

Appendix B

**I-64 Full Closure Project
Crash Evaluation
2009 Annual Report
Appendix B**

**Missouri S&T
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Executive Summary

On January 2, 2008, the Missouri Department of Transportation (MoDOT) closed I-64 for reconstruction. During the planning stages of this reconstruction project, the plan to close all lanes of roadways was met with concern, inciting questions from the general public like: *Could closing the roadway possibly contribute to more (or less) crashes than before on adjacent roadways? And, if noticeable changes existed in the number and types of crashes, are the changes due to closing I-64 or other influencing factors?*

This 2009 Annual Report and its companion 2008 Annual Report aims to answer these questions by examining crash data before and during the closure, and by providing objective explanations to the changes if any. This study retained the same analysis approach conducted in 2008 by conducting two separate analyses (Crash Analysis and Crash Rate Analysis). The following presents the main findings from the two analyses with the inclusion of 2009 crash information:

Crash Analysis:

The research team was provided a 6-year (2004-2009) crash data, which included all the crashes that occurred on the 17 roadways (including parts I-64 that remained opened) in the vicinity of the closure. Using this data set, 2 years closure period crashes (2008 and 2009) are compared to 4 years pre-closure crashes (2004 through 2007). Figures 1 through 3 show the trend in total crashes for roadways that could have been impacted by the I-64 construction project.

General Findings

Comparisons were based on average for the 4-year pre-closure versus 2-year closure crash data

Freeways:

- 2008 - Increase in crashes for I-44 (4.5 percent), I-55 (3.6 percent) and I-70 (8.1 percent)
- 2008 - Decrease in crashes for I-64 (51.7 percent), I-170 (6.3 percent) and I-270 (6.3 percent)
- 2009 – Increase in crashes only for I-70 (15.7 percent)
- 2009 – Decrease in crashes for I-44 (18.8 percent), I-55 (7.6 percent), I-64 (72.5 percent), I-170 (32.6 percent) and I-270 (18.8 percent)

Expressways:

- 2008 - Increase in crashes only for Route D (2.1 percent)
- 2008 - Decrease in crashes for US 40 (34.7 percent), US 61 (7.5 percent), US 67 (15.6 percent) and Route 141 (7 percent)
- 2009 – Increase in crashes only for Route 141 (15.5 percent)
- 2009 – Decrease in crashes for US 40 (11 percent), US 61 (5.1 percent), US 67 (4.2 percent) and Route D (32.2 percent)

Major Arterials:

- 2008 - Increase in crashes only for Route 100 (4.9 percent)
- 2008 - Decrease in crashes for Routes 30 (19.8 percent), 115 (6.1 percent), 180 (13.2 percent), 340 (2.9 percent) and 366 (14.9 percent)
- 2009 – Increase in crashes for Routes 100 (9.5 percent) and 115 (0.1 percent)
- 2009 – Decrease in crashes for Routes 30 (12.6 percent), 180 (19 percent), 340 (14.9 percent) and 366 (5.2 percent)

Figure 1 – All Crashes for Freeway Roadways

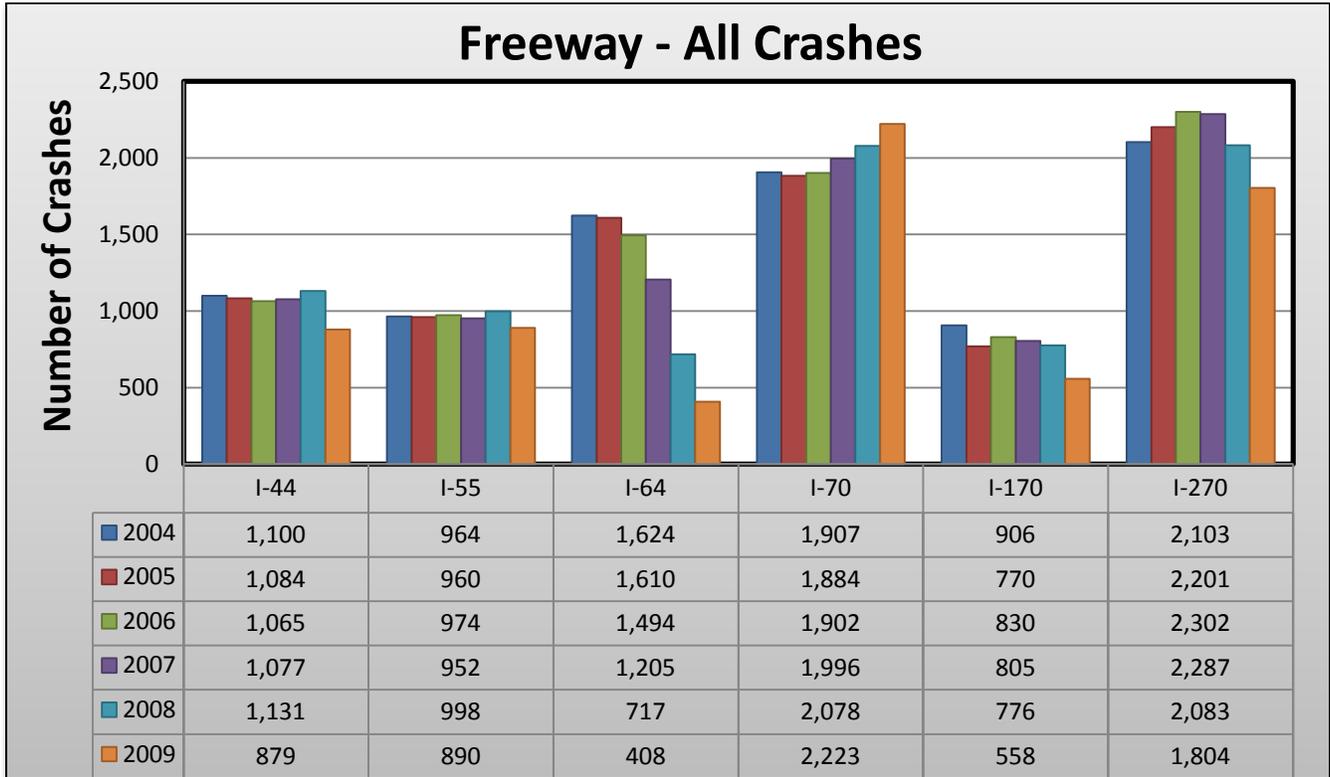


Figure 2 – All Crashes for Expressway Roadways

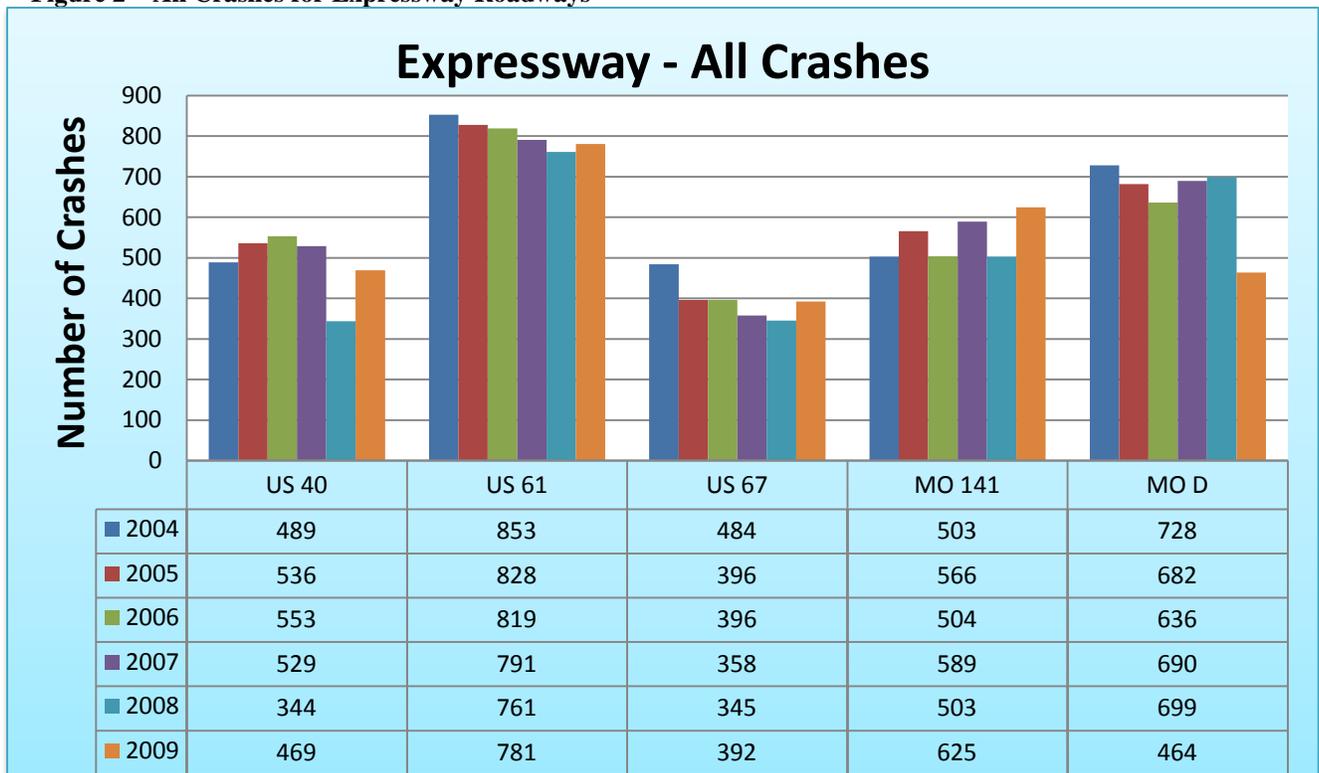
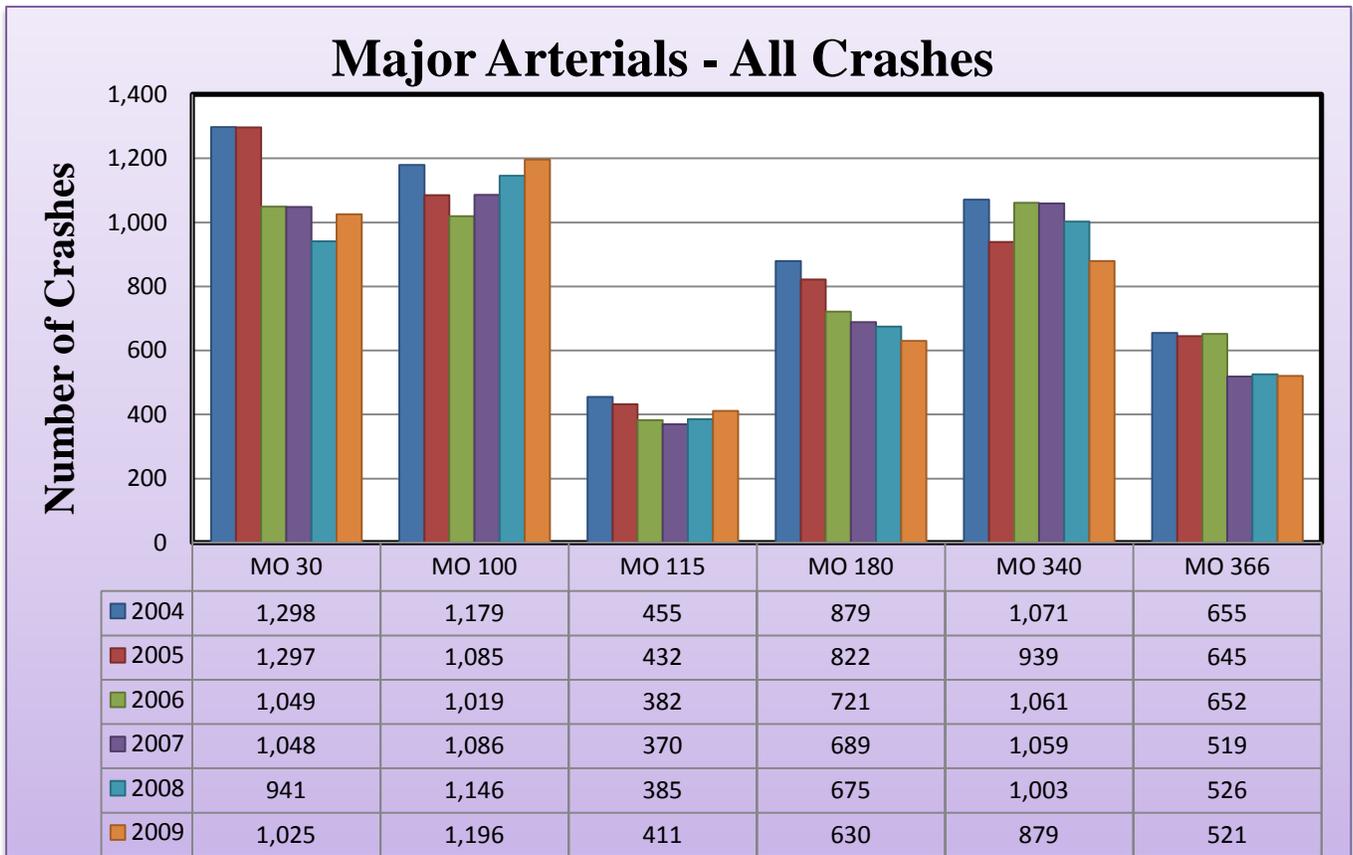


Figure 3 All Crashes for Major Arterial Roadways



Crash Rate Analysis:

The crash rate represents the exposure to crashes relative to total vehicle miles traveled. For example, if roadway A shows a higher crash rate than roadway B, it indicates that roadway A is more vulnerable to crashes than roadway B. Traffic volumes, roadway lengths and number of days are used in calculating crash rates, thus standardizing the comparison between roadways. Figures 4 through 6 present the crash rates for roadways investigated and the major findings from the crash rate analysis are as follow:

General Findings

Comparisons were based on average for the 4-year pre-closure versus 2-year closure crash rate data

Freeways:

- 2008 - Increase in crash rates for I-70 (8.6 percent) and I-55 (0 percent)
- 2008 - Decrease in crash rates for I-44 (0.7 percent), I-64 (50.5 percent), I-170 (6.9 percent) and I-270 (6.7 percent)
- 2009 – Increase in crash rates only for I-70 (12.3 percent)
- 2009 – Decrease in crash rates for I-44 (25.4 percent), I-55 (5.3 percent), I-64 (72.3 percent), I-170 (31.2 percent) and I-270 (20.9 percent)

Expressways:

- 2008 - Increase in crash rates only for Route D (2.1 percent)
- 2008 - Decrease in crash rates for US 40 (34.7 percent), US 61 (7.5 percent), US 67 (15.6 percent) and Route 141 (7 percent)
- 2009 – Increase in crash rates only for Route 141 (15.5 percent)
- 2009 – Decrease in crash rates for US 40 (11 percent), US 61 (5.1 percent), US 67 (4.2 percent) and Route D (32.2 percent)

Major Arterials:

- 2008 - Increase in crash rates only for Route 100 (4.9 percent)
- 2008 - Decrease in crash rates for Routes 30 (19.8 percent), 115 (6.1 percent), 180 (13.2 percent), 340 (2.9 percent) and 366 (14.9 percent)
- 2009 – Increase in crash rates for Routes 100 (9.5 percent) and 115 (0.1 percent)
- 2009 – Decrease in crash rates for Routes 30 (12.6 percent), 180 (19 percent), 340 (14.9 percent) and 366 (5.2 percent)

