Task SHA/MSU/4-1

STATE HIGHWAY ADMINISTRATION

RESEARCH REPORT

Safety Analysis for the Prioritized Three Safety Improvement Locations on I-495

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16. Abstract

This study estimated crash frequencies and rates on the three safety priority interchanges (i.e., I-495 at MD185, US1 and MD295) for the base year (2014), and the horizon year (2040). The safety analysis was carried out by employing the proposed new chapters for HSM and utilizing the Interactive Highway Safety Design Model (IHSDM) version 9.1.0. The safety analysis using IHSDM and ArcGIS visualization clearly identified the priority improvement locations. First, the visualization of predicted crashes indicates many conflicts would occur among vehicles entering and exiting the interchange at I-495 and MD295. At the interchange level, this location should be the first priority for improvement. Second, as revealed by the visual representation of crash magnitude, crashes on I-495 at MD295 may increase by 11% which is higher than the average of three interchanges (8%). Third, an increase in ADT without changing base geometric conditions would increase crashes on all facility types, except for a marginal decrease (-1%) on ramp terminals. Especially, crashes on high-speed locations such as freeway segments, speed changing lanes, and the crossroads (MD) would increase more rapidly than on other facility types. Thus, safety improvements need to be focused on the freeway segments, speed changing lanes and the crossroads. The findings from this task provide a clear picture of the locations for improvement. The next step would be the identification of countermeasures and carrying out improvement tasks.

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EXECUTIVE SUMMARY

This study estimated crash frequencies and rates at the three safety priority interchanges (i.e., I-495 at MD185, US1, and MD295) for the base condition, year 2014, and the future condition, year 2040. Building on the study team's expertise in the application of the Highway Safety Manual (HSM) to Maryland roadways (Shin, Lee and Dadvar 2014), the safety analysis was carried out by employing the proposed new chapters for HSM and utilizing the Interactive Highway Safety Design Model (IHSDM) version 9.1.0 (AASHTO 2014). Interchanges and crossing roads were divided into distinct facility types as defined in the proposed new HSM chapters (Bonnenson, et al. 2012). The facility types include freeway segments, speed-change lanes, ramps, crossroads, and ramp terminals.

The safety analysis using IHSDM and ArcGIS visualization clearly identified the priority improvement locations. First, the visualization of predicted crashes indicates many conflicts would occur among vehicles entering and exiting the interchange at I-495 and MD295. At the interchange level, this location should be the first priority for improvement. Second, as revealed by the visual representation of crash magnitude, crashes on I-495 at MD295 may increase by 11%, which is higher than the average of the three interchanges (8%). Third, an increase in average daily traffic (ADT) without changing base geometric conditions would increase crashes on all facility types, except for a marginal decrease (-1%) on ramp terminals. Especially, crashes on high-speed locations such as freeway segments, speed-change lanes, and the crossroads (MD) would increase more rapidly than other facility types. Thus, safety improvements need to be focused on the freeway segments, speed-change lanes and the crossroads.

There were several limitations that the study team had to address and overcome. First, geocoded crash data were not available to the study team. This limitation prevented us from utilizing the empirical Bayes (EB) method to refine the crash frequency estimation. At least two years of crash data are required to employ the EB method. Second, due to the unavailability of a complete crash data set, the crash frequency was estimated exclusively based on HSM's default crash proportions, instead of Maryland's crash proportions, for the base year. Nevertheless, these limitations do not affect the quality of the study results. Since the primary objective of the study was to identify priority locations, the estimates made by SPFs using the HSM's crash proportion assumptions enabled the study team to compare the relative crash magnitude by facility and between the base and horizon years. Third, the crash frequency estimates of this study are un-calibrated numbers; thus, using un-calibrated SPFs for facilities in the new proposed chapters (freeways and ramps) should be viewed with caution. In other words, crash frequencies presented in this report are raw numbers that can be calibrated if complete data for the base year becomes available. Despite this fact, the comparison of alternatives based on the percentages of changes in predicted number of crashes is completely valid. Fourth, annual average daily traffic (AADT) values are required by the HSM. However, only ADT values were available at the time of the study. This limitation does not depreciate the quality of the analysis since ADT was consistently used throughout this study. Finally, the unavailability of curve data (curve lengths and radii) led to the manual assignment of curve data indirectly from the design file, which was a significant delay factor.

INTRODUCTION

The Maryland State Highway Administration (SHA) has authorized the Morgan State University team to conduct a safety analysis of the three priority interchanges on I-495. They are I-495 at MD185, I-495 at US1, and I-495 at MD295. The objective of the analysis was to estimate predicted crashes at the three study interchanges with given geometric conditions and average daily traffic (ADT) for the base year (2014) and the horizon year (2040).

Building on the study team's expertise in the application of the Highway Safety Manual (HSM) to Maryland roadways (Shin, Lee and Dadvar 2014), the safety analysis was carried out based on the proposed new chapters for the HSM. The chapters provide safety performance functions (SPFs), i.e., crash frequency prediction model equations, for freeway segments, speed-change lanes, ramps, and ramp terminals. The Interactive Highway Safety Design Model (IHSDM) version 9.1.0 was used as a primary safety analysis tool (AASHTO 2014).

With the year 2014 as the base year and the year 2040 with an increased ADT as the horizon year, the current and future crash frequencies and severity were estimated. The crash trends by interchanges and facility types were analyzed and presented as maps, tables, and figures. The study identified priority facility types.

STUDY METHOD

Interchanges and crossroads at the three study locations were divided into distinct facility types as defined in the proposed new HSM chapters (Bonnenson, et al. 2012). The facility types include freeway segments, speed-change lanes, ramps, crossroads, and ramp terminals. The facility types of crossing roads (MD and US roads) were defined based on the current HSM edition. Although Enhanced Interchange Safety Analysis Tool (ISATe), a spreadsheet crash prediction model, was available for the new proposed chapters (Bonneson 2012), its lack of capability of dealing with a large data set prevented us from using the model.[1] Instead, the latest version of IHSDM was utilized for crash frequency estimation. Please note that not all roadway types are included in the HSM and IHSDM; therefore, only facility types available in the existing tool at the time of the study were analyzed.

Predictive Method: Safety Performance Functions

The predictive method includes safety performance functions (SPFs) for each type of freeway facilities. The predicted method provides an 18-step process to estimate the expected average crash frequency (in total or by crash type or severity). This method can be applied to "an existing freeway, a design alternative for an existing freeway, a new freeway, or for alternative time period or a future time period (Bonnenson, et al. 2012, 18-1)."

A base SPF for a base year, N_{spf}, is a function of traffic volume and a set of base site conditions. The general form is:

$$N_{p,w,x,y,z} = N_{spf,w,x,y,z} \times \left(CMF_{1,w,x,y,z} \times CMF_{2,w,x,y,z} \times \ldots \times CMF_{m,w,s,y,z}\right) \times C_{w,x,y,z}$$

[1] Since ISATe can accommodate data only for 20 freeway segments, 40 ramp or C-D road segments, and 6 crossroad ramp terminals at a time, a project with larger data sets like the ones used in the current study should be divided into smaller sub-tasks.

Where,

$N_{p,w,x,y,z}$ = predicted average crash frequency for a specific year for site type *w*, cross section or control type *x*, crash type *y*, and severity *z* (crashes/year).

$N_{spf,w,x,y,z}$ = predicted average crash frequency determined for base conditions of the SPF developed for site type *w*, cross section or control type *x*, crash type *y*, and severity *z* (crashes/year)

$CMF_{m,w,x,y,z}$ = crash modification factors specific to site type *w*, cross section or control type *x*, crash type *y*, and severity *z* for specific geometric design and traffic control features *m;* and

$C_{w,x,y,z}$ = calibration factor to adjust SPF for local conditions for site type *w*, cross section or control type *x*, crash type *y*, and severity *z*.

Facility types include freeway segments, speed change lanes, ramps, and ramp terminals. Each type is further divided into specific facility types by number of through lanes, crash types, location type, control type, etc., resulting in 288 facility types (Bonnenson, et al. 2012).

Figure 1 presents the study process from data collection to crash estimation. Each process will be further discussed in the following sections.

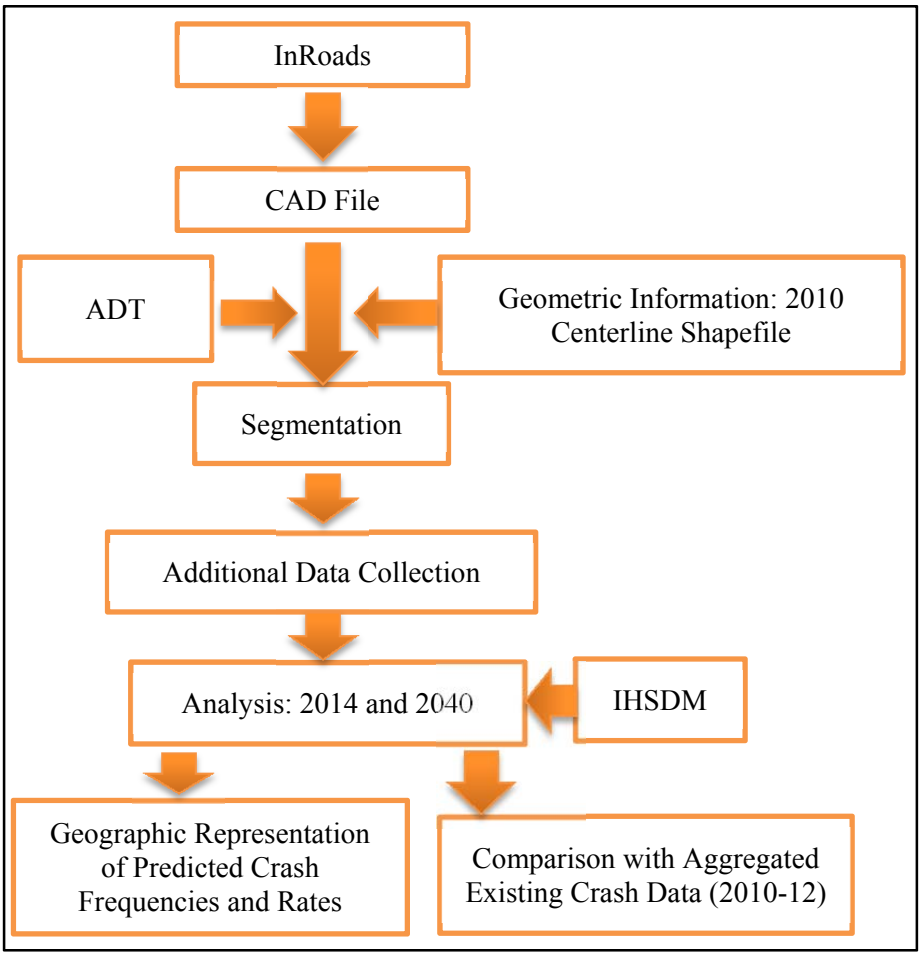

Figure 1. Study Process

DATA COLLECTION

The estimation of crash frequency for each facility requires over 30-40 variables depending on facility types. The detailed data items are summarized in APPENDIX I – DATA REQUIREMENTS. While some data could be obtained directly from SHA, the study team collected an additional number of variables to complete the study data set.

Data from the SHA

The following data items were provided by the SHA:

- Network data: Design files in the DGN format (MicroStation InRoads) for existing conditions of three interchanges on I-495 and a 2010 Centerline shapefile
- Traffic data: the 2014 ADT and the forecasted ADT for the year 2040 in PDF format
- Crash data: PDF format

Additional data manipulation was necessary to create variables required by each SPF. For example, ADT values were not available for all segments inside interchanges. Additional calculations were carried out to assign ADT values to all links without ADT. Figure 2 shows available and missing ADT values for I-495 at MD185.

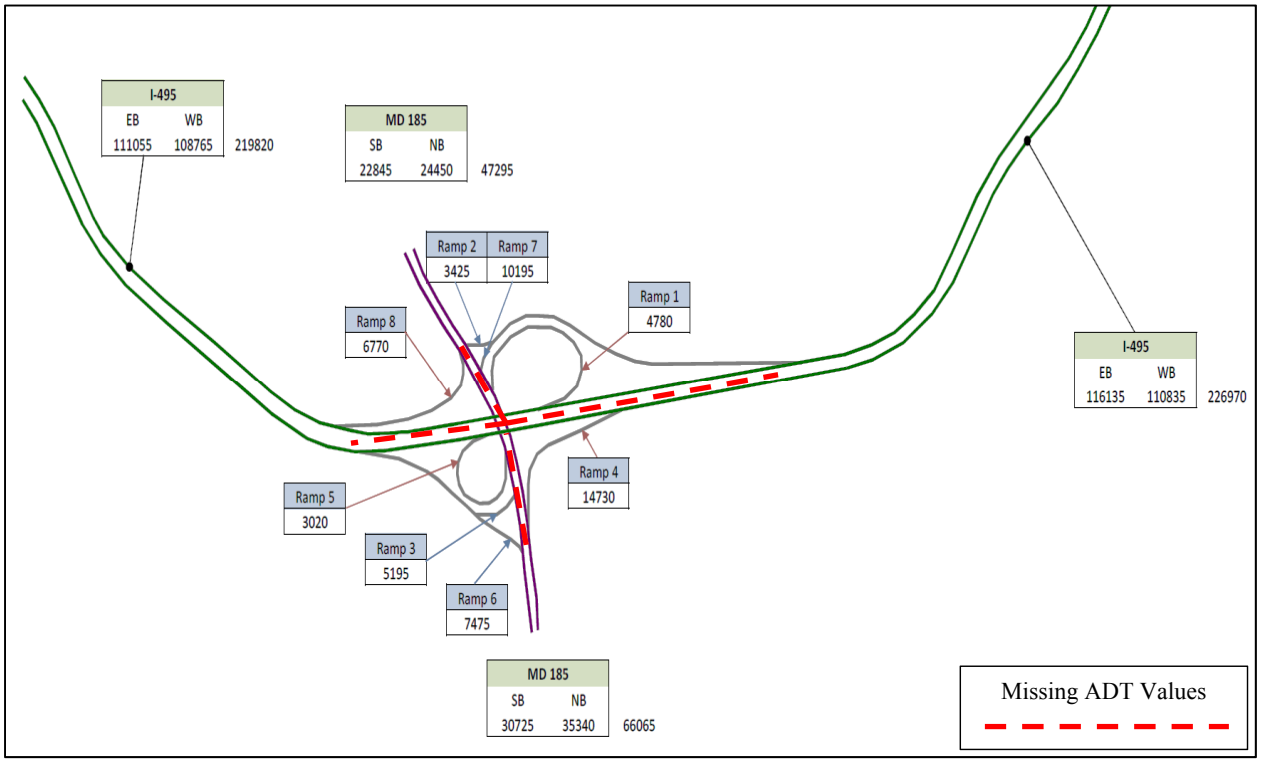

Figure 2. Available and Missing ADT values for I-495 at MD185

Curve Data and Additional Data Collection

Curve data collection was one of the most time-consuming efforts. Due to the mismatch of the link delineations between GIS and CAD files, the manual assignment of CAD file's curve information to the GIS map was inevitable. Figure 3 shows one of the ramps on I-495 at MD295. The map on the left is a GIS line file and the one on the right is a CAD design file. The differences in segmentation between the GIS and CAD maps were not significant. However, no curvature information was stored in the GIS map; thus, corresponding information for each

segment from the CAD map was manually coded to the GIS attribute table. Later, curve data were added to the IHSDM input table.

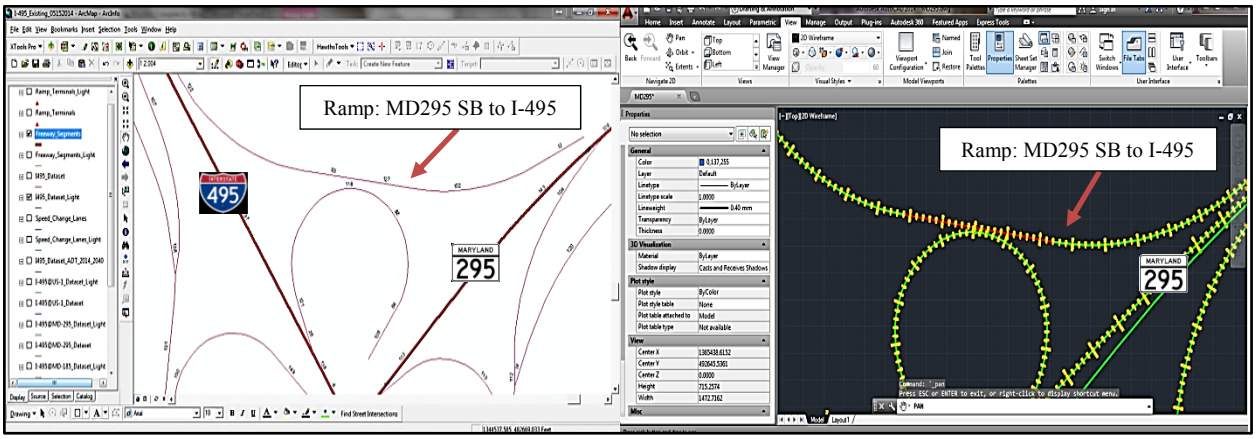

Figure 3. I-495 at MD295 in GIS and CAD Environments

For example, in Figure 3, showing an entrance ramp from MD295 SB to I-495 WB, the GIS map (the map on the left) consists of six segments, while two curve segments and one tangent segment (red segment) constitute the same location in the CAD map (the map on the right). So there are different numbers of segments for this ramp in two environments. To assign curve data from the CAD map to the GIS shapefile, an arbitrary 0.0 mile point was assigned to the beginning of the ramp at the divergence point from MD295 (i.e., the beginning of the segment with Unique FID=12 in the GIS shapefile), following the HSM new chapter guideline (Bonneson 2012).[2] From that point, the curvature value of the first segment (Curve 1) in the CAD map was proportionally assigned to each of three segments in the GIS shapefile (Table 1). For the FID 127 of the shapefile, 0.07 mile of the tangent line of the GIS map was added in order to make the same segment length as the CAD map.

Table 1. An Example of Curve Data Extraction from CAD Data

MD295 SB to I-495 WB (CAD)				MD295 SB to I-495 WB (GIS)				
Mile point*	**Type**	**Length (Mile)**	**Radius (Mile)**	**Unique FID**	**Mile point***	**Proportional Length Type**	**Length (Mile)**	**Radius (Mile)**
0	Curve 1	0.119	0.158	12	0	0.029 Curve 1	0.029	Curve 1
				102	0.029	0.077 Curve 1	0.077	Curve 1
				127	0.106	0.013 Curve 1 + 0.017 Tangent 1	0.03	Curve 1

*Note: Mile points for curve data on the CAD map are different from the SHA mile points. They were created/ used just for the purpose of curve data calculations.

[2] "Milepost of beginning of curve in direction of travel: Measure to the point where the tangent ends and the curve begins. Milepost locations are measured along the right edge of the ramp through lane in the direction of travel (in the absence of tapers and speed-change lanes, this edge coincides with the right edge of traveled way). These mileposts are established for this application, and may or may not coincide with the mileposts (or stations) established for the ramp's design (Bonnenson, et al. 2012, 19-19)."

Additional data collection efforts were made to supplement required variables that could not initially be complemented using the data from the SHA. Tables 2 to 6 summarize the list of additional data and also various data collection sources and methods. Definitions of all variables are provided in APPENDIX I – DATA REQUIREMENTS.

Table 2. Additional Data Needs and Sources for Freeway Segments

List of Variables	Sources
Effective Segment Length	Manual calculation using ArcGIS and Google Earth tools
Effective Median Width	
Proportion Segment Length with Outside Barrier	
Outside Barrier Length	
Average Outside Barrier Offset	
Distance Begin to Entry Increasing	
Distance End to Exit Increasing	
Distance End to Entry Decreasing	
Distance Begin to Exit Decreasing	
Proportion inside Rumble Strips	Google Earth
Proportion outside Rumble Strips	
Outside Clear Zone Width	
Curve Radius	Manual assignment of curve data to the final data set in ArcGIS indirectly from design files
Curve Length within Site	
Curve Side of Road	
Proportion of High Volume	Using HSM provided formula

Table 3. Additional Data Needs and Sources for Speed-Change Lanes

List of Variables	Sources
Effective Median Width	Manual calculation using ArcGIS and Google Earth tools
Ramp Length	
Ramp Side of Road	
Curve Radius	Manual assignment of curve data to the final data set in ArcGIS indirectly from design files
Curve Length within Site	
Curve Side of Road	
Proportion of High Volume	Using HSM provided formula

Table 4. Additional Data Needs and Sources for Ramps and C-D Roads

List of Variables	Sources
Type of traffic control	Google Earth (2D and StreetView)
Proportion of segment length with a barrier present on the right side	Manual calculation using Google Earth tools
Offset to the right-side barrier	
Proportion of segment length with a barrier present on the left side	
Offset to the left-side barrier	
Proportion of segment length with an entrance speed-change lane	
Proportion of segment length with an exit speed-change lane	
Weaving Section Length	
Proportion of segment length within a weaving section	
Curve Length	Manual assignment of curve data to the final data set in ArcGIS indirectly from design files
Curve Radius	
Curve Length Within Subject Segment	
Milepost of beginning of curve in direction of travel	Basically from ArcGIS (double-checked by design files and Google Earth)
Average speed at the point where the ramp connects to the crossroad (mi/h)	Using HSM provided formulas and default assumptions
Average speed on C-D road or connector ramp (measured at the mid-point of the C-D road or ramp) (mi/h)	

Table 5. Additional Data Needs and Sources for Ramp Terminals

List of Variables	Sources
Ramp Terminal Configuration	ArcGIS, design files, and Google Earth
Type of traffic control	Google Earth (2D and StreetView)
Exit ramp skew angle	Measured using Google Earth
Presence of a left-turn lane (or bay) on the inside crossroad approach	Manual calculation using Google Earth tools
Presence of a left-turn lane (or bay) on the outside crossroad approach	
Width of left-turn lane (or bay) on the inside crossroad approach	
Width of left-turn lane (or bay) on the outside crossroad approach	
Presence of a right-turn lane (or bay) on the inside crossroad approach	
Presence of a right-turn lane (or bay) on the outside crossroad approach	
Number of unsignalized driveways on the outside crossroad leg	
Number of unsignalized public street approaches on the outside crossroad leg	
Distance to the adjacent ramp terminal	
Distance to the next public street intersection on the outside crossroad leg	
Presence of protected left-turn operation	
Presence of right-turn channelization on the inside crossroad approach	
Presence of right-turn channelization on the outside crossroad approach	
Presence of right-turn channelization on the exit ramp approach	

Table 6. Additional Data Needs and Sources for Urban/Suburban Arterial Highway – Divided

List of Variables	Sources
Number of major commercial driveways	Manual count using Google Earth and land use maps
Number of minor commercial driveways	
Number of major residential driveways	
Number of minor residential driveways	
Number of major industrial/institutional driveways	
Number of minor industrial/institutional driveways	
Number of other driveways	
Roadside fixed-object density	Google Earth
Roadside fixed-object offset	
Proportion of curb length with parking	
Type of on-street parking	
Presence of lighting	
Use of automated speed enforcement	HSM default assumption

Updating Study Boundaries

Study boundaries for the three priority locations defined by the SHA are as follows:

- I-495 at MD185: I-495 log mile from 7.99 to 8.49 and MD185 log mile from 2.22 to 2.83
- I-495 at US1: I-495 log mile from 21.82 to 22.32 and US1 log mile from 4.73 to 6.72
- I-495 at MD295: I-495 log mile from 24.94 to 25.44 and MD295 log mile from 6.27 to 6.68

However, the beginning point or ending point of exit ramps and/or entrance ramps for some locations was not available on the provided roadway network files. Thus, study boundaries were modified based on the existing milepost on the GIS shapefile, and where necessary the roadway line file was split by the GIS editing tool. The modified study areas are:

- I-495 at MD185: I-495 log mile from 7.99 to **8.73** and MD185 log mile from 2.22 to 2.83
- I-495 at US1: I-495 log mile from 21.82 to **22.34** and US1 log mile from 4.73 to 6.72
- I-495 at MD295: I-495 log mile from **24.84** to 25.44 and MD295 log mile from 6.27 to 6.68

Freeway Facility Types of the Study Interchanges

The identified freeway facility types are provided below.

