***	.02148	2.88	.0040	.01967	.10388
	Standard Deviations of Random Effects					
R.E.(01)	.84848*	.46411	1.93	.0675	-.06116	1.75812
	Dispersion parameter for NegBin distribution					
ScalParm	.86704*	.45707	1.90	.0578	-.02880	1.76287

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Random Coefficients NegBnReg Model	
Dependent variable	VISIBLE
Log likelihood function	-128.43922
Restricted log likelihood	-135.78642
Chi squared [2 d.f.]	14.69440
Significance level	.00064
McFadden Pseudo R-squared	.0541085
Estimation based on N = 844, K = 7	
Inf.Cr.AIC = 270.9 AIC/N =	.321
Model estimated: May 09, 2016, 12:45:41	
Sample is 1 pds and 844 individuals	
Negative binomial regression model	
Simulation based on 100 Halton draws	

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = DCODE2	.001285

All-Districts: Urban Multilane Undivided Advanced Type 2 Random Effects Model– Severe Collision Counts: Segments Without Intersections

SEVERE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
Constant	-10.2042**	4.60234	-2.22	.0266	-19.2246	-1.1838
LNLEN	.93479**	.44522	2.10	.0358	.06217	1.80740
LNADT	.87559*	.48635	1.90	.0718	-.07763	1.82882
	Means for random parameters					
TOTLANES	2.03829**	.88181	2.31	.0208	.30997	3.76662
	Scale parameters for dists. of random parameters					
TOTLANES	.90650**	.43729	2.07	.0382	.04943	1.76357
	Standard Deviations of Random Effects					
R.E.(01)	.90781	.61606	1.47	.1406	-.29965	2.11527
	Dispersion parameter for NegBin distribution					
ScalParm	1.74332	.54494	1.36	.1726	-.32474	1.81138

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

```
Random Coefficients  NegBnReg Model
Dependent variable                   SEVERE
Log likelihood function           -31.83696
Restricted log likelihood        -844.00000
Chi squared [   2 d.f.]          1624.32607
Significance level                   .00000
McFadden Pseudo R-squared          .9622785
Estimation based on N =    844, K =   7
Inf.Cr.AIC  =      77.7 AIC/N =      .092
Model estimated: May 09, 2016, 16:22:07
Sample is  1 pds and    844 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = CTY2	.824120

All-Districts: All Classes Advanced Type 2 Spf Random Effects Model– Property Damage Only Collision Counts: Intersections

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
NUMLANE	.13276***	.01252	10.60	.0000	.10822	.15730
FOURLEG	.23689***	.02197	10.78	.0000	.19383	.27996
T_INTRS	-.33593***	.02092	-16.06	.0000	-.37693	-.29493
STOMAIN	.78140***	.10174	7.68	.0000	.58199	.98081
FWYFSHX	.62001***	.11307	5.48	.0000	.39839	.84162
FWYFSHAL	1.04684***	.10286	10.18	.0000	.84524	1.24843
SGNL2P	.21988***	.04201	5.23	.0000	.13755	.30222
SGNLFL2	.19527***	.04307	4.53	.0000	.11086	.27968
SGNLOTH	.59394***	.10249	5.80	.0000	.39307	.79481
MSTARM	.64897***	.02625	24.72	.0000	.59752	.70042
INTMAT	.21612***	.02884	7.49	.0000	.15959	.27264
INTRT	.26182***	.02301	11.38	.0000	.21673	.30692
INT2WPK	.26847	.20822	1.99	.0973	-.13964	.67658
	Means for random parameters					
Constant	-5.23006***	.14165	-36.92	.0000	-5.50770	-4.95242
LNADTMA	1.00457***	.00914	109.90	.0000	.98666	1.02249
LNADTMI	-.67171***	.01992	-33.73	.0000	-.71074	-.63267
NOLIGHT	-.33984***	.01493	-22.76	.0000	-.36911	-.31058
MNORGHT	-.06231***	.01943	-3.21	.0013	-.10038	-.02424
INT2WLT	.22498***	.02595	8.67	.0000	.17411	.27585
	Scale parameters for dists. of random parameters					
Constant	.05655***	.00587	9.64	.0000	.04505	.06805
LNADTMA	.06907***	.00065	106.33	.0000	.06780	.07035
LNADTMI	.00450***	.00072	6.25	.0000	.00309	.00591
NOLIGHT	.09371***	.01737	5.40	.0000	.05967	.12775
MNORGHT	.00410	.01091	2.38	.0071	-.01728	.02548
INT2WLT	.02888***	.01057	2.73	.0063	.00818	.04959
	Standard Deviations of Random Effects					
R.E.(01)	.09184***	.00581	15.82	.0000	.08046	.10322
R.E.(02)	.16771***	.00582	28.82	.0000	.15631	.17912
R.E.(03)	.05891***	.00577	10.21	.0000	.04760	.07022
R.E.(04)	.05169***	.00595	8.69	.0000	.04004	.06334
R.E.(05)	.09060***	.00580	15.62	.0000	.07923	.10197
R.E.(06)	.00964	.00592	1.93	.1031	-.00195	.02124
R.E.(07)	.05923***	.00587	10.08	.0000	.04771	.07074
	Dispersion parameter for NegBin distribution					
ScalParm	1.12314***	.01597	70.33	.0000	1.09184	1.15444