Figure 4 - All Crash Rates for Freeway Roadways

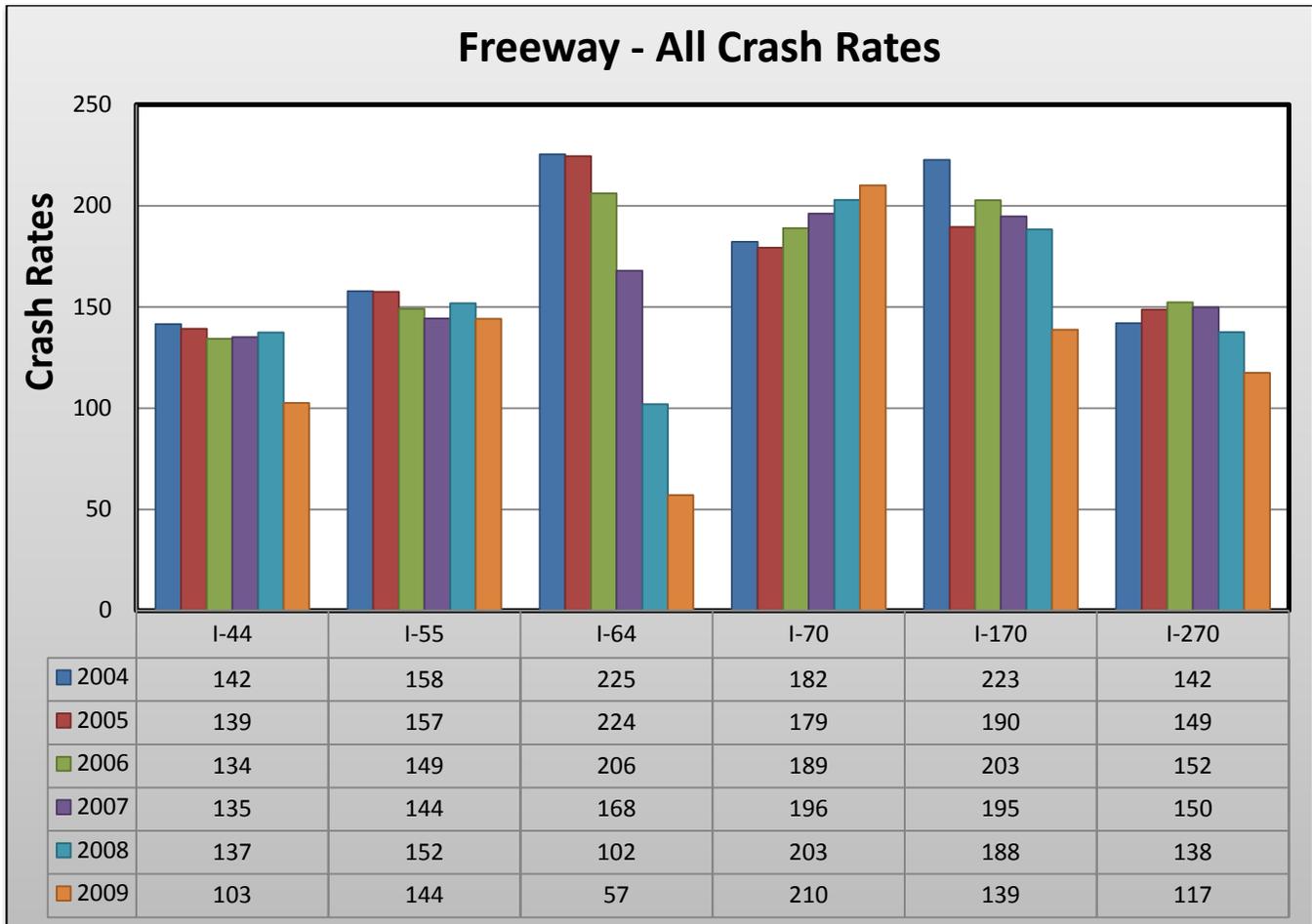


Figure 5 – All Crash Rates for Expressway Roadways

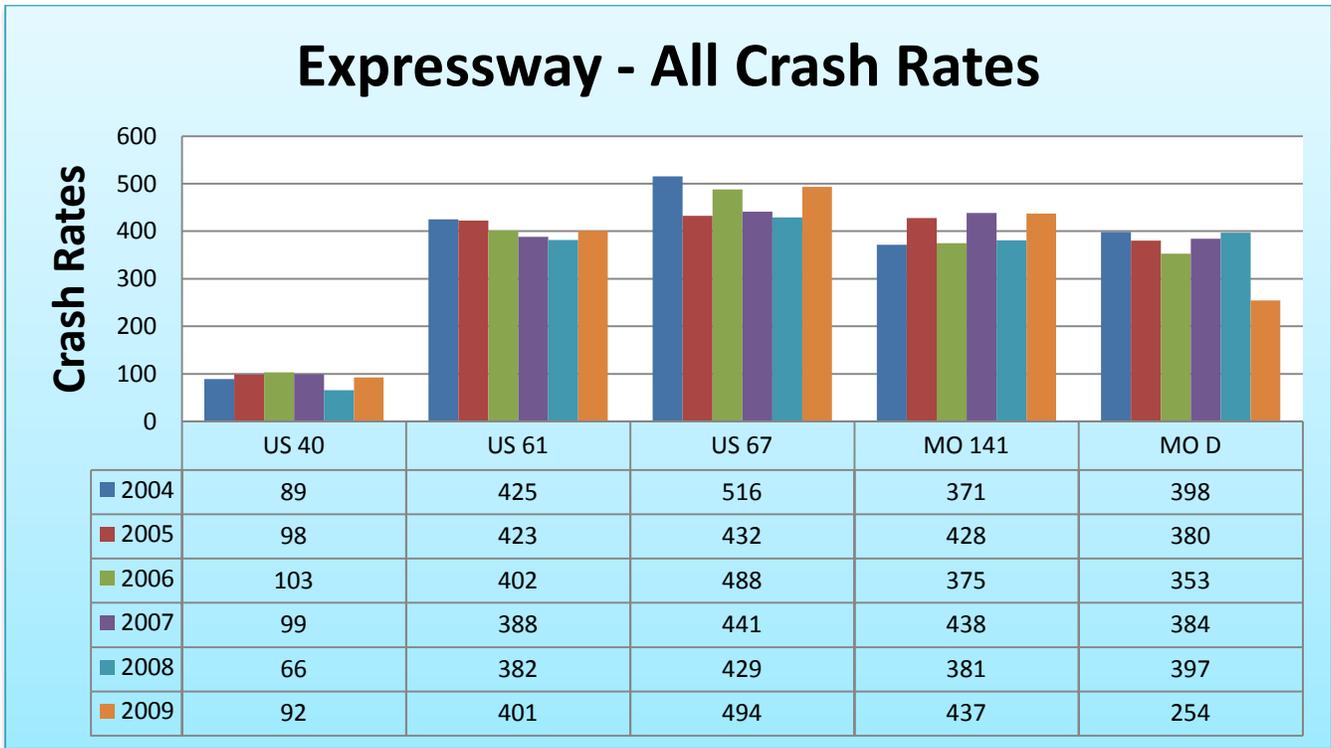
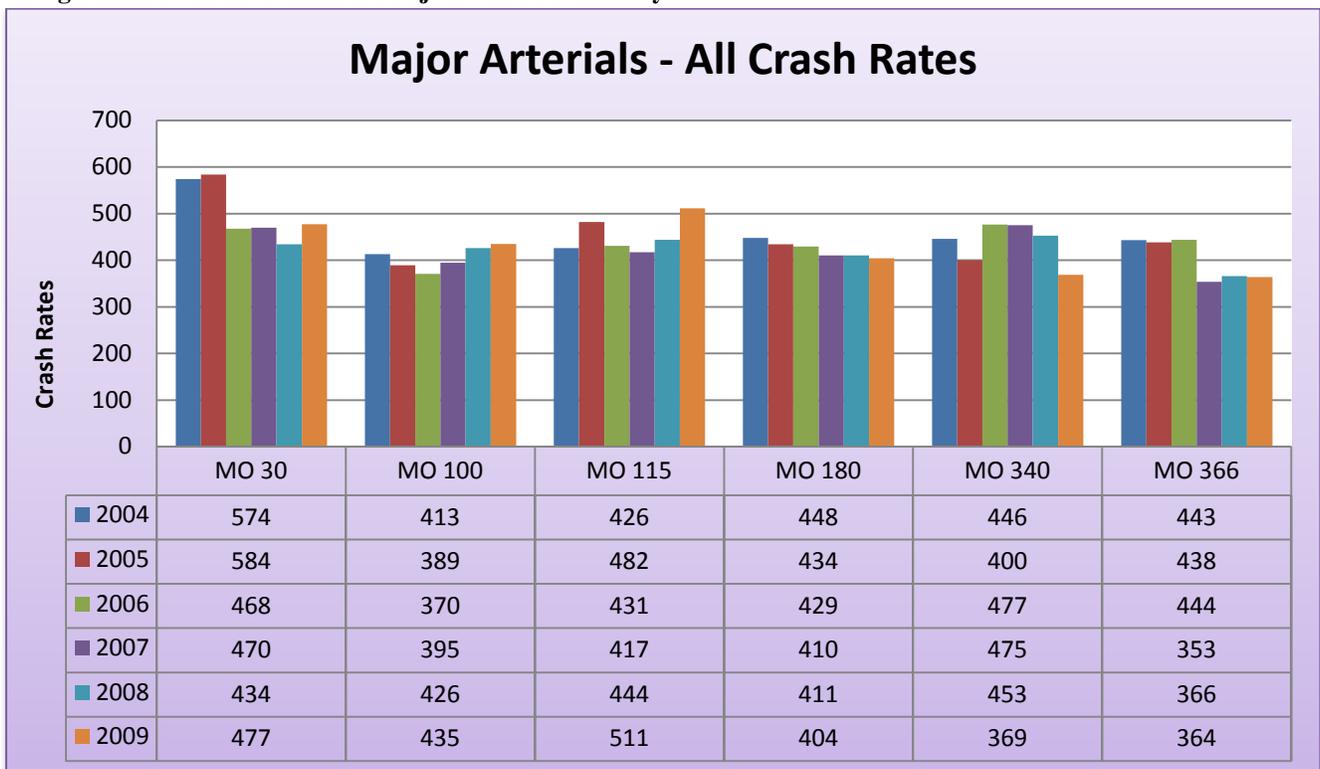


Figure 6 – All Crash Rates for Major Arterial Roadways



Major Conclusion

The major conclusions from the crash analysis and crash rate analysis are as follow:

1. Comparing the average of the pre-closure period (2004 through 2007) to closure period (2008 and 2009), the number of crashes increased (2.1 percent to 8.1 percent) for I-44, I-55, I-70. MO D and MO 100 in 2008 and increased (0.1 percent to 15.7 percent) for I-70, MO 100, MO 155 and MO 141 in 2009. Whereas the crash numbers decreased (2.9 percent to 51.7 percent) for all other routes in 2008 and decreased (4.2 percent to 72.5 percent) for all other routes in 2009.
2. Comparing the average of the pre-closure period (2004 through 2007) to closure period (2008 and 2009), the crash rates increased (2.1 percent to 8.6 percent) for I-55, I-70. MO D and MO 100 in 2008 and increased (0.1 percent to 15.5 percent) for I-70, MO 100, MO 115 and MO 141 in 2009. Whereas the crash numbers decreased (0.7 percent to 50.5 percent) for all other routes in 2008 and decreased (22.9 percent to 72.3 percent) for all other routes in 2009.
3. In cases of I-70 and MO 100, the increasing trend started before the I-64 closure (i.e., before 2008). Based on these pre-closure trends, it was difficult to imply that the I-64 closure caused an increase in crashes and crash rates for these roadways.
4. Although each route shows its own trend, the overall crashes on all three types of highways (i.e. freeways, expressways and major arterials) have decreased in both 2008 and 2009.
5. The significant crash reduction along I-64 segments (50 percent to 70 percent) that were not closed could be a good indicator on the regional awareness of project and their willingness in using designated alternative roadways.
6. Observations on Routes D and 340 saw noticeable safety improvements in 2009 that could have been caused partially by the increase arterial management implemented along these corridors.
7. In general, rear-end type (highest type of crash) decreased noticeably from 7757 in 2007 to 6728 in 2009.
8. The average number of crashes per year across the 4-year pre-closure period was 16,595 and compared against 15,111 in 2008 (8.9 percent below average) and 14,155 in 2009 (14.7 percent).
9. Based on the evaluation of crash (numbers and rates) and their associated trends along the 17 major diversionary roadways, the study team concludes that there was no strong evidence that the closure contributed to any increases in crashes and crash rates.

Introduction

1.1 Study's Objective

On January 2, 2008, the Missouri Department of Transportation (MoDOT) closed I-64 for reconstruction purposes. During the planning stages of this reconstruction project, the plan to close all lanes of roadways was met with concern, inciting questions from the general public like: *Could closing the roadway possibly contribute to more (or less) crashes than before on adjacent roadways? And, if noticeable changes existed in the number and types of crashes, are the changes due to closing I-64 or other influencing factors?*

This 2009 Annual Report and its companion 2008 Annual Report aims to answer these questions by examining crash data before and during the closure, and by providing objective explanations to the changes if any. This study retained the same analysis approach conducted in 2008 by conducting two separate analyses (Crash Analysis and Crash Rate Analysis). The following presents the main findings from the two analyses with the inclusion of 2009 crash information:

1.2 Methodology

The crash analysis was considered as a complicated and challenging task. This was mainly because there are multiple factors involved in crashes. For instance, the contributing factors could be roadway, congestion, weather, human error or combination of these factors. In order to investigate the multifaceted contributing factors efficiently, the following three procedural steps were used in this study:

Step 1 (data acquirement): As the first step of the analysis, the crash data will be obtained from MoDOT's Transportation Management System (TMS) database for selected roadways whose traffic patterns and safety trends could potentially be influenced by the I-64 closure. In addition to the crash data, annual average daily traffic (AADT) counts were also acquired to identify any causal relationship between traffic volume and crashes.

Step 2 (data organization): Second step was to develop a tool that can efficiently organize the information required for the analysis from the acquired crash data. This support tool should also be designed to effectively represent the extracted data in various formats such as graphs and tables, so that it can be a flexible tool for examining the multifaceted crash data.

Step 3 (data analysis): Adopting observational before-after analysis methods, this step examines the data extracted from the crash data using the tool developed in step 2 from different angles. For example, the crash data was extracted in a chronological sequence with different influencing factors such as severity, type, etc, and then examined to identify any evidence proving any change or impact of I-64 closure on the crashes on roadways around the construction area.

The results reported in this study are based on 6 years of crash data that includes 4 years of before and 2 years during the closure period. Since the closure was only for 2 years, this evaluation will base its findings and conclusions on available information. In the final report, the study team will use and conduct a statistical analysis to further investigate the findings and conclusions made in both the 2008 and this 2009 crash analysis reports.

2 Data Collection

2.1 Crash and Annual Average Daily Traffic (AADT) Data

MoDOT provided the research team with the crash data and the traffic volume data for 17 roadways selected by the team. Table S1 summarizes the list of roadways, their associated segment description and lengths that crash data was acquired. Besides crash data, Annual Average Daily Traffic (AADT) counts were also obtained for the investigation of the potential relationship between crashes and traffic volume. Since AADT data was available for shorter segment lengths, these shorter segments are collected and weighed based on traffic count information within each shorter segment to reflect the traffic count for the longer selected segments below. In order to find historical trend in crashes, all data was obtained for 6-year time period (i.e., 2004-2009).

Table S1: Segment Description and Lengths for Crash and AADT Data

Classification	Route	Mileage (miles)	From	To
Freeway	I-44	20.5	Antire Road	Jefferson Avenue
Freeway	I-55	16.40	IL. State Line	Meramec Bottom Road
Freeway	I-64	15	I-270	I-55
Freeway	I-70	22.6	MO Route 94	Walnut Street
Freeway	I-170	10.8	I-270	Galleria Parkway
Freeway	I-270	25.3	I-55	US 67 – Lindbergh
Expressway	US 40	14	Missouri Research Park	I-270
Expressway	US 61	11.2	I-64	I-55
Expressway	US 67	7.4	I-270	I-64
Expressway	MO 141	10.3	MO Route 340	I-44
Expressway	MO D	9.4	I-270	Skinker Parkway
Major Arterial	MO 30	15.5	Jefferson CO. Line	St. Louis City Limits
Major Arterial	MO 100	18.5	Baxter Road	6th Street
Major Arterial	MO 115	10.25	I-70 West Junction	I-70 East Junction
Major Arterial	MO 180	11.6	St. Charles Rock Road	Kingshighway
Major Arterial	MO 340	12.6	Ladue Road	Pennsylvania
Major Arterial	MO 366	11.1	I-44	Grand

3 Crash Data Analysis Results

3.1 Crash Analysis

In this study, crash data from 2004 through 2007 was used to develop the baseline information. Four years of pre-closure crash data was expected to provide a good base to evaluate and compare the I-64 two-year construction closure period. For more efficient comparison, all tables and graphs are grouped into three categories according to the roadway type, i.e.

- a) Freeway roadways including I-44, I-55, I-64, I-70, I-170 and I-270,
- b) Expressway roadways including US 40, US 61, US 67, MO 141 and MO D, and
- c) Major Arterial roadways MO 30, MO 100, MO 115, MO 180, MO 340 and MO 366.

In order to understand a basic picture about the crash trends from 2004 to 2009, all crashes happening from 2004 through 2009 on all roadways were summarized. Table S2 and Figure S1 through S3 illustrate the total number of crashes by roadway type. In 2009, total crashes can be compared to other years and to the average across all six-years of crash data.

This crash data does reflect the normal un-predictability associated with crash information when comparing year-to-year. Patterns and trends are noticed when comparing several years of information. In all freeway crashes, there is noticeable downward decreasing trend since 2006. This same trend to a less degree is also noticed in expressway since 2007 and major arterials since 2005. I-270 is demonstrating downward decrease trend since 2007, while I-70 is demonstrating upward increasing trend since 2007. These freeway facilities were designated and marked, by construction signing, as alternative routes during the closure and for the most part did serve as the most popular diversionary roadways.

I-64 in 2008 and 2009 experienced significant reduction of 429 and 797 crashes less than those in 2007 (reduction of 36 to 66 percent). Obviously, this reduction was due to the I-64 re-construction closure. This proves if you close a roadway you can reduce crashes. However, it should also be noticed that total crashes in 2008 and 2009 on all freeway roadways also decreased by 539 and 1560 respectively when compared to 2007. This overall reduction exceeds the reduction on I-64. This indicates that although I-64 closure caused the traffic to spread to other routes, the total regional crashes on major interstate roadways around the closure area still had a noticeable reduction.

For the most part, most roadways have not experienced a dramatic change over the six-year period. This further enforces the logic that I-64 closure did not adversely impact safety on other roadway facilities that were used as alternative routes around the closed section.

When comparing the average across the six-year period (2004 through 2009) with 2009, the number of crashes were up or increased for I-70, MO 141 and MO 100 whereas the number of crashes were down or decreased for I-44, I-55, I-64, I-170, I-270, US 40, US 61, US 67, MO D,

MO 115, MO 180, MO 340, and MO 366. The change in number of crashes varied with some experiencing significant while other remained about the same. However, it was interesting to observe (in Table S2) that although each route has its own trend, the overall crashes on all three types of roadways decreased in 2009 during the closure, when compared to the previous years before 2007.

In general, the combined totals for the 6-year (2004-2009) period, experienced an overall crash reduction while many of these roadways experienced an increase in traffic. These factors continue to reaffirm the result regarding impacts to regional traffic safety during the closure period as being no adverse impact to adjacent roadways.

Table S2: Total Crashes by Year (2004 - 2009)

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	1,100	1,084	1,065	1,077	1,131	879	1,056
Freeway	I-55	964	960	974	952	998	890	956
Freeway	I-64	1,624	1,610	1,494	1,205	717	408	1,176
Freeway	I-70	1,907	1,884	1,902	1,996	2,078	2,223	1,998
Freeway	I-170	906	770	830	805	776	558	774
Freeway	I-270	2,103	2,201	2,302	2,287	2,083	1,804	2,130
	All	8,604	8,509	8,567	8,322	7,783	6,762	8,091
Expressway	US 40	489	536	553	529	344	469	487
Expressway	US 61	853	828	819	791	761	781	806
Expressway	US 67	484	396	396	358	345	392	395
Expressway	MO 141	503	566	504	589	503	625	548
Expressway	MO D	728	682	636	690	699	464	650
	All	3,057	3,008	2,908	2,957	2,652	2,731	2,886
Major Arterial	MO 30	1,298	1,297	1,049	1,048	941	1,025	1,110
Major Arterial	MO 100	1,179	1,085	1,019	1,086	1,146	1,196	1,119
Major Arterial	MO 115	455	432	382	370	385	411	406
Major Arterial	MO 180	879	822	721	689	675	630	736
Major Arterial	MO 340	1,071	939	1,061	1,059	1,003	879	1,002
Major Arterial	MO 366	655	645	652	519	526	521	586
	All	5,537	5,220	4,884	4,771	4,676	4,662	4,958
Combine Totals		17,198	16,737	16,359	16,050	15,111	14,155	15,935