- Freeway Segments: All I-495 and MD295 segments
- Speed-Change Lanes (Entrance & Exit): On I-495 and MD295 at convergence or divergence points of entrance and exit ramps
- Entrance Ramps and Exit Ramps: All ramps
- Collector-Distributor (C-D) Roads: I-495 at US1 (Eastbound)
- Crossroad Ramp Terminals: I-495 at MD185 (two ramp terminals) and I-495 at US1 (two ramp terminals)
- Urban Multilane Divided Roads: All MD185 and US1 segments

Homogeneous Segmentation based on the HSM Criteria

The next step is to divide each facility into homogeneous segments based on the predefined segmentation criteria of the HSM (Table 7).

Table 7. The HSM Segmentation Criteria (Bonnenson, et al. 2012)

Freeway Segments	Ramps & C-D Roads
• Number of thru lanes • Lane width • Outside/Inside shoulder width • Median width • Ramp Presence • Clear zone width	• Number thru lanes • Lane width • Right/Left shoulder width • Merging ramp or C-D presence • Diverging ramp or C-D presence

Figure 4 to 7 show facilities at each interchange. Table 8 summarizes the number of segments by facility type. A total of 207 sites were inputted to the IHSDM. A list of all facilities with details (including interchange, site type, route number, beginning mile point, ending mile point, road name and RouteID) is provided in APPENDIX II – SITES.

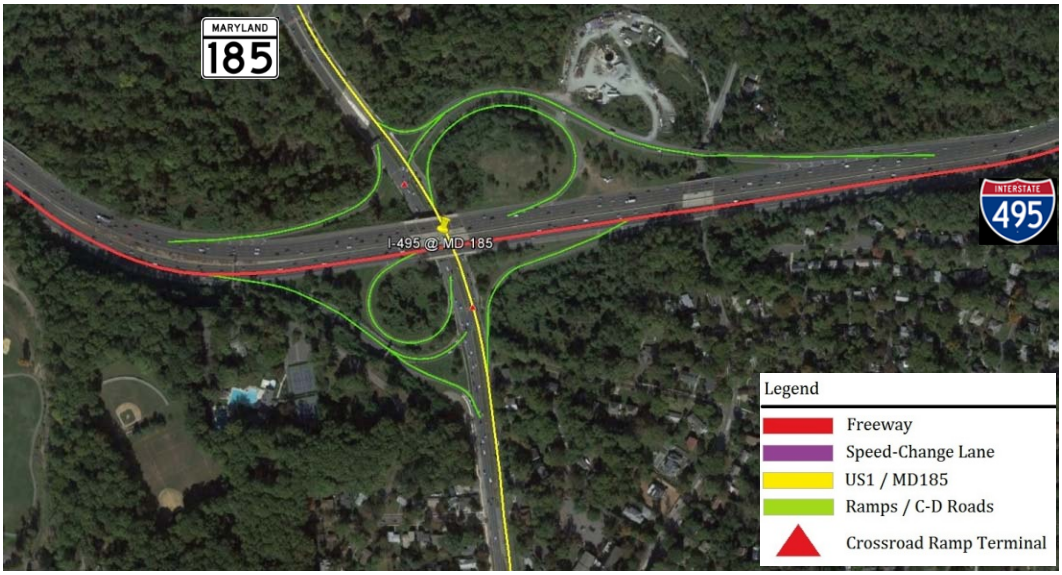

Figure 4. I-495 at MD185 – All Facilities (W/O Speed-Change Lanes)

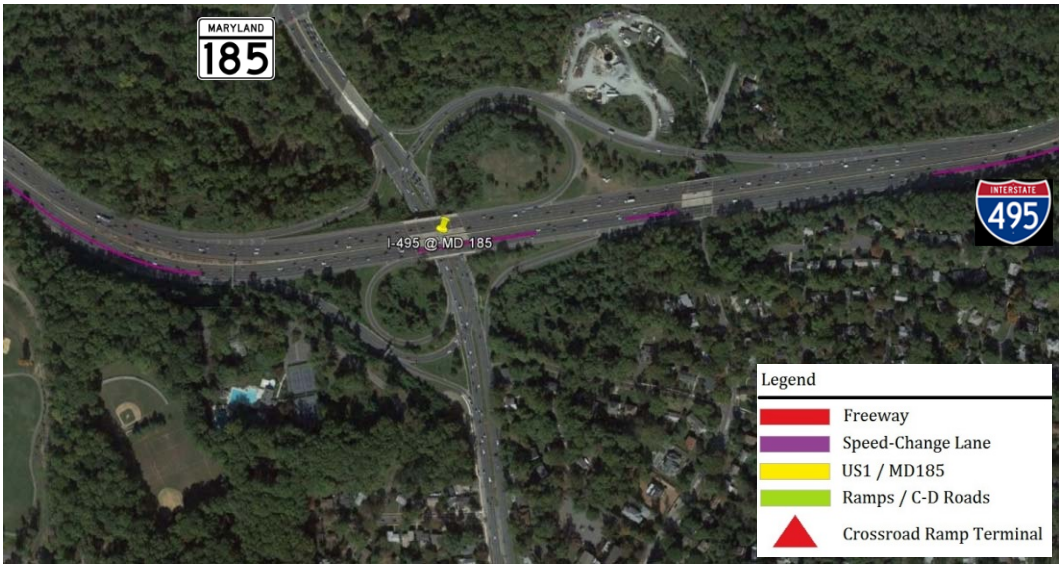

Figure 5. I-495 at MD185 – Speed-Change Lanes

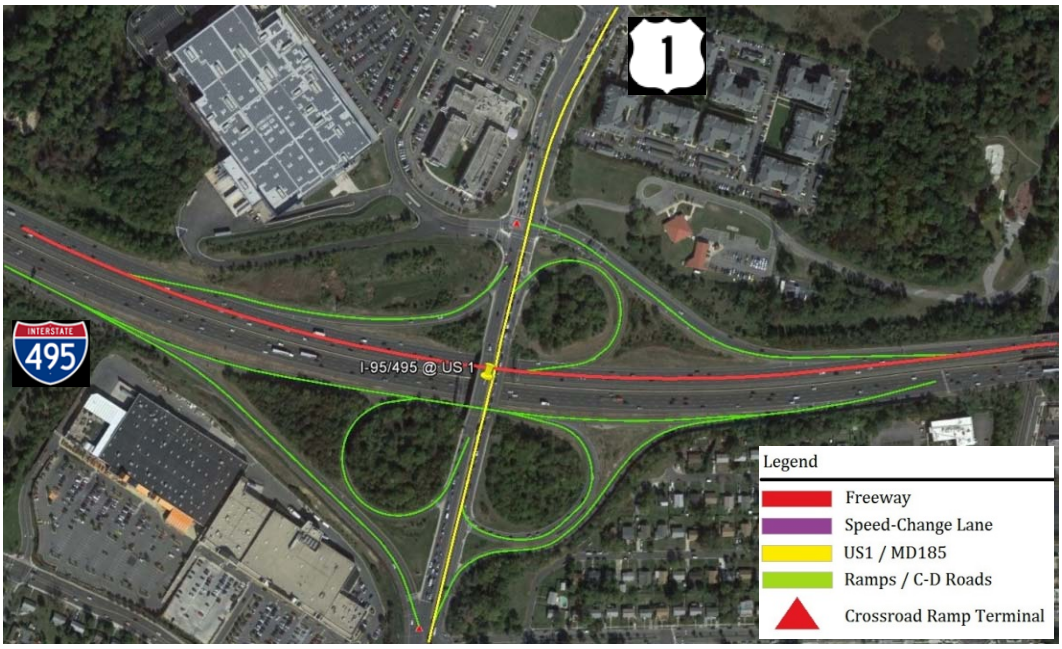

Figure 6. I-495 at US1 – All Facilities (W/O Speed-Change Lanes)

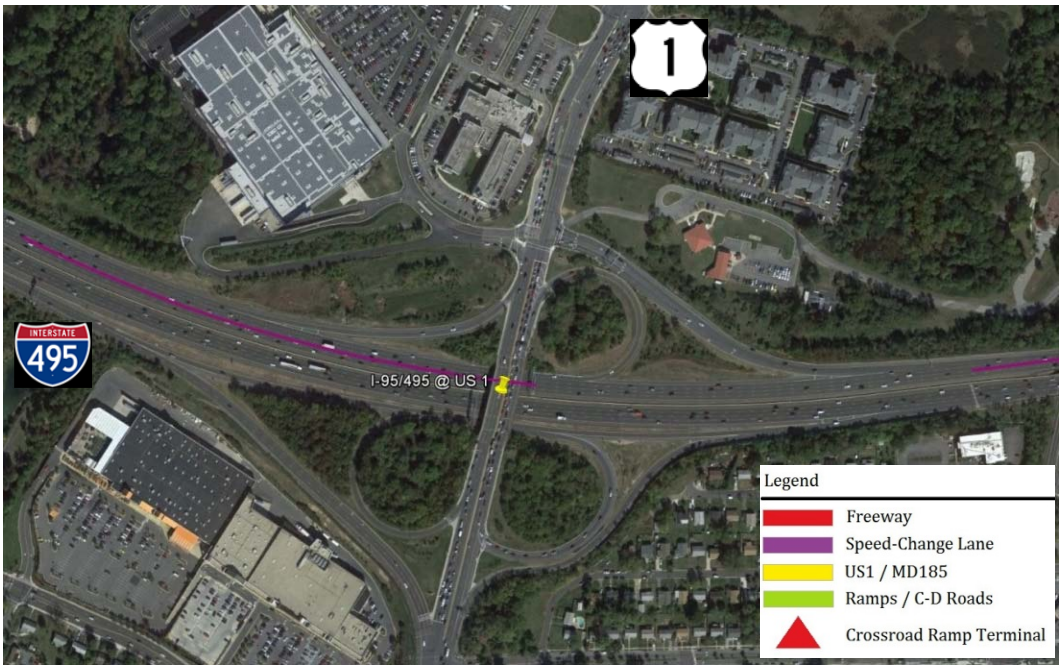

Figure 7. I-495 at US1 – Speed-Change Lanes

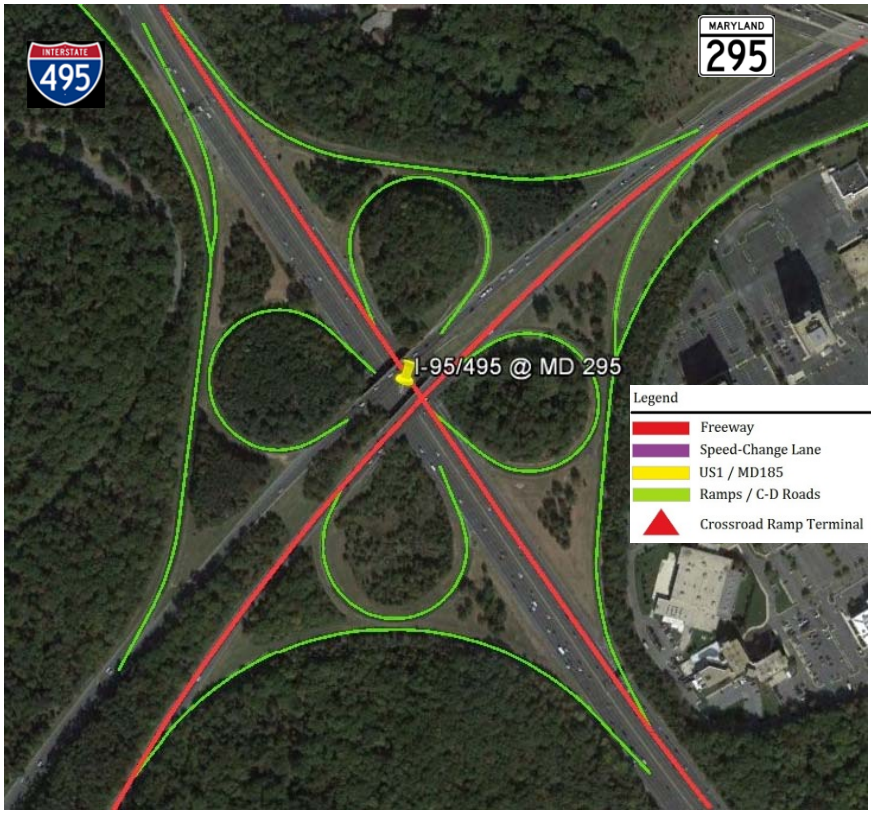

Figure 8. I-495 at MD295 – All Facilities (W/O Speed-Change Lanes)

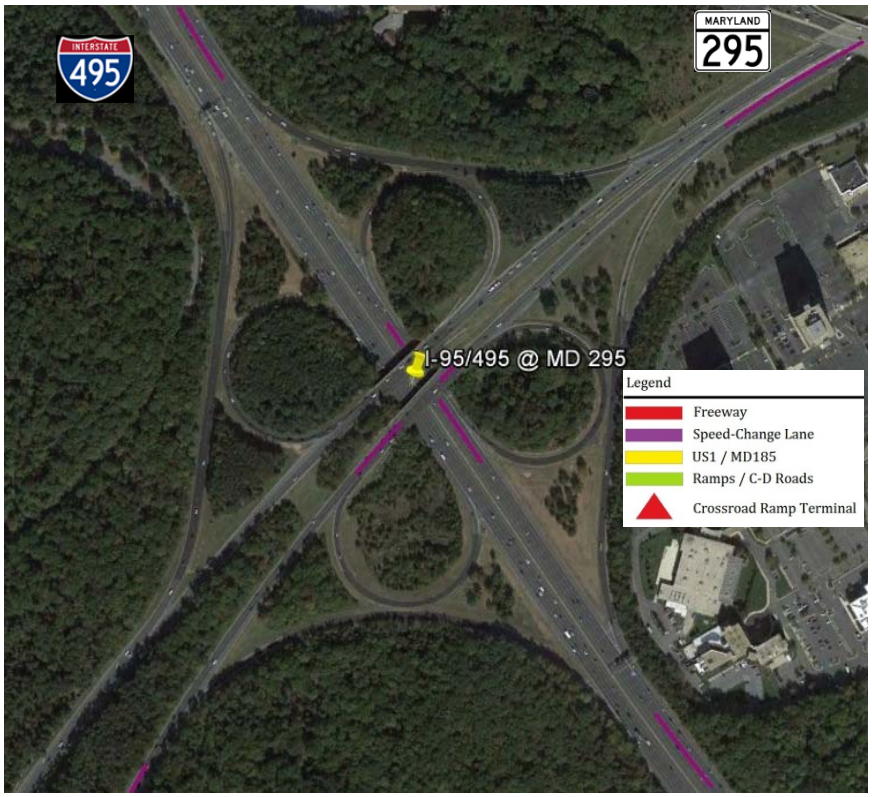

Figure 9. I-495 at MD295 – Speed-Change Lanes

Table 8. Sites Summary by Interchanges

Interchange		Freeway Segment	Ramp Entrance (S-C EN)	Ramp Exit (S-C EX)	Entrance Ramp	Exit Ramp	C-D Road	Urban Multilane Divided Roadway	Ramp Terminal	All (W/O Ramp Terminals and S-C Lanes)	All (W/O Ramp Terminals)
I-495 @ US1	#	6	3	1	9	10	10	12	2	47	51
	Min. Length (mi)	0.02	0.05	0.073	0.01	0.011	0.01	0.01	-	0.01	0.01
	Max. Length (mi)	0.207	0.185	0.073	0.136	0.135	0.114	0.077	-	0.207	0.207
	Mean Length (mi)	0.1	0.1	0.073	0.076	0.063	0.053	0.034	-	0.061	0.063
	Sum (mi)	0.6	0.3	0.073	0.682	0.63	0.53	0.407	-	2.849	3.222
I-495 @ MD185	#	13	4	2	17	22	-	14	2	66	72
	Min. Length (mi)	0.01	0.03	0.06	0.012	0.006	-	0.013	-	0.006	0.006
	Max. Length (mi)	0.287	0.12	0.112	0.151	0.116	-	0.12	-	0.287	0.287
	Mean Length (mi)	0.074	0.059	0.086	0.047	0.035	-	0.044	-	0.048	0.049
	Sum (mi)	0.959	0.237	0.172	0.805	0.764	-	0.61	-	3.138	3.547
I-495 @ MD295	#	19	9	9	19	24	-	-	-	62	80
	Min. Length (mi)	0.01	0.01	0.01	0.019	0.011	-	-	-	0.01	0.01
	Max. Length (mi)	1.151	0.14	0.14	0.21	0.259	-	-	-	1.151	1.151
	Mean Length (mi)	0.125	0.054	0.054	0.058	0.068	-	-	-	0.082	0.076
	Sum (mi)	2.371	0.488	0.488	1.1	1.64	-	-	-	5.111	6.087
Three Interchanges	***#***	***38***	***16***	***12***	***45***	***56***	***10***	***26***	***4***	***175***	***203***
	Min. Length (mi)	***0.01***	***0.01***	***0.01***	***0.01***	***0.006***	***0.01***	***0.01***	***-***	***0.006***	***0.006***
	Max. Length (mi)	***1.151***	***0.185***	***0.14***	***0.21***	***0.259***	***0.114***	***0.12***	***-***	***1.151***	***1.151***
	Mean Length (mi)	***0.103***	***0.064***	***0.061***	***0.057***	***0.054***	***0.053***	***0.039***	***-***	***0.063***	***0.063***
	Sum (mi)	***3.93***	***1.025***	***0.733***	***2.587***	***3.034***	***0.53***	***1.017***	***-***	***11.098***	***12.856***

DATA ANALYSIS

Using the latest version of the IHSDM, study sites were analyzed. The IHSDM results are provided in APPENDIX III – THE IHSDM RESULTS.

High Crash Locations – Predicted Crash Frequencies

All facilities were analyzed based on ADT values of 2014 and 2040. Figure 10 to Figure 15 show predicted crash frequencies for each interchange. Using the natural break data classification method of ArcGIS, the magnitude of crash frequencies were shown in six levels. The segments in purple indicate the locations with the highest crash frequencies, i.e., 38.061 to 42.560 crashes per year (Figure 10), and the segments in red indicate the locations with the second-highest crash frequencies, i.e., 14.521 to 38.060 crashes per year. With the given condition, the 2040 ADT forecasted by the SHA would increase crash frequencies further (Figure 11). The same relationships are applied to the other facilities (Figure 12 to 15). In general, the most crashes occurred on freeway segments, followed by ramps. Especially, traffic entering or exiting MD295 and I495 interchange appeared to have the most conflicts (Figure 14 and Figure 15).

Figure 10. Predicted Crash Frequencies for I-495 at MD185 (2014 ADT)

Figure 11. Predicted Crash Frequencies for I-495 at MD185 (2040 ADT)

Figure 12. Predicted Crash Frequencies for I-495 at US1 (2014 ADT)

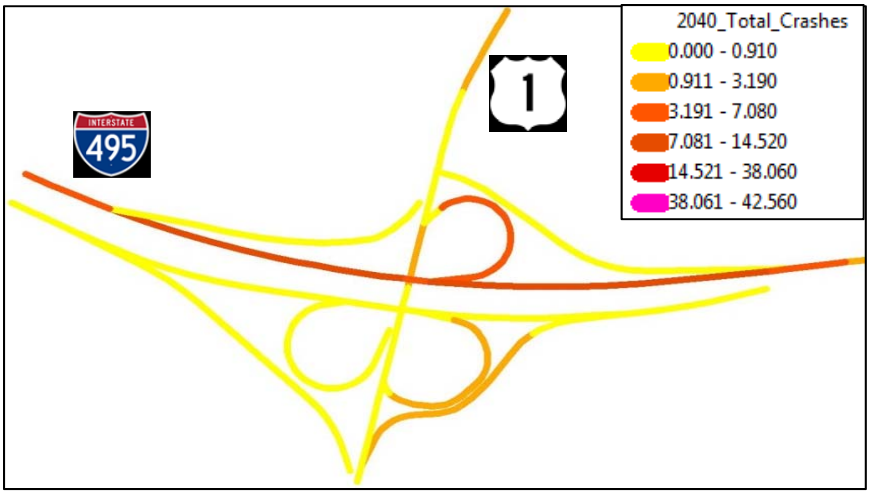

Figure 13. Predicted Crash Frequencies for I-495 at US1 (2040 ADT)

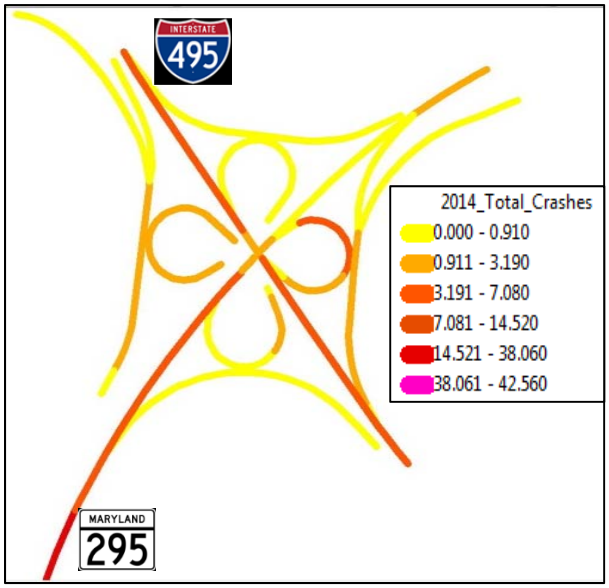

Figure 14. Predicted Crash Frequencies for I-495 at MD295 (2014 ADT)

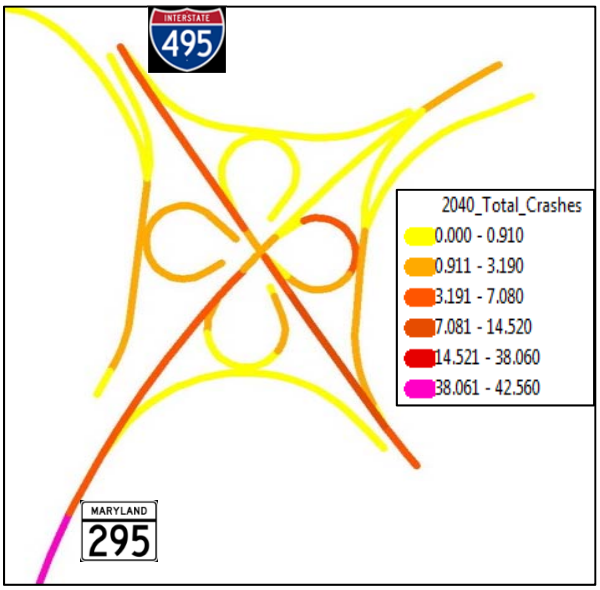

Figure 15. Predicted Crash Frequencies for I-495 at MD295 (2040 ADT)

High Crash Locations – Predicted Crash Rates

To observe the relative magnitude of crash frequency, crash frequency was normalized by segment length. Crash rates per mile were calculated for all facilities based on ADT values of 2014 and 2040. Figure 16 to Figure 21 show predicted crash frequencies for each interchange. Again using the natural break data classification method of ArcGIS, the magnitude of crash rates was visualized in six levels. The segments in purple indicate the locations with the highest crash rates, i.e., 441 to 500 crashes per mile per year (Figure 16), and the segments in red indicate the locations with the second-highest crash rates, i.e., 147.668 to 441 crashes per mile per year. With the given condition, the 2040 ADT forecasted by the SHA would increase crash rates further for some particular locations. Again MD295 entering and exiting I-495 seems to have the most conflicts.