```
Random Coefficients  NegBnReg Model
Dependent variable                      PDO
Log likelihood function    -93245.17635
Restricted log likelihood -153407.93400
Chi squared [  13 d.f.]    120325.51531
Significance level                .00000
McFadden Pseudo R-squared       .3921750
Estimation based on N =  97692, K =  33
Inf.Cr.AIC  = 186556.4 AIC/N =    1.910
Model estimated: May 10, 2016, 15:53:57
Sample is  6 pds and  16282 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.008434
R.E.(02) = CMLTYPE	.028128
R.E.(03) = CFC	.003470
R.E.(04) = CINSTYPE	.002672
R.E.(05) = CLIGHT	.008208
R.E.(06) = CMLTCHAN	.000093
R.E.(07) = CMFLOW	.003508

All-Districts: All Classes Advanced Type 2 Spf Random Effects Model– Complaint of Pain Collision Counts: Intersections

CPAIN	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
NUMLANE	.09915***	.01106	8.96	.0000	.07747	.12083
FOURLEG	.27882***	.02524	11.05	.0000	.22935	.32830
T_INTRS	-.25727***	.02474	-10.40	.0000	-.30577	-.20877
STOMAIN	.63565***	.13879	4.58	.0000	.36363	.90768
FWYFSHX	.54728***	.11197	4.89	.0000	.32783	.76674
FWYFSHAL	.83747***	.12198	6.87	.0000	.59839	1.07655
SGNL2P	.29966***	.03827	7.83	.0000	.22465	.37468
SGNLFL2	.31518***	.03742	8.42	.0000	.24183	.38853
SGNLOTH	.47298***	.14553	3.25	.0012	.18774	.75822
MSTARM	.64575***	.02496	25.88	.0000	.59684	.69466
INTMAT	.21131***	.02630	8.03	.0000	.15976	.26286
INTRT	.18065***	.02208	8.18	.0000	.13738	.22393
INT2WPK	.91844***	.16933	5.42	.0000	.58655	1.25032
	Means for random parameters					
Constant	-8.44296***	.16483	-51.22	.0000	-8.76602	-8.11990
LNADTMA	.92635***	.01262	73.40	.0000	.90161	.95109
LNADTMI	-.29674***	.02399	-12.37	.0000	-.34377	-.24971
NOLIGHT	-.30433***	.01935	-15.72	.0000	-.34227	-.26640
MNORGHT	-.15935***	.02008	-7.94	.0000	-.19870	-.12000
INT2WLT	.36982***	.02765	13.38	.0000	.31563	.42401
	Scale parameters for dists. of random parameters					
Constant	.05671***	.00701	8.09	.0000	.04296	.07045
LNADTMA	.01876***	.00070	26.88	.0000	.01739	.02013
LNADTMI	.05523***	.00088	62.42	.0000	.05349	.05696
NOLIGHT	.03105	.02342	1.93	.0650	-.01486	.07696
MNORGHT	.00940	.01317	1.91	.0553	-.01642	.03522
INT2WLT	.02475**	.01245	1.99	.0468	.00035	.04915
	Standard Deviations of Random Effects					
R.E.(01)	.21591***	.00691	31.23	.0000	.20236	.22946
R.E.(02)	.03718***	.00686	5.42	.0000	.02373	.05063
R.E.(03)	.10629***	.00689	15.43	.0000	.09279	.11979
R.E.(04)	.07676***	.00689	11.13	.0000	.06325	.09027
R.E.(05)	.24685***	.00697	35.41	.0000	.23319	.26052
R.E.(06)	.01755**	.00687	2.56	.0106	.00410	.03101
R.E.(07)	.01258*	.00692	1.82	.0691	-.00098	.02615
	Dispersion parameter for NegBin distribution					
ScalParm	2.14883***	.06803	31.59	.0000	2.01550	2.28217

```
Random Coefficients  NegBnReg Model
Dependent variable                    CPAIN
Log likelihood function    -55542.25324
Restricted log likelihood  -70032.63820
Chi squared [  13 d.f.]     28980.76992
Significance level                .00000
McFadden Pseudo R-squared      .2069090
Estimation based on N =  97692, K =  33
Inf.Cr.AIC  = 111150.5 AIC/N =    1.138
Model estimated: May 10, 2016, 15:51:13
Sample is  6 pds and  16282 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.046619
R.E.(02) = CMLTYPE	.001382
R.E.(03) = CFC	.011297
R.E.(04) = CINSTYPE	.005892
R.E.(05) = CLIGHT	.060935
R.E.(06) = CMLTCHAN	.000308
R.E.(07) = CMFLOW	.000158

All-Districts: All Classes Advanced Type 2 Spf Random Effects Model– Visible Collision Counts: Intersections

VISIBLE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
NUMLANE	.07650***	.01546	4.95	.0000	.04621	.10679
FOURLEG	.29348***	.03400	8.63	.0000	.22684	.36013
T_INTRS	-.18314***	.03312	-5.53	.0000	-.24805	-.11823
STOMAIN	.75608***	.17966	4.21	.0000	.40396	1.10820
FWYFSHX	.67923***	.13519	5.02	.0000	.41426	.94420
FWYFSHAL	.45600**	.20506	2.22	.0262	.05408	.85792
SGNL2P	.26235***	.05408	4.85	.0000	.15637	.36834
SGNLFL2	.31465***	.05022	6.27	.0000	.21623	.41307
SGNLOTH	.50016***	.17152	2.92	.0035	.16400	.83633
MSTARM	.36902***	.03539	10.43	.0000	.29966	.43839
INTMAT	.23087***	.03717	6.21	.0000	.15802	.30372
INTRT	.18181***	.03041	5.98	.0000	.12220	.24141
INT2WPK	.83120***	.23703	3.51	.0005	.36662	1.29577
	Means for random parameters					
Constant	-7.92359***	.21587	-36.71	.0000	-8.34668	-7.50050
LNADTMA	.60391***	.01416	42.66	.0000	.57616	.63165
LNADTMI	-.07011**	.03133	-2.24	.0252	-.13153	-.00870
NOLIGHT	.03233	.02449	1.92	.0468	-.01567	.08034
MNORGHT	-.11083***	.02732	-4.06	.0000	-.16438	-.05728
INT2WLT	.45717***	.04174	10.95	.0000	.37536	.53898
	Scale parameters for dists. of random parameters					
Constant	.02384***	.00913	2.61	.0090	.00596	.04173
LNADTMA	.03627***	.00093	38.95	.0000	.03445	.03810
LNADTMI	.02004***	.00111	18.01	.0000	.01786	.02222
NOLIGHT	.01268	.02696	1.47	.0681	-.04016	.06553
MNORGHT	.01555	.01702	1.91	.0509	-.01780	.04891
INT2WLT	.03448**	.01613	2.14	.0325	.00287	.06609
	Standard Deviations of Random Effects					
R.E.(01)	.09053***	.00901	10.04	.0000	.07286	.10820
R.E.(02)	.22265***	.00894	24.92	.0000	.20514	.24017
R.E.(03)	.08754***	.00898	9.75	.0000	.06994	.10514
R.E.(04)	.02879***	.00899	3.20	.0014	.01117	.04641
R.E.(05)	.05404***	.00901	6.00	.0000	.03638	.07171
R.E.(06)	.01776**	.00901	1.97	.0487	.00011	.03542
R.E.(07)	.18366***	.00904	20.32	.0000	.16594	.20138
	Dispersion parameter for NegBin distribution					
ScalParm	2.42755***	.16917	14.35	.0000	2.09598	2.75912