Figure S1 – All Crashes for Freeway Roadways

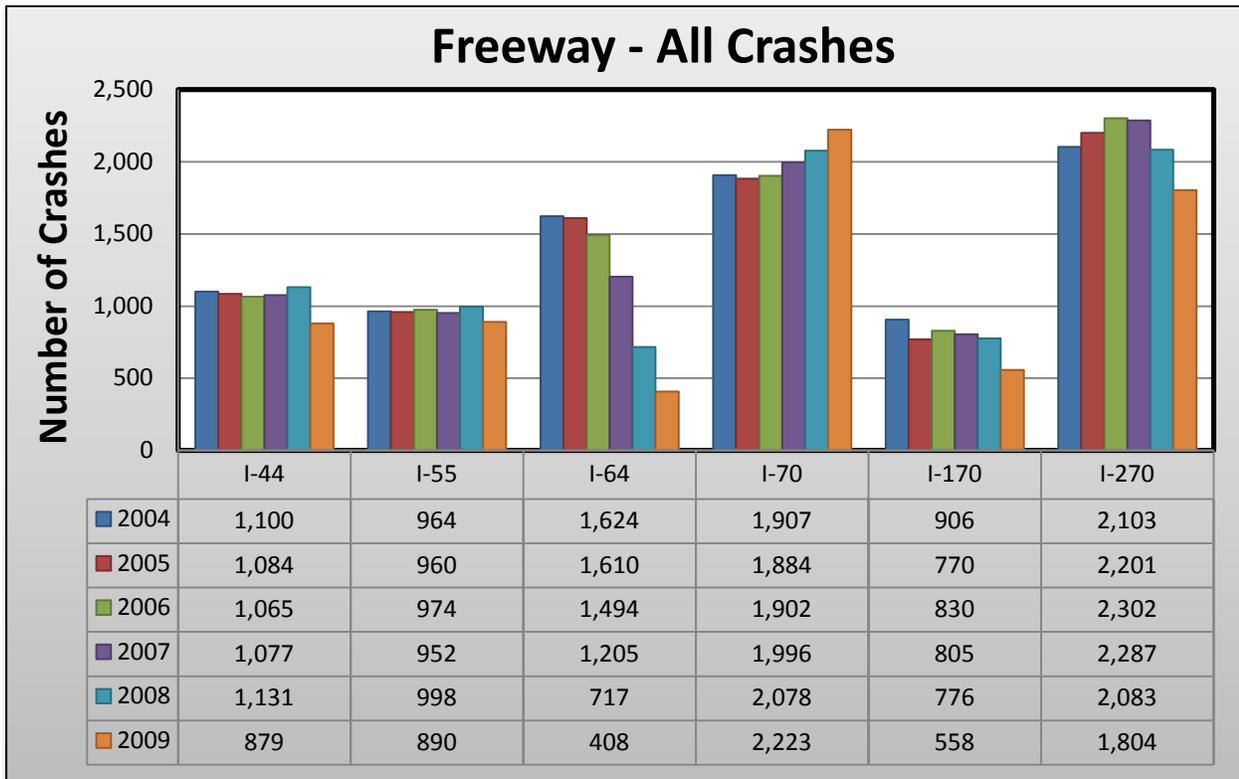


Figure S2 – All Crashes for Expressway Roadways

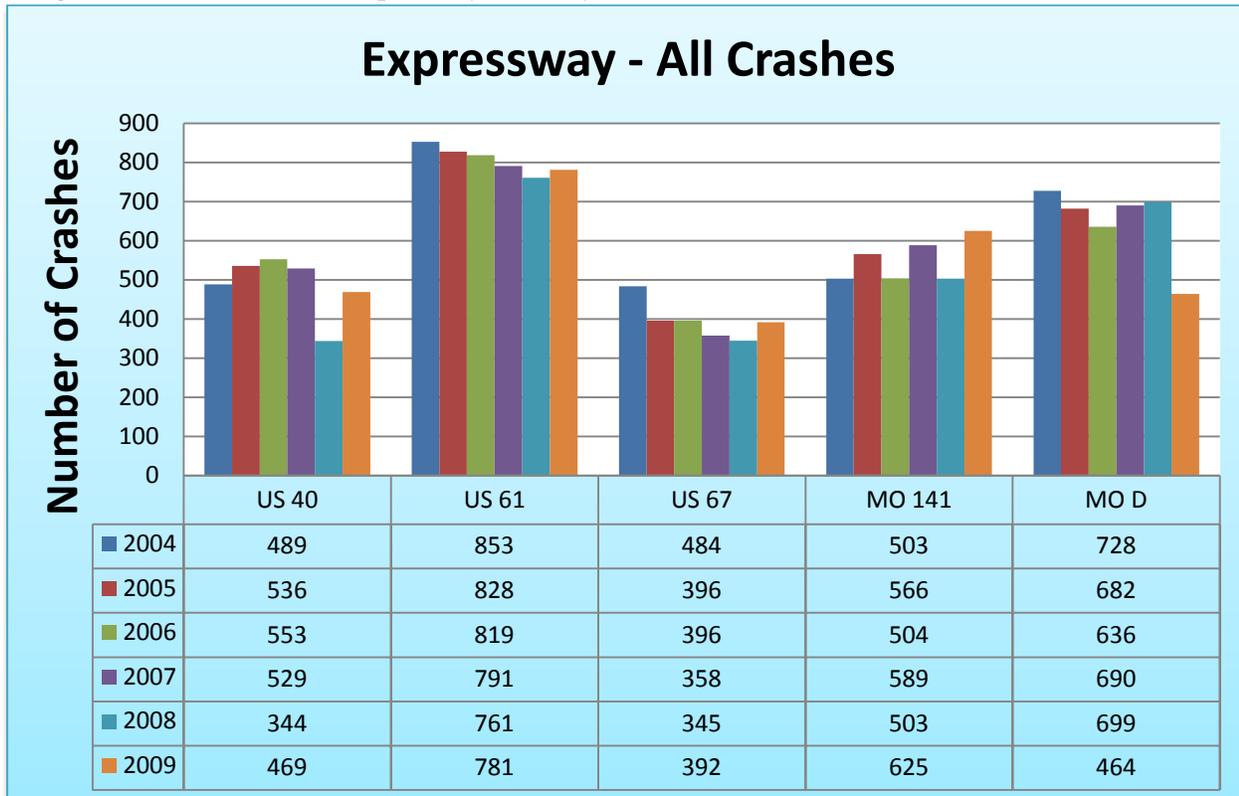
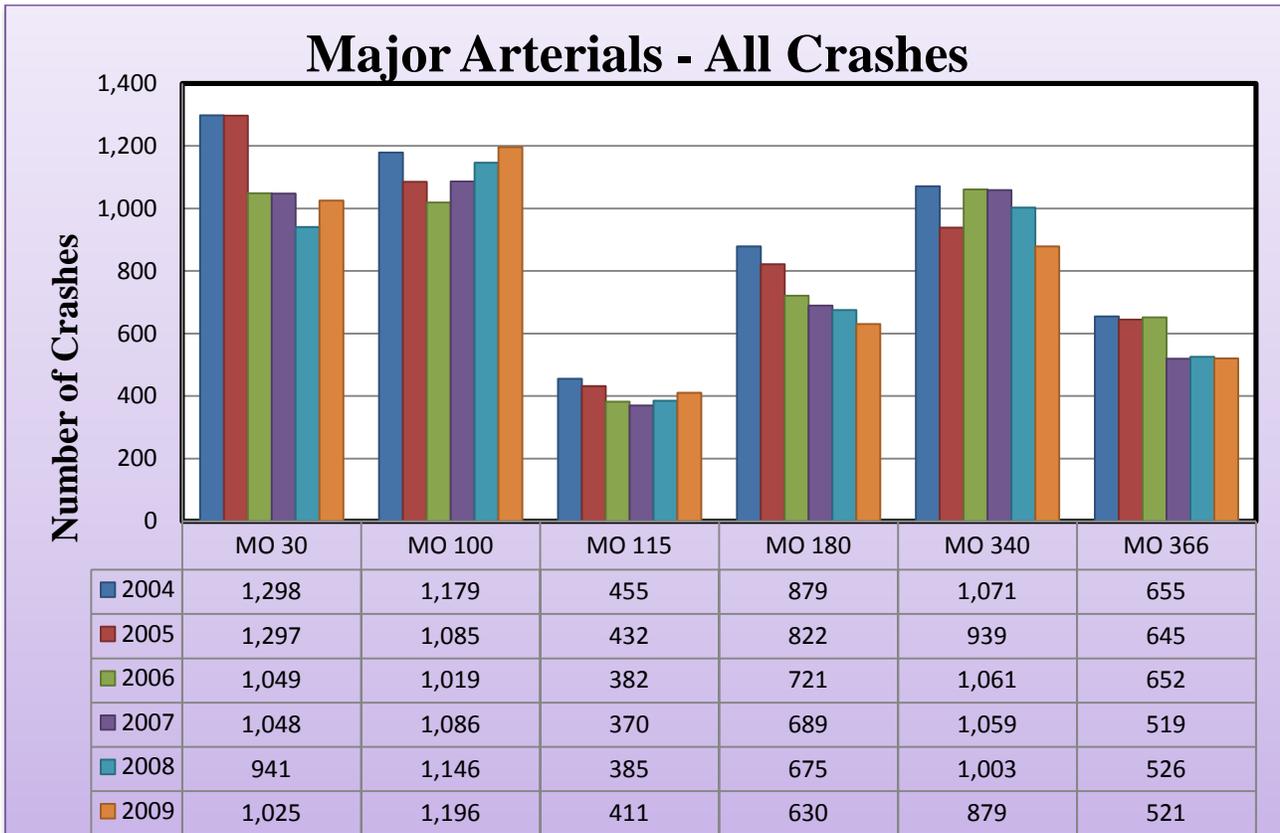


Figure S3 – All Crashes for Major Arterial Roadways



Although solid statistical validation was needed, this quick inspection described above leads us to a tentative conclusion that there was no strong evidence proving that I-64 closure contributed to an increased number of crashes on the adjacent roadways.

For a more detailed evaluation on crash numbers, various figures have been prepared and presented in the Appendix based on the combination of influencing variables such as crash severity and cause. As mentioned earlier in this report and in the 2008 Crash Report, the crash rate analysis is a better comparative methodology when investigating potential safety impacts. The remaining part of this report will be dedicated to the crash rate analysis.

3.2 Crash Rate Analysis

The crash rate represents the intensity or exposure to crashes relative to total vehicle miles traveled. For example, if roadway A shows a higher crash rate than roadway B, it indicates that roadway A was more vulnerable to crashes than roadway B. Crash rates consider traffic volume, roadway lengths and days to create a standardized method for comparing roadways. For a given segment of a roadway, crash rate (CR) is given by:

$$CR = \frac{CRASH}{VMT} \quad (1)$$

- CRASH = Number of crashes for the section,

- Days = Number of days for the study,
- AADT = Annual Average Daily Traffic is a weighted AADT as shown below based segments define in table S1,
- Length = Length of Section,

(2)

As explained, crash rate calculation requires not only the number of crashes but also traffic volumes (in vehicles per day), length of the roadway (in miles) and period being evaluated (in days). MoDOT provided the team with AADT information for the highways based the previous Table S1 segment of roadways which were used in this study.

Annual Average Daily Traffic (AADT) for six-year evaluation is displayed in Table S2. These annual average daily traffic volumes are seasonally adjusted to reflect annual average conditions.

Table S2 – Weighted AADT

Classification	Route	2004	2005	2006	2007	2008	2009
Freeway	I-44	103,554	104,050	105,969	106,500	109,679	114,483
Freeway	I-55	101,755	101,872	109,144	110,235	109,552	103,117
Freeway	I-64	131,235	130,998	132,404	131,095	128,032	130,807
Freeway	I-70	126,538	127,442	122,046	123,334	123,846	128,223
Freeway	I-170	102,955	103,073	103,820	104,858	104,208	101,957
Freeway	I-270	159,966	160,161	163,650	165,286	163,590	166,383
Expressway	US 40	106,765	106,550	105,118	104,120	102,156	99,087
Expressway	US 61	48,975	47,937	49,856	49,856	48,655	47,485
Expressway	US 67	34,663	33,928	30,041	30,041	29,680	29,324
Expressway	MO 141	35,941	35,181	35,745	35,745	35,015	37,942
Expressway	MO D	53,125	52,260	52,584	52,352	51,192	53,062
Major Arterial	MO 30	39,872	39,256	39,653	39,421	38,219	37,945
Major Arterial	MO 100	42,167	41,277	40,737	40,737	39,754	40,743
Major Arterial	MO 115	28,445	23,944	23,705	23,705	23,133	21,493
Major Arterial	MO 180	46,233	44,717	39,682	39,682	38,725	36,827
Major Arterial	MO 340	52,097	51,011	48,405	48,437	48,052	51,808
Major Arterial	MO 366	37,156	36,373	36,248	36,248	35,374	35,334

Crash rates over the past 6 years (2004-2009) are presented in Table S3 and displayed in Figures S4, S5 and S6.

Table S3 – Crash Rates

Classification	Route	2004	2005	2006	2007	2008	2009
Freeway	I-44	142	139	134	135	137	103
Freeway	I-55	158	157	149	144	152	144
Freeway	I-64	225	224	206	168	102	57
Freeway	I-70	182	179	189	196	203	210
Freeway	I-170	223	190	203	195	188	139
Freeway	I-270	142	149	152	150	138	117
Expressway	US 40	89	98	103	99	66	92
Expressway	US 61	425	423	402	388	382	401
Expressway	US 67	516	432	488	441	429	494
Expressway	MO 141	371	428	375	438	381	437
Expressway	MO D	398	380	353	384	397	254
Major Arterial	MO 30	574	584	468	470	434	477
Major Arterial	MO 100	413	389	370	395	426	435
Major Arterial	MO 115	426	482	431	417	444	511
Major Arterial	MO 180	448	434	429	410	411	404
Major Arterial	MO 340	446	400	477	475	453	369
Major Arterial	MO 366	443	438	444	353	366	364

Figure S4 – All Crash Rates for Freeway Roadways

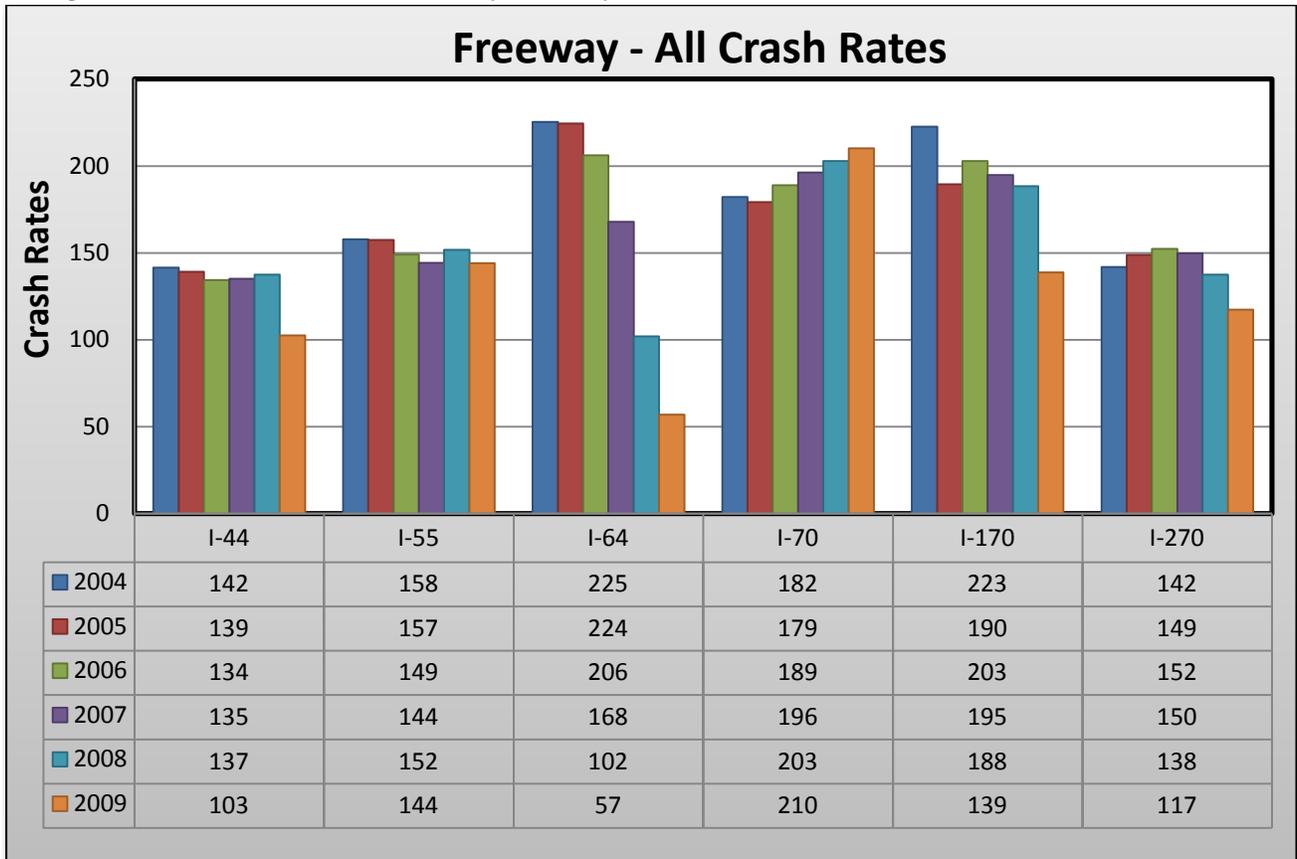


Figure S5 – All Crash Rates for Expressway Roadways

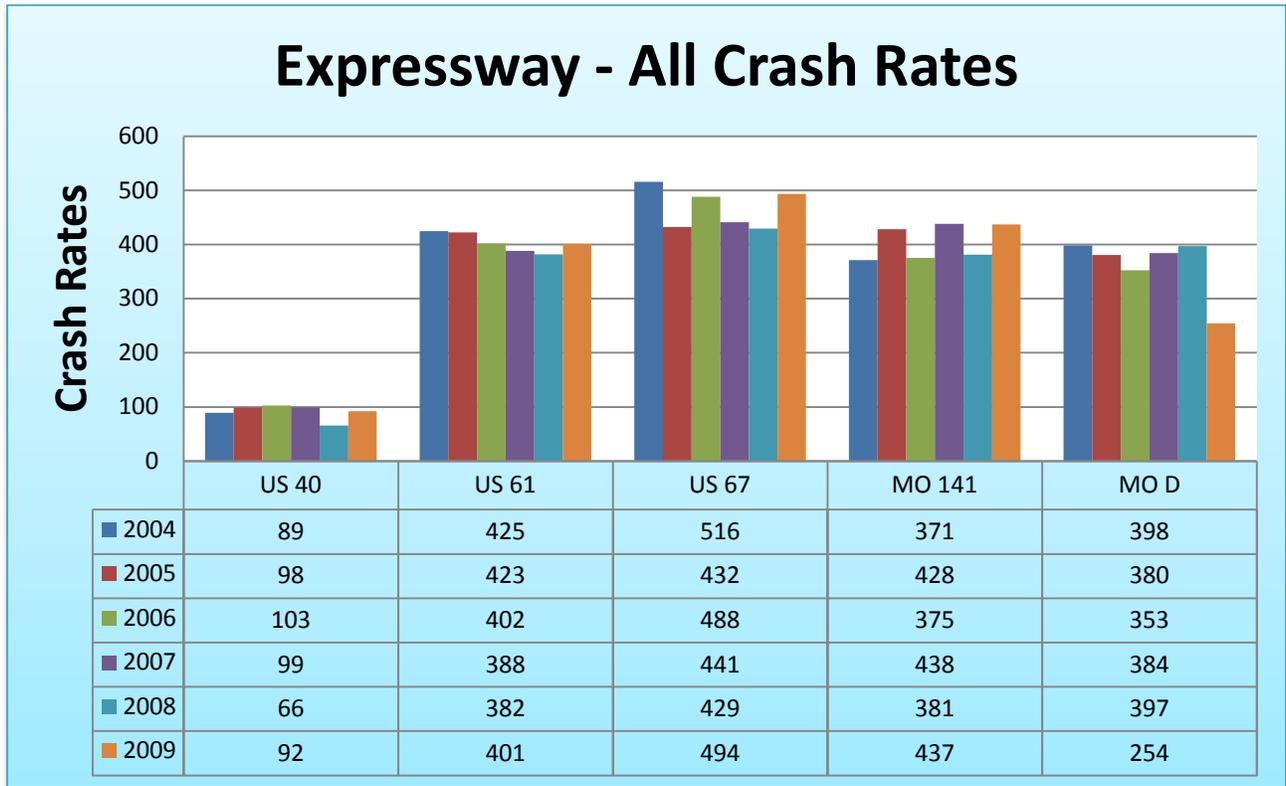
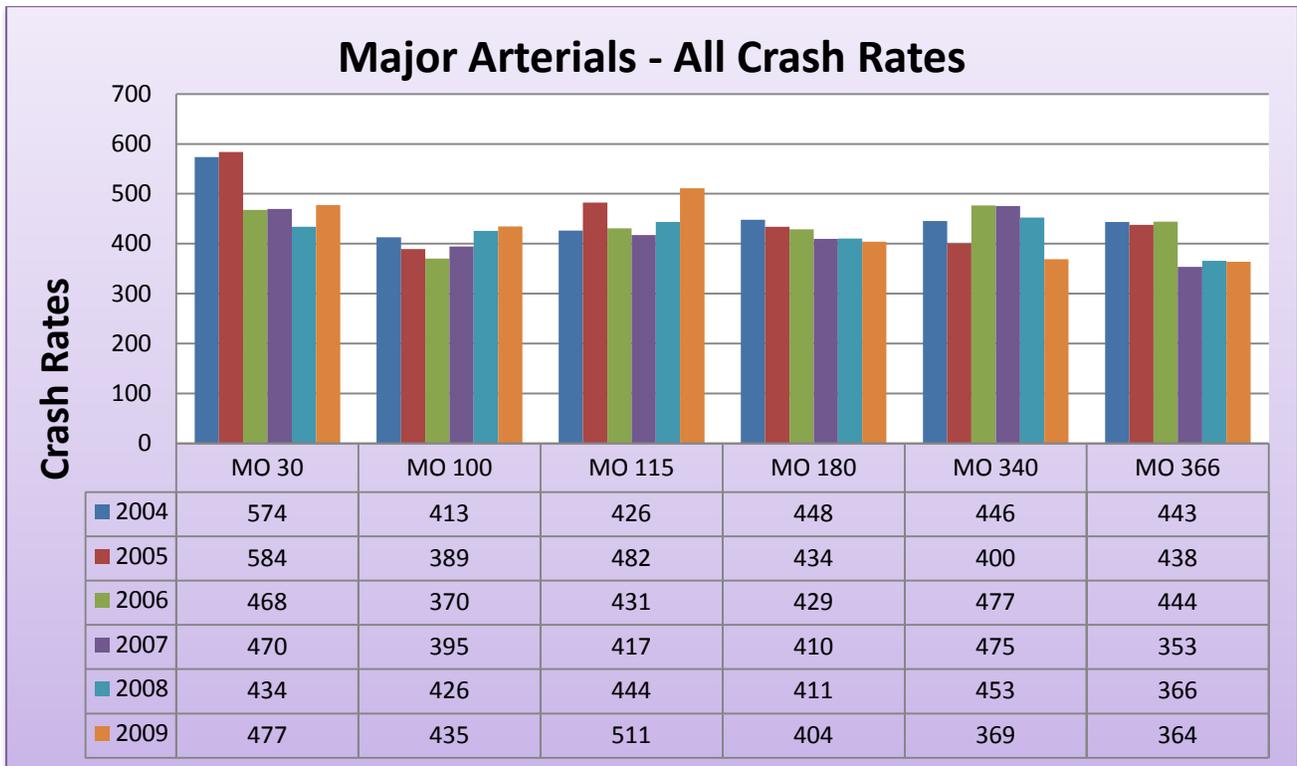


Figure S6 – All Crash Rates for Major Arterial Roadways



Another way to view crash rates is to analyze the annual crash rate to a base year (like year 2004). This permits at a quick glance to see how the crash rates have changed over time when compared to base year. A value greater than 1 shows an increase while a value less than 1 shows a decrease. Corresponding ‘relative’ crash rates are provided in Table S4 and shown in Figures S7, S8 and S9.