Figure 16. Predicted Crash Rates for I-495 at MD185 (2014 ADT)

Figure 17. Predicted Crash Rates for I-495 at MD185 (2040 ADT)

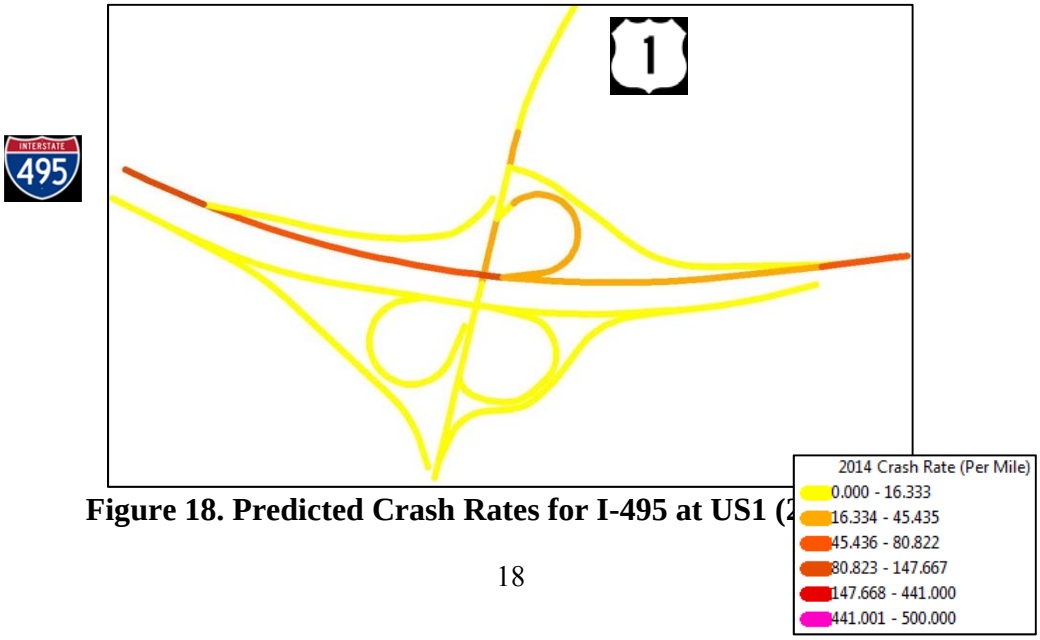

Figure 18. Predicted Crash Rates for I-495 at US1 (2

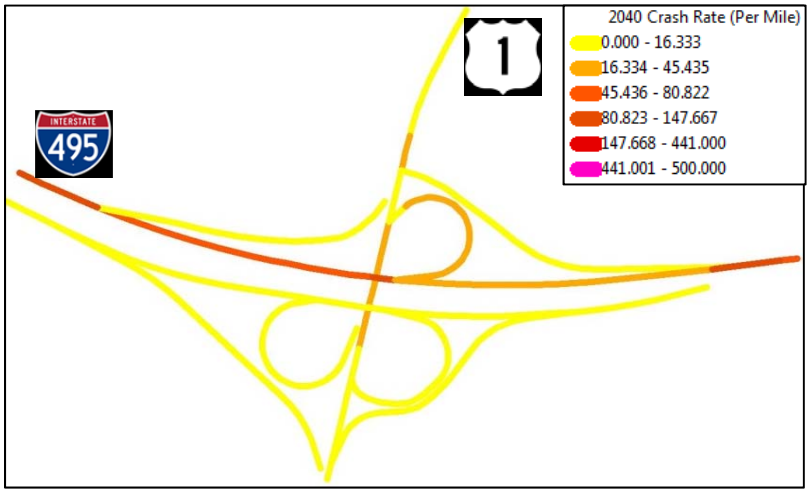

Figure 19. Predicted Crash Rates for I-495 at US1 (2040 ADT)

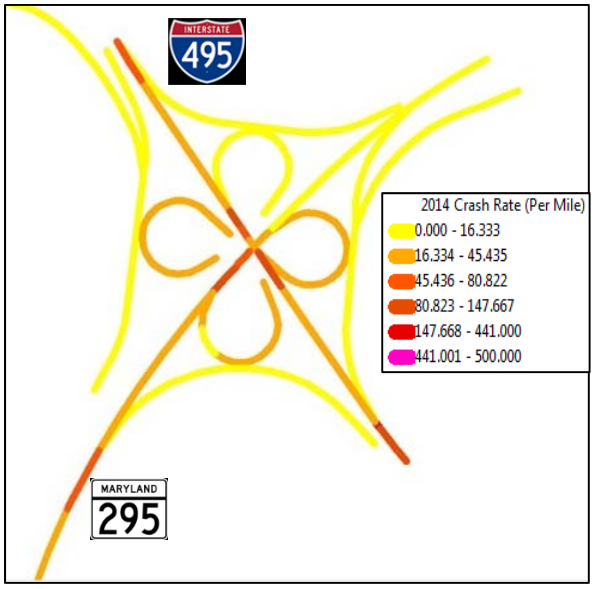

Figure 20. Predicted Crash Rates for I-495 at MD295 (2014 ADT)

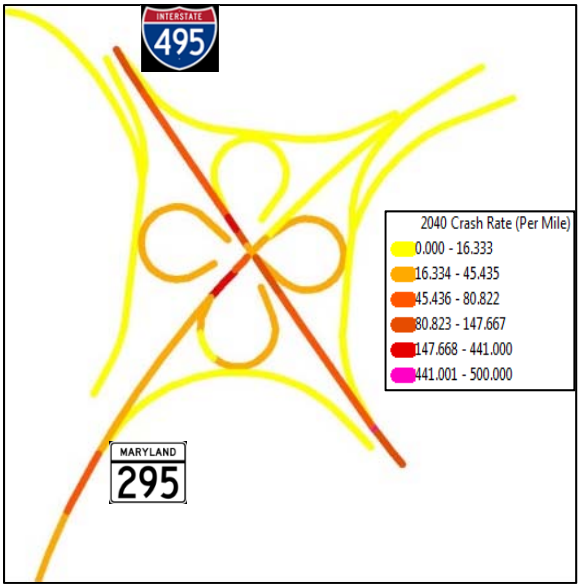

Figure 21. Predicted Crash Rates for I-495 at MD295 (2040 ADT)

Total Crash Trends by Interchange

Table 9 compares observed crashes (from 2010 to 2012) with predicted crashes for the base and future years. Increasing trends in crashes at all three interchanges are clearly observed. Please note that predicted crashes for 2014 and 2040 are not calibrated to Maryland's average trend. For example, 95 crashes occurred on I-495 at MD185 in 2012, and the HSM model forecasted that there would be 143 crashes in 2014. This does not mean that there would be a whopping 48 more crashes (95 to 143). When calibrated, the 2014 crash frequency would be lower or higher than 95, which can be done once the 2014 crash data set is completed sometime in 2015.

The table indicates that all interchanges may experience a higher number of crashes if no improvements are applied. Between 2014 and 2040, interchanges at I-495 and MD295 would witness an increase in the number of crashes by 11.39%, the highest among the three study locations, confirming the visual observation in the earlier section. The interchange at MD185 would experience the second-highest increase in crashes with 8.14%, followed I-495 at US1, roughly 3.12%.

Table 9. Observed Crashes vs. Predicted Crashes

Interchange	Year					% Change 2014 vs. 2040
	2010	2011	2012	2014	2040	
I-495 @ MD185	85	87	95	***143***	***154***	***8.14%***
I-495 @ US1	86	64	73	***86***	***88***	***3.12%***
I-495 @ MD295	73	52	63	***124***	***138***	***11.39%***
Total	244	203	231	***352***	***381***	***8.06%***

Note: Predicted crashes for 2014 and 2040 may not add up due to rounding.

Crashes and Crash Severity by Facility Type

Table 10 compares the total crashes (Figure 22) and crash severity by facility type (Table 8) for the base year and 2040. The total predicted crashes would increase by 8% from 352 crashes in 2014 to 380 crashes in 2040. During the study years, predicted crash frequencies would increase for all facility types except crossroad ramp terminals. Freeway segments would experience more crashes, a 15% increase, followed by speed-change lane entrance (SC_EN) and urban multilane divided arterials (UMD; i.e. MD185 and US1). Overall, crash severity would increase except for property-damage-only (PDO) crashes at ramp terminals.

Table 10. Predicted Crash Severity: 2014 vs. 2040

Facility	2014						2040						% Change
	K	A	B	C	O	Total	K	A	B	C	O	Total	
Freeway	0.57	1.52	10.07	22.32	92.26	126.74	0.64	1.71	11.34	24.18	105.59	143.46	13%
SC_EN	0.22	0.59	3.99	8.78	33.47	47.05	0.25	0.67	4.59	9.69	37.01	52.21	11%
SC_EX	0.10	0.27	1.71	3.68	17.28	23.04	0.11	0.29	1.87	3.88	18.53	24.68	7%
EN_Ramp	0.23	0.71	4.55	5.89	15.83	27.21	0.25	0.76	4.89	6.33	16.98	29.21	7%
EX_Ramp	0.29	0.87	3.37	5.30	13.76	23.60	0.31	0.93	3.60	5.66	14.65	25.15	7%
CD	0.01	0.03	0.16	0.29	0.93	1.42	0.01	0.03	0.18	0.33	1.01	1.55	9%
Ramp Terminal	0.06	1.56	7.84	23.77	53.27	86.51	0.07	1.64	8.24	25.09	50.87	85.89	-1%
UMD	4.37				12.51	16.89	4.83				13.89	18.72	11%
All	**113.13**				**239.33**	**352.46**	**122.36**				**258.51**	**380.88**	**8%**

Note:

K – Fatality
A – Incapacitating crashes
B – Non-incapacitating crashes
C – Complain of injuries
D – Property damage only crashes

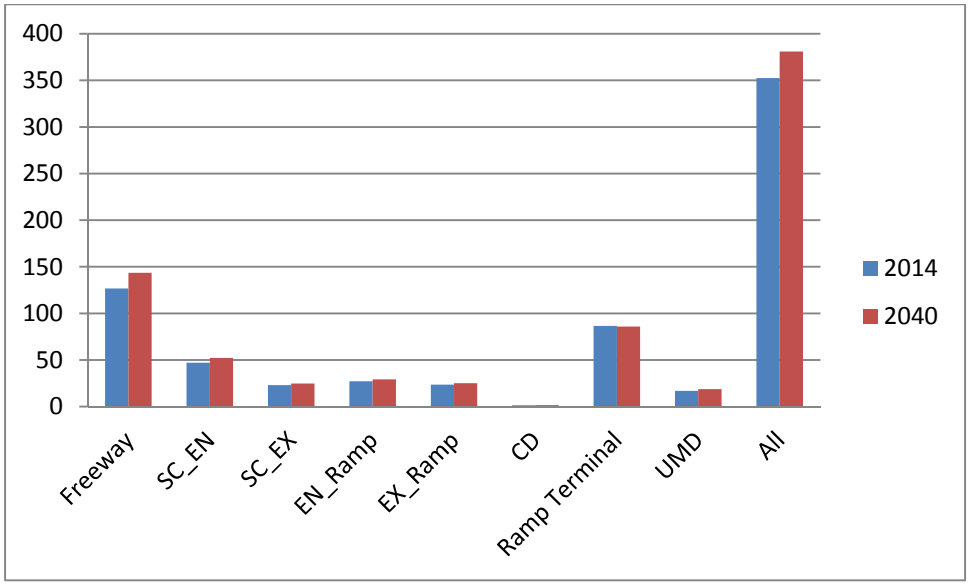

Figure 22. Predicted Total Crashes: 2014 vs. 2040

Impact of ADT Increase on Crash Frequency

The only variable that was not constant during this study was traffic volume; Figure 23 demonstrates the impact of ADT increase from 2014 to 2040 on predicted crashes. Freeway segments, US1 and MD185 (UMD), and speed-change lanes (S-C) are more sensitive to the increase of ADT because vehicles travel on them at high speeds. Therefore, an increase in ADT is interpreted as more conflicts among high-speed vehicles.

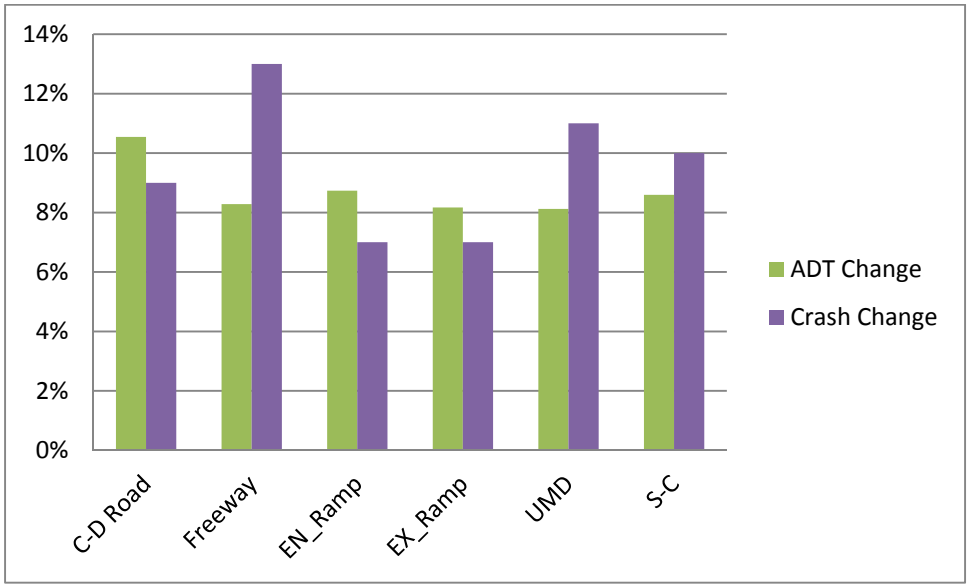

Figure 23. ADT Increase and Changes in Crashes between 2014 and 2040

FINDINGS

The safety analysis using IHSDM and ArcGIS visualization clearly identified the priority improvement locations. First, the visualization of predicted crashes indicates many conflicts would occur among vehicles entering and exiting the interchange at I-495 and MD295. At the interchange level, this location should be the first priority for improvement. Second, as revealed by the visual representation of crash magnitude, crashes on I-495 at MD295 may increase by 11%, which is higher than the average of the three interchanges (8%). Third, an increase in ADT without changing base geometric conditions would increase crashes on all facility types, except for a marginal decrease (-1%) on ramp terminals. Especially, crashes on high-speed locations such as freeway segments, speed-change lanes, and the crossroads (MD) would increase more rapidly than other facility types. Thus, safety improvements need to focus on the freeway segments, speed-change lanes, and the crossroads.

Limitations of Study

There were several limitations that the study team had to address and overcome. First, geocoded crash data were not available to the study team. This limitation prevented us from utilizing the empirical Bayes (EB) method to refine the crash frequency estimation. At least two years of crash data are required to employ the EB method. Second, due to the unavailability of a complete crash data set, the crash frequency was estimated exclusively based on HSM's default crash proportions, instead of Maryland's crash proportions, for the base year. Nevertheless, these limitations do not affect the quality of the study results. Since the primary objective of the study was to identify priority locations, the estimates made by SPFs using the HSM's crash proportion

assumptions enabled the study team to compare the relative crash magnitude by facility and between the base and horizon years. Third, the crash frequency estimates of this study are un-calibrated numbers; thus, using un-calibrated SPFs for facilities in the new proposed chapters (freeways and ramps) should be viewed with caution. In other words, crash frequencies presented in this report are raw numbers that can be calibrated if complete data for the base year becomes available. Despite this fact, the comparison of alternatives based on the percentages of changes in predicted number of crashes is completely valid. Fourth, annual average daily traffic (AADT) values are required by the HSM. However, only ADT values were available at the time of the study. This limitation does not depreciate the quality of the analysis since ADT was consistently used throughout this study. Finally, the unavailability of curve data (curve lengths and radii) led to the manual assignment of curve data indirectly from the design file, which was a significant delay factor. There are also some limitations of predictive methods that the HSM provides for users (Appendix IV – Limitations of the HSM Predictive Method).

Next Steps for Implementation

The findings from this task provide a clear picture of the locations for improvement. The next step would be the identifying countermeasures and carrying out improvement tasks.

APPENDIX I – DATA REQUIREMENTS

Freeway Segments

#	Data Item	Description	The HSM Default Assumption
1	Area Type	Specifies the alignment area type. Types are urban, suburban, and rural. The value of this item is used to select the appropriate crash prediction model.	Need actual data.
2	Number of Thru Lanes	Number of Thru Lanes, including both directions. The number of lanes in each direction at a site is expected to be the same. The value of this item must be an even number.	Need actual data.
3	Length	Length of the roadway segment. The unit of measure is miles or kilometers. The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
4	Effective Segment Length	Effective Length of the segment without the speed-change lanes. The unit of measure is miles or kilometers. The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
5	Average Lane Width	Average Width of lanes of the roadway segment. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
6	Effective Median Width	Effective Width of the median, including inside shoulders. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
7	Proportion Segment Length With Median Barrier	Proportion of Segment Length that has Median Barrier. The value of this item must be between (including) 0 and 1.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
8	Average Median Barrier Offset	Average Median Barrier Distance, from the edge of the inside shoulder to the barrier face. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
9	Proportion Segment Length With Outside Barrier	Proportion of Segment Length that has Outside Barrier. The value of this item must be between (including) 0 and 1.	Need actual data.
10	Outside Barrier Length	Outside Barrier Length. Added length for all barriers for the site. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
11	Average Outside Barrier Offset	Average Median Barrier Offset, from the edge of the outside shoulder to the barrier face. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
12	Average Inside Shoulder Width	Average Inside Shoulder Width. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
13	Average Outside Shoulder Width	Average Outside Shoulder Width. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
14	Proportion Weave Increasing	Proportion of segment length within a Type B weaving section for travel in increasing milepost direction. The value of this item must be between (including) 0 and 1.	Need actual data.
15	Length Weave Increasing	Weaving section length for travel in increasing milepost direction (may extend beyond segment boundaries). The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
16	Proportion Weave Decreasing	Proportion of segment length within a Type B weaving section for travel in decreasing milepost direction. The value of this item must be between (including) 0 and 1.	Need actual data.
17	Length Weave Decreasing	Weaving section length for travel in decreasing milepost direction (may extend beyond segment boundaries). The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
18	Distance Begin To Entry Increasing	Distance from the begin milepost of a segment to the nearest upstream entrance ramp gore point, for travel in increasing milepost direction. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
19	AADT Begin To Entry Increasing	AADT volume of entrance ramp located at the nearest (to the beginning of segment) upstream entrance ramp gore point(veh/day).The value of this item must be greater than or equal to 0 vpd, and less than or equal to 500,000 vpd.	Need actual data.
20	Distance End To Exit Increasing	Distance from the end milepost of a segment to the nearest downstream exit ramp gore point, for travel in increasing milepost direction. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
21	AADT End To Exit Increasing	AADT volume of exit ramp located at the nearest (to the end of segment) downstream exit ramp gore point (veh/day).The value of this item must be greater than or equal to 0 vpd, and less than or equal to 500,000 vpd.	Need actual data.
22	Distance End To Entry Decreasing	Distance from segment end milepost to nearest upstream entrance ramp gore point, for travel in decreasing milepost direction. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
23	AADT End To Entry Increasing	AADT volume of entrance ramp located at the nearest (to the end of segment) upstream entrance ramp gore point (veh/day).The value of this item must be greater than or equal to 0 vpd, and less than or equal to 500,000 vpd.	Need actual data.
24	Distance Begin To Exit Decreasing	Distance from segment begin-milepost to nearest downstream exit ramp gore point, for travel in decreasing milepost direction. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
25	AADT Begin To Exit Decreasing	AADT volume of exit ramp located at the nearest (to the beginning of segment) downstream exit ramp gore point (veh/day).The value of this item must be greater than or equal to 0 vpd, and less than or equal to 500,000 vpd.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
26	Years of Crash Data	Number of years of crash data for the site. Integer value expected. The value of this item must be greater than or equal to 1 and be less than or equal to 3.	Need actual data.
27	Year 1	The year for the first year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
28	Year 1 AADT	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
29	Year 2	The year for the second year of data Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
30	Year 2 AADT	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
31	Year 3	The year for the third year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
32	Year 3 AADT	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
33	Observed Number of Crashes	Total number of crashes observed at the site during the specified years. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
34	Proportion Inside Rumble Strips	Proportion of length of roadway that has Inside Rumble Strips. The value of this item must be between (including) 0 and 1.	It is computed by summing the length of roadway with rumble strips on the inside shoulder in both travel directions and dividing by twice the freeway segment length Lfs.
35	Proportion Outside Rumble Strips	Proportion of length of roadway that has Outside Rumble Strips. The value of this item must be between (including) 0 and 1.	It is computed by summing the length of roadway with rumble strips on the outside shoulder in both travel directions and dividing by twice the freeway segment length Lfs.
36	Outside Clear Zone Width	Average Outside Clear Zone Width. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Supplemental Calculations are provided at Section 18.7.3.
37	Proportion of High Volume	Proportion of AADT during hours where volume exceeds 1000 veh/hour/land. The value of this item must be between (including) 0 and 1.	A default value can be computed as $Phv = 1.0 - exp\ (1.45 - 0.000124 \times AADT/n)$. If the value computed is less than 0.0, then it is set to 0.0. [n is the number of through lanes.]
38	Curve Radius	Radius of the horizontal curve. The unit of measure is feet or meters.	Need actual data.
39	Curve Length Within Site	Length of the horizontal curve within the specified site. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.00 ft.	Need actual data.
40	Curve Side of Road	Indicator if the horizontal curve is on one or both roadbeds, only applicable to curve and spiral elements.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
41	Collision Type (Single-Vehicle)	Types of collisions considered by the model. The available values are: o Collision with Animal o Collision with Fixed Object o Collision with Other Object o Collision with Parked Vehicles o Other Single-vehicle Collision	Need actual data.
42	Collision Type (Multiple-Vehicle)	Types of collisions considered by the model. The available values are: o Head-on Collision o Rear-end Collision o Angle Collision o Sideswipe, Same Direction Collision o Other Multi-vehicle Collision	Need actual data.
43	Severity	The crash severity, e.g., FI or PDO. Enumeration values: o Fatal and Injury – Fatal and injury (FI) crash severity o Property Damage Only – Property damage only (PDO) crash severity	Need actual data.

Speed-Change Lanes (Ramp-Entrances & Ramp-Exits)

#	Data Item	Description	The HSM Default Assumption
1	Area Type	Specifies the alignment area type. Types are urban, suburban, and rural. The value of this item is used to select the appropriate crash prediction model.	Need actual data.
2	Number of Thru Lanes	Number of Thru Lanes, including both directions. The number of lanes in each direction at a site is expected to be the same. The value of this item must be an even number.	Need actual data.
3	Length	Length of the roadway segment. The unit of measure is miles or kilometers. The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
4	Average Lane Width	Average Width of lanes of the roadway segment. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
5	Effective Median Width	Effective Width of the median, including inside shoulders. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
6	Proportion Segment Length With Median Barrier	Proportion of Segment Length that has Median Barrier. The value of this item must be between (including) 0 and 1.	Need actual data.
7	Average Median Barrier Offset	Average Median Barrier Distance, from the edge of the inside shoulder to the barrier face. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
8	Average Inside Shoulder Width	Average Inside Shoulder Width. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
9	Ramp Length	Length of the ramp. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.00 ft.	Need actual data.
10	Ramp Side of Road	Specifies the side of the road (in the direction of travel) for the ramp, i.e., Inside (right side in direction of travel) or Outside (left side in direction of travel)	Need actual data.
11	AADT of Ramp	AADT of the ramp. The value of this item must be greater than or equal to 0 vpd, and less than or equal to 500,000 vpd.	Need actual data.
12	Years of Crash Data	Number of years of crash data for the site. Integer value expected. The value of this item must be greater than or equal to 1 and be less than or equal to 3.	Need actual data.
13	Year 1	The year for the first year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
14	Year 1 AADT	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
15	Year 2	The year for the second year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
16	Year 2 AADT	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
17	Year 3	The year for the third year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
18	Year 3 AADT	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
19	Observed Number of Crashes	Total number of crashes observed at the site during the specified years. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
20	Proportion of High Volume	Proportion of AADT during hours where volume exceeds 1000 veh/hour/land. The value of this item must be between (including) 0 and 1.	A default value can be computed as Phv = 1.0 – exp (1.45 − 0.000124 × AADT/n). If the value computed is less than 0.0, then it is set to 0.0. [n is the number of through lanes.]
21	Curve Radius	Radius of the horizontal curve. The unit of measure is feet or meters.	Need actual data.
22	Curve Length Within Site	Length of the horizontal curve within the specified site. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.00 ft.	Need actual data.
23	Curve Side of Road	Indicator if the horizontal curve is on one or both roadbeds, only applicable to curve and spiral elements.	Need actual data.
24	Collision Type (Single-Vehicle)	Types of collisions considered by the model. The available values are: o Collision with Animal o Collision with Fixed Object o Collision with Other Object o Collision with Parked Vehicles o Other Single-vehicle Collision	Need actual data.

#	Data Item	Description	The HSM Default Assumption
25	Collision Type (Multiple-Vehicle)	Types of collisions considered by the model. The available values are: o Head-on Collision o Rear-end Collision o Angle Collision o Sideswipe, Same Direction Collision o Other Multi-vehicle Collision	Need actual data.
26	Severity	The crash severity, e.g., FI or PDO. Enumeration values: o Fatal and Injury – Fatal and injury (FI) crash severity o Property Damage Only – Property damage only (PDO) crash severity	Need actual data.
27	Ramp Type	Specifies if the crash is related to an entrance ramp or an exit ramp. Enumeration values are: o Entrance – Entrance ramp. o Exit – Exit ramp.	Need actual data.