```
Random Coefficients  NegBnReg Model
Dependent variable                  VISIBLE
Log likelihood function    -37328.50566
Restricted log likelihood  -39854.05761
Chi squared [  13 d.f.]      5051.10390
Significance level                .00000
McFadden Pseudo R-squared      .0633700
Estimation based on N =  97692, K =  33
Inf.Cr.AIC  =  74723.0 AIC/N =     .765
Model estimated: May 10, 2016, 20:10:42
Sample is  6 pds and  16282 individuals
Negative binomial regression model
Simulation based on    100 Halton draws
```

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.008195
R.E.(02) = CMLTYPE	.049575
R.E.(03) = CFC	.007663
R.E.(04) = CINSTYPE	.000829
R.E.(05) = CLIGHT	.002921
R.E.(06) = CMLTCHAN	.000316
R.E.(07) = CMFLOW	.033730

All-Districts: All Classes Advanced Type 2 Spf Random Effects Model– Severe Collision Counts: Intersections

SEVERE	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
NUMLANE	.00753	.03376	.22	.8234	-.05863	.07370
FOURLEG	.20848***	.06556	3.18	.0015	.07999	.33697
T_INTRS	-.25014***	.06396	-3.91	.0001	-.37550	-.12477
STOMAIN	.64614*	.33624	1.92	.0546	-.01287	1.30516
FWYFSHX	.35116	.35120	1.00	.3174	-.33719	1.03951
FWYFSHAL	-.54435	.59030	-.92	.3564	-1.70131	.61261
SGNL2P	.23957**	.10949	2.19	.0287	.02498	.45416
SGNLFL2	.17141	.11587	1.48	.1391	-.05569	.39851
SGNLOTH	.21724	.42614	.51	.6102	-.61798	1.05245
MSTARM	.35126***	.07545	4.66	.0000	.20338	.49915
INTMAT	.10237	.07913	1.29	.1957	-.05271	.25746
INTRT	.05583	.06433	.87	.3854	-.07025	.18192
INT2WPK	.10548	.64904	.16	.8709	-1.16661	1.37757
	Means for random parameters					
Constant	-7.48343***	.45484	-16.45	.0000	-8.37490	-6.59195
LNADTMA	.47071***	.02642	17.82	.0000	.41893	.52248
LNADTMI	-.10001	.06422	-1.56	.1194	-.22588	.02587
NOLIGHT	.24831***	.04746	5.23	.0000	.15530	.34133
MNORGHT	-.21491***	.05675	-3.79	.0002	-.32613	-.10369
INT2WLT	.45247***	.09217	4.91	.0000	.27182	.63312
	Scale parameters for dists. of random parameters					
Constant	.82932D-04	.01814	.00	.9964	-.35470D-01	.35636D-01
LNADTMA	.00063	.00187	.34	.7371	-.00303	.00429
LNADTMI	.47865D-04	.00224	.02	.9829	-.43391D-02	.44348D-02
NOLIGHT	.87472D-04	.04852	.00	.9986	-.95014D-01	.95189D-01
MNORGHT	.00014	.03466	.00	.9968	-.06779	.06807
INT2WLT	.00032	.03199	.01	.9919	-.06238	.06303
	Standard Deviations of Random Effects					
R.E.(01)	.12234D-04	.01807	.00	.9995	-.35412D-01	.35436D-01
R.E.(02)	.00032	.01799	.02	.9857	-.03493	.03557
R.E.(03)	.00092	.01801	.05	.9594	-.03438	.03622
R.E.(04)	.45639D-04	.01820	.00	.9980	-.35619D-01	.35711D-01
R.E.(05)	.00108	.01812	.06	.9524	-.03443	.03660
R.E.(06)	.00068	.01813	.04	.9702	-.03485	.03621
R.E.(07)	.00014	.01797	.01	.9938	-.03508	.03536
	Dispersion parameter for NegBin distribution					
ScalParm	.99955***	.16082	6.22	.0000	.68434	1.31475

Random Coefficients NegBnReg Model
Dependent variable SEVERE
Log likelihood function -13112.41486
Restricted log likelihood -13243.05771
Chi squared [13 d.f.] 261.28570
Significance level .00000
McFadden Pseudo R-squared .0098650
Estimation based on N = 97692, K = 33
Inf.Cr.AIC = 26290.8 AIC/N = .269
Model estimated: May 10, 2016, 17:11:36
Sample is 6 pds and 16282 individuals
Negative binomial regression model
Simulation based on 100 Halton draws

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.000000
R.E.(02) = CMLTYPE	.000000
R.E.(03) = CFC	.000001
R.E.(04) = CINSTYPE	.000000
R.E.(05) = CLIGHT	.000001
R.E.(06) = CMLTCHAN	.000000
R.E.(07) = CMFLOW	.000000

All-Districts: All Classes Advanced Type 2 Spf Random Effects Model– Fatal Collision Counts: Intersections

FATAL	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
FOURLEG	.46987***	.06625	7.09	.0000	.34002	.59972
SGNL2P	-.40082*	.23312	-1.72	.0855	-.85774	.05609
INTMAT	.58361***	.08910	6.55	.0000	.40897	.75825
	Means for random parameters					
Constant	-9.87201***	.40743	-24.23	.0000	-10.67055	-9.07347
LNADTMA	.49001***	.03679	13.32	.0000	.41791	.56211
NOLIGHT	.43443***	.07402	5.87	.0000	.28935	.57952
INT2WLT	.37935***	.14113	2.69	.0072	.10275	.65596
	Scale parameters for dists. of random parameters					
Constant	.12648D-04	.02990	.00	.9997	-.58599D-01	.58624D-01
LNADTMA	.00012	.00307	.04	.9685	-.00589	.00614
NOLIGHT	.58633D-05	.07674	.00	.9999	-.15041D+00	.15042D+00
INT2WLT	.18081D-04	.05272	.00	.9997	-.10330D+00	.10334D+00
	Standard Deviations of Random Effects					
R.E.(01)	.53149D-04	.02965	.00	.9986	-.58053D-01	.58159D-01
R.E.(02)	.00018	.02964	.01	.9951	-.05792	.05828
R.E.(03)	.00024	.02947	.01	.9935	-.05753	.05800
R.E.(04)	.00016	.02972	.01	.9957	-.05808	.05840
R.E.(05)	.90607D-04	.02946	.00	.9975	-.57644D-01	.57826D-01
R.E.(06)	.00012	.02967	.00	.9968	-.05803	.05826
	Dispersion parameter for NegBin distribution					
ScalParm	.99983**	.41796	2.39	.0167	.18064	1.81901

Random Coefficients NegBnReg Model
Dependent variable FATAL
Log likelihood function -5858.15776
Restricted log likelihood -5886.81600
Chi squared [10 d.f.] 57.31649
Significance level .00000
McFadden Pseudo R-squared .0048682
Estimation based on N = 97692, K = 18
Inf.Cr.AIC = 11752.3 AIC/N = .120
Model estimated: May 10, 2016, 17:39:49
Sample is 6 pds and 16282 individuals
Negative binomial regression model