Table S4 – Relative Crash Rates based Base Year 2004

Classification	Route	2004	2005	2006	2007	2008	2009
Freeway	I-44	1.00	0.98	0.95	0.95	0.97	0.72
Freeway	I-55	1.00	1.00	0.94	0.91	0.96	0.91
Freeway	I-64	1.00	1.00	0.91	0.74	0.45	0.25
Freeway	I-70	1.00	0.98	1.04	1.08	1.11	1.15
Freeway	I-170	1.00	0.85	0.91	0.87	0.85	0.62
Freeway	I-270	1.00	1.05	1.07	1.06	0.97	0.83
Expressway	US 40	1.00	1.10	1.15	1.11	0.74	1.03
Expressway	US 61	1.00	0.99	0.95	0.91	0.90	0.94
Expressway	US 67	1.00	0.84	0.95	0.86	0.83	0.96
Expressway	141	1.00	1.15	1.01	1.18	1.03	1.18
Expressway	D	1.00	0.95	0.89	0.96	1.00	0.64
Major Arterial	30	1.00	1.02	0.81	0.82	0.76	0.83
Major Arterial	100	1.00	0.94	0.90	0.96	1.03	1.05
Major Arterial	115	1.00	1.13	1.01	0.98	1.04	1.20
Major Arterial	180	1.00	0.97	0.96	0.92	0.92	0.90
Major Arterial	340	1.00	0.90	1.07	1.07	1.02	0.83
Major Arterial	366	1.00	0.99	1.00	0.80	0.83	0.82

Figure S7 – Relative All Crash Rates for Freeway Roadways (Base Year 2004)

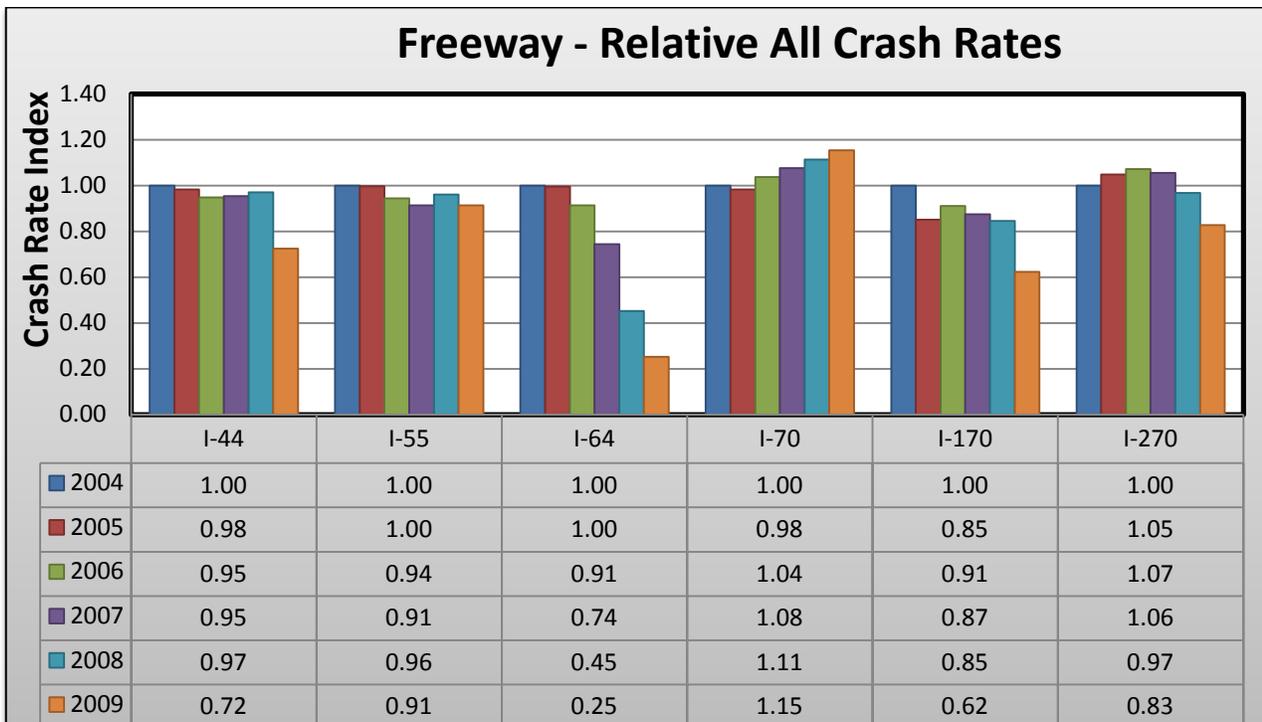


Figure S8 – Relative All Crash Rates for Expressway Roadways (Base Year 2004)

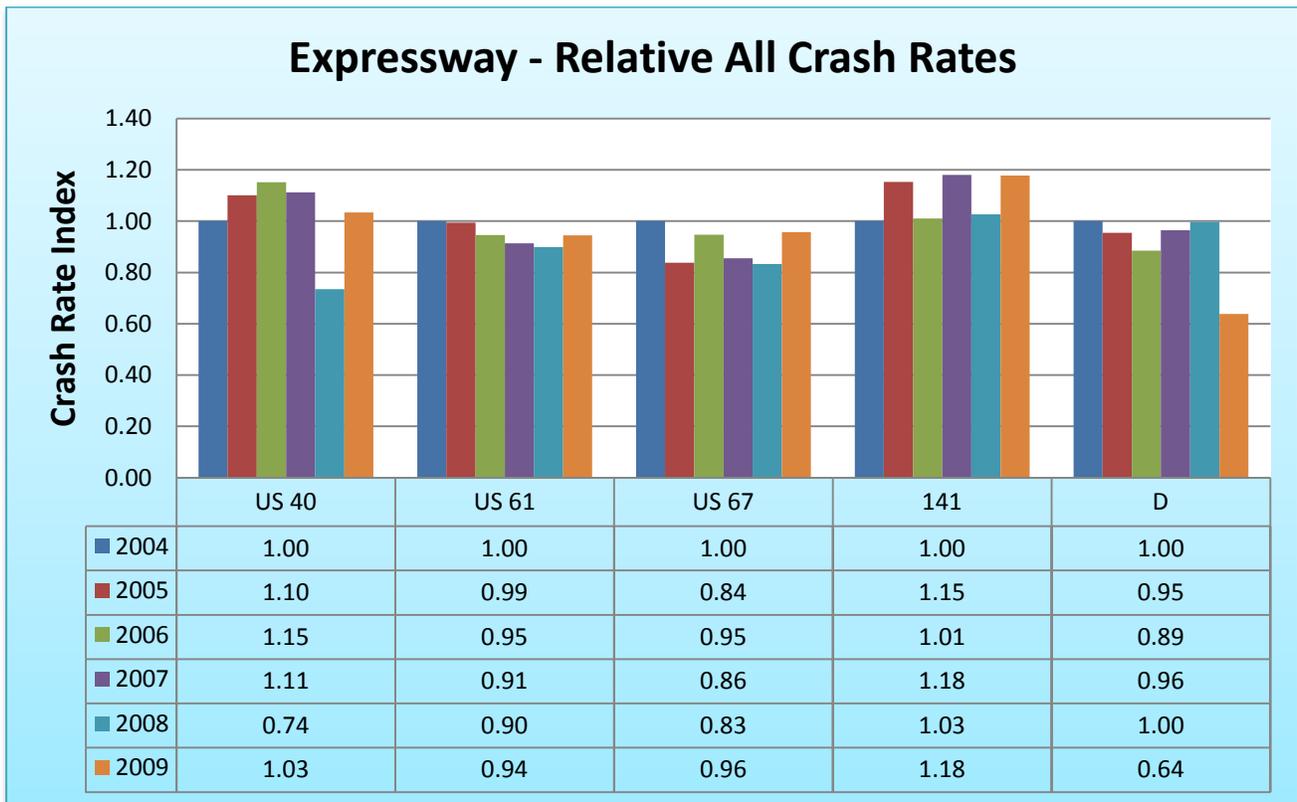
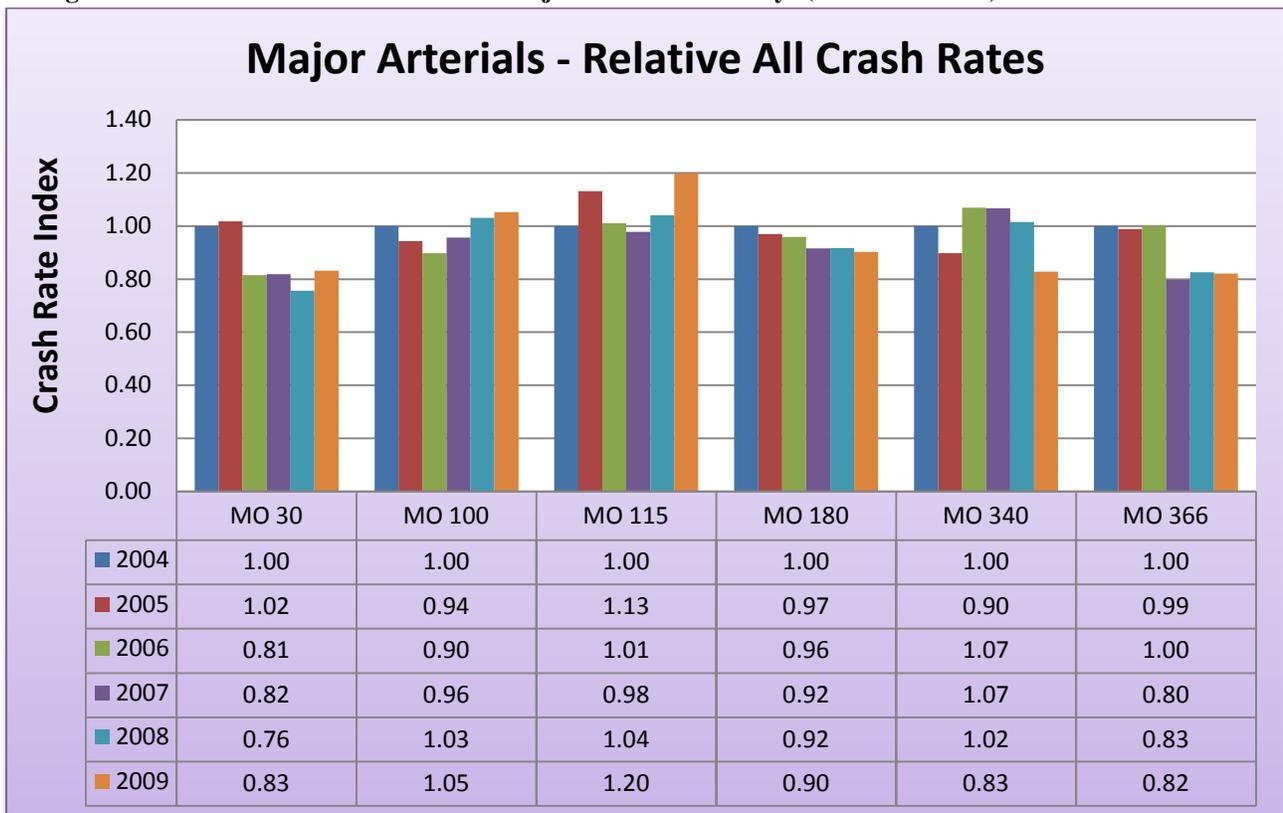


Figure S9 – Relative All Crash Rates for Major Arterial Roadways (Base Year 2004)



Crash Severity and Types Evaluation

The information discussed thus far in this report have centered on all crashes. All crashes expressed in both crash numbers and crash rates provide a very good overview of the information reviewed in the 2009 report. Similar trends and patterns have been observed in both crash severity and crash types. This report's Appendix section contains figures and tables that show evaluation results based on severity and crash type.

Property Damage Only Crashes Evaluation

'Property Damage Only' crashes represent approximately 72 percent to 80 percent of all crashes reviewed in this study. Table S5 and Figures S10 through S12 are shown to provide an example of the crash severity evaluation.

Table S5 – Property Damage Only Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	823	836	813	814	849	677	802
Freeway	I-55	677	701	706	712	742	658	699
Freeway	I-64	1,215	1,183	1,144	913	558	301	886
Freeway	I-70	1,373	1,320	1,377	1,421	1,464	1,579	1,422
Freeway	I-170	680	555	625	633	592	429	586
Freeway	I-270	1,633	1,630	1,732	1,744	1,568	1,393	1,617
	All	6,401	6,225	6,397	6,237	5,773	5,037	6,012
Expressway	US 40	345	368	395	407	257	362	356
Expressway	US 61	650	652	643	597	592	547	614
Expressway	US 67	357	292	295	267	251	306	295
Expressway	MO 141	368	448	397	472	417	521	437
Expressway	MO D	566	523	489	534	557	367	506
	All	2,286	2,283	2,219	2,277	2,074	2,103	2,207
Major Arterial	MO 30	998	971	773	790	691	805	838
Major Arterial	MO 100	932	855	806	878	934	938	891
Major Arterial	MO 115	356	328	289	266	281	312	305
Major Arterial	MO 180	660	585	528	496	493	461	537
Major Arterial	MO 340	839	714	845	822	766	685	779
Major Arterial	MO 366	515	467	492	377	398	393	440
	All	4,300	3,920	3,733	3,629	3,563	3,594	3,790
Combine Totals		12,987	12,428	12,349	12,143	11,410	10,734	12,009