Ramps and Collector-Distributor Roads

#	Data Item	Description	The HSM Default Assumption
1	Area Type	Specifies the alignment area type. Types are urban, suburban, and rural. The value of this item is used to select the appropriate crash prediction model.	Need actual data.
2	Number of Thru Lanes	The total number of Thru Lanes in the segment. The value of this item must be an even number.	Need actual data.
3	Length of Ramp or C-D Road Segment.	Length of the segment. The unit of measure is miles or kilometers. The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
4	Type of traffic control	The options are none, yield, stop, and signal. The term "None" is appropriate if the ramp intersects the crossroad as a speed-change lane or as a lane added (or lane dropped).	Need actual data.
5	Average Lane Width	Average Width of lanes of the ramp or C-D road segment. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
6	Right Shoulder Width	Shoulder Width represents the paved width. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
7	Left Shoulder Width	Shoulder Width represents the paved width. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
8	Proportion of segment length with a barrier present on the right side	Measured separately for each short piece of barrier and for barrier that continues for the length of the segment (and beyond). Each piece is represented once for a site. Barrier length is measured along the reference line.	Need actual data.
9	Offset to the right-side barrier	Offset is the distance from the edge of right shoulder to the barrier face. The value of this item must be 30 ft. or less.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
10	Proportion of segment length with a barrier present on the left side	Measured separately for each short piece of barrier and for barrier that continues for the length of the segment (and beyond). Each piece is represented once for a site. Barrier length is measured along the reference line.	Need actual data.
11	Offset to the left-side barrier	Offset is the distance from the edge of left shoulder to the barrier face. The value of this item must be 30 ft. or less.	Need actual data.
12	Proportion of segment length with an entrance speed-change lane	Speed-change lane (due to a second merging ramp) length in the segment is measured between the segment's begin and end points. It cannot exceed the length of the segment, regardless of the length of the speed-change lane. It cannot exceed the length of the speed-change lane.	Need actual data.
13	Proportion of segment length with an exit speed-change lane	Speed-change lane (due to a second diverging ramp) length in the segment is measured between the segment's begin and end points. It cannot exceed the length of the segment, regardless of the length of the speed-change lane. It cannot exceed the length of the speed-change lane.	Need actual data.
14	Presence of added lane	Lane added to the ramp or C-D road (not as a result of a second merging ramp). The value of this item must be 1.0 if one or more lanes are added, 0.0 otherwise.	Need actual data.
15	Presence of dropped lane	Lane dropped from the ramp or C-D road (not as a result of a second diverging ramp). The value of this item must be 1.0 if one or more lanes are dropped, 0.0 otherwise.	Need actual data.
16	Proportion of segment length with a lane add	If there is a lane-add, then the length of the taper in the segment is needed. This length is measured between the segment's begin and end points. This length cannot exceed the length of the segment. This length cannot exceed the taper length.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
17	Proportion of segment length with a lane drop	If there is a lane drop, then the length of the taper in the segment is needed. This length is measured between the segment's begin and end points. This length cannot exceed the length of the segment. This length cannot exceed the taper length.	Need actual data.
18	Weaving Section Length	This length is measured along the edge of the C-D road traveled way from the gore point of the ramp entrance to the gore point of the next ramp exit (may extend beyond segment boundaries). The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
19	Proportion of segment length within a weaving section	Length of weaving section located in the subject segment, between the segment's begin- and end-points. This length cannot exceed the length of the segment.	Need actual data.
20	Years of Crash Data	Number of years of crash data for the site. Integer value expected. The value of this item must be greater than or equal to 1 and be less than or equal to 3.	Need actual data.
21	Year 1	The year for the first year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
22	Year 1 AADT	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
23	Year 2	The year for the second year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
24	Year 2 AADT	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
25	Year 3	The year for the third year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
26	Year 3 AADT	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
27	Observed Number of Crashes	Total number of crashes observed at the site during the specified years. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
28	Average traffic speed on the freeway during off-peak periods of the typical day	This speed is used to compute the speed for each curve (if any) that is present on the ramp.	If better information is not available, then this speed can be estimated as the freeway's maximum speed limit.
29	Average speed at the point where the ramp connects to the crossroad (mi/h)	This speed is needed for the entrance ramp, exit ramp, and connector ramp at the service interchange.	15 (mi/h) – ramps with stop-, yield-, or signal-controlled crossroad ramp terminals 30 (mi/h) – all other ramps at service interchanges.
30	Average speed on C-D road or connector ramp (measured at the mid-point of the C-D road or ramp) (mi/h)	This speed is needed for the C-D road, and connector ramp at the system interchange.	40 (mi/h)
31	Curve Length	Length of the horizontal curve prior to (or in) the subject segment. Curves located prior to the segment influence the speed on the subject segment. Special cases are curves with spiral transitions and continuous curve from a curve on an intersecting alignment.	Need actual data.
32	Curve Radius	Radius of the horizontal curve prior to (or in) the subject segment. The unit of measure is feet or meters.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
33	Curve Length Within Subject Segment	Length of the horizontal curve within the specified site. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.00 ft.	Need actual data.
34	Milepost of beginning of curve in direction of travel	Measure to the point where the tangent ends and the curve begins. Milepost locations are measured along the right edge of the ramp through the lane in the direction of travel (in the absence of tapers and speed-change lanes, this edge coincides with the right edge of traveled way). These mileposts are established for this application, and may or may not coincide with the mileposts (or stations) established for the ramp's design.	Need actual data.
35	Collision Type (Single-Vehicle)	Types of collisions considered by the model. The available values are: o Collision with Animal o Collision with Fixed Object o Collision with Other Object o Collision with Parked Vehicles o Other Single-vehicle Collision	Need actual data.
36	Collision Type (Multiple-Vehicle)	Types of collisions considered by the model. The available values are: o Head-on Collision o Rear-end Collision o Angle Collision o Sideswipe, Same Direction Collision o Other Multi-vehicle Collision	Need actual data.
37	Crash Severity	The crash severity, e.g., FI or PDO. Enumeration values: o Fatal and Injury – Fatal and injury (FI) crash severity o Property Damage Only – Property damage only (PDO) crash severity	Need actual data.

Crossroad Ramp Terminals

#	Data Item	Description	The HSM Default Assumption
-	Ramp Terminal Configuration	Based on Figure 19-1.	-
1	Area Type	Specifies the alignment area type. Types are urban, suburban, and rural. The value of this item is used to select the appropriate crash prediction model.	Need actual data.
2	Type of traffic control	The options are signal, one-way stop control, and all-way stop control.	Need actual data.
3	Number of thru lanes on the inside crossroad approach	Number of lanes (shared or exclusive) serving through traffic on the crossroad approach that is nearest to the freeway (i.e., the inside approach). This variable includes only lanes that continue through the intersection. Count the lanes along the crosswalk (or the logical location of the crosswalk if it is not marked). The value of this item must be a number.	Need actual data.
4	Number of thru lanes on the outside crossroad approach	Number of lanes (shared or exclusive) serving through traffic on the crossroad approach that is more distant from the freeway (i.e., the outside approach). This variable includes only lanes that continue through the intersection. Count the lanes along the crosswalk (or the logical location of the crosswalk if it is not marked). The value of this item must be a number.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
5	Number of lanes on the exit ramp leg at the terminal	Lanes can serve any movement (left, right, or through). If right-turn channelization is provided, then count the lanes at the last point where all exiting movements are joined (i.e., count at the channelization gore point). All lanes counted must be fully developed for 100 ft. or more before they intersect the crossroad. If a lane's development length is less than 100 ft., then it is not counted as a lane for this application. The lane (or lanes) associated with the loop exit ramp at a B4 terminal configuration are not included in this count. The value of this item must be a number.	Need actual data.
6	Presence of a non-ramp public street leg at the terminal	This data item is only for signal control type. This situation occurs occasionally. When it does, the public street leg is opposite from one ramp, and the other ramp either does not exist or is located at some distance from the subject ramp terminal such that it is not part of the terminal. The value of this item must be 1.0 if leg is present, 0.0 otherwise.	Need actual data.
7	Exit ramp skew angle	This data item is only for one-way stop control type. Skew angle equals 90 minus the intersection angle (in degrees).	Need actual data.
8	Presence of a left-turn lane (or bay) on the inside crossroad approach	The lane (or bay) can have one or two lanes. A lane (or bay) is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft. or more back from the stop line, and (c) ends at the intersection stop line. The value of this item must be 1.0 if a left-turn lane (bay) is present, 0.0 otherwise.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
9	Presence of a left-turn lane (or bay) on the outside crossroad approach	The lane (or bay) can have one or two lanes. A lane (or bay) is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft. or more back from the stop line, and (c) ends at the intersection stop line. The value of this item must be 1.0 if a left-turn lane (bay) is present, 0.0 otherwise.	Need actual data.
10	Width of left-turn lane (or bay) on the inside crossroad approach	This variable represents the total width of all lanes that exclusively serve turning vehicles on the subject approach. It is measured from the near edge of the traveled way of the adjacent through lane to the near lane marking (or curb face) that delineates the median. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
11	Width of left-turn lane (or bay) on the outside crossroad approach	This variable represents the total width of all lanes that exclusively serve turning vehicles on the subject approach. It is measured from the near edge of the traveled way of the adjacent through lane to the near lane marking (or curb face) that delineates the median. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
12	Presence of a right-turn lane (or bay) on the inside crossroad approach	The lane (or bay) can have one or two lanes. The value of this item must be 1.0 if a right-turn lane (bay) is present, 0.0 otherwise.	Need actual data.
13	Presence of a right-turn lane (or bay) on the outside crossroad approach	The lane (or bay) can have one or two lanes. The value of this item must be 1.0 if a right-turn lane (bay) is present, 0.0 otherwise.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
14	Number of unsignalized driveways on the outside crossroad leg	This data item is only for signal control type. This number represents the count of unsignalized driveways on the outside crossroad leg and within 250 ft. of the ramp terminal. The count is taken on both sides of the leg (i.e., it is a two-way total). The count should only include "active" driveways (i.e., those driveways with an average daily volume of 10 veh/day or more).	Need actual data.
15	Number of unsignalized public street approaches on the outside crossroad leg	This number represents the count of unsignalized public street approaches on the outside crossroad leg and within 250 ft. of the ramp terminal. The count is taken on both sides of the leg (i.e., it is a two-way total). If a public street approach is present at the terminal, then it is not counted for this entry.	Need actual data.
16	Distance to the adjacent ramp terminal	This data element represents the distance between the subject ramp terminal and the adjacent ramp terminal (measured along the crossroad from terminal center to terminal center). The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
17	Distance to the next public street intersection on the outside crossroad leg	This data element represents the distance between the subject ramp terminal and the nearest public street intersection located in a direction away from the freeway (measured along the crossroad from subject terminal center to intersection center). The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
18	Crossroad median width	This width is measured along a line perpendicular to the centerline of the crossroad in the vicinity of the intersection. If no median exists, then a width of 0.0 ft. is used in the predictive model. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
19	Presence of protected left-turn operation	This data item is only for signal control type. The value of this item must be 1.0 if protected operation exists, 0.0 otherwise.	Need actual data.
20	Presence of right-turn channelization on the inside crossroad approach	This data item is only for signal control type. This channelization creates a turning roadway that serves right-turn vehicles. It is separated from the intersection by a triangular channelizing island (delineated by markings or a raised curb). The gore point at the upstream end of the island must be within 200 ft. of the downstream stop line for right-turn channelization to be considered "present." The value of this item must be 1.0 if right-turn channelization exists, 0.0 otherwise.	Need actual data.
21	Presence of right-turn channelization on the outside crossroad approach	This data item is only for signal control type. This channelization creates a turning roadway that serves right-turn vehicles. It is separated from the intersection by a triangular channelizing island (delineated by markings or a raised curb). The gore point at the upstream end of the island must be within 200 ft. of the downstream stop line for right-turn channelization to be considered "present." The value of this item must be 1.0 if right-turn channelization exists, 0.0 otherwise.	Need actual data.
22	Presence of right-turn channelization on the exit ramp approach	This data item is only for signal control type. This channelization creates a turning roadway that serves right-turn vehicles. It is separated from the intersection by a triangular channelizing island (delineated by markings or a raised curb). The gore point at the upstream end of the island must be within 200 ft. of the downstream stop line for right-turn channelization to be considered "present." The value of this item must be 1.0 if right-turn channelization exists, 0.0 otherwise.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
23	Years of Crash Data	Number of years of crash data for the site. Integer value expected. The value of this item must be greater than or equal to 1 and be less than or equal to 3.	Need actual data.
24	Year 1	The year for the first year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
25	Year 1 AADT for the entrance ramp	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
26	Year 1 AADT for the exit ramp	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
27	Year 1 AADT for the crossroad leg between ramps	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
28	Year 1 AADT for the crossroad leg outside of interchange	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
29	Year 2	The year for the second year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
30	Year 2 AADT for the entrance ramp	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
31	Year 2 AADT for the exit ramp	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
32	Year 2 AADT for the crossroad leg between ramps	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
33	Year 2 AADT for the crossroad leg outside of interchange	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
34	Year 3	The year for the third year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
35	Year 3 AADT for the entrance ramp	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
36	Year 3 AADT for the exit ramp	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
37	Year 3 AADT for the crossroad leg between ramps	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
38	Year 3 AADT for the crossroad leg outside of interchange	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
39	Collision Type (Single-Vehicle)	Types of collisions considered by the model. The available values are: o Collision with Animal o Collision with Fixed Object o Collision with Other Object o Collision with Parked Vehicles o Other Single-vehicle Collision	Need actual data.

#	Data Item	Description	The HSM Default Assumption
40	Collision Type (Multiple-Vehicle)	Types of collisions considered by the model. The available values are: o Head-on Collision o Rear-end Collision o Angle Collision o Sideswipe, Same Direction Collision o Other Multi-vehicle Collision	Need actual data.
41	Severity	The crash severity, e.g., FI or PDO. Enumeration values: o Fatal and Injury – Fatal and injury (FI) crash severity o Property Damage Only – Property damage only (PDO) crash severity	Need actual data.

Urban/Suburban Arterial Highway – Divided

#	Data Item	Description	The HSM Default Assumption
1	Area type (rural/suburban/urban)	Specifies the alignment area type. Types are urban, suburban, and rural. The value of this item is used to select the appropriate crash prediction model.	Need actual data.
2	Segment length	Length of the roadway segment. Numeric value expected. The unit of this item is miles or kilometers. The value of this item must be greater than or equal to 0.0000 mi.	Need actual data.
3	Number of through traffic lanes	The total number of Through Lanes in the segment. The value of this item must be an even number.	Need actual data.
4	Average Lane Width	Average Width of lanes of the roadway segment. The unit of measure is feet or meters. The value of this item must be greater than or equal to 0.0000 ft.	Need actual data.
5	Median Type	The type of median element. Enumeration values are: ○ Traversable Median – Area separating opposing traffic lanes is traversable. ○ Non-Traversable Median – Area separating opposing traffic lanes is non-traversable.	Need actual data.
6	Median Width	Effective width of the median. Median width is measured between the inside edges of the through travel lanes in the opposing direction of travel. Thus, inside shoulder and turning lanes are included in the median width. Numeric value expected. The unit of this item is feet or meters. The value of this item must be greater than or equal to 0.00 ft.	Need actual data.
7	Number of major commercial driveways	This item defines the number of driveways of the specified type. Actual data are required, but simplified land-use categories (e.g., commercial or residential only) may be used to estimate the number. Integer value expected. The value of this item must be greater than or	Need actual data.
8	Number of minor commercial driveways		Need actual data.
9	Number of major residential		Need actual data.

#	Data Item	Description	The HSM Default Assumption
	driveways	equal to 0.	
10	Number of minor residential driveways		Need actual data.
11	Number of major industrial/institutional driveways		Need actual data.
12	Number of minor industrial/institutional driveways		Need actual data.
13	Number of other driveways		Need actual data.
14	Roadside fixed-object density	Density of fixed objects along the side of the roadway. This item must be specified site-by-site. It can be directly specified or selected from a set of categorized values. The unit of this item is fixed objects per mile or fixed objects per kilometer. Enumeration values are: ○ 0 objects/mile. ○ 50 objects/mile. ○ 100 objects/mile.	Database default on fixed-object offsets and density categories.
15	Roadside fixed-object offset	Offset to fixed objects. This item must be specified site-by-site. It can be directly specified or selected from the following categorized values. The unit of this item is feet or meters. Enumeration values are: ○ 5 ft. offset. ○ 20 ft. offset.	
16	Proportion of Curb Length with Parking	Proportion of curb length with on-street parking. Numeric value expected. The value of this item must be greater than or equal to 0.000, and be less than or equal to 1.000.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
17	Type of on-street parking	Type of parking and land use on the right side of the roadway. Enumeration values: ○ Parallel, Residential/Other – Parallel parking for residential or other type land use. ○ Parallel, Commercial/Industrial/Institutional – Parallel parking for commercial, industrial, or institutional land use. ○ Angle, Residential/Other – Angle parking for residential or other type land use. ○ Angle, Commercial/Industrial/Institutional – Angle parking for commercial, industrial, or institutional land use.	Need actual data.
18	Presence of lighting	Indicates the presence of roadway lighting. Enumeration values are: No or Yes.	Assume no lighting.
19	Low-speed vs. intermediate or high-speed	Speed level or category for urban/suburban arterial crash prediction. Enumeration values are: ○ Low – Low traffic speeds, 30 mph or 48 km/h or lower. ○ Intermediate/High – Intermediate or high traffic speeds, more than 30 mph or 48 km/h	Need actual data.
20	Use of automated speed enforcement	Indicates the presence of automated speed enforcement. Enumeration values are: No or Yes.	Base default on current practice.
21	Years of Crash Data	Number of years of crash data for the site. Integer value expected. The value of this item must be greater than or equal to 1 and be less than or equal to 3.	Need actual data.
22	Year 1	The year for the first year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
23	Year 1 AADT	AADT for first year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.

#	Data Item	Description	The HSM Default Assumption
24	Year 2	The year for the second year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
25	Year 2 AADT	AADT for second year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
26	Year 3	The year for the third year of data. Integer value expected. The unit of this item is year. The value of this item must be greater than or equal to 1970, and be less than or equal to 2050.	Need actual data.
27	Year 3 AADT	AADT for third year of data. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
28	Observed Number of Crashes	Total number of crashes observed at the site during the specified years. Integer value expected. The value of this item must be greater than or equal to 0.	Need actual data.
29	Collision Type	Types of collisions considered by the model. The available values are: o Collision with Animal o Collision with Fixed Object o Collision with Other Object o Collision with Parked Vehicles o Other Single-vehicle Collision o Head-on Collision o Rear-end Collision o Angle Collision o Sideswipe, Same Direction Collision o Other Multi-vehicle Collision	Need actual data.

#	Data Item	Description	The HSM Default Assumption
30	Severity	The crash severity, e.g., FI or PDO. Enumeration values: o Fatal and Injury – Fatal and injury (FI) crash severity o Property Damage Only – Property damage only (PDO) crash severity	Need actual data.