Simulation based on 100 Halton draws

Random effects in the model are based on these expanded qualitative variables.	Random Effect Variance
R.E.(01) = SPFCLASS	.000000
R.E.(02) = CMLTYPE	.000000
R.E.(03) = CFC	.000000
R.E.(04) = CINSTYPE	.000000
R.E.(05) = CLIGHT	.000000
R.E.(06) = CMLTCHAN	.000000

Advanced Type 2 SPF for Ramp Segment Total Crashes.

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-----------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable             TCRASHES
Log likelihood function    -21751.12084
Restricted log likelihood  -44051.19284
Chi squared [  10 d.f.]     44600.14399
Significance level               .00000
McFadden Pseudo R-squared      .5062308
Estimation based on N =  12252, K =  44
Inf.Cr.AIC  =  43590.2 AIC/N =    3.558
Model estimated: Jun 26, 2016, 00:36:10
Sample is  6 pds and   2042 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
--------+--------------------------------------------------------------------
        |                Standard            Prob.      95% Confidence
TCRASHES|  Coefficient      Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
   NBDIR|     .08568***      .01873     4.58  .0000      .04898    .12238
   WBDIR|    -.07357***      .02733    -2.69  .0071     -.12713   -.02000
    SLIP|    -.25441***      .06239    -4.08  .0000     -.37670   -.13213
  RMPMTR|    -.07020**       .02728    -2.57  .0101     -.12367   -.01673
   NOHOV|     .27689***      .06456     4.29  .0000      .15036    .40342
   BHOOK|     .16130***      .05188     3.11  .0019      .05961    .26299
 DIAMOND|     .47079***      .03940    11.95  .0000      .39357    .54800
  DSDIRR|     .22564***      .04155     5.43  .0000      .14420    .30707
  LOOPLT|     .43029***      .05256     8.19  .0000      .32728    .53330
 LOOPWLT|     .32219***      .04518     7.13  .0000      .23364    .41074
   SPLIT|    -.46893***      .05302    -8.84  .0000     -.57284   -.36502
  DIST11|    -.24669***      .03179    -7.76  .0000     -.30900   -.18438
  DIST12|     .09434***      .02518     3.75  .0002      .04500    .14369
   DIST6|     .35146***      .04888     7.19  .0000      .25566    .44725
   CTY18|     .18207***      .04855     3.75  .0002      .08692    .27723
   CTY29|    -.28690***      .06360    -4.51  .0000     -.41154   -.16225
   CTY23|    -.28078***      .05489    -5.12  .0000     -.38836   -.17321
     RT5|    -.22926***      .02681    -8.55  .0000     -.28181   -.17671
     RT8|     .18629**       .08452     2.20  .0275      .02063    .35194
    RT10|     .30319***      .02943    10.30  .0000      .24551    .36087
    RT50|     .14977**       .06852     2.19  .0288      .01547    .28406
    RT60|     .08719*        .04475     1.95  .0514     -.00052    .17489
    RT78|     .43643***      .07202     6.06  .0000      .29527    .57758
   RT105|     .26295***      .06000     4.38  .0000      .14536    .38055
   RT210|    -.31153***      .04498    -6.93  .0000     -.39969   -.22337
   RT710|     .12334*        .06736     1.93  .0671     -.00869    .25536
   RT880|     .23113***      .05771     4.00  .0001      .11801    .34424
```

```
        |Means for random parameters
Constant|   -6.00867***      .14817   -40.55  .0000    -6.29909  -5.71826
  LOGADT|     .62768***      .01118    56.14  .0000      .60576    .64959
  LOGLEN|     .05049**       .02257     2.24  .0253      .00624    .09473
  NLANES|     .05390***      .01672     3.22  .0013      .02112    .08667
  ONRAMP|    -.28128***      .03738    -7.52  .0000     -.35455   -.20801
    LOOP|     .39878***      .06423     6.21  .0000      .27288    .52468
        |Scale parameters for dists. of random parameters
Constant|     .10855***      .01096    19.91  .0000      .08708    .13002
  LOGADT|     .06212***      .00101    61.38  .0000      .06014    .06411
  LOGLEN|     .07912***      .00525    15.07  .0000      .06882    .08941
  NLANES|     .03290***      .00526     6.25  .0000      .02259    .04322
  ONRAMP|     .07677***      .01389     5.53  .0000      .04954    .10400
    LOOP|     .06291**       .02767     2.27  .0230      .00868    .11715
        |Standard Deviations of Random Effects
R.E.(01)|     .02994***      .00763     3.93  .0001      .01499    .04488
R.E.(02)|     .17965**       .07834     2.29  .0218      .02611    .33319
R.E.(03)|     .10083***      .00781    12.90  .0000      .08551    .11614
R.E.(04)|     .01778**       .00807     2.20  .0276      .00196    .03360
R.E.(05)|     .02381***      .00759     3.14  .0017      .00894    .03867
        |Dispersion parameter for NegBin distribution
ScalParm|    2.96365***      .09697    30.56  .0000     2.77358   3.15371
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------

+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = DCLASS                          |      .000896 |
| R.E.(02) = CTYCLASS                        |      .000157 |
| R.E.(03) = RCLASS                          |      .010166 |
| R.E.(04) = DIRCLASS                        |      .000316 |
| R.E.(05) = HVCLASS                         |      .000567 |
+--------------------------------------------+--------------+
```