Figure S10 – Property Damage Only Crashes Freeway Roadways

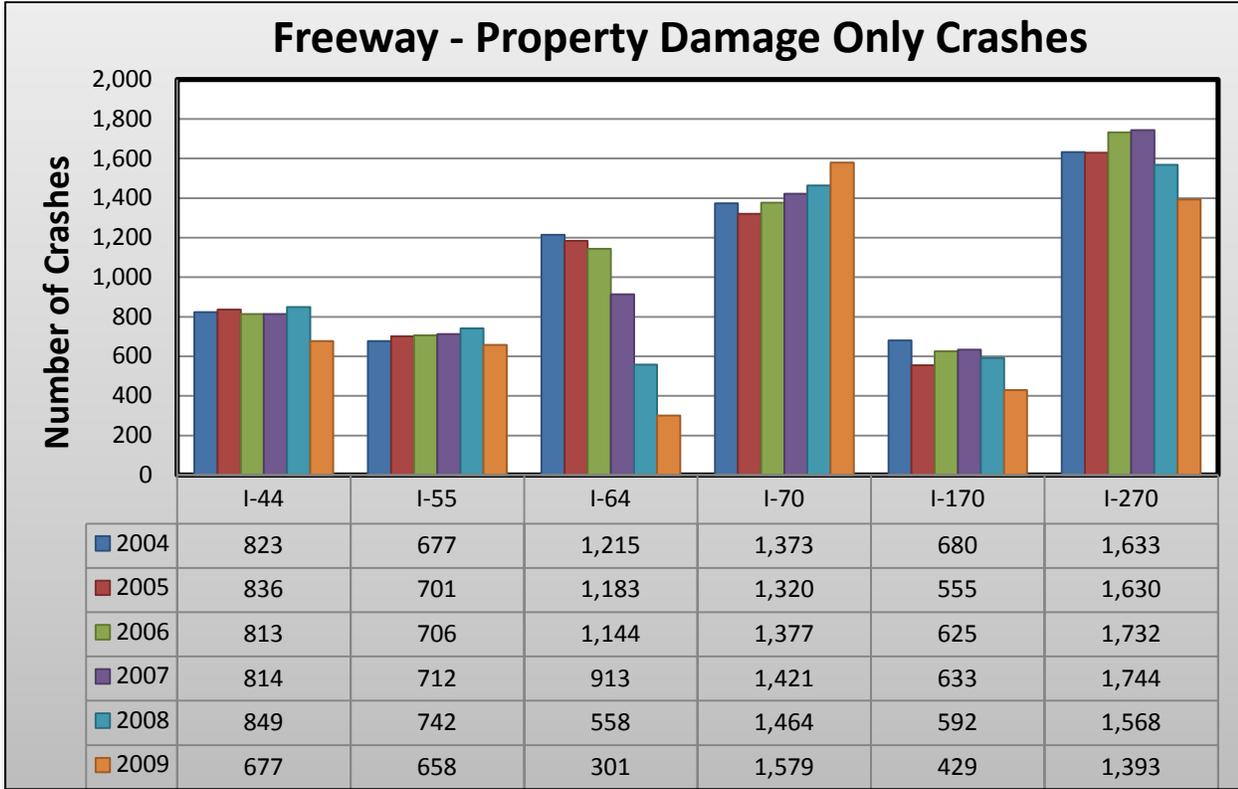


Figure S11 – Property Damage Only Crashes Expressway Roadways

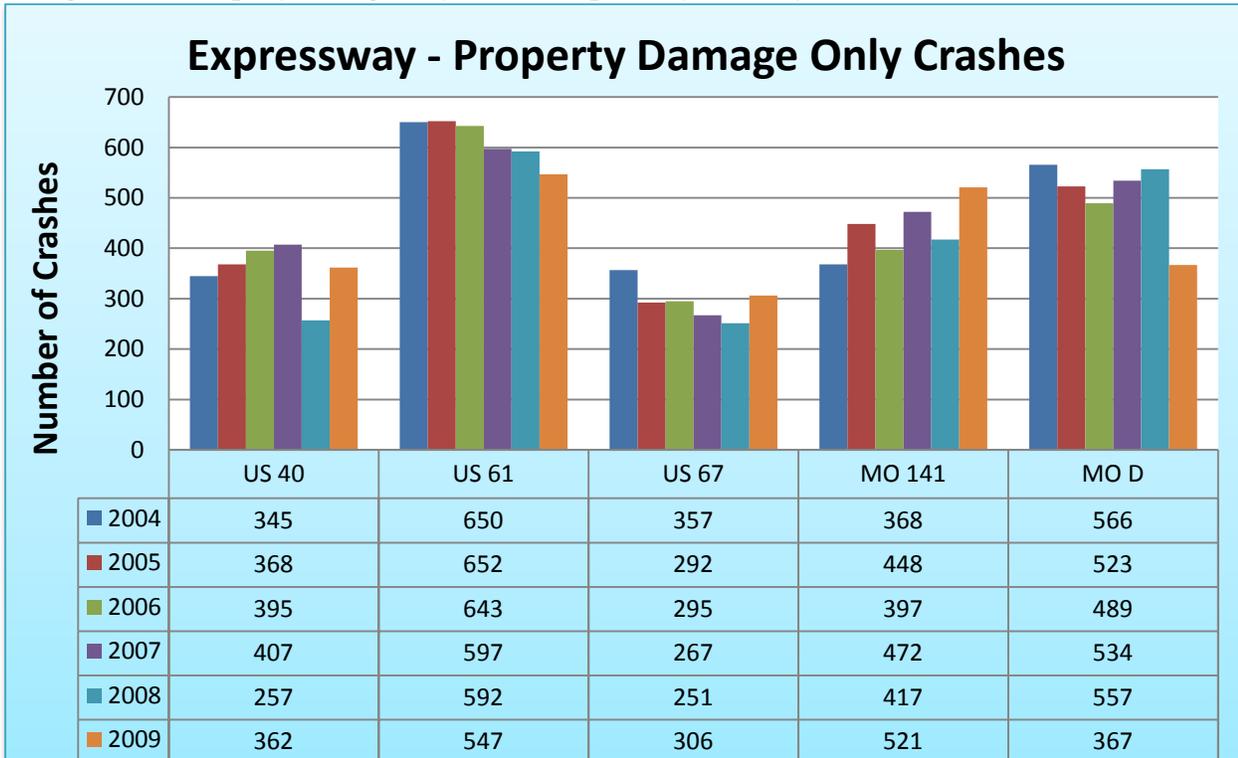
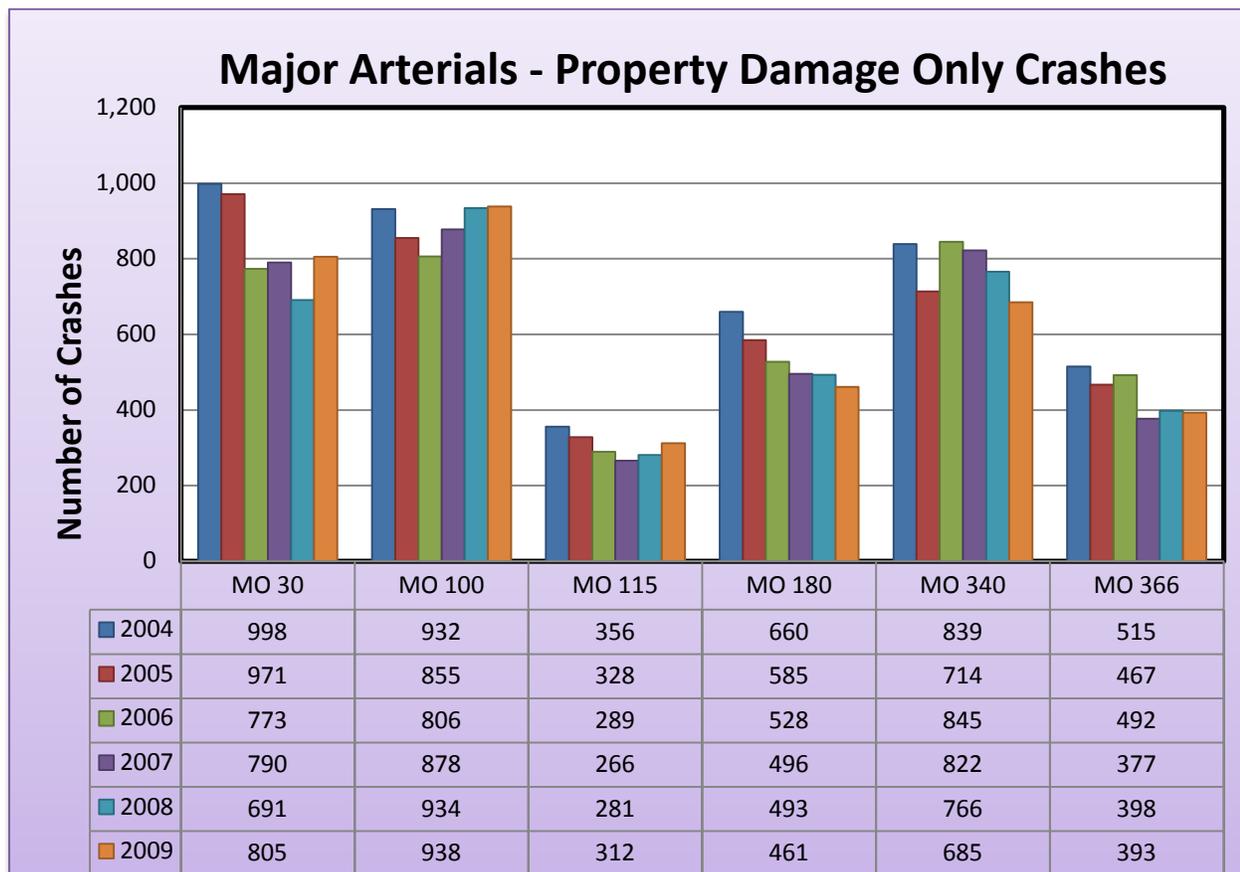


Figure S12 – Property Damage Only Crashes Major Arterial Roadways



Rear-End Type Crashes Evaluation

Rear-end type crash by far represents the most predominated type of crash. Percentage of crashes along 17 roadway corridors ranges between 30 percent and 65 percent of total crashes. Table S6 and Figures S13 through S15 provide an example of the crash type evaluation.

Table S6 – Rear-end Type Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	472	462	461	478	433	347	442
Freeway	I-55	362	344	363	318	328	286	334
Freeway	I-64	971	844	800	595	308	197	619
Freeway	I-70	691	675	661	656	655	823	694
Freeway	I-170	455	389	466	472	362	296	407
Freeway	I-270	1,151	1,146	1,358	1,387	1,203	1,081	1,221
All	Average	4,102	3,860	4,109	3,906	3,289	3,030	3,716
Expressway	US 40	287	294	337	353	198	318	298
Expressway	US 61	442	418	408	391	401	381	407
Expressway	US 67	272	224	198	195	160	208	210
Expressway	MO 141	301	344	344	393	308	439	355
Expressway	MO D	363	373	334	364	352	189	329
Major Arterial	MO 30	518	490	474	444	372	451	458
Major Arterial	MO 100	532	486	448	514	573	600	526
Major Arterial	MO 115	158	143	92	106	97	161	126
Major Arterial	MO 180	386	389	320	313	317	279	334
Major Arterial	MO 340	579	531	552	587	565	467	547
Major Arterial	MO 366	270	249	269	191	203	205	231
	All	2,443	2,288	2,155	2,155	2,127	2,163	2,222
Combine Totals		8,210	7,801	7,885	7,757	6,835	6,728	7,536

Figure S13 – Rear-end Type Crashes Freeway Roadways

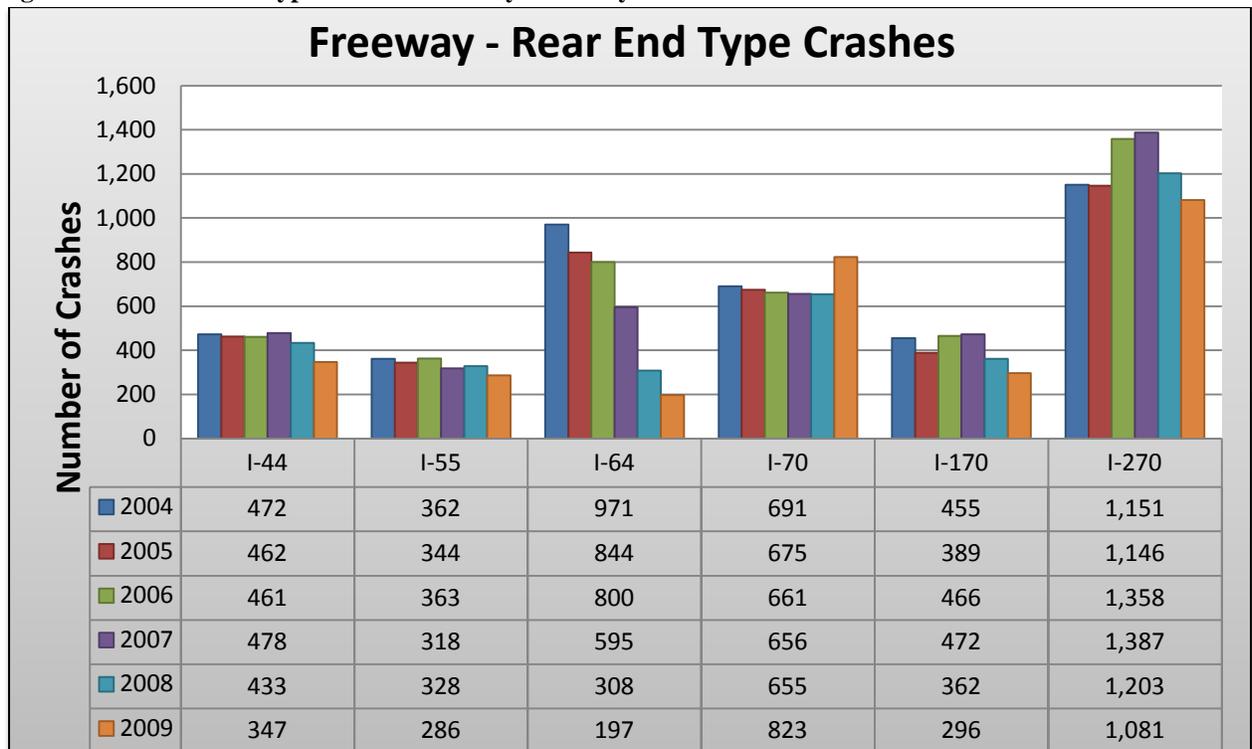


Figure S14 – Rear-end Type Crashes Expressway Roadways

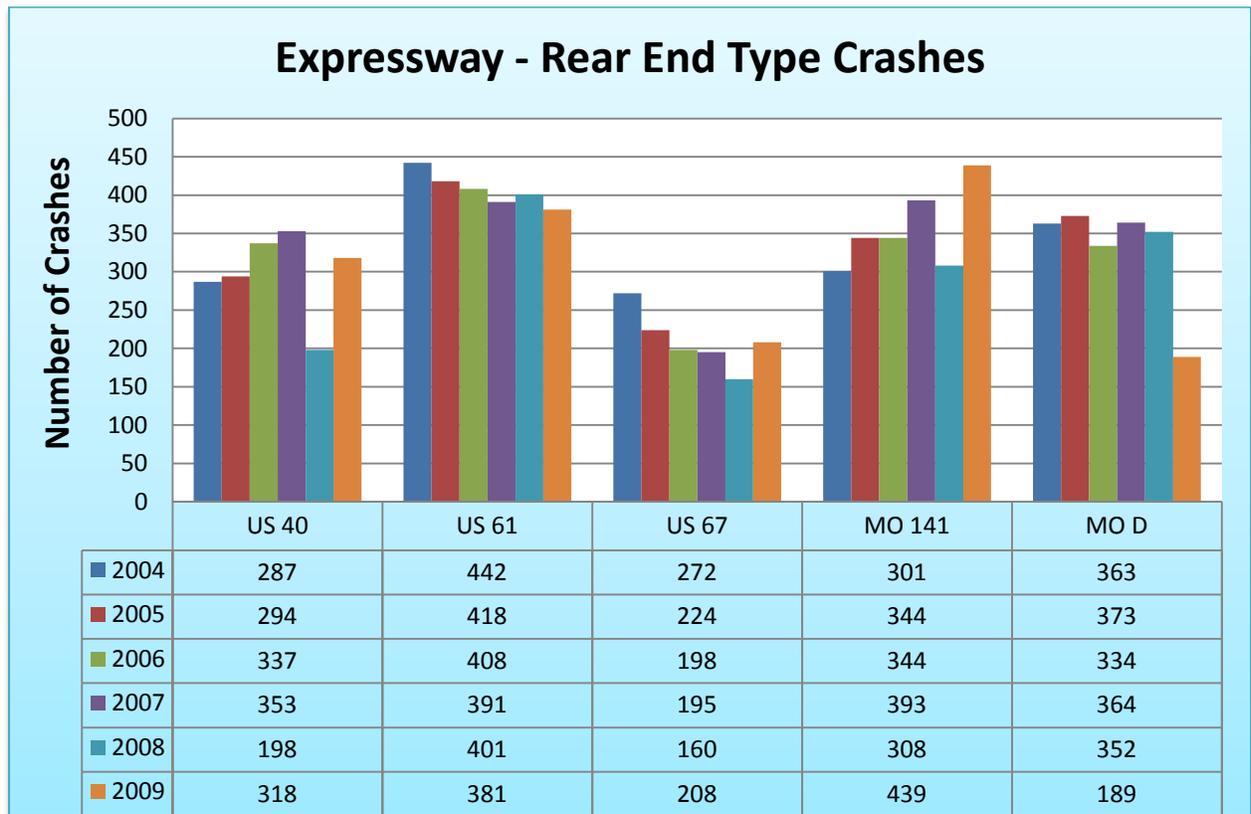
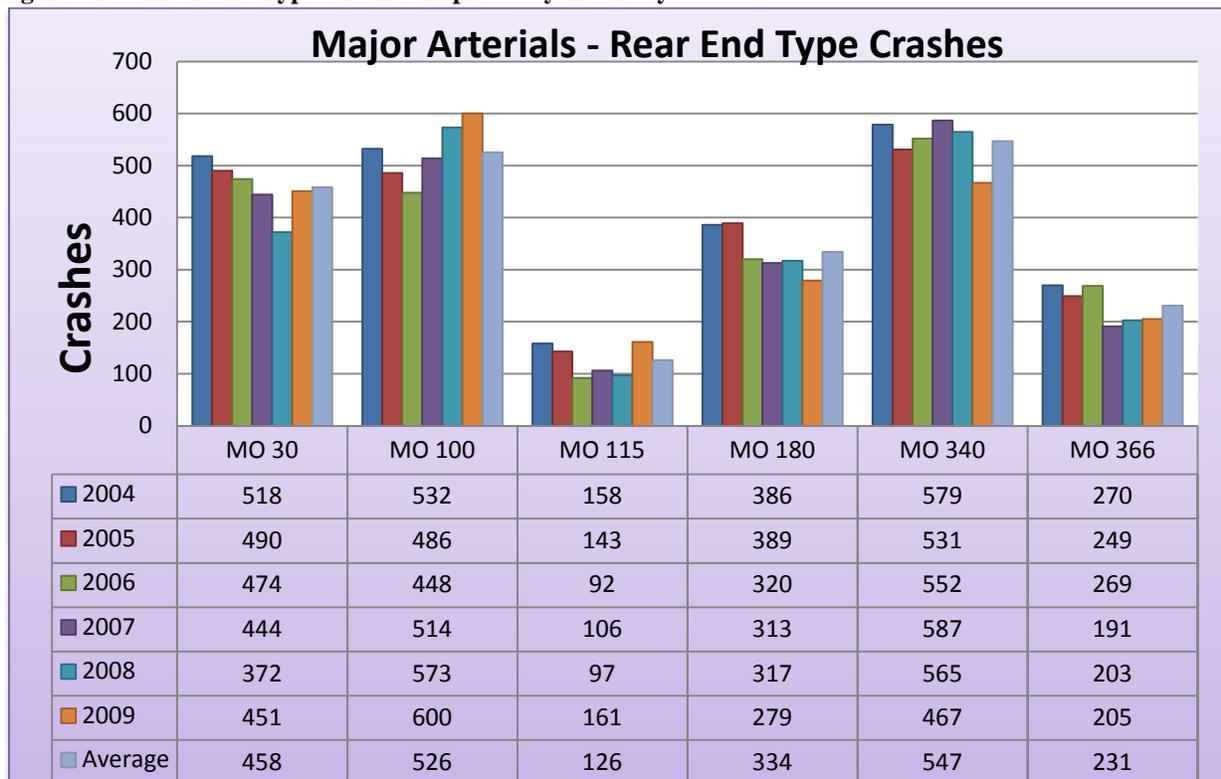


Figure S15 – Rear-end Type Crashes Expressway Roadway



General Findings

Freeways

I-44, I-64, I-170 and I-270 showed a general decreasing trend for crash rates especially after 2007. Again, I-64 (I-270 to I-55 downtown) was impacted by the closure and showed significant reduction in crash rates. In reviewing the 2009 crash rate index, I-44, I-55, I-64, I-170 and I-270 experienced reduction in crash rates from the 2004 base year a 28 percent, 9 percent, 75 percent, 35 percent and 17 percent reduction. I-70 was the only freeway roadway that experienced an increase in crash rate in 2009. A further in-depth crash investigation beyond the scope of this project could provide a better insight to why I-70 is not following a similar decreasing trend noticed in all freeways.

Expressways

The US Route 40 (I-270 and Missouri Research Park) was recently designated as I-64 with the upgrade completion out to I-70 near Wentzville. This roadway was at a freeway standard and its crash rates reflect the higher standard roadway with similar freeway crash rates. US Route 61, US Route 67 and Route D have been stable over the 6-year evaluation with Route D having a noticeable decrease in crash rates of 36 percent in 2009 based on the 2004 base year. Route 141 has shown no noticeable trend other than increasing one year and decreasing the next year. It would be good to investigate these routes in the future, to determine the impact to the investment made in an extensive regional arterial management system that was part of the preparatory work to I-64 project. Reduction in crash rates in 3 of the 4 expressways made in part have been the results of the long-term investment of the regional arterial management system in these adjacent roadways.

Major Arterials

Routes 30, 180, 340 and 366 have shown a decreasing crash rate trend throughout the six-year or at least the past 3 to 4 years with respective decreases of 17 percent, 10 percent, 17 percent and 18 percent when compared to the 2004 base year. Routes 100 and 115 have experienced fluctuating trends across the six-year period. Route 100 has seen a slight fluctuation between 10 percent decrease to 5 percent increase when compared to the 2004 base year. Route 115 has seen a slightly higher fluctuation between 2 percent decrease to a 20 percent increase when compared to the 2004 base year. As mentioned in the expressways' findings, the investment made in the regional arterial management system may have long-term value in improved safety and traffic flow along these corridors, too.