APPENDIX II – SITES

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
0	I-495 @ US-1	Entrance Ramp	No	95	0	0.023	RAMP 5 FR US 1 SB TO RAMP 10 (TO IS 95)	16000RP00095 02SSIS25 05	
1	I-495 @ MD-185	Exit Ramp	No	495	0	0.02	RAMP 7 FR RAMP 2 (FR IS 495) TO MD 185 SB	15000RP00495 02WWIS33 07	
2	I-495 @ MD-185	Exit Ramp	No	495	0	0.03	RAMP 3 FR IS 495 EB TO MD 185 NB	15000RP00495 02EEIS33 03	
3	I-495 @ MD-295	Entrance Ramp	No	95	0	0.028	RAMP 7 FR MD 295 WB TO IS 95 SB	16000RP00095 02WWIS22 07	
4	I-495 @ MD-185	Exit Ramp	No	495	0	0.116	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
5	I-495 @ MD-185	Urban Multilane Road	No	185	2.62	2.65	CONNECTICUT AVE	15000MD00185 01NN********** *****	
6	I-495 @ MD-295	Freeway	No	95	22.12	22.150002	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
7	I-495 @ MD-295	Entrance Ramp	No	95	0	0.05	RAMP 6 FR MD 295 EB TO IS 95 SB	16000RP00095 02EEIS22 06	
8	I-495 @ US-1	Entrance Ramp	No	95	0	0.015	RAMP 1 FR US 1 NB TO IS 95 WB	16000RP00095 02NNIS25 01	
9	I-495 @ US-1	Exit Ramp	No	95	0	0.03	RAMP 7 FR IS 95 WB TO US 1 SB	16000RP00095 02WWIS25 07	
10	I-495 @ US-1	Exit Ramp	No	95	0	0.026	RAMP 3 FR RAMP 10 (FR IS 495) TO US 1 NB	16000RP00095 02SSIS25 03	
11	I-495 @ MD-185	Exit Ramp	No	495	0	0.022	RAMP 6 FR RAMP 3 (FR IS 495) TO MD 185 SB	15000RP00495 02EEIS33 06	
12	I-495 @ MD-295	Entrance Ramp	No	95	0	0.029	RAMP 2 FR MD 295 WB TO IS 95 NB	16000RP00095 02WWIS22 02	
13	I-495 @ MD-	Entrance	No	495	0	0.023	RAMP 1 FR MD 185 NB	15000RP00495	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
	185	Ramp					TO IS 495 WB	02NNIS33 01	
14	I-495 @ US-1	Freeway	Ramp Entrance & Ramp Exit	95	25.19	25.375	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
15	I-495 @ US-1	Urban Multilane Road	No	1	6.43	6.49	BALTIMORE AVE	16000US00001 01NN********** *****	
16	I-495 @ MD-295	Freeway	No	295	5.99	6.01	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
17	I-495 @ US-1	Exit Ramp	No	95	0	0.078	RAMP 6 FR RAMP 10 (FR IS 495) TO US 1 SB	16000RP00095 02SSIS25 06	
18	I-495 @ MD-295	Exit Ramp	No	95	0	0.022	RAMP 9 FR RAMP 4 (FR MD 295) TO MD 193	16000RP00095 02NNIS22 09	
19	I-495 @ MD-185	Entrance Ramp	No	495	0	0.023	RAMP 5 FR MD 185 SB TO IS 495 EB	15000RP00495 02SSIS33 05	
20	I-495 @ MD-295	Freeway	No	295	4.5	5.651	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
21	I-495 @ MD-295	Entrance Ramp	No	95	0	0.035	RAMP 3 FR MD 295 EB TO IS 95 NB	16000RP00095 02EEIS22 03	
22	I-495 @ US-1	Entrance Ramp	No	95	0	0.11	RAMP 8 FR US 1 SB TO IS 95 WB	16000RP00095 02WWIS25 08	
23	I-495 @ MD-185	Entrance Ramp	No	495	0	0.028	RAMP 8 FR MD 185 SB TO IS 495 WB	15000RP00495 02SSIS33 08	
24	I-495 @ MD-185	Entrance Ramp	No	495	0	0.028	RAMP 4 FR MD 185 NB TO IS 495 EB	15000RP00495 02NNIS33 04	
25	I-495 @ MD-295	Exit Ramp	No	95	0	0.011	RAMP 5 FR IS 95 SB TO MD 295 EB	16000RP00095 02SSIS22 05	
26	I-495 @ MD-295	Exit Ramp	No	95	0	0.021	RAMP 1 FR IS 95 NB TO MD 295 WB	16000RP00095 02NNIS22 01	
27	I-495 @ US-1	Entrance Ramp	No	95	0	0.136	RAMP 4 FR US 1 NB TO RAMP 10 (TO IS 95)	16000RP00095 02NNIS25 04	
28	I-495 @ MD-295	Exit Ramp	No	95	0	0.024	RAMP 4 FR IS 95 NB TO MD 295 EB	16000RP00095 02NNIS22 04	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
29	I-495 @ MD-295	Exit Ramp	No	95	0	0.022	RAMP 8 FR IS 95 SB TO MD 295 WB	16000RP00095 02SSIS22 08	
30	I-495 @ US-1	Urban Multilane Road	No	1	6.27	6.3	BALTIMORE AVE	16000US00001 01NN********** *****	
31	I-495 @ MD-185	Freeway	No	495	8.24	8.252999	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
32	I-495 @ US-1	Urban Multilane Road	No	1	6.49	6.53	BALTIMORE AVE	16000US00001 01NN********** *****	
33	I-495 @ MD-185	Urban Multilane Road	No	185	2.48	2.54	CONNECTICUT AVE	15000MD00185 01NN********** *****	
34	I-495 @ US-1	Urban Multilane Road	No	1	6.38	6.43	BALTIMORE AVE	16000US00001 01NN********** *****	
35	I-495 @ MD-185	Urban Multilane Road	No	185	2.46	2.48	CONNECTICUT AVE	15000MD00185 01NN********** *****	
36	I-495 @ MD-185	Urban Multilane Road	No	185	2.68	2.717	CONNECTICUT AVE	15000MD00185 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
37	I-495 @ US-1	Urban Multilane Road	No	1	6.351	6.38	BALTIMORE AVE	16000US00001 01NN********** *****	
38	I-495 @ MD-185	Urban Multilane Road	No	185	2.65	2.68	CONNECTICUT AVE	15000MD00185 01NN********** *****	
39	I-495 @ MD-185	Urban Multilane Road	No	185	2.4	2.46	CONNECTICUT AVE	15000MD00185 01NN********** *****	
40	I-495 @ US-1	Urban Multilane Road	No	1	6.32	6.335	BALTIMORE AVE	16000US00001 01NN********** *****	
41	I-495 @ MD-	Urban	No	185	2.36	2.4	CONNECTICUT AVE	15000MD00185	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
	185	Multilane Road						01NN**********	
42	I-495 @ MD-185	Urban Multilane Road	No	185	2.58	2.62	CONNECTICUT AVE	15000MD00185 01NN**********	
43	I-495 @ MD-185	Urban Multilane Road	No	185	2.77	2.83	CONNECTICUT AVE	15000MD00185 01NN**********	
44	I-495 @ US-1	Urban Multilane Road	No	1	6.3	6.32	BALTIMORE AVE	16000US00001 01NN**********	
45	I-495 @ US-1	Urban Multilane Road	No	1	6.53	6.54	BALTIMORE AVE	16000US00001 01NN**********	
46	I-495 @ MD-185	Urban Multilane Road	No	185	2.54	2.58	CONNECTICUT AVE	15000MD00185 01NN**********	
47	I-495 @ MD-185	Urban Multilane Road	No	185	2.34	2.36	CONNECTICUT AVE	15000MD00185 01NN**********	
48	I-495 @ US-1	Urban Multilane Road	No	1	6.6	6.677	BALTIMORE AVE	16000US00001 01NN**********	
49	I-495 @ US-1	Urban Multilane Road	No	1	6.56	6.6	BALTIMORE AVE	16000US00001 01NN**********	
50	I-495 @ MD-185	Entrance Ramp	No	495	0.028	0.063	RAMP 8 FR MD 185 SB TO IS 495 WB	15000RP00495 02SSIS33 08	
51	I-495 @ MD-185	Entrance Ramp	No	495	0.028	0.059	RAMP 4 FR MD 185 NB TO IS 495 EB	15000RP00495 02NNIS33 04	
52	I-495 @ MD-185	Entrance Ramp	No	495	0.203	0.225	RAMP 1 FR MD 185 NB TO IS 495 WB	15000RP00495 02NNIS33 01	
53	I-495 @ MD-185	Exit Ramp	No	495	0.296	0.39	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
54	I-495 @ MD-185	Exit Ramp	No	495	0.077	0.083	RAMP 6 FR RAMP 3 (FR IS 495) TO MD 185 SB	15000RP00495 02EEIS33 06	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
55	I-495 @ MD-185	Exit Ramp	No	495	0.152	0.19	RAMP 3 FR IS 495 EB TO MD 185 NB	15000RP00495 02EEIS33 03	Manual split and modification of associated variables for I-495 Safety Analysis.
56	I-495 @ MD-185	Entrance Ramp	No	495	0.138	0.15	RAMP 5 FR MD 185 SB TO IS 495 EB	15000RP00495 02SSIS33 05	
57	I-495 @ MD-185	Entrance Ramp	No	495	0.052	0.203	RAMP 1 FR MD 185 NB TO IS 495 WB	15000RP00495 02NNIS33 01	
58	I-495 @ MD-185	Exit Ramp	No	495	0.271	0.296	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
59	I-495 @ MD-185	Entrance Ramp	No	495	0.023	0.138	RAMP 5 FR MD 185 SB TO IS 495 EB	15000RP00495 02SSIS33 05	
60	I-495 @ MD-185	Exit Ramp	No	495	0.12	0.14	RAMP 3 FR IS 495 EB TO MD 185 NB	15000RP00495 02EEIS33 03	
61	I-495 @ MD-185	Entrance Ramp	No	495	0.023	0.052	RAMP 1 FR MD 185 NB TO IS 495 WB	15000RP00495 02NNIS33 01	
62	I-495 @ MD-185	Exit Ramp	No	495	0.116	0.155	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
63	I-495 @ MD-185	Exit Ramp	No	495	0.022	0.044	RAMP 6 FR RAMP 3 (FR IS 495) TO MD 185 SB	15000RP00495 02EEIS33 06	
64	I-495 @ MD-185	Exit Ramp	No	495	0.054	0.12	RAMP 3 FR IS 495 EB TO MD 185 NB	15000RP00495 02EEIS33 03	
65	I-495 @ MD-185	Entrance Ramp	No	495	0.148	0.205	RAMP 4 FR MD 185 NB TO IS 495 EB	15000RP00495 02NNIS33 04	
66	I-495 @ MD-185	Entrance Ramp	No	495	0.225	0.25	RAMP 1 FR MD 185 NB TO IS 495 WB	15000RP00495 02NNIS33 01	
67	I-495 @ MD-185	Exit Ramp	No	495	0.41	0.43	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
68	I-495 @ MD-185	Exit Ramp	No	495	0.044	0.077	RAMP 6 FR RAMP 3 (FR IS 495) TO MD 185 SB	15000RP00495 02EEIS33 06	
69	I-495 @ MD-	Freeway	No	495	8.409	8.419001	CAPITAL BELTWAY	15000IS00495	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
	185							01EE********** ****	
70	I-495 @ MD-185	Entrance Ramp	No	495	0.112	0.18	RAMP 8 FR MD 185 SB TO IS 495 WB	15000RP00495 02SSIS33 08	
71	I-495 @ MD-185	Entrance Ramp	No	495	0.059	0.148	RAMP 4 FR MD 185 NB TO IS 495 EB	15000RP00495 02NNIS33 04	
72	I-495 @ MD-185	Entrance Ramp	No	495	0.15	0.17	RAMP 5 FR MD 185 SB TO IS 495 EB	15000RP00495 02SSIS33 05	
73	I-495 @ MD-185	Exit Ramp	No	495	0.03	0.054	RAMP 3 FR IS 495 EB TO MD 185 NB	15000RP00495 02EEIS33 03	
74	I-495 @ MD-185	Exit Ramp	No	495	0.39	0.41	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
75	I-495 @ MD-185	Freeway	Ramp Entrance	495	8.335	8.409	CAPITAL BELTWAY	15000IS00495 01EE********** ****	Manual split and modification of associated variables for I-495 Safety Analysis.
76	I-495 @ MD-185	Freeway	Ramp Entrance & Ramp Exit	495	8.21	8.24	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
77	I-495 @ MD-185	Freeway	Ramp Entrance & Ramp Exit	495	7.92	8.04	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
78	I-495 @ MD-185	Freeway	Ramp Exit	495	8.04	8.1	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
79	I-495 @ MD-185	Freeway	Ramp Entrance	495	8.253	8.3	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
80	I-495 @ MD-185	Freeway	No	495	8.1	8.21	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
81	I-495 @ MD-185	Freeway	No	495	8.3	8.335	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
82	I-495 @ MD-295	Exit Ramp	No	95	0.124	0.145	RAMP 1 FR IS 95 NB TO MD 295 WB	16000RP00095 02NNIS22 01	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
83	I-495 @ MD-295	Entrance Ramp	No	95	0.136	0.169	RAMP 2 FR MD 295 WB TO IS 95 NB	16000RP00095 02WWIS22 02	
84	I-495 @ MD-295	Exit Ramp	No	95	0.145	0.193	RAMP 1 FR IS 95 NB TO MD 295 WB	16000RP00095 02NNIS22 01	
85	I-495 @ MD-295	Exit Ramp	No	95	0.113	0.139	RAMP 5 FR IS 95 SB TO MD 295 EB	16000RP00095 02SSIS22 05	
86	I-495 @ US-1	C-D Road	No	95	1.08	1.16	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
87	I-495 @ US-1	Exit Ramp	No	95	0.026	0.161	RAMP 3 FR RAMP 10 (FR IS 495) TO US 1 NB	16000RP00095 02SSIS25 03	
88	I-495 @ US-1	C-D Road	No	95	1.07	1.08	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
89	I-495 @ US-1	Entrance Ramp	No	95	0.015	0.14	RAMP 1 FR US 1 NB TO IS 95 WB	16000RP00095 02NNIS25 01	
90	I-495 @ US-1	Exit Ramp	No	95	0.095	0.208	RAMP 7 FR IS 95 WB TO US 1 SB	16000RP00095 02WWIS25 07	
91	I-495 @ US-1	C-D Road	No	95	0.98	1.07	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
92	I-495 @ US-1	Entrance Ramp	No	95	0.023	0.15	RAMP 5 FR US 1 SB TO RAMP 10 (TO IS 95)	16000RP00095 02SSIS25 05	
93	I-495 @ US-1	Exit Ramp	No	95	0.03	0.064	RAMP 7 FR IS 95 WB TO US 1 SB	16000RP00095 02WWIS25 07	
94	I-495 @ US-1	Entrance Ramp	No	95	0.11	0.202	RAMP 8 FR US 1 SB TO IS 95 WB	16000RP00095 02WWIS25 08	
95	I-495 @ US-1	C-D Road	No	95	0.822	0.936	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
96	I-495 @ US-1	C-D Road	No	95	1.19	1.27	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
97	I-495 @ US-1	Entrance Ramp	No	95	0.136	0.18	RAMP 4 FR US 1 NB TO RAMP 10 (TO IS 95)	16000RP00095 02NNIS25 04	
98	I-495 @ US-1	Exit Ramp	No	95	0.153	0.25	RAMP 6 FR RAMP 10 (FR IS 495) TO US 1 SB	16000RP00095 02SSIS25 06	
99	I-495 @ US-1	C-D Road	No	95	1.16	1.19	RAMP 10 FR IS 495 WB	16000RP00095	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
							TO IS 95 WB	02EEIS25 10	
100	I-495 @ US-1	C-D Road	No	95	0.78	0.79	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
101	I-495 @ MD-295	Exit Ramp	No	95	0.11	0.313	RAMP 8 FR IS 95 SB TO MD 295 WB	16000RP00095 02SSIS22 08	
102	I-495 @ MD-295	Entrance Ramp	No	95	0.029	0.106	RAMP 2 FR MD 295 WB TO IS 95 NB	16000RP00095 02WWIS22 02	
103	I-495 @ MD-295	Freeway	No	295	6.04	6.15	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
104	I-495 @ MD-295	Exit Ramp	No	95	0.22	0.321	RAMP 4 FR IS 95 NB TO MD 295 EB	16000RP00095 02NNIS22 04	
105	I-495 @ MD-295	Entrance Ramp	No	95	0.05	0.101	RAMP 6 FR MD 295 EB TO IS 95 SB	16000RP00095 02EEIS22 06	
106	I-495 @ MD-295	Exit Ramp	No	95	0.17	0.21	RAMP 5 FR IS 95 SB TO MD 295 EB	16000RP00095 02SSIS22 05	
107	I-495 @ MD-295	Exit Ramp	No	95	0.022	0.11	RAMP 8 FR IS 95 SB TO MD 295 WB	16000RP00095 02SSIS22 08	
108	I-495 @ MD-295	Exit Ramp	No	95	0.031	0.29	RAMP 10 FR MD 193 TO RAMP 8 (TO IS 95)	16000RP00095 02SSIS22 10	
109	I-495 @ MD-295	Exit Ramp	No	95	0.193	0.22	RAMP 1 FR IS 95 NB TO MD 295 WB	16000RP00095 02NNIS22 01	
110	I-495 @ MD-295	Entrance Ramp	No	95	0.035	0.135	RAMP 3 FR MD 295 EB TO IS 95 NB	16000RP00095 02EEIS22 03	
111	I-495 @ MD-295	Freeway	Ramp Entrance & Ramp Exit	295	5.93	5.97	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
112	I-495 @ MD-295	Exit Ramp	No	95	0.19	0.22	RAMP 4 FR IS 95 NB TO MD 295 EB	16000RP00095 02NNIS22 04	
113	I-495 @ MD-295	Entrance Ramp	No	95	0.135	0.21	RAMP 3 FR MD 295 EB TO IS 95 NB	16000RP00095 02EEIS22 03	
114	I-495 @ MD-295	Entrance Ramp	No	95	0.28	0.3	RAMP 2 FR MD 295 WB TO IS 95 NB	16000RP00095 02WWIS22 02	
115	I-495 @ MD-295	Exit Ramp	No	95	0.024	0.19	RAMP 4 FR IS 95 NB TO MD 295 EB	16000RP00095 02NNIS22 04	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
116	I-495 @ MD-295	Exit Ramp	No	95	0.072	0.113	RAMP 5 FR IS 95 SB TO MD 295 EB	16000RP00095 02SSIS22 05	
117	I-495 @ MD-295	Entrance Ramp	No	95	0.028	0.055	RAMP 7 FR MD 295 WB TO IS 95 SB	16000RP00095 02WWIS22 07	
118	I-495 @ MD-295	Exit Ramp	No	95	0.099	0.124	RAMP 1 FR IS 95 NB TO MD 295 WB	16000RP00095 02NNIS22 01	
119	I-495 @ MD-295	Freeway	No	295	5.73	5.93	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
120	I-495 @ MD-295	Exit Ramp	No	95	0.022	0.261	RAMP 9 FR RAMP 4 (FR MD 295) TO MD 193	16000RP00095 02NNIS22 09	
121	I-495 @ MD-295	Exit Ramp	No	95	0.021	0.099	RAMP 1 FR IS 95 NB TO MD 295 WB	16000RP00095 02NNIS22 01	
122	I-495 @ MD-295	Entrance Ramp	No	95	0.169	0.28	RAMP 2 FR MD 295 WB TO IS 95 NB	16000RP00095 02WWIS22 02	
123	I-495 @ MD-295	Freeway	Ramp Entrance & Ramp Exit	295	5.651	5.73	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
124	I-495 @ MD-295	Exit Ramp	No	95	0.011	0.072	RAMP 5 FR IS 95 SB TO MD 295 EB	16000RP00095 02SSIS22 05	
125	I-495 @ MD-295	Entrance Ramp	No	95	0.311	0.33	RAMP 6 FR MD 295 EB TO IS 95 SB	16000RP00095 02EEIS22 06	
126	I-495 @ MD-295	Entrance Ramp	No	95	0.21	0.24	RAMP 3 FR MD 295 EB TO IS 95 NB	16000RP00095 02EEIS22 03	
127	I-495 @ MD-295	Entrance Ramp	No	95	0.106	0.136	RAMP 2 FR MD 295 WB TO IS 95 NB	16000RP00095 02WWIS22 02	
128	I-495 @ MD-295	Exit Ramp	No	95	0.321	0.35	RAMP 4 FR IS 95 NB TO MD 295 EB	16000RP00095 02NNIS22 04	
129	I-495 @ MD-295	Freeway	Ramp Entrance	295	6.22	6.36	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
130	I-495 @ MD-295	Entrance Ramp	No	95	0.101	0.311	RAMP 6 FR MD 295 EB TO IS 95 SB	16000RP00095 02EEIS22 06	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
131	I-495 @ MD-295	Exit Ramp	No	95	0.313	0.34	RAMP 8 FR IS 95 SB TO MD 295 WB	16000RP00095 02SSIS22 08	
132	I-495 @ MD-295	Freeway	Ramp Entrance	95	21.88	21.889999	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
133	I-495 @ MD-295	Freeway	Ramp Entrance & Ramp Exit	95	21.829	21.880001	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
134	I-495 @ MD-295	Freeway	No	95	22.09	22.120001	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
135	I-495 @ MD-295	Freeway	No	95	21.89	22.049999	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
136	I-495 @ MD-295	Freeway	Ramp Entrance	95	22.05	22.09	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
137	I-495 @ MD-295	Freeway	No	95	22.18	22.272	CAPITAL BELTWAY	16000IS00095 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
138	I-495 @ MD-295	Freeway	Ramp Entrance & Ramp Exit	95	22.15	22.18	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
139	I-495 @ US-1	Urban Multilane Road	No	1	6.54	6.56	BALTIMORE AVE	16000US00001 01NN********** *****	
140	I-495 @ MD-185	Freeway	No	495	8.44	8.726999	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
141	I-495 @ MD-185	Freeway	No	495	8.419	8.44	CAPITAL BELTWAY	15000IS00495 01EE********** ****	
142	I-495 @ MD-295	Exit Ramp	No	95	0.139	0.17	RAMP 5 FR IS 95 SB TO MD 295 EB	16000RP00095 02SSIS22 05	
143	I-495 @ MD-295	Freeway	No	295	6.15	6.22	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN*********	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
								*****	
144	I-495 @ US-1	Freeway	Ramp Entrance & Ramp Exit	95	25.14	25.189999	CAPITAL BELTWAY	16000IS00095 01NN********* *****	
145	I-495 @ MD-185	Exit Ramp	No	495	0.14	0.152	RAMP 3 FR IS 495 EB TO MD 185 NB	15000RP00495 02EEIS33 03	
146	I-495 @ MD-185	Exit Ramp	No	495	0.18	0.19	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
147	I-495 @ MD-185	Exit Ramp	No	495	0.155	0.18	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
148	I-495 @ US-1	Exit Ramp	No	95	0.064	0.095	RAMP 7 FR IS 95 WB TO US 1 SB	16000RP00095 02WWIS25 07	
149	I-495 @ MD-295	Entrance Ramp	No	95	0.125	0.23	RAMP 7 FR MD 295 WB TO IS 95 SB	16000RP00095 02WWIS22 07	
150	I-495 @ MD-295	Entrance Ramp	No	95	0.093	0.125	RAMP 7 FR MD 295 WB TO IS 95 SB	16000RP00095 02WWIS22 07	
151	I-495 @ MD-295	Entrance Ramp	No	95	0.055	0.093	RAMP 7 FR MD 295 WB TO IS 95 SB	16000RP00095 02WWIS22 07	
152	I-495 @ MD-185	Entrance Ramp	No	495	0.063	0.112	RAMP 8 FR MD 185 SB TO IS 495 WB	15000RP00495 02SSIS33 08	
153	I-495 @ MD-185	Exit Ramp	No	495	0.02	0.05	RAMP 7 FR RAMP 2 (FR IS 495) TO MD 185 SB	15000RP00495 02WWIS33 07	
154	I-495 @ MD-185	Exit Ramp	No	495	0.43	0.44	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
155	I-495 @ MD-185	Exit Ramp	No	495	0.19	0.271	RAMP 2 FR IS 495 WB TO MD 185 NB	15000RP00495 02WWIS33 02	
156	I-495 @ US-1	C-D Road	No	95	0.936	0.98	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
157	I-495 @ US-1	Exit Ramp	No	95	0.078	0.153	RAMP 6 FR RAMP 10 (FR IS 495) TO US 1 SB	16000RP00095 02SSIS25 06	
158	I-495 @ US-1	Entrance Ramp	No	95	0.18	0.19	RAMP 4 FR US 1 NB TO RAMP 10 (TO IS 95)	16000RP00095 02NNIS25 04	
159	I-495 @ US-1	C-D Road	No	95	0.79	0.822	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	
160	I-495 @ US-1	Exit Ramp	No	95	0.161	0.172	RAMP 3 FR RAMP 10 (FR IS 495) TO US 1 NB	16000RP00095 02SSIS25 03	
161	I-495 @ US-1	Urban Multilane Road	No	1	6.335	6.351	BALTIMORE AVE	16000US00001 01NN********** *****	
162	I-495 @ MD-295	Freeway	No	295	5.97	5.99	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
163	I-495 @ MD-185	Urban Multilane Road	No	185	2.73	2.77	CONNECTICUT AVE	15000MD00185 01NN********** *****	
164	I-495 @ MD-295	Freeway	Ramp Entrance	295	6.01	6.04	BALTIMORE WASHINGTON PKWY	16000MD00295 01NN********** *****	
165	I-495 @ US-1	Freeway	No	95	24.84	24.860001	CAPITAL BELTWAY	16000IS00095 01NN********** *****	
166	I-495 @ US-1	Freeway	No	95	24.93	25.140001	CAPITAL BELTWAY	16000IS00095 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
167	I-495 @ MD-185	Urban Multilane Road	No	185	2.22	2.34	CONNECTICUT AVE	15000MD00185 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
168	I-495 @ US-1	Freeway	Ramp Entrance & Ramp Exit	95	25.375	25.44	CAPITAL BELTWAY	16000IS00095 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
169	I-495 @ US-1	C-D Road	No	95	0.74	0.78	RAMP 10 FR IS 495 WB TO IS 95 WB	16000RP00095 02EEIS25 10	Manual split and modification of associated variables for I-495 Safety Analysis.
170	I-495 @ MD-295	Freeway	Ramp Entrance	95	22.272	22.34	CAPITAL BELTWAY	16000IS00095 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
171	I-495 @ US-1	Freeway	Ramp Exit	95	24.86	24.93	CAPITAL BELTWAY	16000IS00095 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
172	I-495 @ MD-185	Freeway	Ramp Exit	495	8.44	8.552	CAPITAL BELTWAY	15000IS00495 01EE********** ****	Manual split and modification of associated variables for I-495 Safety Analysis.
173	I-495 @ MD-185	Freeway	No	495	8.375	8.409	CAPITAL BELTWAY	15000IS00495 01EE********** ****	Manual split and modification of associated variables for I-495 Safety Analysis.
174	I-495 @ MD-185	Urban Multilane Road	No	185	2.717	2.73	CONNECTICUT AVE	15000MD00185 01NN********** *****	Manual split and modification of associated variables for I-495 Safety Analysis.
Ramp Terminal -1	I-495 @ MD-185	Ramp Terminal	No	-	-	-	-	-	Ramp Terminal located at south of I-495 @ MD-185.
Ramp Terminal -2	I-495 @ MD-185	Ramp Terminal	No	-	-	-	-	-	Ramp Terminal located at north of I-495 @ MD-185.
Ramp Terminal	I-495 @ US-1	Ramp Terminal	No	-	-	-	-	-	Ramp Terminal located at south of I-

Unique FID	Interchange	Site Type	Speed-Change Lane	ID_RTE_NO	ID_MP	END_MP	ROAD_NAME	ROUTEID	Note
-3									495 @ US-1.
Ramp Terminal -4	I-495 @ US-1	Ramp Terminal	No	-	-	-	-	-	Ramp Terminal located at north of I-495 @ US-1.