Advanced Type 2 SPF for Ramp Segment Property Damage Only.

```
Random Coefficients  NegBnReg Model
Dependent variable                  PDO
Log likelihood function    -18690.84030
Restricted log likelihood  -30904.47262
Chi squared [  10 d.f.]     24427.26464
Significance level               .00000
McFadden Pseudo R-squared      .3952060
Estimation based on N =  12252, K =  41
Inf.Cr.AIC  =  37463.7 AIC/N =    3.058
Model estimated: Jun 26, 2016, 00:51:38
Sample is  6 pds and   2042 individuals
Negative binomial 100 Halton draws
```

PDO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
	Nonrandom parameters					
NBDIR	.07279***	.01973	3.69	.0002	.03412	.11146
WBDIR	-.05479**	.02241	-2.45	.0145	-.09871	-.01087
LOOP	.10164***	.02922	3.48	.0005	.04436	.15892
SLIP	-.32202***	.06867	-4.69	.0000	-.45661	-.18743
RMPMTR	-.05790**	.02917	-1.98	.0472	-.11507	-.00072
NOHOV	.30902***	.05441	5.68	.0000	.20238	.41565
BHOOK	.16704***	.04973	3.36	.0008	.06957	.26450
DIAMOND	.44016***	.03566	12.34	.0000	.37026	.51006
DSDIRR	.25125***	.03687	6.81	.0000	.17898	.32352
LOOPLT	.43149***	.05233	8.25	.0000	.32893	.53405
LOOPWLT	.34627***	.04487	7.72	.0000	.25832	.43422
SPLIT	-.58236***	.05061	-11.51	.0000	-.68156	-.48316
DIST11	-.59526***	.03855	-15.44	.0000	-.67080	-.51971
DIST6	.31508***	.05059	6.23	.0000	.21593	.41423
CTY29	-.38658***	.07227	-5.35	.0000	-.52823	-.24493
CTY23	-.31009***	.05554	-5.58	.0000	-.41894	-.20124
RT5	-.13669***	.02700	-5.06	.0000	-.18962	-.08377
RT8	.30607***	.08946	3.42	.0006	.13072	.48142
RT10	.32241***	.02746	11.74	.0000	.26858	.37623
RT50	.30785***	.06243	4.93	.0000	.18549	.43020
RT60	.13383***	.04655	2.88	.0040	.04260	.22506
RT78	.60898***	.08129	7.49	.0000	.44966	.76830
RT210	-.29134***	.04886	-5.96	.0000	-.38711	-.19557
RT710	.21329***	.05910	3.61	.0003	.09745	.32912
RT880	.18893***	.05910	3.20	.0014	.07309	.30477

```
        |Means for random parameters
Constant|   -6.02516***      .12428   -48.48  .0000    -6.26875  -5.78158
  LOGADT|     .68402***      .01210    56.51  .0000      .66030    .70775
  LOGLEN|     .05463**       .02205     2.48  .0132      .01142    .09784
  NLANES|     .08832***      .01749     5.05  .0000      .05403    .12261
  ONRAMP|    -.20822***      .03707    -5.62  .0000     -.28087   -.13556
        |Scale parameters for dists. of random parameters
Constant|     .04157***      .00770     5.40  .0000      .02648    .05665
  LOGADT|     .04299***      .00102    42.33  .0000      .04100    .04498
  LOGLEN|     .01096*        .00634     1.97  .0738     -.00146    .02338
  NLANES|     .01781***      .00443     4.02  .0001      .00912    .02650
  ONRAMP|     .04823***      .01787     2.70  .0070      .01321    .08325
        |Standard Deviations of Random Effects
R.E.(01)|     .04793***      .00803     5.97  .0000      .03220    .06366
R.E.(02)|     .06433***      .00763     8.43  .0000      .04937    .07929
R.E.(03)|     .01847**       .00830     2.22  .0261      .00220    .03474
R.E.(04)|     .16241***      .00822    19.76  .0000      .14630    .17852
R.E.(05)|     .05050***      .00807     6.26  .0000      .03468    .06631
        |Dispersion parameter for NegBin distribution
ScalParm|    2.53709***      .09125    27.80  .0000     2.35824   2.71594
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------

+-------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.     |     Variance |
| R.E.(01) = DCLASS                         |      .002297 |
| R.E.(02) = CTYCLASS                       |      .004139 |
| R.E.(03) = RCLASS                         |      .000341 |
| R.E.(04) = DIRCLASS                       |      .026376 |
| R.E.(05) = HVCLASS                        |      .002550 |
+-------------------------------------------+--------------+
```