Conclusion

From this evaluation, we can conclude that no observational evidence was found to prove the fact that I-64 closure influences increased crashes on adjacent highways around the closure. The support of this conclusion is based on the following points:

- I-64 experienced a decrease in crashes of 1,841 in 2008 and 2009 when compared to the 4-year pre-closure average for 2004 through 2007

- Sixteen other adjacent roadways evaluated experienced a decrease in crashes of 2,125 in 2008 and 2009 when compared to the 4-year pre-closure average for 2004 through 2007
- Crashes and Crash Rates decreased for most freeways, expressways and major arterials with only I-70, Route 141, Route 100 and Route 115 showing increases on the 2-year closure period
- The following table compares the pre-closure 4-year period to 2008 and 2009 for 17 roadways evaluated in the study. The only increase was in ‘out of control’ type crashes:

Table S7 Comparison Severity and Crash Types

Severity	2004- 2007 Average	2008	2009	Percent Change 2008 and 2009
Fatal	46	39	26	-15 % and -43%
Disabling Injury	306	295	247	-4% and -19%
Minor Injury	3766	3367	3148	-11% and -16%
Property Damage Only	12477	11410	10734	-9% and -14%
All Crashes	16595	15111	14155	-9% and -15%
Crash Type	2004- 2007 Average	2008	2009	Percent Change 2008 and 2009
Rear-end	7913	6835	6728	-14% and -15%
Out of Control	2280	2584	2490	+13% and +9
Passing	1934	1660	1367	-14% and -29%
Other Type	4464	4035	3523	-10% and -21%

Please note a negative (-) means a decrease in crashes and positive (+) means an increase in crashes

Appendix

EXHIBIT CRASH ANALYSIS

Table S8 All Crashes by Year (2004 through 2009)

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	1,100	1,084	1,065	1,077	1,131	879	1,056
Freeway	I-55	964	960	974	952	998	890	956
Freeway	I-64	1,624	1,610	1,494	1,205	717	408	1,176
Freeway	I-70	1,907	1,884	1,902	1,996	2,078	2,223	1,998
Freeway	I-170	906	770	830	805	776	558	774
Freeway	I-270	2,103	2,201	2,302	2,287	2,083	1,804	2,130
	All	8,604	8,509	8,567	8,322	7,783	6,762	8,091
Expressway	US 40	489	536	553	529	344	469	487
Expressway	US 61	853	828	819	791	761	781	806
Expressway	US 67	484	396	396	358	345	392	395
Expressway	MO 141	503	566	504	589	503	625	548
Expressway	MO D	728	682	636	690	699	464	650
	All	3,057	3,008	2,908	2,957	2,652	2,731	2,886
Major Arterial	MO 30	1,298	1,297	1,049	1,048	941	1,025	1,110
Major Arterial	MO 100	1,179	1,085	1,019	1,086	1,146	1,196	1,119
Major Arterial	MO 115	455	432	382	370	385	411	406
Major Arterial	MO 180	879	822	721	689	675	630	736
Major Arterial	MO 340	1,071	939	1,061	1,059	1,003	879	1,002
Major Arterial	MO 366	655	645	652	519	526	521	586
	All	5,537	5,220	4,884	4,771	4,676	4,662	4,958
Combine Totals		17,198	16,737	16,359	16,050	15,111	14,155	15,935

Figure S15 – All Freeway Crashes

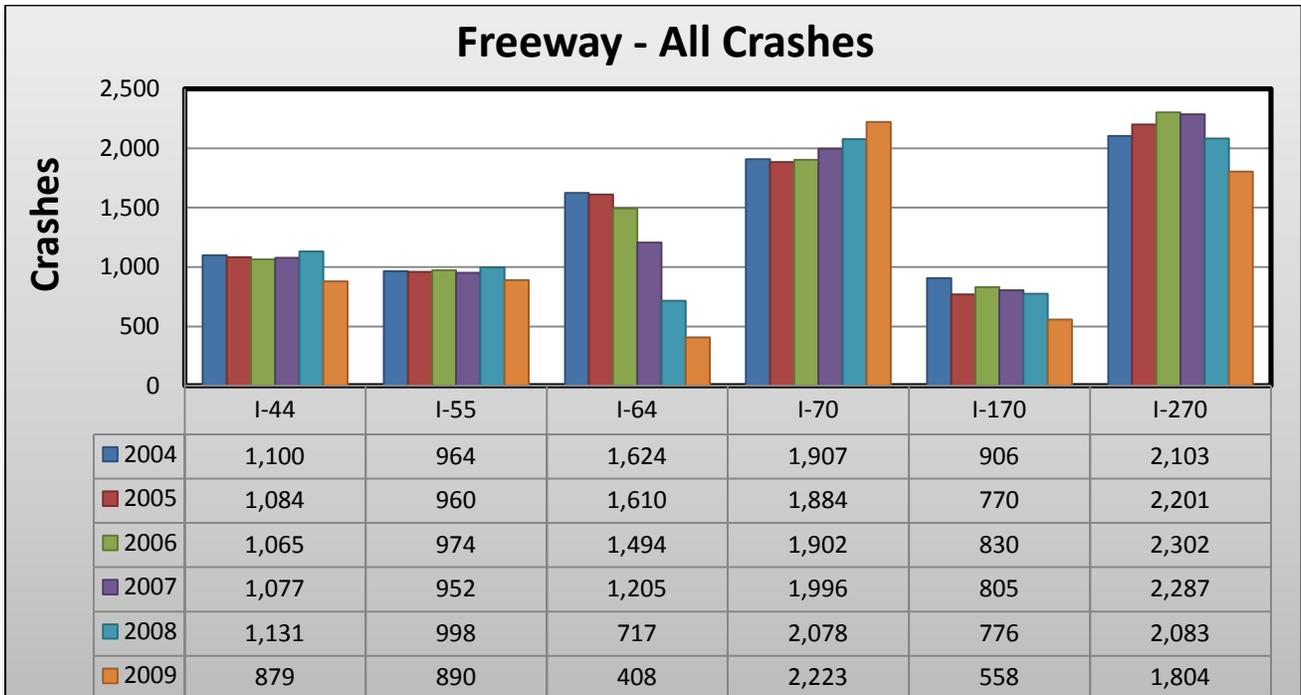


Figure S16 – All Expressway Crashes

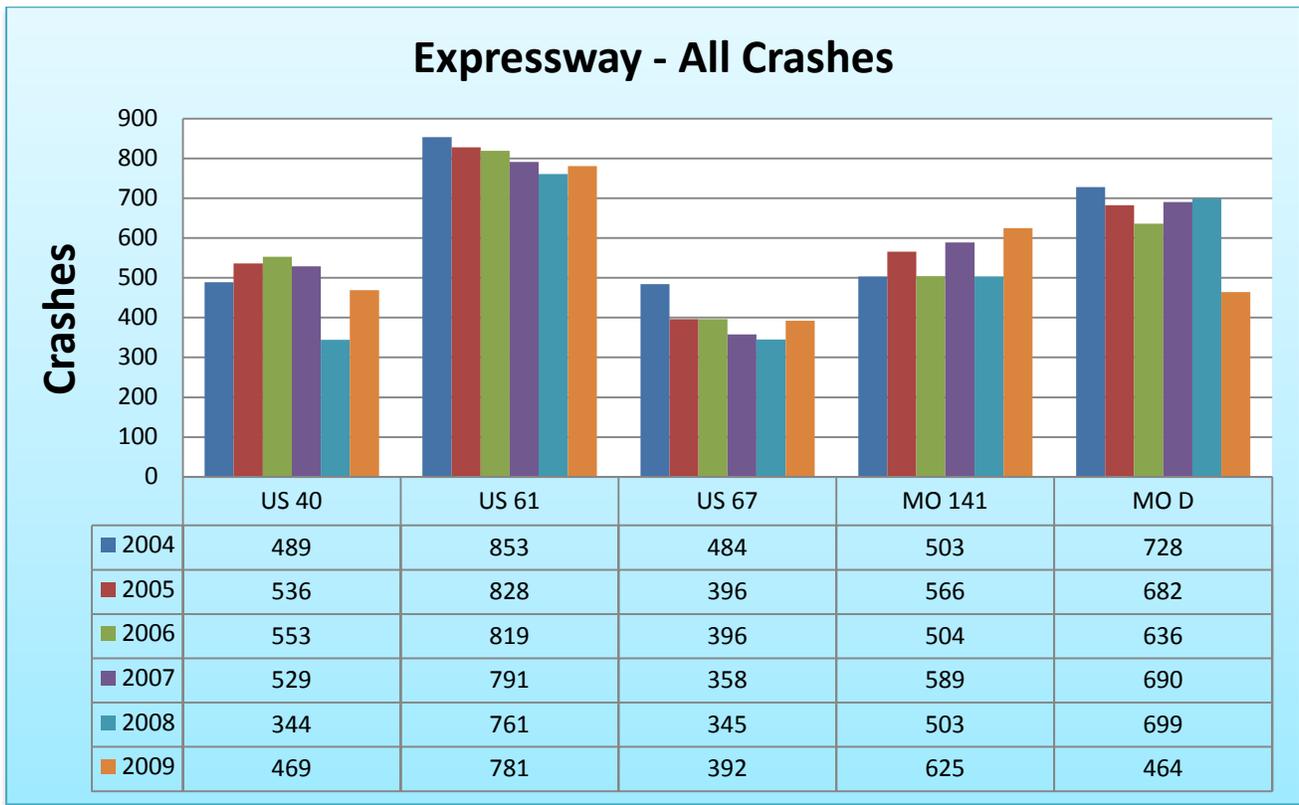


Figure S17 – All Major Arterial Crashes

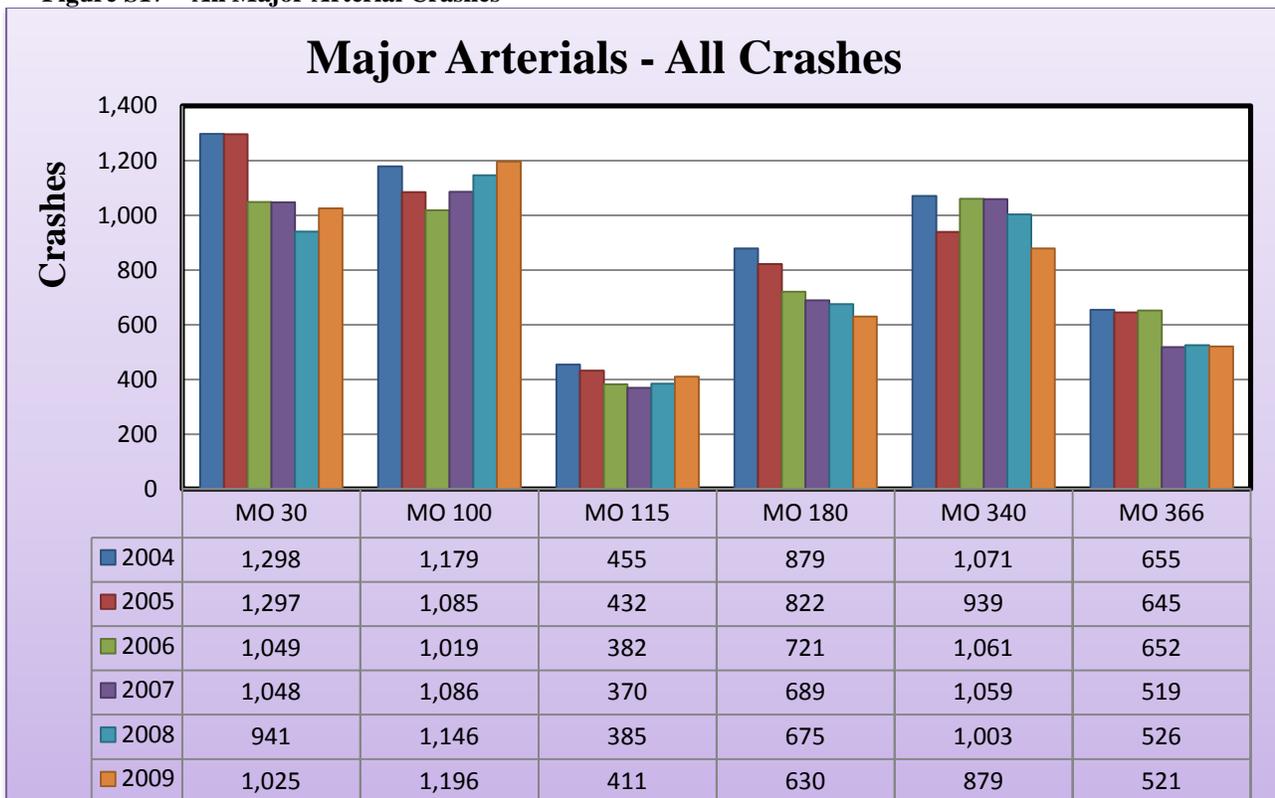


Table S9 All Fatal Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	5	3	8	6	3	1	4.3
Freeway	I-55	10	7	7	4	5	7	6.7
Freeway	I-64	6	4	5	3	1	0	3.2
Freeway	I-70	2	10	5	6	15	8	7.7
Freeway	I-170	5	3	2	1	6	1	3.0
Freeway	I-270	6	8	4	4	0	2	4.0
	All	34	35	31	24	30	19	28.8
Expressway	US 40	2	0	1	1	1	0	0.8
Expressway	US 61	0	1	1	0	0	1	0.5
Expressway	US 67	2	0	3	1	3	0	1.5
Expressway	MO 141	0	1	0	1	0	1	0.5
Expressway	MO D	2	1	4	0	3	0	1.7
	All	6	3	9	3	7	2	5.0
Major Arterial	MO 30	5	8	3	3	2	0	3.5
Major Arterial	MO 100	0	1	0	1	0	1	0.5
Major Arterial	MO 115	1	1	1	0	0	0	0.5
Major Arterial	MO 180	1	1	1	1	0	2	1.0
Major Arterial	MO 340	3	1	1	1	0	0	1.0
Major Arterial	MO 366	0	0	1	2	0	2	0.8
	All	10	12	7	8	2	5	7.3
Combine Totals		50	50	47	35	39	26	41