APPENDIX III – THE IHSDM RESULTS

Freeway Segments (ADT 2014)

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
6	1	Eight-lane Freeway	95	Freeway	0.03	2.3	76.7159	1.01
14	2	Eight-lane Freeway	95	Freeway	0.105	5.38	51.1942	0.68
16	3	Four-lane Freeway	295	Freeway	0.02	0	0	0
20	4	Four-lane Freeway	295	Freeway	1.151	38.06	33.065	0.87
31	5	Eight-lane Freeway	495	Freeway	0.0065	0.42	65.207	0.88
69	6	Eight-lane Freeway	495	Freeway	0.01	0.61	61.4226	0.79
75	7	Eight-lane Freeway	495	Freeway	0.02	1.2	60.0425	0.77
76	8	Eight-lane Freeway	495	Freeway	0.015	1	66.6967	0.9
77	9	Eight-lane Freeway	495	Freeway	0.06	3.91	65.234	0.81
78	10	Eight-lane Freeway	495	Freeway	0.03	3.7	123.2585	1.58
79	11	Eight-lane Freeway	495	Freeway	0.0235	1.51	64.3099	0.87
80	12	Eight-lane Freeway	495	Freeway	0.11	5.56	50.5145	0.69
81	13	Eight-lane Freeway	495	Freeway	0.035	1.75	49.9282	0.69
103	14	Four-lane Freeway	295	Freeway	0.11	0	0	0
111	15	Four-lane Freeway	295	Freeway	0	0	0	0
119	16	Four-lane Freeway	295	Freeway	0.2	4.73	23.6435	0.79
123	17	Four-lane Freeway	295	Freeway	0.0198	0.86	43.3907	1.14
129	18	Five-lane Freeway	295	Freeway	0.035	0	0	0
132	19	Eight-lane Freeway	95	Freeway	0	0	0	0
133	20	Eight-lane Freeway	95	Freeway	0.0255	1.75	68.7776	0.92
134	21	Eight-lane Freeway	95	Freeway	0.015	1.1	73.423	0.97
135	22	Eight-lane Freeway	95	Freeway	0.16	6.8	42.4997	0.64
136	23	Eight-lane Freeway	95	Freeway	0.01	0.67	66.7566	0.96

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
137	24	Eight-lane Freeway	95	Freeway	0.092	4.18	45.4272	0.66
138	25	Eight-lane Freeway	95	Freeway	0.0075	0.54	71.777	1.04
140	26	Eight-lane Freeway	495	Freeway	0.2152	11.71	54.4032	0.7
141	27	Eight-lane Freeway	495	Freeway	0.0105	0.64	61.2754	0.79
143	28	Four-lane Freeway	295	Freeway	0.07	0	0	0
144	29	Eight-lane Freeway	95	Freeway	0.025	1.62	64.8249	0.87
162	30	Four-lane Freeway	295	Freeway	0.02	0.98	49.0772	1.24
164	31	Four-lane Freeway	295	Freeway	0.0075	0	0	0
165	32	Eight-lane Freeway	95	Freeway	0.02	1.15	57.3105	0.72
166	33	Eight-lane Freeway	95	Freeway	0.1552	7.08	45.5889	0.64
168	34	Eight-lane Freeway	95	Freeway	0.0325	1.99	61.3369	0.79
170	35	Eight-lane Freeway	95	Freeway	0.017	1.13	66.2166	0.84
171	36	Eight-lane Freeway	95	Freeway	0.0548	3.08	56.3453	0.71
172	37	Eight-lane Freeway	495	Freeway	0.084	8.64	102.881	1.24
173	38	Eight-lane Freeway	495	Freeway	0.0555	2.69	48.5453	0.67

Freeway Segments (ADT 2040)

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
6	1	Eight-lane Freeway	95	Freeway	0.03	2.73	90.9138	1.07
14	2	Eight-lane Freeway	95	Freeway	0.105	6.32	60.2383	0.72
16	3	Four-lane Freeway	295	Freeway	0.02	0	0	0
20	4	Four-lane Freeway	295	Freeway	1.151	42.56	36.9723	0.9
31	5	Eight-lane Freeway	495	Freeway	0.0065	0.46	71.4341	0.9
69	6	Eight-lane Freeway	495	Freeway	0.01	0.67	67.2624	0.81
75	7	Eight-lane Freeway	495	Freeway	0.02	1.32	65.7848	0.8
76	8	Eight-lane Freeway	495	Freeway	0.015	1.1	73.0606	0.92
77	9	Eight-lane Freeway	495	Freeway	0.06	4.56	76.0546	0.89
78	10	Eight-lane Freeway	495	Freeway	0.03	4.06	135.3156	1.63
79	11	Eight-lane Freeway	495	Freeway	0.0235	1.66	70.4153	0.89
80	12	Eight-lane Freeway	495	Freeway	0.11	6.1	55.462	0.71
81	13	Eight-lane Freeway	495	Freeway	0.035	1.92	54.7484	0.71
103	14	Four-lane Freeway	295	Freeway	0.11	0	0	0
111	15	Four-lane Freeway	295	Freeway	0	0	0	0
119	16	Four-lane Freeway	295	Freeway	0.2	5.23	26.1549	0.81
123	17	Four-lane Freeway	295	Freeway	0.0198	0.95	48.32	1.17
129	18	Five-lane Freeway	295	Freeway	0.035	0	0	0
132	19	Eight-lane Freeway	95	Freeway	0	0	0	0
133	20	Eight-lane Freeway	95	Freeway	0.0255	2.07	81.1868	0.97
134	21	Eight-lane Freeway	95	Freeway	0.015	1.31	87.1032	1.03
135	22	Eight-lane Freeway	95	Freeway	0.16	8.1	50.645	0.68
136	23	Eight-lane Freeway	95	Freeway	0.01	0.79	79.1896	1.01
137	24	Eight-lane Freeway	95	Freeway	0.092	5.01	54.4475	0.7
138	25	Eight-lane Freeway	95	Freeway	0.0075	0.64	85.5942	1.1

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
140	26	Eight-lane Freeway	495	Freeway	0.2152	12.83	59.6021	0.72
141	27	Eight-lane Freeway	495	Freeway	0.0105	0.7	66.9325	0.81
143	28	Four-lane Freeway	295	Freeway	0.07	0	0	0
144	29	Eight-lane Freeway	95	Freeway	0.025	1.89	75.6359	0.91
162	30	Four-lane Freeway	295	Freeway	0.02	1.08	54.1495	1.28
164	31	Four-lane Freeway	295	Freeway	0.0075	0	0	0
165	32	Eight-lane Freeway	95	Freeway	0.02	1.35	67.6057	0.76
166	33	Eight-lane Freeway	95	Freeway	0.1552	8.31	53.498	0.68
168	34	Eight-lane Freeway	95	Freeway	0.0325	2.34	72.1547	0.84
170	35	Eight-lane Freeway	95	Freeway	0.017	1.35	79.2519	0.89
171	36	Eight-lane Freeway	95	Freeway	0.0548	3.64	66.4816	0.75
172	37	Eight-lane Freeway	495	Freeway	0.084	9.45	112.5349	1.28
173	38	Eight-lane Freeway	495	Freeway	0.0555	2.96	53.2475	0.69

Freeway Segments by Crash Severity (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
Freeway	6	1	0.009	0.024	0.1738	0.4204	1.6728	2.3	0.0105	0.0281	0.2043	0.4707	2.0164	2.73
Freeway	14	2	0.0259	0.0707	0.4505	0.9037	3.9292	5.38	0.0303	0.0823	0.5247	1.0045	4.6782	6.32
Freeway	16	3	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	20	4	0.178	0.4786	3.0293	6.7522	27.6219	38.06	0.1982	0.5316	3.3668	7.2592	31.2042	42.56
Freeway	31	5	0.0016	0.0044	0.0318	0.0775	0.3047	0.42	0.0018	0.0048	0.0347	0.0822	0.3365	0.46
Freeway	69	6	0.0024	0.0065	0.0468	0.1117	0.4426	0.61	0.0026	0.007	0.051	0.1186	0.4908	0.67
Freeway	75	7	0.0047	0.0126	0.0903	0.209	0.8834	1.2	0.0052	0.0137	0.0985	0.2222	0.9804	1.32
Freeway	76	8	0.0039	0.0104	0.0757	0.1847	0.7253	1	0.0043	0.0114	0.0826	0.1959	0.8058	1.1
Freeway	77	9	0.0177	0.0473	0.3171	0.6534	2.8745	3.91	0.0204	0.0547	0.3665	0.7362	3.3822	4.56
Freeway	78	10	0.0164	0.0446	0.2839	0.5589	2.7962	3.7	0.0178	0.0485	0.3088	0.5916	3.0933	4.06
Freeway	79	11	0.0058	0.0156	0.1133	0.2767	1.0986	1.51	0.0064	0.0171	0.1238	0.2934	1.2193	1.66
Freeway	80	12	0.0216	0.058	0.4201	1.0333	4.027	5.56	0.0237	0.0634	0.46	1.0975	4.4554	6.1
Freeway	81	13	0.0071	0.0188	0.1341	0.3112	1.2788	1.75	0.0078	0.0206	0.1467	0.3304	1.4145	1.92
Freeway	103	14	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	111	15	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	119	16	0.0252	0.0685	0.4056	0.9307	3.3	4.73	0.0281	0.076	0.4505	0.9837	3.6917	5.23
Freeway	123	17	0.0044	0.0119	0.075	0.1451	0.6236	0.86	0.0049	0.0131	0.083	0.1552	0.6938	0.95
Freeway	129	18	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	132	19	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	133	20	0.0079	0.0204	0.1427	0.3065	1.2725	1.75	0.0092	0.0239	0.167	0.3417	1.5282	2.07
Freeway	134	21	0.0043	0.0115	0.0834	0.2018	0.799	1.1	0.0051	0.0135	0.0981	0.2261	0.9672	1.31
Freeway	135	22	0.0301	0.0785	0.5471	1.2529	4.8914	6.8	0.0359	0.0933	0.6514	1.3971	5.9223	8.1
Freeway	136	23	0.0026	0.007	0.0505	0.1275	0.4824	0.67	0.0031	0.0082	0.0598	0.1423	0.5766	0.79
Freeway	137	24	0.0216	0.0563	0.3458	0.7249	3.0314	4.18	0.0258	0.0671	0.4125	0.8124	3.6922	5.01
Freeway	138	25	0.0021	0.0056	0.0406	0.1028	0.3889	0.54	0.0025	0.0067	0.0483	0.115	0.4675	0.64
Freeway	140	26	0.0494	0.1301	0.9261	2.0762	8.5282	11.71	0.0539	0.1417	1.009	2.2057	9.4197	12.83

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
Freeway	141	27	0.0025	0.0068	0.0492	0.1173	0.4642	0.64	0.0028	0.0074	0.0534	0.1244	0.512	0.7
Freeway	143	28	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	144	29	0.0075	0.0207	0.135	0.29	1.1668	1.62	0.0087	0.0239	0.1559	0.3197	1.3818	1.89
Freeway	162	30	0.004	0.0107	0.0774	0.1832	0.7047	0.98	0.0044	0.0117	0.0848	0.1954	0.7837	1.08
Freeway	164	31	0	0	0	0	0	0	0	0	0	0	0	0
Freeway	165	32	0.0044	0.0118	0.0857	0.2028	0.8453	1.15	0.0052	0.0138	0.1	0.227	1.004	1.35
Freeway	166	33	0.0329	0.0891	0.5863	1.2572	5.1145	7.08	0.0385	0.1038	0.6836	1.3912	6.0929	8.31
Freeway	168	34	0.009	0.025	0.162	0.3394	1.4546	1.99	0.0105	0.029	0.1884	0.3783	1.7338	2.34
Freeway	170	35	0.0043	0.0116	0.0843	0.2	0.8298	1.13	0.0052	0.0137	0.0997	0.226	1.0054	1.35
Freeway	171	36	0.0119	0.0317	0.2302	0.5443	2.2619	3.08	0.0139	0.037	0.2685	0.6095	2.7111	3.64
Freeway	172	37	0.037	0.1023	0.6637	1.3542	6.4828	8.64	0.0401	0.1106	0.7185	1.4345	7.1463	9.45
Freeway	173	38	0.0118	0.0307	0.2142	0.4672	1.9661	2.69	0.0129	0.0336	0.2344	0.4959	2.1832	2.96
Total	**NA**	**NA**	**0.567**	**1.5217**	**10.0715**	**22.3167**	**92.2631**	**126.74**	**0.6397**	**1.7112**	**11.3352**	**24.1835**	**105.5904**	**143.46**

Speed-Change Lanes (Ramp-Entrances) (ADT 2014)

Unique FID	Site No.	Type	Highway	Site Description	Length (mi)	Expected No. Crashes for Evaluation Period	Travel Crash Rate (crashes/million veh-mi)
14	1	Eight-lane Freeway Speed Change	95	EN	0.09	4.35	0.64
75	2	Eight-lane Freeway Speed Change	495	EN	0.04	2.95	0.95
76	3	Eight-lane Freeway Speed Change	495	EN	0.03	2.41	1.08
77	4	Eight-lane Freeway Speed Change	495	EN	0.12	5.75	0.6
79	5	Eight-lane Freeway Speed Change	495	EN	0.047	2.8	0.8
111	6	Four-lane Freeway Speed Change	295	EN	0.04	2.18	1.65
123	7	Four-lane Freeway Speed Change	295	EN	0.079	3.79	1.26
129	8	Five-lane Freeway	295	EN	0.14	0	0
132	9	Eight-lane Freeway Speed Change	95	EN	0.01	4.41	5.92
133	10	Eight-lane Freeway Speed Change	95	EN	0.051	2.62	0.69
136	11	Eight-lane Freeway Speed Change	95	EN	0.04	2.59	0.93
138	12	Eight-lane Freeway Speed Change	95	EN	0.03	2.44	1.17
144	13	Eight-lane Freeway Speed Change	95	EN	0.05	3.07	0.82
164	14	Four-lane Freeway Speed Change	295	EN	0.03	0	0
168	15	Eight-lane Freeway Speed Change	95	EN	0.065	4.05	0.8
170	16	Eight-lane Freeway Speed Change	95	EN	0.068	3.64	0.68

Speed-Change Lanes (Ramp-Exits) (ADT 2014)

Unique FID	Site No.	Type	Highway	Site Description	Length (mi)	Expected No. Crashes for Evaluation Period	Travel Crash Rate (crashes/million veh-mi)
78	1	Eight-lane Freeway Speed Change	495	EX	0.06	3.59	0.77
111	2	Four-lane Freeway Speed Change	295	EX	0.04	1	0.76
123	3	Four-lane Freeway Speed Change	295	EX	0.079	2.13	0.7
129	4	Five-lane Freeway	295	EX	0.14	0	0
132	5	Eight-lane Freeway Speed Change	95	EX	0.01	0.53	0.71
133	6	Eight-lane Freeway Speed Change	95	EX	0.051	1.91	0.5
136	7	Eight-lane Freeway Speed Change	95	EX	0.04	1.45	0.52
138	8	Eight-lane Freeway Speed Change	95	EX	0.03	1.11	0.54
164	9	Four-lane Freeway Speed Change	295	EX	0.03	0	0
170	10	Eight-lane Freeway Speed Change	95	EX	0.068	2.62	0.49
171	11	Eight-lane Freeway Speed Change	95	EX	0.073	2.82	0.48
172	12	Eight-lane Freeway Speed Change	495	EX	0.112	5.88	0.63

Speed-Change Lanes (Ramp-Entrances) (ADT 2040)

Unique FID	Site No.	Type	Highway	Site Description	Length (mi)	Expected No. Crashes for Evaluation Period	Travel Crash Rate (crashes/million veh-mi)
14	1	Eight-lane Freeway Speed Change	95	EN	0.09	4.9	0.65
75	2	Eight-lane Freeway Speed Change	495	EN	0.04	3.15	0.95
76	3	Eight-lane Freeway Speed Change	495	EN	0.03	2.58	1.09
77	4	Eight-lane Freeway Speed Change	495	EN	0.12	6.21	0.6
79	5	Eight-lane Freeway Speed Change	495	EN	0.047	3	0.81
111	6	Four-lane Freeway Speed Change	295	EN	0.04	2.37	1.66
123	7	Four-lane Freeway Speed Change	295	EN	0.079	4.14	1.27
129	8	Five-lane Freeway	295	EN	0.14	0	0
132	9	Eight-lane Freeway Speed Change	95	EN	0.01	5	6
133	10	Eight-lane Freeway Speed Change	95	EN	0.051	2.96	0.7
136	11	Eight-lane Freeway Speed Change	95	EN	0.04	2.94	0.94
138	12	Eight-lane Freeway Speed Change	95	EN	0.03	2.77	1.18
144	13	Eight-lane Freeway Speed Change	95	EN	0.05	3.46	0.83
164	14	Four-lane Freeway Speed Change	295	EN	0.03	0	0
168	15	Eight-lane Freeway Speed Change	95	EN	0.065	4.55	0.81
170	16	Eight-lane Freeway Speed Change	95	EN	0.068	4.18	0.69

Speed-Change Lanes (Ramp-Exits) (ADT 2040)

Unique FID	Site No.	Type	Highway	Site Description	Length (mi)	Expected No. Crashes for Evaluation Period	Travel Crash Rate (crashes/million veh-mi)
78	1	Eight-lane Freeway Speed Change	495	EX	0.06	3.78	0.76
111	2	Four-lane Freeway Speed Change	295	EX	0.04	1.06	0.74
123	3	Four-lane Freeway Speed Change	295	EX	0.079	2.26	0.69
129	4	Five-lane Freeway	295	EX	0.14	0	0
132	5	Eight-lane Freeway Speed Change	95	EX	0.01	0.57	0.69
133	6	Eight-lane Freeway Speed Change	95	EX	0.051	2.08	0.49
136	7	Eight-lane Freeway Speed Change	95	EX	0.04	1.58	0.5
138	8	Eight-lane Freeway Speed Change	95	EX	0.03	1.22	0.52
164	9	Four-lane Freeway Speed Change	295	EX	0.03	0	0
170	10	Eight-lane Freeway Speed Change	95	EX	0.068	2.88	0.48
171	11	Eight-lane Freeway Speed Change	95	EX	0.073	3.07	0.48
172	12	Eight-lane Freeway Speed Change	495	EX	0.112	6.18	0.63

Speed-Change Lanes by Crash Severity (Ramp-Entrances) (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
SC_EN	14	1	0.0216	0.0588	0.3763	0.7592	3.1341	4.35	0.0254	0.0689	0.4413	0.8498	3.5146	4.9
SC_EN	75	2	0.014	0.0371	0.2669	0.6174	2.0146	2.95	0.0153	0.0405	0.2909	0.656	2.1473	3.15
SC_EN	76	3	0.009	0.0242	0.1756	0.4287	1.7725	2.41	0.0099	0.0266	0.1927	0.4569	1.8939	2.58
SC_EN	77	4	0.0243	0.0645	0.4459	0.9534	4.2619	5.75	0.027	0.0715	0.4946	1.0308	4.5861	6.21
SC_EN	79	5	0.0106	0.0283	0.2053	0.5013	2.0545	2.8	0.0118	0.0315	0.2283	0.5411	2.1873	3
SC_EN	111	6	0.0131	0.0352	0.2218	0.4521	1.4578	2.18	0.0147	0.0395	0.2491	0.4863	1.5804	2.37
SC_EN	123	7	0.0246	0.0664	0.4207	0.8133	2.465	3.79	0.0277	0.0746	0.473	0.8846	2.6801	4.14
SC_EN	129	8	0	0	0	0	0	0	0	0	0	0	0	0
SC_EN	132	9	0.0214	0.0555	0.3875	0.8336	3.112	4.41	0.0254	0.0656	0.4586	0.9395	3.5109	5
SC_EN	133	10	0.0085	0.0221	0.154	0.3307	2.1047	2.62	0.0101	0.0261	0.1823	0.3729	2.3686	2.96
SC_EN	136	11	0.0116	0.0311	0.2252	0.5686	1.7535	2.59	0.0138	0.0369	0.2674	0.6363	1.9856	2.94
SC_EN	138	12	0.0114	0.0306	0.2215	0.5613	1.6152	2.44	0.0135	0.0361	0.2622	0.6246	1.8336	2.77
SC_EN	144	13	0.0148	0.0409	0.267	0.5734	2.1739	3.07	0.0174	0.048	0.3134	0.6423	2.4389	3.46
SC_EN	164	14	0	0	0	0	0	0	0	0	0	0	0	0
SC_EN	168	15	0.0187	0.0519	0.3369	0.7066	2.9359	4.05	0.0218	0.0602	0.3914	0.7871	3.2895	4.55
SC_EN	170	16	0.0148	0.0395	0.2866	0.68	2.6191	3.64	0.0178	0.0475	0.3446	0.7815	2.9886	4.18
Total	**NA**	**NA**	**0.2184**	**0.5861**	**3.9912**	**8.7796**	**33.4747**	**47.05**	**0.2516**	**0.6735**	**4.5898**	**9.6897**	**37.0054**	**52.21**

Speed-Change Lanes by Crash Severity (Ramp-Exits) (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
SC_EX	78	1	0.0133	0.0355	0.2391	0.5025	2.7996	3.59	0.0142	0.0379	0.2551	0.5218	2.951	3.78
SC_EX	111	2	0.0052	0.0139	0.0878	0.179	0.7141	1	0.0056	0.015	0.0948	0.185	0.7596	1.06
SC_EX	123	3	0.01	0.0271	0.1715	0.3316	1.5898	2.13	0.0108	0.0292	0.1852	0.3463	1.6885	2.26
SC_EX	129	4	0	0	0	0	0	0	0	0	0	0	0	0
SC_EX	132	5	0.0041	0.0107	0.0749	0.1612	0.2791	0.53	0.0046	0.012	0.0838	0.1717	0.2979	0.57
SC_EX	133	6	0.0083	0.0216	0.1509	0.3241	1.4051	1.91	0.0093	0.0241	0.1688	0.3454	1.5324	2.08
SC_EX	136	7	0.0056	0.0149	0.1082	0.2732	1.0481	1.45	0.0063	0.0169	0.1222	0.2909	1.1437	1.58
SC_EX	138	8	0.0046	0.0123	0.0888	0.225	0.7793	1.11	0.0052	0.0139	0.1007	0.2399	0.8603	1.22
SC_EX	164	9	0	0	0	0	0	0	0	0	0	0	0	0
SC_EX	170	10	0.0096	0.0256	0.1857	0.4405	1.9586	2.62	0.0108	0.0288	0.2093	0.4747	2.1564	2.88
SC_EX	171	11	0.0102	0.0274	0.1985	0.4695	2.1144	2.82	0.0114	0.0305	0.2214	0.5025	2.3042	3.07
SC_EX	172	12	0.028	0.0765	0.4064	0.7734	4.5957	5.88	0.0298	0.0811	0.431	0.8027	4.8354	6.18
Total	**NA**	**NA**	**0.0989**	**0.2655**	**1.7118**	**3.68**	**17.2838**	**23.04**	**0.108**	**0.2894**	**1.8723**	**3.8809**	**18.5294**	**24.68**

Ramps (ADT 2014)

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
0	1	One-lane Ramp Entrance	95	Entrance Ramp	0.023	0.04	1.6484	0.79
3	2	One-lane Ramp Entrance	95	Entrance Ramp	0.028	1.13	40.4993	6.34
7	3	One-lane Ramp Entrance	95	Entrance Ramp	0.05	0.03	0.6144	2.4
8	4	One-lane Ramp Entrance	95	Entrance Ramp	0.015	0.04	2.6835	0.7
12	5	One-lane Ramp Entrance	95	Entrance Ramp	0.029	0.08	2.6889	0.85
13	6	One-lane Ramp Entrance	495	Entrance Ramp	0.023	0.04	1.5816	0.91
19	7	One-lane Ramp Entrance	495	Entrance Ramp	0.023	0.17	7.5863	6.88
21	8	One-lane Ramp Entrance	95	Entrance Ramp	0.035	0.66	18.954	3.2
22	9	One-lane Ramp Entrance	95	Entrance Ramp	0.11	0.38	3.4839	1.2
23	10	One-lane Ramp Entrance	495	Entrance Ramp	0.028	0.29	10.4385	4.22
24	11	One-lane Ramp Entrance	495	Entrance Ramp	0.028	0.15	5.231	0.97
27	12	One-lane Ramp Entrance	95	Entrance Ramp	0.136	1.23	9.0646	4.83
50	13	One-lane Ramp Entrance	495	Entrance Ramp	0.035	0.44	12.583	5.09
51	14	One-lane Ramp Entrance	495	Entrance Ramp	0.031	0.48	15.5827	2.9
52	15	One-lane Ramp Entrance	495	Entrance Ramp	0.022	0.22	9.8111	5.62
56	16	One-lane Ramp Entrance	495	Entrance Ramp	0.012	0.08	6.9717	6.32
57	17	One-lane Ramp Entrance	495	Entrance Ramp	0.151	0.61	4.0465	2.32
59	18	One-lane Ramp Entrance	495	Entrance Ramp	0.115	0.89	7.707	6.99
61	19	One-lane Ramp Entrance	495	Entrance Ramp	0.029	0.17	5.7515	3.3
65	20	One-lane Ramp Entrance	495	Entrance Ramp	0.057	0.18	3.1359	0.58
66	21	One-lane Ramp Entrance	495	Entrance Ramp	0.025	0.26	10.2503	5.88
70	22	One-lane Ramp Entrance	495	Entrance Ramp	0.068	0.12	1.8315	0.74
71	23	One-lane Ramp Entrance	495	Entrance Ramp	0.089	0.5	5.6205	1.04
72	24	One-lane Ramp Entrance	495	Entrance Ramp	0.02	0.04	2.2475	2.04