Advanced Type 2 SPF for Ramp Segment Complaint of Pain.

```
-----------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable                   CP
Log likelihood function    -10448.10739
Restricted log likelihood  -12053.23463
Chi squared [  10 d.f.]      3210.25448
Significance level               .00000
McFadden Pseudo R-squared      .1331698
Estimation based on N =  12252, K =  35
Inf.Cr.AIC  =  20966.2 AIC/N =    1.711
Model estimated: Jun 26, 2016, 00:59:31
Sample is  6 pds and   2042 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
      CP|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
   NBDIR|     .06532**       .03238     2.02  .0437       .00185    .12878
    LOOP|     .06023***      .01560     3.86  .0001       .02966    .09080
   NOHOV|     .40617***      .10735     3.78  .0002       .19575    .61658
   BHOOK|     .35788***      .08837     4.05  .0001       .18468    .53108
 DIAMOND|     .76917***      .06408    12.00  .0000       .64357    .89478
  DSDIRR|     .32268***      .06972     4.63  .0000       .18602    .45933
  LOOPLT|     .58835***      .08952     6.57  .0000       .41290    .76380
 LOOPWLT|     .37048***      .08166     4.54  .0000       .21043    .53053
   SPLIT|    -.37833***      .11534    -3.28  .0010      -.60440   -.15226
  DIST11|     .19741***      .04419     4.47  .0000       .11080    .28402
   DIST6|     .29891***      .11293     2.65  .0081       .07758    .52024
   CTY18|     .44609***      .08234     5.42  .0000       .28471    .60747
   CTY23|    -.22994***      .08607    -2.67  .0076      -.39863   -.06124
     RT5|    -.19768***      .04662    -4.24  .0000      -.28906   -.10631
    RT10|     .18181***      .05657     3.21  .0013       .07094    .29269
    RT78|     .27704**       .12376     2.24  .0252       .03448    .51960
   RT105|     .39764***      .09666     4.11  .0000       .20818    .58710
   RT210|    -.36711***      .09753    -3.76  .0002      -.55826   -.17596
   RT880|     .33321***      .08923     3.73  .0002       .15832    .50810
```

```
        |Means for random parameters
Constant|   -6.10397***      .25435   -24.00  .0000    -6.60249  -5.60545
  LOGADT|     .59565***      .02542    23.44  .0000      .54583    .64546
  LOGLEN|     .14212***      .04077     3.49  .0005      .06222    .22203
  NLANES|    -.07697***      .02846    -2.70  .0068     -.13274   -.02120
  ONRAMP|    -.37705***      .06581    -5.73  .0000     -.50603   -.24807
        |Scale parameters for dists. of random parameters
Constant|     .14635***      .01419    10.31  .0000      .11853    .17416
  LOGADT|     .04544***      .00168    27.07  .0000      .04215    .04873
  LOGLEN|     .17021***      .01171    14.53  .0000      .14725    .19317
  NLANES|     .03922***      .00774     5.07  .0000      .02405    .05438
  ONRAMP|     .08799***      .02531     3.48  .0005      .03839    .13759
        |Standard Deviations of Random Effects
R.E.(01)|     .09338***      .01459     6.40  .0000      .06478    .12198
R.E.(02)|     .10443***      .01461     7.15  .0000      .07579    .13307
R.E.(03)|     .07559***      .01290     5.86  .0000      .05029    .10088
R.E.(04)|     .12513***      .01449     8.64  .0000      .09673    .15353
R.E.(05)|     .05893***      .02166     2.72  .0065      .01647    .10139
        |Dispersion parameter for NegBin distribution
ScalParm|    2.12350***      .17471    12.15  .0000     1.78108   2.46593
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------

+-------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.     |     Variance |
| R.E.(01) = DCLASS                         |      .008720 |
| R.E.(02) = CTYCLASS                       |      .010906 |
| R.E.(03) = RCLASS                         |      .005713 |
| R.E.(04) = DIRCLASS                       |      .015657 |
| R.E.(05) = HVCLASS                        |      .000488 |
+-------------------------------------------+--------------+
```