Figure S18 – Freeway Fatal Crashes

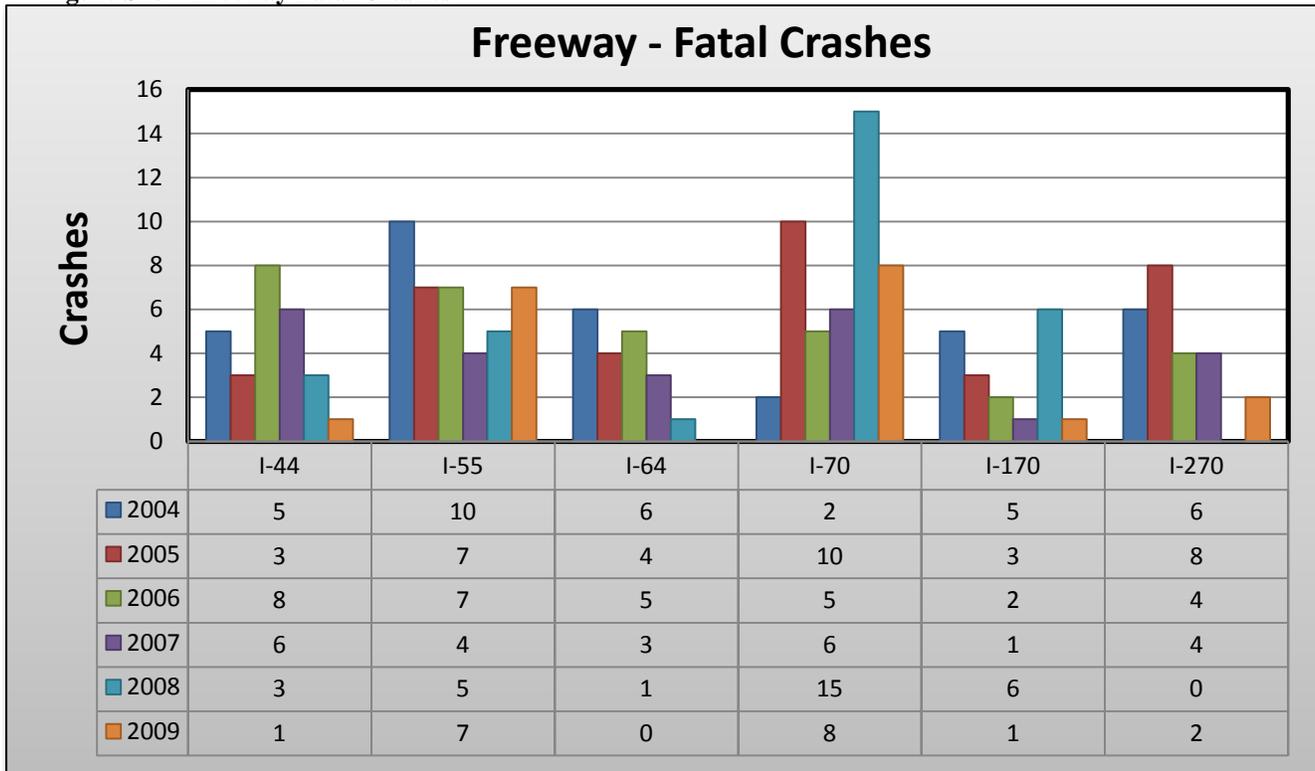


Figure S19 – Expressway Fatal Crashes

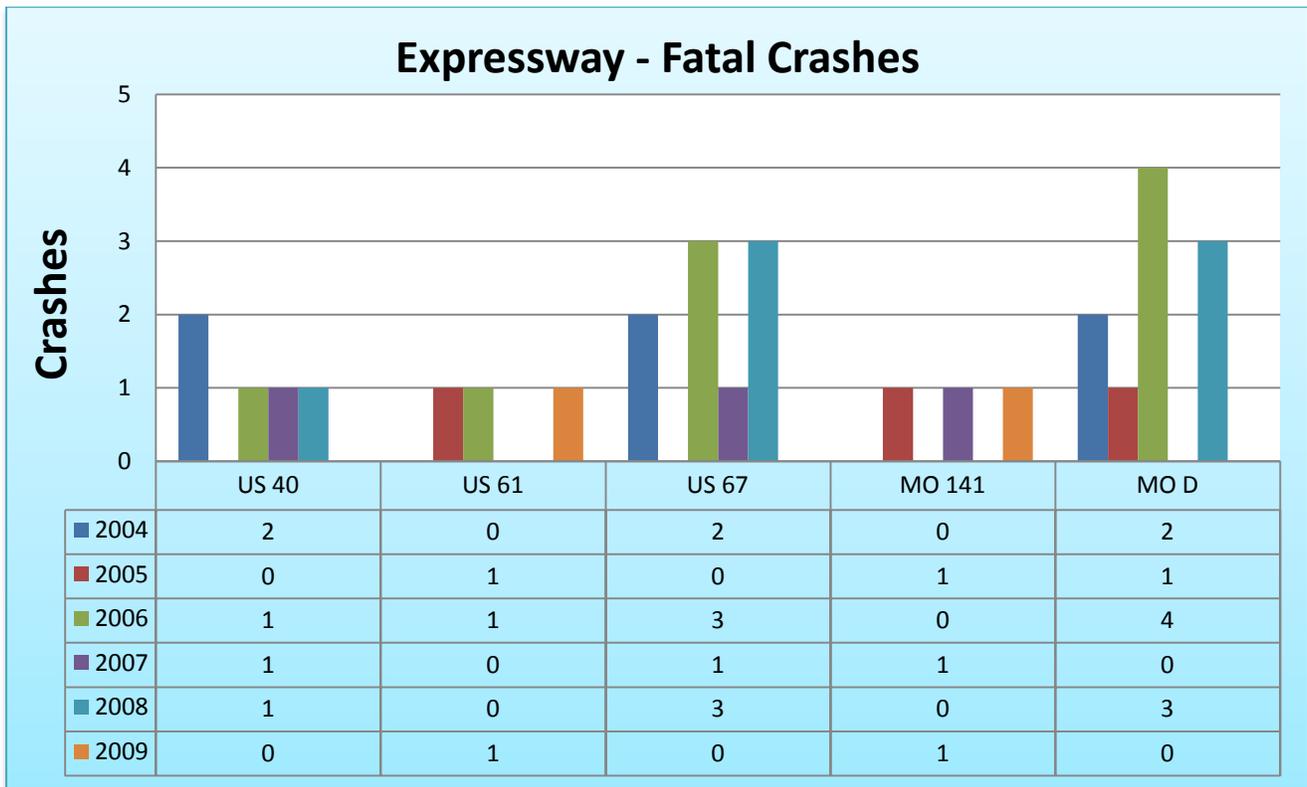


Figure S20 – Major Arterial Fatal Crashes

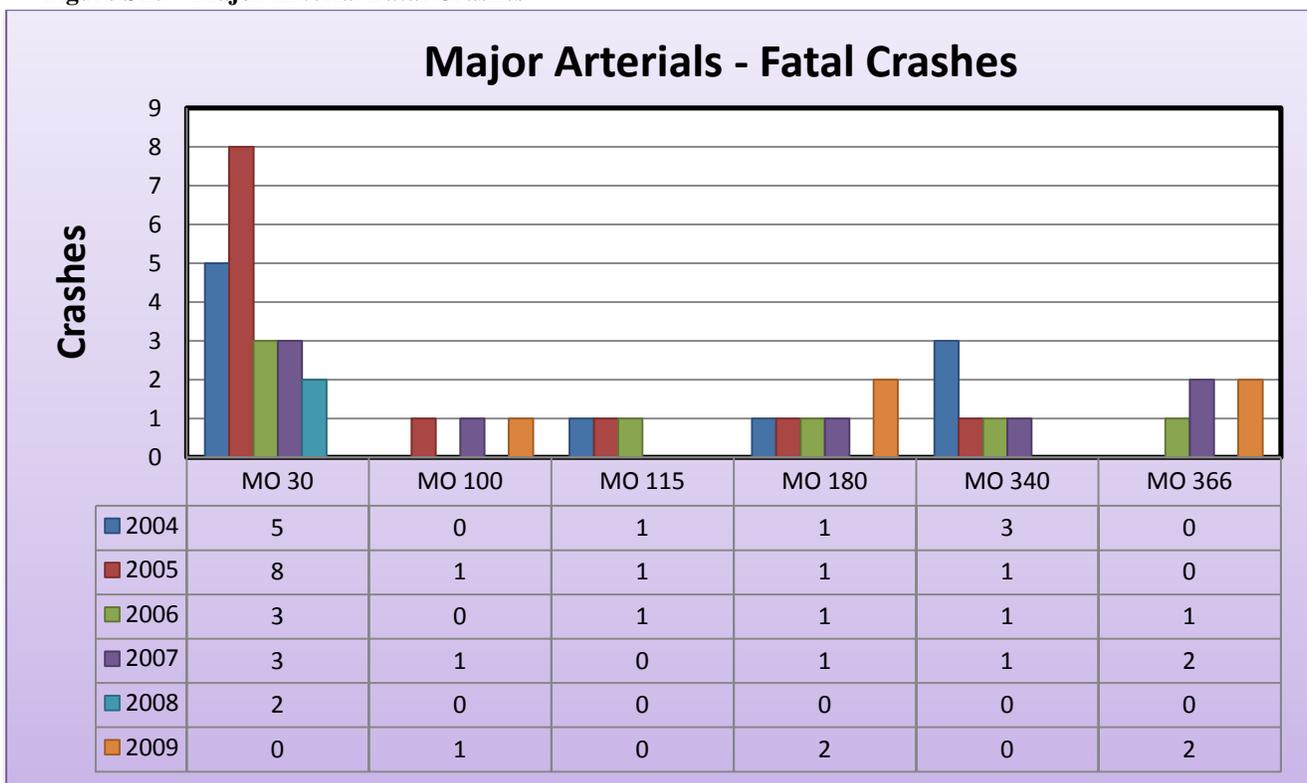


Table S10 All Disabling Injury Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	25	11	18	19	23	18	19
Freeway	I-55	26	32	32	23	24	21	19
Freeway	I-64	24	16	19	13	8	6	14
Freeway	I-70	50	35	45	59	65	47	50
Freeway	I-170	26	19	19	9	16	12	17
Freeway	I-270	49	49	36	42	41	31	41
	All	200	162	169	165	177	135	168
Expressway	US 40	8	12	7	9	5	4	8
Expressway	US 61	16	13	11	9	10	8	11
Expressway	US 67	9	10	11	7	9	6	9
Expressway	MO 141	10	8	3	3	3	6	6
Expressway	MO D	14	13	13	8	13	10	12
	All	57	56	45	36	40	34	45
Major Arterial	MO 30	30	22	23	15	21	13	21
Major Arterial	MO 100	25	16	8	18	14	26	18
Major Arterial	MO 115	5	5	7	6	9	8	7
Major Arterial	MO 180	19	16	10	16	13	9	14
Major Arterial	MO 340	11	19	11	15	18	18	15
Major Arterial	MO 366	8	13	12	3	3	4	7
	All	98	91	71	73	78	78	82
Combine Totals		355	309	285	274	295	247	294

Figure S21 – Freeway Disabling Injury Crashes

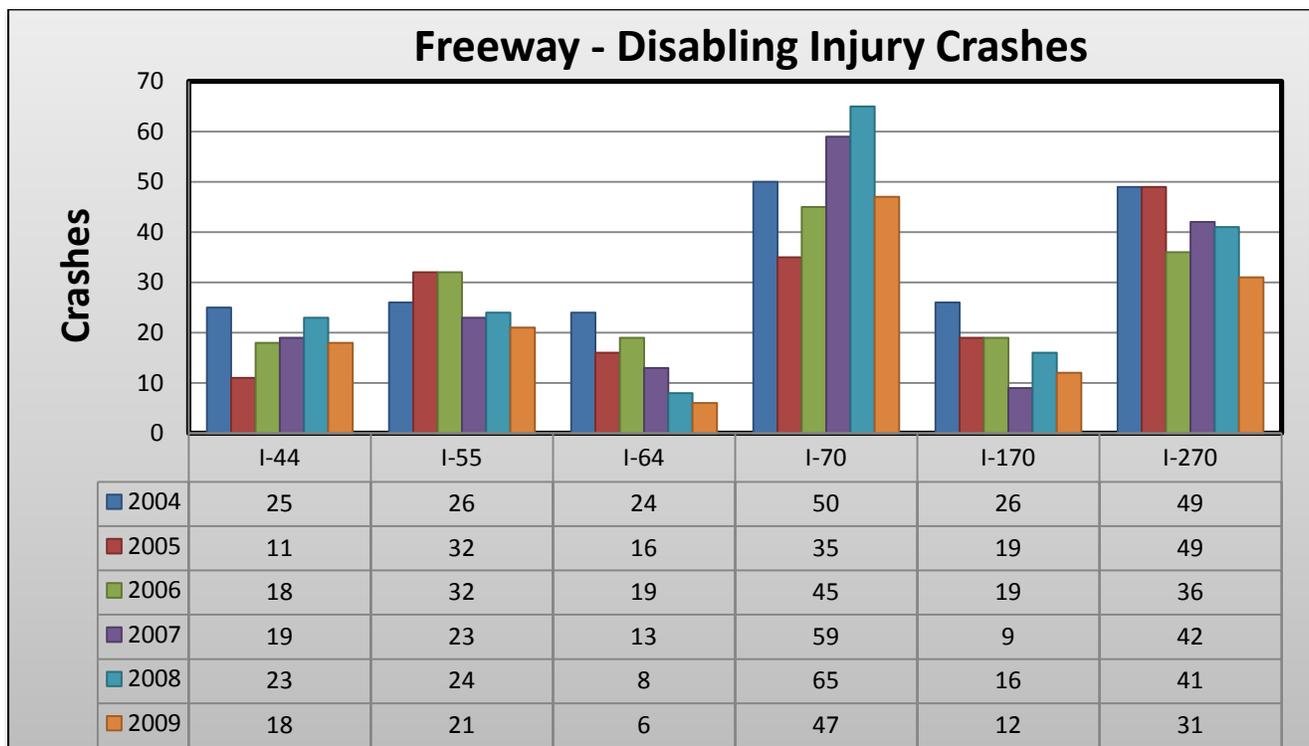


Figure S22 – Expressway Disabling Injury Crashes

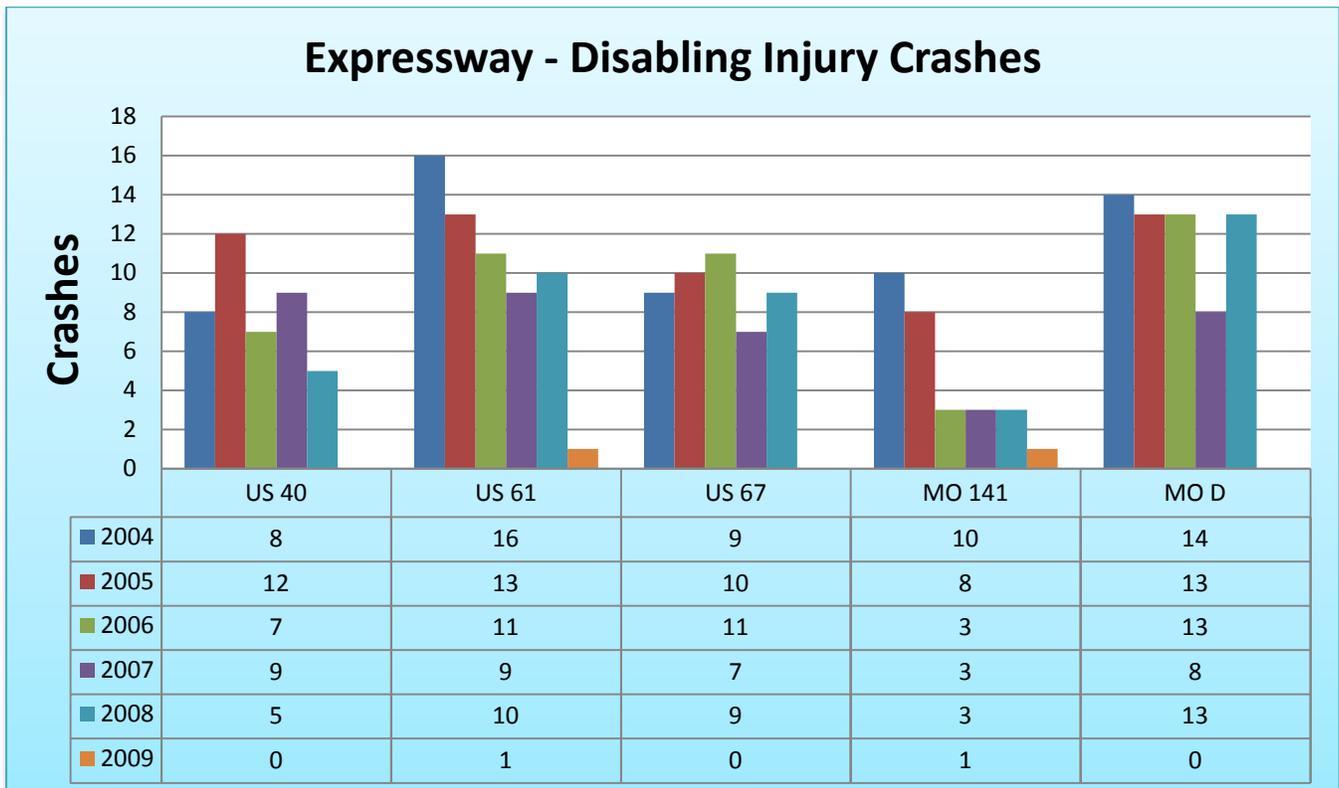


Figure S23 – Major Arterial Disabling Injury Crashes

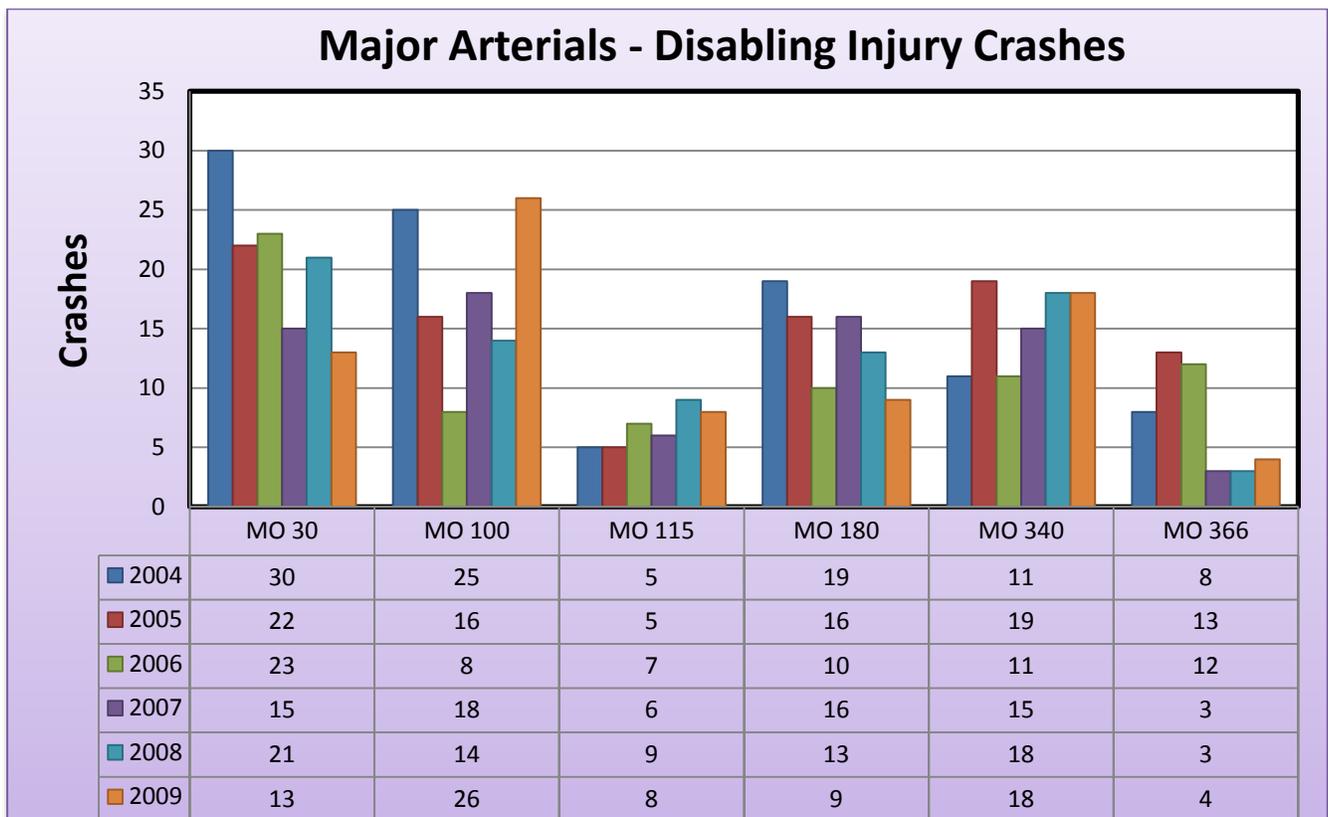


Table S11 All Minor Injury Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	247	234	226	238	256	186	231
Freeway	I-55	251	220	229	213	227	208	225
Freeway	I-64	379	407	326	276	151	103	274
Freeway	I-70	482	537	475	510	534	593	522
Freeway	I-170	195	193	184	162	162	119	169
Freeway	I-270	415	514	530	497	474	381	469
	All	1,969	2,105	1,970	1,896	1,804	1,590	1,889
Expressway	US 40	134	156	150	112	81	106	123
Expressway	US 61	187	162	164	185	159	163	170
Expressway	US 67	116	94	87	93	83	82	93
Expressway	MO 141	125	109	104	113	84	101	106
Expressway	MO D	146	145	130	148	126	90	131
	All	708	666	635	651	533	542	623
Major Arterial	MO 30	265	296	250	240	222	207	247
Major Arterial	MO 100	222	214	205	190	198	231	210
Major Arterial	MO 115	93	98	85	98	97	93	94
Major Arterial	MO 180	199	220	182	176	169	182	188
Major Arterial	MO 340	218	205	204	221	219	176	207
Major Arterial	MO 366	132	165	147	137	125	127	139
	All	1,129	1,198	1,073	1,062	1,030	1,016	1,085
Combine Totals		3,806	3,969	3,678	3,609	3,367	3,148	3,596