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
83	25	One-lane Ramp Entrance	95	Entrance Ramp	0.033	0.1	3.0128	0.95
89	26	One-lane Ramp Entrance	95	Entrance Ramp	0.125	3.19	25.549	6.64
92	27	One-lane Ramp Entrance	95	Entrance Ramp	0.127	0.48	3.7512	1.79
94	28	One-lane Ramp Entrance	95	Entrance Ramp	0.092	0.17	1.8525	0.64
97	29	One-lane Ramp Entrance	95	Entrance Ramp	0.044	0.16	3.5428	1.89
102	30	One-lane Ramp Entrance	95	Entrance Ramp	0.077	0.32	4.2013	1.33
105	31	One-lane Ramp Entrance	95	Entrance Ramp	0.051	0.03	0.6205	2.43
110	32	One-lane Ramp Entrance	95	Entrance Ramp	0.1	4.08	40.8272	6.89
113	33	One-lane Ramp Entrance	95	Entrance Ramp	0.075	2.47	32.9585	5.56
114	34	One-lane Ramp Entrance	95	Entrance Ramp	0.02	0.19	9.514	3
117	35	One-lane Ramp Entrance	95	Entrance Ramp	0.027	1.1	40.5705	6.35
122	36	One-lane Ramp Entrance	95	Entrance Ramp	0.111	0.39	3.5024	1.11
125	37	One-lane Ramp Entrance	95	Entrance Ramp	0.019	0.01	0.5675	2.22
126	38	One-lane Ramp Entrance	95	Entrance Ramp	0.03	0.49	16.2422	2.74
127	39	One-lane Ramp Entrance	95	Entrance Ramp	0.03	0.11	3.6593	1.16
130	40	One-lane Ramp Entrance	95	Entrance Ramp	0.21	0.12	0.5668	2.22
149	41	One-lane Ramp Entrance	95	Entrance Ramp	0.105	2.92	27.8022	4.35
150	42	One-lane Ramp Entrance	95	Entrance Ramp	0.032	1.27	39.776	6.23
151	43	One-lane Ramp Entrance	95	Entrance Ramp	0.038	1.25	32.9196	5.16
152	44	One-lane Ramp Entrance	495	Entrance Ramp	0.049	0.08	1.6896	0.68
158	45	One-lane Ramp Entrance	95	Entrance Ramp	0.01	0.05	4.8277	2.57

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
1	1	Two-lane Ramp Exit	495	Exit Ramp	0.02	1.19	59.3171	15.94
2	2	One-lane Ramp Exit	495	Exit Ramp	0.03	0.08	2.5918	0.56
4	3	Two-lane Ramp Exit	495	Exit Ramp	0.116	0.46	3.996	0.8
9	4	One-lane Ramp Exit	95	Exit Ramp	0.03	0.08	2.5791	0.69
10	5	One-lane Ramp Exit	95	Exit Ramp	0.026	0.06	2.1439	0.86
11	6	One-lane Ramp Exit	495	Exit Ramp	0.022	0.04	1.63	0.6
17	7	Two-lane Ramp Exit	95	Exit Ramp	0.078	0.46	5.8386	1.27
18	8	One-lane Ramp Exit	95	Exit Ramp	0.022	0.02	0.9554	0.75
25	9	One-lane Ramp Exit	95	Exit Ramp	0.011	0.36	32.3063	10.3
26	10	One-lane Ramp Exit	95	Exit Ramp	0.021	0.05	2.514	7.87
28	11	One-lane Ramp Exit	95	Exit Ramp	0.024	0.18	7.2897	0.93
29	12	One-lane Ramp Exit	95	Exit Ramp	0.022	0.16	7.0496	1.04
53	13	One-lane Ramp Exit	495	Exit Ramp	0.094	1.35	14.3939	2.9
54	14	One-lane Ramp Exit	495	Exit Ramp	0.006	0.01	2.2052	0.81
55	15	Two-lane Ramp Exit	495	Exit Ramp	0.039	1.23	31.6401	16.69
58	16	One-lane Ramp Exit	495	Exit Ramp	0.025	0.08	3.2693	0.66
60	17	Two-lane Ramp Exit	495	Exit Ramp	0.02	0.64	32.2185	16.99
62	18	Two-lane Ramp Exit	495	Exit Ramp	0.039	0.15	3.9611	0.8
63	19	One-lane Ramp Exit	495	Exit Ramp	0.022	0.06	2.8723	1.05
64	20	Two-lane Ramp Exit	495	Exit Ramp	0.066	0.39	5.9508	1.29
67	21	One-lane Ramp Exit	495	Exit Ramp	0.02	0.03	1.4975	1.2
68	22	One-lane Ramp Exit	495	Exit Ramp	0.033	0.12	3.4905	1.28
73	23	One-lane Ramp Exit	495	Exit Ramp	0.024	0.08	3.3674	0.73
74	24	One-lane Ramp Exit	495	Exit Ramp	0.02	0.03	1.4975	1.2
82	25	One-lane Ramp Exit	95	Exit Ramp	0.021	0.12	5.5414	17.35

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
84	26	One-lane Ramp Exit	95	Exit Ramp	0.048	0.29	6.0322	18.89
85	27	One-lane Ramp Exit	95	Exit Ramp	0.026	0.63	24.3733	7.77
87	28	One-lane Ramp Exit	95	Exit Ramp	0.135	1.48	10.9486	4.38
90	29	Two-lane Ramp Exit	95	Exit Ramp	0.113	0.7	6.1464	1.64
93	30	Two-lane Ramp Exit	95	Exit Ramp	0.034	0.17	4.9609	1.33
98	31	Two-lane Ramp Exit	95	Exit Ramp	0.097	0.55	5.6611	1.23
101	32	Two-lane Ramp Exit	95	Exit Ramp	0.203	1.64	8.1032	1.03
104	33	One-lane Ramp Exit	95	Exit Ramp	0.101	0.67	6.6659	1.01
106	34	One-lane Ramp Exit	95	Exit Ramp	0.04	0.91	22.7189	7.25
107	35	One-lane Ramp Exit	95	Exit Ramp	0.088	0.56	6.4037	0.94
108	36	One-lane Ramp Exit	95	Exit Ramp	0.259	0.32	1.2307	1.13
109	37	One-lane Ramp Exit	95	Exit Ramp	0.027	0.12	4.6277	14.49
112	38	One-lane Ramp Exit	95	Exit Ramp	0.03	0.14	4.5053	0.68
115	39	One-lane Ramp Exit	95	Exit Ramp	0.166	1.04	6.2422	0.79
116	40	One-lane Ramp Exit	95	Exit Ramp	0.041	0.73	17.8681	5.7
118	41	One-lane Ramp Exit	95	Exit Ramp	0.025	0.02	0.5861	1.84
120	42	One-lane Ramp Exit	95	Exit Ramp	0.239	0.23	0.9554	0.75
121	43	One-lane Ramp Exit	95	Exit Ramp	0.078	0.39	5.0311	15.75
124	44	One-lane Ramp Exit	95	Exit Ramp	0.061	1.69	27.6526	8.82
128	45	One-lane Ramp Exit	95	Exit Ramp	0.029	0.19	6.4941	0.98
131	46	Two-lane Ramp Exit	95	Exit Ramp	0.027	0.3	11.2384	1.43
142	47	One-lane Ramp Exit	95	Exit Ramp	0.031	0.09	2.7932	0.89
145	48	Two-lane Ramp Exit	495	Exit Ramp	0.012	0.38	31.4618	16.59
146	49	Two-lane Ramp Exit	495	Exit Ramp	0.01	0.04	3.8248	0.77
147	50	Two-lane Ramp Exit	495	Exit Ramp	0.025	0.1	3.8243	0.77
148	51	One-lane Ramp Exit	95	Exit Ramp	0.031	0.12	3.787	1.01

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
153	52	Two-lane Ramp Exit	495	Exit Ramp	0.03	1.88	62.6822	16.84
154	53	One-lane Ramp Exit	495	Exit Ramp	0.01	0.02	1.5593	1.25
155	54	Two-lane Ramp Exit	495	Exit Ramp	0.081	0.33	4.0572	0.82
157	55	Two-lane Ramp Exit	95	Exit Ramp	0.075	0.37	4.8931	1.06
160	56	One-lane Ramp Exit	95	Exit Ramp	0.011	0.07	6.0666	2.42

Ramps (ADT 2040)

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
0	1	One-lane Ramp Entrance	95	Entrance Ramp	0.023	0.04	1.7525	0.77
3	2	One-lane Ramp Entrance	95	Entrance Ramp	0.028	1.18	42.1953	6.28
7	3	One-lane Ramp Entrance	95	Entrance Ramp	0.05	0.03	0.6756	2.31
8	4	One-lane Ramp Entrance	95	Entrance Ramp	0.015	0.04	2.9792	0.69
12	5	One-lane Ramp Entrance	95	Entrance Ramp	0.029	0.09	3.0805	0.83
13	6	One-lane Ramp Entrance	495	Entrance Ramp	0.023	0.04	1.741	0.88
19	7	One-lane Ramp Entrance	495	Entrance Ramp	0.023	0.18	7.9096	6.77
21	8	One-lane Ramp Entrance	95	Entrance Ramp	0.035	0.72	20.4501	3.15
22	9	One-lane Ramp Entrance	95	Entrance Ramp	0.11	0.41	3.713	1.18
23	10	One-lane Ramp Entrance	495	Entrance Ramp	0.028	0.32	11.2682	4.12
24	11	One-lane Ramp Entrance	495	Entrance Ramp	0.028	0.15	5.4409	0.97
27	12	One-lane Ramp Entrance	95	Entrance Ramp	0.136	1.4	10.2818	4.62
50	13	One-lane Ramp Entrance	495	Entrance Ramp	0.035	0.48	13.578	4.96
51	14	One-lane Ramp Entrance	495	Entrance Ramp	0.031	0.5	16.153	2.87
52	15	One-lane Ramp Entrance	495	Entrance Ramp	0.022	0.24	10.7284	5.44
56	16	One-lane Ramp Entrance	495	Entrance Ramp	0.012	0.09	7.2688	6.22
57	17	One-lane Ramp Entrance	495	Entrance Ramp	0.151	0.67	4.4297	2.25
59	18	One-lane Ramp Entrance	495	Entrance Ramp	0.115	0.92	8.0354	6.88
61	19	One-lane Ramp Entrance	495	Entrance Ramp	0.029	0.18	6.2941	3.19
65	20	One-lane Ramp Entrance	495	Entrance Ramp	0.057	0.19	3.2652	0.58
66	21	One-lane Ramp Entrance	495	Entrance Ramp	0.025	0.28	11.2081	5.69
70	22	One-lane Ramp Entrance	495	Entrance Ramp	0.068	0.14	1.9891	0.73
71	23	One-lane Ramp Entrance	495	Entrance Ramp	0.089	0.52	5.8342	1.04
72	24	One-lane Ramp Entrance	495	Entrance Ramp	0.02	0.05	2.3449	2.01

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
83	25	One-lane Ramp Entrance	95	Entrance Ramp	0.033	0.11	3.436	0.92
89	26	One-lane Ramp Entrance	95	Entrance Ramp	0.125	3.5	28.0037	6.45
92	27	One-lane Ramp Entrance	95	Entrance Ramp	0.127	0.5	3.9752	1.76
94	28	One-lane Ramp Entrance	95	Entrance Ramp	0.092	0.18	1.9816	0.63
97	29	One-lane Ramp Entrance	95	Entrance Ramp	0.044	0.18	4.0287	1.81
102	30	One-lane Ramp Entrance	95	Entrance Ramp	0.077	0.37	4.7852	1.28
105	31	One-lane Ramp Entrance	95	Entrance Ramp	0.051	0.04	0.6823	2.34
110	32	One-lane Ramp Entrance	95	Entrance Ramp	0.1	4.4	43.9609	6.77
113	33	One-lane Ramp Entrance	95	Entrance Ramp	0.075	2.66	35.4749	5.46
114	34	One-lane Ramp Entrance	95	Entrance Ramp	0.02	0.22	10.772	2.89
117	35	One-lane Ramp Entrance	95	Entrance Ramp	0.027	1.14	42.2693	6.29
122	36	One-lane Ramp Entrance	95	Entrance Ramp	0.111	0.44	3.9927	1.07
125	37	One-lane Ramp Entrance	95	Entrance Ramp	0.019	0.01	0.624	2.14
126	38	One-lane Ramp Entrance	95	Entrance Ramp	0.03	0.53	17.541	2.7
127	39	One-lane Ramp Entrance	95	Entrance Ramp	0.03	0.12	4.1663	1.12
130	40	One-lane Ramp Entrance	95	Entrance Ramp	0.21	0.13	0.6234	2.14
149	41	One-lane Ramp Entrance	95	Entrance Ramp	0.105	3.04	28.965	4.31
150	42	One-lane Ramp Entrance	95	Entrance Ramp	0.032	1.33	41.4359	6.17
151	43	One-lane Ramp Entrance	95	Entrance Ramp	0.038	1.3	34.2896	5.11
152	44	One-lane Ramp Entrance	495	Entrance Ramp	0.049	0.09	1.835	0.67
158	45	One-lane Ramp Entrance	95	Entrance Ramp	0.01	0.06	5.487	2.46

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
1	1	Two-lane Ramp Exit	495	Exit Ramp	0.02	1.24	61.8417	15.69
2	2	One-lane Ramp Exit	495	Exit Ramp	0.03	0.08	2.7798	0.55
4	3	Two-lane Ramp Exit	495	Exit Ramp	0.116	0.49	4.2004	0.79
9	4	One-lane Ramp Exit	95	Exit Ramp	0.03	0.09	2.8634	0.66
10	5	One-lane Ramp Exit	95	Exit Ramp	0.026	0.06	2.3135	0.83
11	6	One-lane Ramp Exit	495	Exit Ramp	0.022	0.04	1.7615	0.58
17	7	Two-lane Ramp Exit	95	Exit Ramp	0.078	0.49	6.3386	1.24
18	8	One-lane Ramp Exit	95	Exit Ramp	0.022	0.02	1.0312	0.72
25	9	One-lane Ramp Exit	95	Exit Ramp	0.011	0.38	34.7176	10.01
26	10	One-lane Ramp Exit	95	Exit Ramp	0.021	0.06	2.7132	7.62
28	11	One-lane Ramp Exit	95	Exit Ramp	0.024	0.18	7.6056	0.91
29	12	One-lane Ramp Exit	95	Exit Ramp	0.022	0.17	7.5406	1.02
53	13	One-lane Ramp Exit	495	Exit Ramp	0.094	1.42	15.0647	2.85
54	14	One-lane Ramp Exit	495	Exit Ramp	0.006	0.01	2.3829	0.79
55	15	Two-lane Ramp Exit	495	Exit Ramp	0.039	1.3	33.3811	16.33
58	16	One-lane Ramp Exit	495	Exit Ramp	0.025	0.09	3.4283	0.65
60	17	Two-lane Ramp Exit	495	Exit Ramp	0.02	0.68	33.9913	16.63
62	18	Two-lane Ramp Exit	495	Exit Ramp	0.039	0.16	4.1629	0.79
63	19	One-lane Ramp Exit	495	Exit Ramp	0.022	0.07	3.0994	1.02
64	20	Two-lane Ramp Exit	495	Exit Ramp	0.066	0.42	6.3861	1.26
67	21	One-lane Ramp Exit	495	Exit Ramp	0.02	0.03	1.5835	1.17
68	22	One-lane Ramp Exit	495	Exit Ramp	0.033	0.12	3.7673	1.24
73	23	One-lane Ramp Exit	495	Exit Ramp	0.024	0.09	3.6077	0.71
74	24	One-lane Ramp Exit	495	Exit Ramp	0.02	0.03	1.5835	1.17
82	25	One-lane Ramp Exit	95	Exit Ramp	0.021	0.13	5.9798	16.8

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
84	26	One-lane Ramp Exit	95	Exit Ramp	0.048	0.31	6.5097	18.29
85	27	One-lane Ramp Exit	95	Exit Ramp	0.026	0.68	26.1898	7.55
87	28	One-lane Ramp Exit	95	Exit Ramp	0.135	1.59	11.7832	4.25
90	29	Two-lane Ramp Exit	95	Exit Ramp	0.113	0.77	6.8396	1.59
93	30	Two-lane Ramp Exit	95	Exit Ramp	0.034	0.19	5.5199	1.28
98	31	Two-lane Ramp Exit	95	Exit Ramp	0.097	0.6	6.1331	1.2
101	32	Two-lane Ramp Exit	95	Exit Ramp	0.203	1.79	8.8163	1.02
104	33	One-lane Ramp Exit	95	Exit Ramp	0.101	0.7	6.8996	1
106	34	One-lane Ramp Exit	95	Exit Ramp	0.04	0.98	24.4167	7.04
107	35	One-lane Ramp Exit	95	Exit Ramp	0.088	0.6	6.8512	0.93
108	36	One-lane Ramp Exit	95	Exit Ramp	0.259	0.36	1.3823	1.08
109	37	One-lane Ramp Exit	95	Exit Ramp	0.027	0.14	4.9941	14.03
112	38	One-lane Ramp Exit	95	Exit Ramp	0.03	0.14	4.667	0.68
115	39	One-lane Ramp Exit	95	Exit Ramp	0.166	1.08	6.5161	0.78
116	40	One-lane Ramp Exit	95	Exit Ramp	0.041	0.79	19.2056	5.54
118	41	One-lane Ramp Exit	95	Exit Ramp	0.025	0.02	0.6329	1.78
120	42	One-lane Ramp Exit	95	Exit Ramp	0.239	0.25	1.0312	0.72
121	43	One-lane Ramp Exit	95	Exit Ramp	0.078	0.42	5.4292	15.26
124	44	One-lane Ramp Exit	95	Exit Ramp	0.061	1.81	29.7158	8.57
128	45	One-lane Ramp Exit	95	Exit Ramp	0.029	0.2	6.7189	0.97
131	46	Two-lane Ramp Exit	95	Exit Ramp	0.027	0.33	12.1884	1.4
142	47	One-lane Ramp Exit	95	Exit Ramp	0.031	0.09	3.0103	0.87
145	48	Two-lane Ramp Exit	495	Exit Ramp	0.012	0.4	33.193	16.24
146	49	Two-lane Ramp Exit	495	Exit Ramp	0.01	0.04	4.0207	0.76
147	50	Two-lane Ramp Exit	495	Exit Ramp	0.025	0.1	4.0203	0.76
148	51	One-lane Ramp Exit	95	Exit Ramp	0.031	0.13	4.2005	0.98

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
153	52	Two-lane Ramp Exit	495	Exit Ramp	0.03	1.96	65.3453	16.58
154	53	One-lane Ramp Exit	495	Exit Ramp	0.01	0.02	1.6489	1.22
155	54	Two-lane Ramp Exit	495	Exit Ramp	0.081	0.34	4.2597	0.8
157	55	Two-lane Ramp Exit	95	Exit Ramp	0.075	0.4	5.316	1.04
160	56	One-lane Ramp Exit	95	Exit Ramp	0.011	0.07	6.5347	2.36

Ramp-Entrances by Crash Severity (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
EN_RAMP	0	1	0.0003	0.0008	0.0055	0.0084	0.025	0.04	0.0003	0.0009	0.0059	0.0089	0.024	0.04
EN_RAMP	3	2	0.0111	0.0335	0.2136	0.2606	0.6112	1.13	0.0116	0.0351	0.2232	0.2723	0.6378	1.18
EN_RAMP	7	3	0.0003	0.001	0.0061	0.0074	0.0152	0.03	0.0003	0.001	0.0067	0.0081	0.0139	0.03
EN_RAMP	8	4	0.0003	0.001	0.0064	0.0078	0.0245	0.04	0.0004	0.0011	0.0071	0.0087	0.0227	0.04
EN_RAMP	12	5	0.0008	0.0023	0.0148	0.0195	0.0426	0.08	0.0009	0.0026	0.0169	0.0223	0.0473	0.09
EN_RAMP	13	6	0.0004	0.0011	0.007	0.0085	0.023	0.04	0.0004	0.0012	0.0077	0.0093	0.0214	0.04
EN_RAMP	19	7	0.0013	0.0041	0.026	0.0317	0.1069	0.17	0.0014	0.0043	0.0271	0.033	0.1142	0.18
EN_RAMP	21	8	0.0065	0.0197	0.1254	0.153	0.3554	0.66	0.007	0.0213	0.1359	0.1658	0.39	0.72
EN_RAMP	22	9	0.0028	0.0086	0.0552	0.076	0.2374	0.38	0.003	0.0091	0.0588	0.081	0.2581	0.41
EN_RAMP	23	10	0.0027	0.0081	0.0517	0.0631	0.1644	0.29	0.0029	0.0088	0.0558	0.0681	0.1844	0.32
EN_RAMP	24	11	0.0014	0.0043	0.0271	0.033	0.0842	0.15	0.0015	0.0044	0.0282	0.0344	0.0815	0.15
EN_RAMP	27	12	0.0095	0.0287	0.1865	0.2704	0.7349	1.23	0.0107	0.0326	0.2115	0.3067	0.8385	1.4
EN_RAMP	50	13	0.0038	0.0114	0.0729	0.0945	0.2574	0.44	0.004	0.0123	0.0787	0.102	0.283	0.48
EN_RAMP	51	14	0.0045	0.0136	0.0865	0.1056	0.2698	0.48	0.0047	0.0141	0.0899	0.1096	0.2817	0.5
EN_RAMP	52	15	0.002	0.006	0.0381	0.0464	0.1275	0.22	0.0022	0.0065	0.0416	0.0508	0.1389	0.24
EN_RAMP	56	16	0.0006	0.0017	0.0112	0.0157	0.0508	0.08	0.0006	0.0018	0.0117	0.0164	0.0595	0.09
EN_RAMP	57	17	0.005	0.015	0.0956	0.1167	0.3777	0.61	0.0054	0.0164	0.1046	0.1276	0.416	0.67
EN_RAMP	59	18	0.0066	0.0199	0.1279	0.1665	0.5691	0.89	0.0069	0.0208	0.1333	0.1736	0.5854	0.92
EN_RAMP	61	19	0.0015	0.0045	0.0288	0.0351	0.1001	0.17	0.0016	0.0049	0.0315	0.0384	0.1036	0.18
EN_RAMP	65	20	0.0015	0.0045	0.0287	0.0366	0.1087	0.18	0.0015	0.0047	0.03	0.0382	0.1156	0.19
EN_RAMP	66	21	0.0023	0.0071	0.0451	0.0551	0.1504	0.26	0.0026	0.0078	0.0494	0.0602	0.16	0.28
EN_RAMP	70	22	0.0009	0.0028	0.0184	0.0279	0.07	0.12	0.001	0.0031	0.02	0.0302	0.0857	0.14
EN_RAMP	71	23	0.004	0.0121	0.077	0.094	0.3129	0.5	0.0041	0.0126	0.0801	0.0977	0.3255	0.52
EN_RAMP	72	24	0.0003	0.0008	0.0053	0.0081	0.0255	0.04	0.0003	0.0009	0.0056	0.0084	0.0348	0.05
EN_RAMP	83	25	0.0009	0.0026	0.017	0.0221	0.0574	0.1	0.001	0.003	0.0193	0.0251	0.0616	0.11
EN_RAMP	89	26	0.023	0.0699	0.4507	0.6152	2.0312	3.19	0.0253	0.0768	0.4952	0.6759	2.2268	3.5
EN_RAMP	92	27	0.0034	0.0104	0.0674	0.0977	0.3011	0.48	0.0036	0.011	0.0714	0.1034	0.3106	0.5
EN_RAMP	94	28	0.0015	0.0044	0.0282	0.0344	0.1015	0.17	0.0016	0.0047	0.03	0.0367	0.107	0.18
EN_RAMP	97	29	0.0011	0.0034	0.022	0.0333	0.1002	0.16	0.0013	0.0038	0.025	0.0378	0.1121	0.18
EN_RAMP	102	30	0.0032	0.0098	0.0622	0.0759	0.1689	0.32	0.0037	0.0111	0.0708	0.0864	0.198	0.37
EN_RAMP	105	31	0.0003	0.0009	0.0059	0.008	0.0149	0.03	0.0003	0.001	0.0065	0.0088	0.0234	0.04
EN_RAMP	110	32	0.0378	0.1147	0.7366	0.9712	2.2197	4.08	0.0409	0.124	0.7968	1.0507	2.3876	4.4

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
EN_RAMP	113	33	0.0215	0.0652	0.4164	0.5213	1.4456	2.47	0.0233	0.0705	0.4504	0.564	1.5518	2.66
EN_RAMP	114	34	0.0016	0.0047	0.0309	0.0468	0.106	0.19	0.0018	0.0054	0.035	0.053	0.1248	0.22
EN_RAMP	117	35	0.0107	0.0324	0.2063	0.2517	0.5989	1.1	0.0112	0.0339	0.2156	0.263	0.6163	1.14
EN_RAMP	122	36	0.0028	0.0084	0.0557	0.1002	0.2229	0.39	0.0031	0.0095	0.0634	0.1141	0.2499	0.44
EN_RAMP	125	37	0.0001	0.0003	0.0021	0.0025	0.005	0.01	0.0001	0.0004	0.0023	0.0028	0.0044	0.01
EN_RAMP	126	38	0.0042	0.0127	0.0829	0.1254	0.2648	0.49	0.0045	0.0138	0.0899	0.1361	0.2857	0.53
EN_RAMP	127	39	0.0009	0.0028	0.0179	0.0252	0.0632	0.11	0.001	0.0031	0.0203	0.0287	0.0669	0.12
EN_RAMP	130	40	0.001	0.0031	0.0203	0.0295	0.0661	0.12	0.0011	0.0034	0.0223	0.0323	0.0709	0.13
EN_RAMP	149	41	0.0259	0.0787	0.5007	0.611	1.7037	2.92	0.0271	0.0822	0.5233	0.6386	1.7688	3.04
EN_RAMP	150	42	0.012	0.0365	0.2323	0.2835	0.7057	1.27	0.0126	0.0381	0.2428	0.2962	0.7403	1.33
EN_RAMP	151	43	0.0111	0.0337	0.2143	0.2615	0.7294	1.25	0.0116	0.0352	0.2239	0.2732	0.7561	1.3
EN_RAMP	152	44	0.0006	0.0017	0.0111	0.0188	0.0478	0.08	0.0006	0.0018	0.012	0.0204	0.0552	0.09
EN_RAMP	158	45	0.0004	0.0011	0.0075	0.0114	0.0296	0.05	0.0004	0.0013	0.0085	0.0129	0.0369	0.06
Total	**NA**	**NA**	**0.2344**	**0.71**	**4.5492**	**5.8882**	**15.8282**	**27.21**	**0.2514**	**0.7623**	**4.8859**	**6.3318**	**16.9786**	**29.21**