Advanced Type 2 SPF for Ramp Segment Visible Injury.

```
-----------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable              VISIBLE
Log likelihood function     -5885.04021
Restricted log likelihood   -6149.37938
Chi squared [  10 d.f.]       528.67834
Significance level               .00000
McFadden Pseudo R-squared      .0429863
Estimation based on N =  12252, K =  23
Inf.Cr.AIC  =  11816.1 AIC/N =     .964
Model estimated: Jun 26, 2016, 01:09:12
Sample is  6 pds and   2042 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
--------+--------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
 VISIBLE|  Coefficient       Error       z    |z|>Z*         Interval
--------+--------------------------------------------------------------------
        |Nonrandom parameters
    LOOP|     .15454***      .05879     2.63  .0086      .03931    .26976
 DIAMOND|     .36444***      .04821     7.56  .0000      .26995    .45892
  DIST11|     .20925***      .06296     3.32  .0009      .08585    .33265
  DIST12|     .25371***      .06722     3.77  .0002      .12196    .38547
     RT5|    -.18775***      .06822    -2.75  .0059     -.32146   -.05405
   RT105|     .59982***      .11267     5.32  .0000      .37899    .82065
   RT210|    -.44984***      .13378    -3.36  .0008     -.71203   -.18764
        |Means for random parameters
Constant|   -5.07882***      .34231   -14.84  .0000    -5.74973  -4.40791
  LOGADT|     .42858***      .03595    11.92  .0000      .35812    .49904
  LOGLEN|     .22025***      .05519     3.99  .0001      .11207    .32843
  NLANES|     .09157**       .04229     2.17  .0304      .00869    .17445
  ONRAMP|    -.60214***      .08334    -7.22  .0000     -.76548   -.43879
        |Scale parameters for dists. of random parameters
Constant|     .21958***      .05588     3.93  .0001      .11006    .32910
  LOGADT|     .02675***      .00248    10.81  .0000      .02190    .03160
  LOGLEN|     .62025***      .13362     4.64  .0000      .35835    .88215
  NLANES|      05564**       .02192     2.54  .0111      .01268    .09861
  ONRAMP|     .21584***      .06327     3.41  .0006      .09184    .33985
        |Standard Deviations of Random Effects
R.E.(01)|     .04224*        .02262     1.97  .0618     -.00209    .08656
R.E.(02)|     .05123**       .02177     2.35  .0186      .00856    .09390
R.E.(03)|     .09977***      .02236     4.46  .0000      .05594    .14359
R.E.(04)|     .06624***      .02205     3.00  .0027      .02302    .10946
R.E.(05)|     .04472**       .02147     2.08  .0373      .00264    .08680
        |Dispersion parameter for NegBin distribution
ScalParm|    1.10164***      .13644     8.07  .0000      .83422   1.36905
--------+--------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-----------------------------------------------------------------------------
+----------------------------------------+--------------+
| Random effects in the model are based on |Random Effect |
| these expanded qualitative variables.    |   Variance   |
| R.E.(01) = DCLASS                        |     .001784  |
| R.E.(02) = CTYCLASS                      |     .002624  |
| R.E.(03) = RCLASS                        |     .009953  |
| R.E.(04) = DIRCLASS                      |     .004388  |
| R.E.(05) = HVCLASS                       |     .001064  |
+----------------------------------------+--------------+
```

Advanced Type 2 SPF for Ramp Segment Severe Injury.

```
--------------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable              SEVERE
Log likelihood function     -1277.27810
Restricted log likelihood   -1288.68755
Chi squared [   6 d.f.]        22.81889
Significance level               .00086
McFadden Pseudo R-squared      .0088535
Estimation based on N =  12252, K =  16
Inf.Cr.AIC  =   2586.6 AIC/N =     .211
Model estimated: Jun 26, 2016, 01:31:39
Sample is  6 pds and   2042 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
--------+-----------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
  SEVERE|  Coefficient       Error       z    |z|>Z*         Interval
--------+-----------------------------------------------------------------------
        |Nonrandom parameters
  NLANES|     .12550         .12264     2.02  .0162     -.11487    .36588
 DIAMOND|     .28166**       .13135     2.14  .0320      .02422    .53910
  DIST11|     .33879**       .16808     2.02  .0438      .00936    .66822
     RT5|    -.32278         .20010    -1.91  .0767     -.71497    .06941
   RT210|    -.71195         .43987    -1.92  .0755    -1.57409    .15019
        |Means for random parameters
Constant|   -6.34243***      .99552    -6.37  .0000    -8.29361  -4.39126
  LOGADT|     .34845***      .09851     3.54  .0004      .15538    .54152
  LOGLEN|     .43060**       .17168     2.51  .0121      .09412    .76709
  ONRAMP|    -.91439*        .49057    -1.96  .0623    -1.87588    .04711
        |Scale parameters for dists. of random parameters
Constant|     .41472***      .15822     2.62  .0088      .10461    .72482
  LOGADT|     .03283***      .00668     4.91  .0000      .01973    .04594
  LOGLEN|     .18946***      .05219     3.63  .0003      .08717    .29175
  ONRAMP|     .65628***      .11438     5.74  .0000      .43211    .88045
        |Standard Deviations of Random Effects
R.E.(01)|     .38493**       .17191     2.24  .0251      .04799    .72187
R.E.(02)|     .39771**       .16908     2.35  .0187      .06631    .72910
        |Dispersion parameter for NegBin distribution
ScalParm|     .33905**       .17056     1.99  .0468      .00476    .67333
--------+-----------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
--------------------------------------------------------------------------------

+--------------------------------------------+--------------+
| Random effects in the model are based on   |Random Effect |
| these expanded qualitative variables.      |     Variance |
| R.E.(01) = CTYCLASS                        |      .000242 |
| R.E.(02) = RCLASS                          |      .000222 |
+--------------------------------------------+--------------+
```

Advanced Type 2 SPF for Ramp Segment Fatal Injury.

```
--------------------------------------------------------------------------------
Random Coefficients  NegBnReg Model
Dependent variable              FATAL
Log likelihood function     -485.65083
Restricted log likelihood   -487.03567
Chi squared [   4 d.f.]        2.76969
Significance level              .59708
McFadden Pseudo R-squared     .0028434
Estimation based on N =  12252, K =  11
Inf.Cr.AIC  =    993.3 AIC/N =     .081
Model estimated: Jun 26, 2016, 01:47:00
Sample is  6 pds and   2042 individuals
Negative binomial regression model
Simulation based on      100 Halton draws
--------+-----------------------------------------------------------------------
        |                  Standard            Prob.      95% Confidence
   FATAL|  Coefficient       Error       z    |z|>Z*         Interval
--------+-----------------------------------------------------------------------
        |Nonrandom parameters
  LOGLEN|     .03371***      .01218     2.77  .0057      .00983    .05759
  ONRAMP|    -.63418         .42388    -1.90  .0746    -1.46497    .19662
   DIST3|    1.09140***      .32819     3.33  .0009      .44816   1.73464
   RT105|    1.00625*        .56255     1.99  .0537     -.09633   2.10884
        |Means for random parameters
Constant|   -10.1021***     1.53316    -6.59  .0000    -13.1071   -7.0972
  LOGADT|     .65206***      .15465     4.22  .0000      .34895    .95516
        |Scale parameters for dists. of random parameters
Constant|     .03225***      .01217     2.65  .0081      .00839    .05611
  LOGADT|     .02915**       .01220     2.39  .0169      .00524    .05306
        |Standard Deviations of Random Effects
R.E.(01)|     .01658**       .00843     1.97  .0491      .00006    .03309
        |Dispersion parameter for NegBin distribution
ScalParm|     .80428*        .48033     1.67  .0940     -.13716   1.74571
--------+-----------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
--------------------------------------------------------------------------------

+-------------------------------------------+--------------+
| Random effects in the model are based on  |Random Effect |
| these expanded qualitative variables.     |     Variance |
| R.E.(02) = CTYCLASS                       |      .000502 |
+-------------------------------------------+--------------+
```