Ramp-Exits by Crash Severity (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
EX_RAMP	1	1	0.0144	0.0437	0.1479	0.2788	0.7052	1.19	0.0151	0.0456	0.1543	0.2908	0.7342	1.24
EX_RAMP	2	2	0.0007	0.0022	0.0096	0.0145	0.053	0.08	0.0008	0.0024	0.0103	0.0155	0.051	0.08
EX_RAMP	4	3	0.0046	0.0139	0.0481	0.1124	0.281	0.46	0.0048	0.0146	0.0505	0.118	0.3021	0.49
EX_RAMP	9	4	0.0007	0.0022	0.0094	0.0142	0.0535	0.08	0.0008	0.0024	0.0104	0.0158	0.0606	0.09
EX_RAMP	10	5	0.0007	0.0021	0.0087	0.0125	0.036	0.06	0.0007	0.0022	0.0094	0.0135	0.0342	0.06
EX_RAMP	11	6	0.0004	0.0013	0.0056	0.0068	0.0259	0.04	0.0005	0.0015	0.0061	0.0074	0.0245	0.04
EX_RAMP	17	7	0.005	0.0153	0.053	0.124	0.2627	0.46	0.0055	0.0166	0.0575	0.1346	0.2758	0.49
EX_RAMP	18	8	0.0003	0.0008	0.0034	0.0041	0.0114	0.02	0.0003	0.0009	0.0037	0.0045	0.0106	0.02
EX_RAMP	25	9	0.0046	0.0141	0.0599	0.0907	0.1907	0.36	0.005	0.0151	0.0645	0.0976	0.1978	0.38
EX_RAMP	26	10	0.0008	0.0024	0.0098	0.0119	0.0251	0.05	0.0008	0.0025	0.0106	0.0129	0.0332	0.06
EX_RAMP	28	11	0.002	0.0061	0.0262	0.0396	0.1061	0.18	0.0021	0.0064	0.0273	0.0414	0.1028	0.18
EX_RAMP	29	12	0.0018	0.0056	0.0237	0.0358	0.0931	0.16	0.002	0.0059	0.0254	0.0384	0.0983	0.17
EX_RAMP	53	13	0.0177	0.0537	0.2248	0.2926	0.7612	1.35	0.0185	0.0562	0.2355	0.3065	0.8033	1.42
EX_RAMP	54	14	0.0002	0.0006	0.0024	0.0029	0.0039	0.01	0.0002	0.0006	0.0025	0.0031	0.0036	0.01
EX_RAMP	55	15	0.0144	0.0438	0.1479	0.2789	0.745	1.23	0.0152	0.0462	0.1562	0.2944	0.788	1.3
EX_RAMP	58	16	0.0011	0.0034	0.0141	0.0172	0.0442	0.08	0.0012	0.0035	0.0147	0.018	0.0526	0.09
EX_RAMP	60	17	0.0071	0.0216	0.0739	0.1508	0.3866	0.64	0.0075	0.0229	0.078	0.1592	0.4124	0.68
EX_RAMP	62	18	0.0013	0.004	0.0141	0.0379	0.0927	0.15	0.0014	0.0042	0.0149	0.0398	0.0997	0.16
EX_RAMP	63	19	0.0007	0.0023	0.0094	0.0114	0.0362	0.06	0.0008	0.0024	0.0101	0.0123	0.0444	0.07
EX_RAMP	64	20	0.0026	0.008	0.0284	0.0823	0.2687	0.39	0.0028	0.0086	0.0305	0.0884	0.2897	0.42
EX_RAMP	67	21	0.0005	0.0015	0.0064	0.0078	0.0138	0.03	0.0005	0.0016	0.0068	0.0083	0.0128	0.03
EX_RAMP	68	22	0.0016	0.0047	0.0196	0.024	0.0701	0.12	0.0017	0.0051	0.0212	0.0259	0.0661	0.12
EX_RAMP	73	23	0.0007	0.0022	0.0093	0.0141	0.0537	0.08	0.0008	0.0023	0.01	0.0151	0.0618	0.09
EX_RAMP	74	24	0.0005	0.0015	0.0064	0.0078	0.0138	0.03	0.0005	0.0016	0.0068	0.0083	0.0128	0.03
EX_RAMP	82	25	0.0015	0.0047	0.0197	0.0262	0.0679	0.12	0.0017	0.0051	0.0213	0.0284	0.0735	0.13
EX_RAMP	84	26	0.0042	0.0127	0.0527	0.0643	0.1561	0.29	0.0045	0.0137	0.0569	0.0695	0.1654	0.31
EX_RAMP	85	27	0.0086	0.0259	0.1079	0.1316	0.356	0.63	0.0092	0.0279	0.1161	0.1416	0.3852	0.68
EX_RAMP	87	28	0.0162	0.0491	0.2075	0.2925	0.9147	1.48	0.0174	0.0529	0.2236	0.3152	0.9809	1.59
EX_RAMP	90	29	0.0059	0.0179	0.0631	0.1737	0.4394	0.7	0.0065	0.0198	0.0701	0.1931	0.4805	0.77
EX_RAMP	93	30	0.0016	0.0049	0.017	0.0398	0.1067	0.17	0.0018	0.0055	0.0189	0.0443	0.1195	0.19
EX_RAMP	98	31	0.0049	0.0148	0.0506	0.1039	0.3758	0.55	0.0053	0.016	0.0548	0.1125	0.4114	0.6
EX_RAMP	101	32	0.0198	0.0601	0.2032	0.3831	0.9738	1.64	0.0217	0.0657	0.2221	0.4187	1.0618	1.79

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
EX_RAMP	104	33	0.0101	0.0308	0.1279	0.156	0.3452	0.67	0.0105	0.0319	0.1324	0.1616	0.3636	0.7
EX_RAMP	106	34	0.0135	0.0409	0.1702	0.2076	0.4778	0.91	0.0145	0.044	0.1831	0.2234	0.515	0.98
EX_RAMP	107	35	0.008	0.0241	0.1003	0.1224	0.3052	0.56	0.0085	0.0258	0.1075	0.1311	0.3271	0.6
EX_RAMP	108	36	0.005	0.0151	0.0627	0.0765	0.1607	0.32	0.0056	0.0169	0.0704	0.0859	0.1812	0.36
EX_RAMP	109	37	0.0017	0.0051	0.0214	0.03	0.0618	0.12	0.0018	0.0055	0.0231	0.0324	0.0772	0.14
EX_RAMP	112	38	0.0021	0.0063	0.026	0.0317	0.0739	0.14	0.0021	0.0065	0.0269	0.0329	0.0716	0.14
EX_RAMP	115	39	0.0133	0.0403	0.1693	0.2271	0.59	1.04	0.0139	0.0421	0.177	0.2375	0.6095	1.08
EX_RAMP	116	40	0.0107	0.0325	0.1357	0.171	0.3801	0.73	0.0115	0.035	0.146	0.184	0.4135	0.79
EX_RAMP	118	41	0.0002	0.0006	0.0028	0.0041	0.0123	0.02	0.0002	0.0007	0.003	0.0044	0.0117	0.02
EX_RAMP	120	42	0.0029	0.0089	0.0369	0.045	0.1363	0.23	0.0032	0.0096	0.0398	0.0485	0.1489	0.25
EX_RAMP	121	43	0.0055	0.0167	0.0694	0.0846	0.2138	0.39	0.0059	0.018	0.075	0.0915	0.2296	0.42
EX_RAMP	124	44	0.0229	0.0696	0.2925	0.3933	0.9117	1.69	0.0247	0.0748	0.3147	0.4231	0.9727	1.81
EX_RAMP	128	45	0.0026	0.0078	0.0323	0.0394	0.1079	0.19	0.0026	0.008	0.0334	0.0408	0.1152	0.2
EX_RAMP	131	46	0.0035	0.0106	0.0357	0.0674	0.1828	0.3	0.0038	0.0115	0.0389	0.0734	0.2024	0.33
EX_RAMP	142	47	0.0014	0.0043	0.0177	0.0216	0.045	0.09	0.0015	0.0046	0.0191	0.0233	0.0415	0.09
EX_RAMP	145	48	0.0044	0.0134	0.0453	0.0853	0.2316	0.38	0.0047	0.0141	0.0478	0.0901	0.2433	0.4
EX_RAMP	146	49	0.0003	0.0009	0.0033	0.0097	0.0258	0.04	0.0003	0.001	0.0035	0.0102	0.025	0.04
EX_RAMP	147	50	0.0008	0.0024	0.0084	0.0243	0.0641	0.1	0.0008	0.0025	0.0088	0.0255	0.0624	0.1
EX_RAMP	148	51	0.0014	0.0041	0.0177	0.0268	0.07	0.12	0.0015	0.0046	0.0196	0.0297	0.0746	0.13
EX_RAMP	153	52	0.0213	0.0647	0.2188	0.4125	1.1627	1.88	0.0223	0.0675	0.2283	0.4303	1.2116	1.96
EX_RAMP	154	53	0.0002	0.0007	0.003	0.0046	0.0115	0.02	0.0002	0.0007	0.0032	0.0048	0.0111	0.02
EX_RAMP	155	54	0.0031	0.0093	0.0317	0.0632	0.2227	0.33	0.0032	0.0098	0.0333	0.0663	0.2274	0.34
EX_RAMP	157	55	0.0048	0.0146	0.0494	0.0931	0.2081	0.37	0.0052	0.0158	0.0536	0.101	0.2244	0.4
EX_RAMP	160	56	0.0009	0.0028	0.0119	0.0162	0.0382	0.07	0.001	0.003	0.0128	0.0174	0.0358	0.07
Total	**NA**	**NA**	**0.2877**	**0.8736**	**3.374**	**5.3015**	**13.7632**	**23.6**	**0.3071**	**0.9318**	**3.6022**	**5.6621**	**14.6468**	**25.15**

Collector-Distributor Roads (ADT 2014)

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
86	1	One-lane C-D Ramp	95	C-D Road	0.08	0.1	1.1936	0.41
88	2	One-lane C-D Ramp	95	C-D Road	0.01	0.03	3.2805	1.14
91	3	One-lane C-D Ramp	95	C-D Road	0.09	0.37	4.1501	0.77
95	4	One-lane C-D Ramp	95	C-D Road	0.114	0.16	1.3764	0.42
96	5	One-lane C-D Ramp	95	C-D Road	0.08	0.16	2.0011	0.42
99	6	One-lane C-D Ramp	95	C-D Road	0.03	0.14	4.7084	0.99
100	7	One-lane C-D Ramp	95	C-D Road	0.01	0.06	5.97	0.76
156	8	One-lane C-D Ramp	95	C-D Road	0.044	0.06	1.3764	0.42
159	9	One-lane C-D Ramp	95	C-D Road	0.032	0.07	2.0895	0.64
169	10	Two-lane C-D Ramp	95	C-D Road	0.04	0.27	6.638	0.84

Collector-Distributor Roads (ADT 2040)

Unique FID	Site No.	Type	Highway	Site Description	Effective Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
86	1	One-lane C-D Ramp	95	C-D Road	0.08	0.1	1.3152	0.41
88	2	One-lane C-D Ramp	95	C-D Road	0.01	0.03	3.4019	1.07
91	3	One-lane C-D Ramp	95	C-D Road	0.09	0.39	4.3471	0.73
95	4	One-lane C-D Ramp	95	C-D Road	0.114	0.18	1.5482	0.42
96	5	One-lane C-D Ramp	95	C-D Road	0.08	0.18	2.3053	0.43
99	6	One-lane C-D Ramp	95	C-D Road	0.03	0.14	4.6339	0.86
100	7	One-lane C-D Ramp	95	C-D Road	0.01	0.07	6.9981	0.8
156	8	One-lane C-D Ramp	95	C-D Road	0.044	0.07	1.5482	0.42
159	9	One-lane C-D Ramp	95	C-D Road	0.032	0.08	2.3504	0.64
169	10	Two-lane C-D Ramp	95	C-D Road	0.04	0.31	7.7192	0.88

Collector-Distributor Roads by Crash Severity (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	Site No.	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
CD	86	1	0.0007	0.0021	0.0134	0.0185	0.0653	0.1	0.0007	0.0023	0.0146	0.0202	0.0622	0.1
CD	88	2	0.0002	0.0006	0.004	0.0075	0.0177	0.03	0.0002	0.0006	0.0041	0.0077	0.0174	0.03
CD	91	3	0.002	0.006	0.04	0.0751	0.2469	0.37	0.0021	0.0063	0.0421	0.079	0.2605	0.39
CD	95	4	0.001	0.0032	0.0207	0.0313	0.1038	0.16	0.0012	0.0035	0.0231	0.035	0.1172	0.18
CD	96	5	0.0011	0.0032	0.0209	0.0316	0.1032	0.16	0.0012	0.0037	0.0242	0.0366	0.1143	0.18
CD	99	6	0.0007	0.0022	0.0141	0.0213	0.1017	0.14	0.0007	0.0021	0.0136	0.0206	0.103	0.14
CD	100	7	0.0005	0.0015	0.0098	0.0184	0.0298	0.06	0.0006	0.0018	0.0119	0.0224	0.0333	0.07
CD	156	8	0.0004	0.0012	0.0076	0.0126	0.0382	0.06	0.0004	0.0013	0.0085	0.014	0.0458	0.07
CD	159	9	0.0005	0.0015	0.0097	0.0182	0.0401	0.07	0.0005	0.0016	0.0109	0.0204	0.0466	0.08
CD	169	10	0.0013	0.0038	0.0208	0.0603	0.1838	0.27	0.0015	0.0047	0.0254	0.0736	0.2048	0.31
Total	**NA**	**NA**	**0.0084**	**0.0253**	**0.161**	**0.2948**	**0.9305**	**1.42**	**0.0091**	**0.0279**	**0.1784**	**0.3295**	**1.0051**	**1.55**

Crossroad Ramp Terminals by Crash Severity (ADT 2014 & 2040)

K-Fatality A-Severe Injury B-Minor Injury C-Complain of Injury O-Property Damage Only

Type	Unique_FID	K_2014	A_2014	B_2014	C_2014	O_2014	Total_2014	K_2040	A_2040	B_2040	C_2040	O_2040	Total_2040
A4	Ramp Terminal -1	0.017	0.418	2.752	9.260	20.390	32.837	0.018	0.449	2.955	9.944	22.029	35.395
A4	Ramp Terminal -2	0.010	0.241	1.439	6.519	11.075	19.283	0.010	0.256	1.528	6.923	11.740	20.458
A4	Ramp Terminal -3	0.010	0.244	1.095	2.472	7.273	11.094	0.010	0.243	1.090	2.460	4.376	8.179
A4	Ramp Terminal -4	0.026	0.659	2.558	5.522	14.535	23.301	0.028	0.688	2.667	5.759	12.721	21.863
Total	**NA**	**0.063**	**1.563**	**7.844**	**23.773**	**53.272**	**86.514**	**0.065**	**1.636**	**8.241**	**25.086**	**50.867**	**85.894**

Urban/Suburban Arterial Highway – Divided (ADT 2014)

Unique FID	Site No.	Type	Highway	Site Description	Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Crash Rate (crashes/million veh-mi)
5	1	4D	185	Urban Multilane	0.03	0.67	22.3292	1.18
15	2	4D	1	Urban Multilane	0.06	1.13	18.8678	1.05
30	3	4D	1	Urban Multilane	0.03	0.29	9.6154	0.63
32	4	4D	1	Urban Multilane	0.04	0.48	12.0843	0.71
33	5	4D	185	Urban Multilane	0.06	1.18	19.6081	0.92
34	6	4D	1	Urban Multilane	0.05	0.76	15.2319	0.85
35	7	4D	185	Urban Multilane	0.02	0.46	22.7958	0.94
36	8	4D	185	Urban Multilane	0.037	0.45	12.1531	0.9
37	9	4D	1	Urban Multilane	0.029	0.33	11.4603	0.72
38	10	4D	185	Urban Multilane	0.03	0.54	18.1148	1.05
39	11	4D	185	Urban Multilane	0.06	1.37	22.823	0.95
40	12	4D	1	Urban Multilane	0.015	0.12	8.1394	0.61
41	13	4D	185	Urban Multilane	0.04	0.97	24.3615	1.01
42	14	4D	185	Urban Multilane	0.04	0.72	18.1056	1.01
43	15	4D	185	Urban Multilane	0.06	0.68	11.3139	0.66
44	16	4D	1	Urban Multilane	0.02	0.19	9.3979	0.71
45	17	4D	1	Urban Multilane	0.01	0.23	23.32	1.43
46	18	4D	185	Urban Multilane	0.04	0.49	12.1578	0.76
47	19	4D	185	Urban Multilane	0.02	0.57	28.6234	1.19
48	20	4D	1	Urban Multilane	0.077	1.11	14.455	0.88
49	21	4D	1	Urban Multilane	0.04	0.47	11.7264	0.72
139	22	4D	1	Urban Multilane	0.02	0.43	21.3041	1.3
161	23	4D	1	Urban Multilane	0.016	0.14	9.0188	0.68
163	24	4D	185	Urban Multilane	0.04	0.46	11.4825	0.66
167	25	4D	185	Urban Multilane	0.12	2.44	20.325	0.84
174	26	4D	185	Urban Multilane	0.013	0.6	46.0006	2.66

Urban/Suburban Arterial Highway – Divided (ADT 2040)

Unique FID	Site No.	Type	Highway	Site Description	Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Crash Rate (crashes/million veh-mi)
5	1	4D	185	Urban Multilane	0.03	0.74	24.5173	1.2
15	2	4D	1	Urban Multilane	0.06	1.3	21.683	1.09
30	3	4D	1	Urban Multilane	0.03	0.34	11.2238	0.65
32	4	4D	1	Urban Multilane	0.04	0.55	13.7513	0.73
33	5	4D	185	Urban Multilane	0.06	1.28	21.3527	0.94
34	6	4D	1	Urban Multilane	0.05	0.88	17.5046	0.88
35	7	4D	185	Urban Multilane	0.02	0.5	24.9872	0.97
36	8	4D	185	Urban Multilane	0.037	0.49	13.281	0.91
37	9	4D	1	Urban Multilane	0.029	0.38	13.2293	0.75
38	10	4D	185	Urban Multilane	0.03	0.59	19.7512	1.07
39	11	4D	185	Urban Multilane	0.06	1.5	24.9975	0.97
40	12	4D	1	Urban Multilane	0.015	0.14	9.4034	0.63
41	13	4D	185	Urban Multilane	0.04	1.07	26.6801	1.03
42	14	4D	185	Urban Multilane	0.04	0.8	19.8976	1.03
43	15	4D	185	Urban Multilane	0.06	0.75	12.4612	0.67
44	16	4D	1	Urban Multilane	0.02	0.22	10.8574	0.73
45	17	4D	1	Urban Multilane	0.01	0.26	25.938	1.45
46	18	4D	185	Urban Multilane	0.04	0.53	13.3469	0.78
47	19	4D	185	Urban Multilane	0.02	0.62	31.224	1.21
48	20	4D	1	Urban Multilane	0.077	1.24	16.1519	0.9
49	21	4D	1	Urban Multilane	0.04	0.53	13.1469	0.74
139	22	4D	1	Urban Multilane	0.02	0.48	23.7571	1.33
161	23	4D	1	Urban Multilane	0.016	0.17	10.4194	0.7
163	24	4D	185	Urban Multilane	0.04	0.51	12.6469	0.68
167	25	4D	185	Urban Multilane	0.12	2.67	22.2354	0.86
174	26	4D	185	Urban Multilane	0.013	0.65	50.2528	2.7

Urban/Suburban Arterial Highway – Divided by Crash Severity (ADT 2014 & 2040)

FI-Fatal & Injury PDO-Property Damage Only

Type	Unique_FID	Site No.	FI_2014	PDO_2014	Total_2014	FI_2040	PDO_2040	Total_2040
UMD	5	1	0.1679	0.4863	0.6542	0.1838	0.5345	0.7183
UMD	15	2	0.2844	0.8212	1.1055	0.3253	0.9451	1.2705
UMD	30	3	0.0729	0.2088	0.2817	0.0847	0.2441	0.3288
UMD	32	4	0.1217	0.3504	0.472	0.1379	0.3992	0.5372
UMD	33	5	0.2943	0.8546	1.1489	0.3195	0.9316	1.2511
UMD	34	6	0.1913	0.5524	0.7437	0.2189	0.6358	0.8547
UMD	35	7	0.113	0.3322	0.4452	0.1235	0.3646	0.488
UMD	36	8	0.114	0.3251	0.4391	0.1243	0.3556	0.4799
UMD	37	9	0.0839	0.2407	0.3246	0.0964	0.2782	0.3747
UMD	38	10	0.1367	0.394	0.5307	0.1487	0.43	0.5786
UMD	39	11	0.3418	0.9955	1.3373	0.3731	1.0916	1.4647
UMD	40	12	0.031	0.0883	0.1192	0.0357	0.1021	0.1377
UMD	41	13	0.2434	0.7082	0.9516	0.2657	0.7765	1.0422
UMD	42	14	0.1819	0.5253	0.7072	0.1993	0.5779	0.7773
UMD	43	15	0.1708	0.4922	0.6629	0.1875	0.5426	0.7301
UMD	44	16	0.0477	0.1359	0.1836	0.0549	0.1572	0.2121
UMD	45	17	0.0618	0.1659	0.2277	0.0687	0.1846	0.2533
UMD	46	18	0.1229	0.352	0.4749	0.1346	0.3867	0.5214
UMD	47	19	0.1479	0.4112	0.5591	0.1609	0.4489	0.6098
UMD	48	20	0.2867	0.8003	1.087	0.3195	0.8951	1.2145
UMD	49	21	0.1182	0.3398	0.4581	0.1321	0.3814	0.5136
UMD	139	22	0.1112	0.3049	0.4161	0.1237	0.3403	0.464
UMD	161	23	0.0366	0.1043	0.1409	0.0421	0.1207	0.1628
UMD	163	24	0.1155	0.333	0.4485	0.1269	0.3671	0.494
UMD	167	25	0.615	1.7669	2.3818	0.6706	1.9351	2.6057
UMD	174	26	0.16	0.424	0.584	0.1746	0.4634	0.638
Total	**NA**	**NA**	**4.3725**	**12.5134**	**16.8855**	**4.8329**	**13.8899**	**18.723**

Appendix IV – Limitations of the HSM Predictive Method

The predictive method does not account for the influence of the following conditions on freeway safety (Bonnenson, et al. 2012):

- Freeways with 11 or more through lanes in urban areas.
- Freeways with 9 or more through lanes in rural areas.
- Freeways with continuous access high-occupancy vehicle (HOV) lanes.
- Freeways with limited access managed lanes that are buffer-separated from the general purpose lanes.
- Ramp metering.
- Use of safety shoulders as travel lanes.
- Toll plazas.
- Reversible lanes.

The predictive method described in this chapter does not account for the influence of the following conditions on ramp safety (Bonnenson, et al. 2012):

- Ramp or C-D road segments in rural areas with 2 or more lanes.
- Ramp or C-D road segments in urban areas with 3 or more lanes.
- Ramps and C-D roads providing two-way travel.
- Ramp metering.
- A high-occupancy vehicle (HOV) bypass lane on a ramp or C-D road.
- A frontage-road segment.
- A frontage-road ramp terminal.
- A frontage-road crossroad terminal.
- A crossroad speed-change lane.
- A crossroad ramp terminal with 3 or more left-turn lanes on a crossroad approach.
- A crossroad ramp terminal where the crossroad provides one-way travel.
- The crossroad ramp terminal formed by a single-point urban interchange or roundabout.

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