Figure S24 – Freeway Minor Injury Crashes

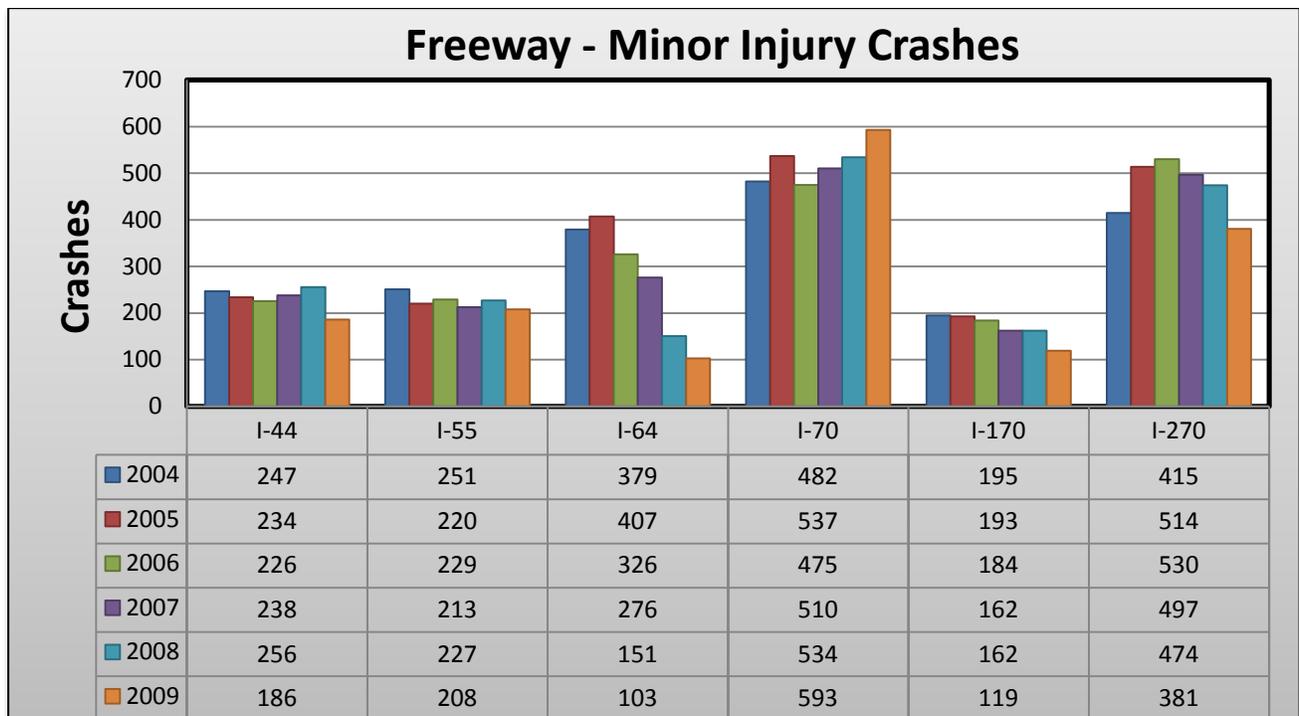


Figure S25 – Expressway Minor Injury Crashes

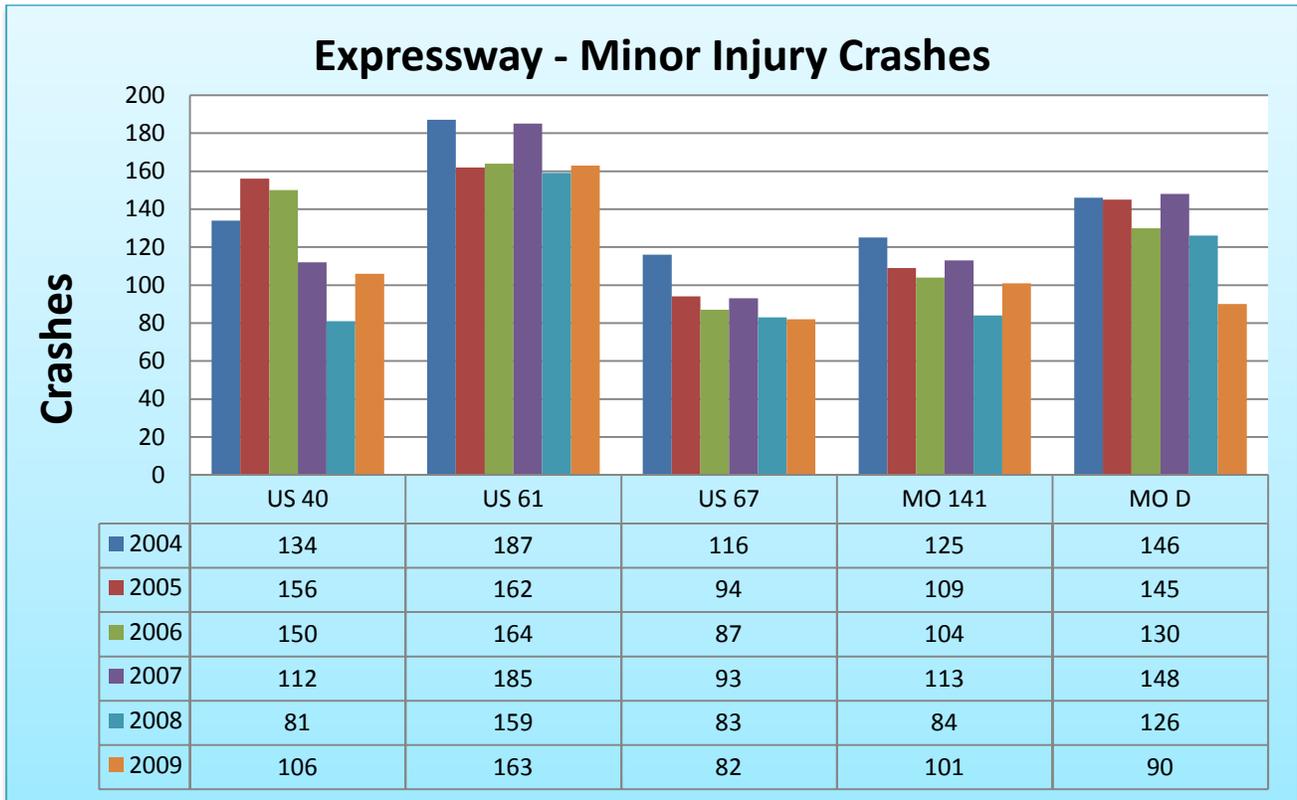


Figure S26 – Major Arterial Minor Injury Crashes

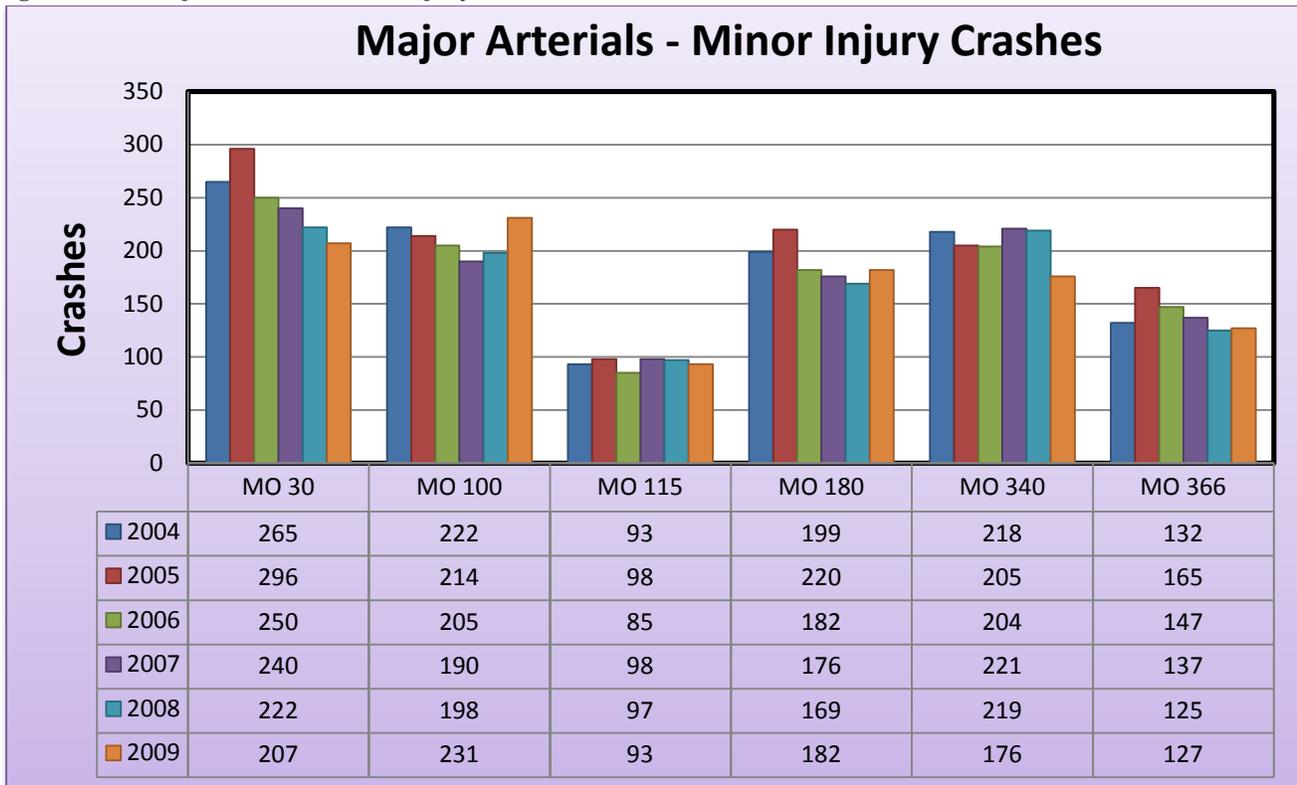


Table S12 All Property Damage Only Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	823	836	813	814	849	677	802
Freeway	I-55	677	701	706	712	742	658	699
Freeway	I-64	1,215	1,183	1,144	913	558	301	886
Freeway	I-70	1,373	1,320	1,377	1,421	1,464	1,579	1,422
Freeway	I-170	680	555	625	633	592	429	586
Freeway	I-270	1,633	1,630	1,732	1,744	1,568	1,393	1,617
	All	6,401	6,225	6,397	6,237	5,773	5,037	6,012
Expressway	US 40	345	368	395	407	257	362	356
Expressway	US 61	650	652	643	597	592	547	614
Expressway	US 67	357	292	295	267	251	306	295
Expressway	MO 141	368	448	397	472	417	521	437
Expressway	MO D	566	523	489	534	557	367	506
	All	2,286	2,283	2,219	2,277	2,074	2,103	2,207
Major Arterial	MO 30	998	971	773	790	691	805	838
Major Arterial	MO 100	932	855	806	878	934	938	891
Major Arterial	MO 115	356	328	289	266	281	312	305
Major Arterial	MO 180	660	585	528	496	493	461	537
Major Arterial	MO 340	839	714	845	822	766	685	779
Major Arterial	MO 366	515	467	492	377	398	393	440
	All	4,300	3,920	3,733	3,629	3,563	3,594	3,790
Combine Totals		12,987	12,428	12,349	12,143	11,410	10,734	12,009

Figure S27 – Freeway Property Damage Only Crashes

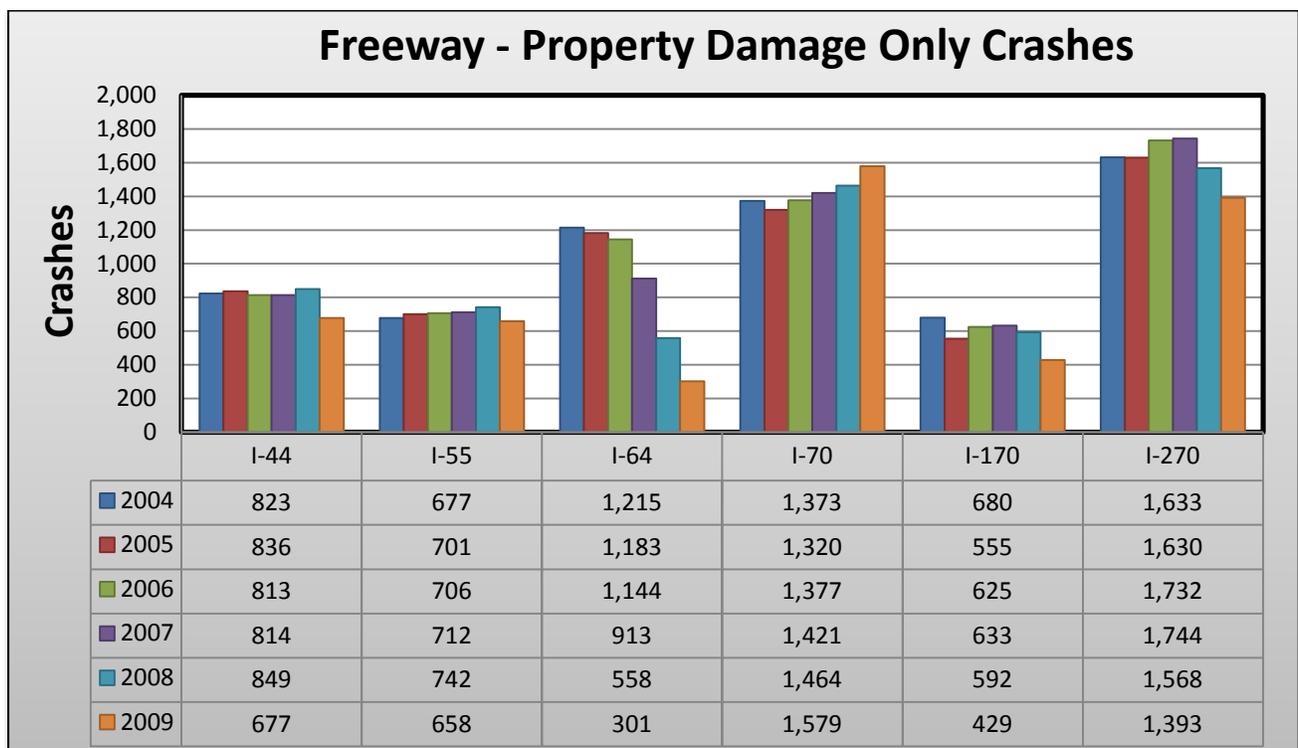


Figure S28 – Expressway Property Damage Only Crashes

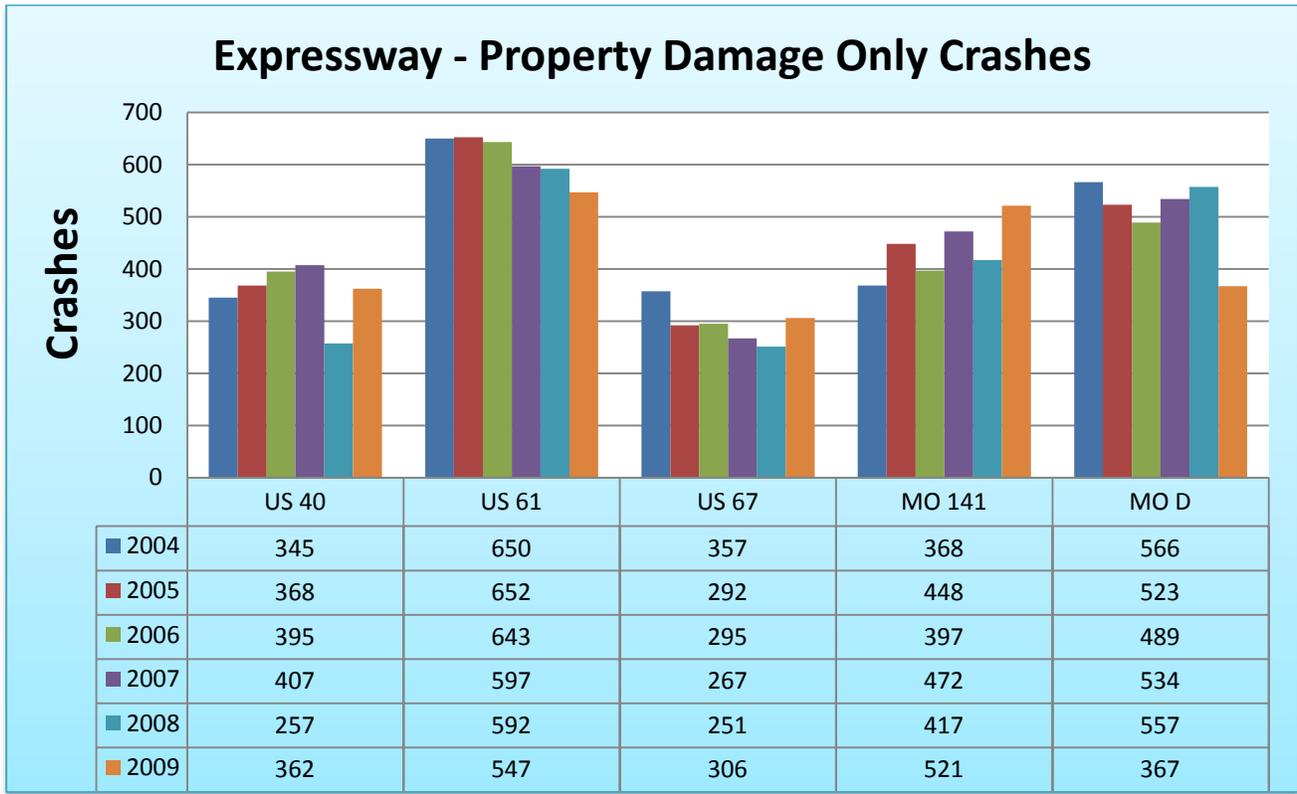


Figure S29 – Major Arterial Property Damage Only Crashes

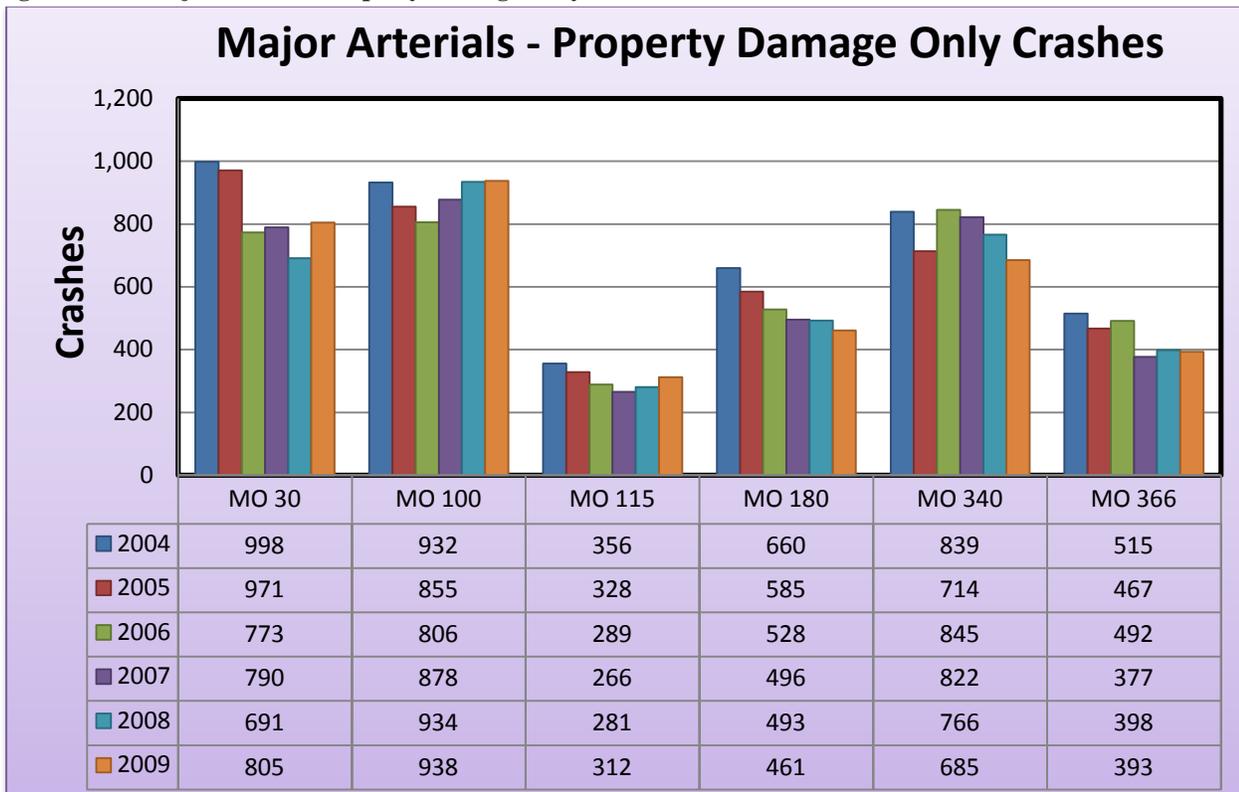


EXHIBIT CRASH RATE ANALYSIS

Table S13 All Crash Rates by Year (2004 through 2009)

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	142	139	134	135	137	103	132
Freeway	I-55	158	157	149	144	152	144	151
Freeway	I-64	225	224	206	168	102	57	164
Freeway	I-70	182	179	189	196	203	210	193
Freeway	I-170	223	190	203	195	188	139	189
Freeway	I-270	142	149	152	150	138	117	141
Expressway	US 40	89	98	103	99	66	92	91
Expressway	US 61	425	423	402	388	382	401	403
Expressway	US 67	516	432	488	441	429	494	467
Expressway	MO 141	371	428	375	438	381	437	405
Expressway	MO D	398	380	353	384	397	254	361
Major Arterial	MO 30	574	584	468	470	434	477	501
Major Arterial	MO 100	413	389	370	395	426	435	405
Major Arterial	MO 115	426	482	431	417	444	511	452
Major Arterial	MO 180	448	434	429	410	411	404	423
Major Arterial	MO 340	446	400	477	475	453	369	437
Major Arterial	MO 366	443	438	444	353	366	364	401

Figure S30 – Freeway All Crash Rates

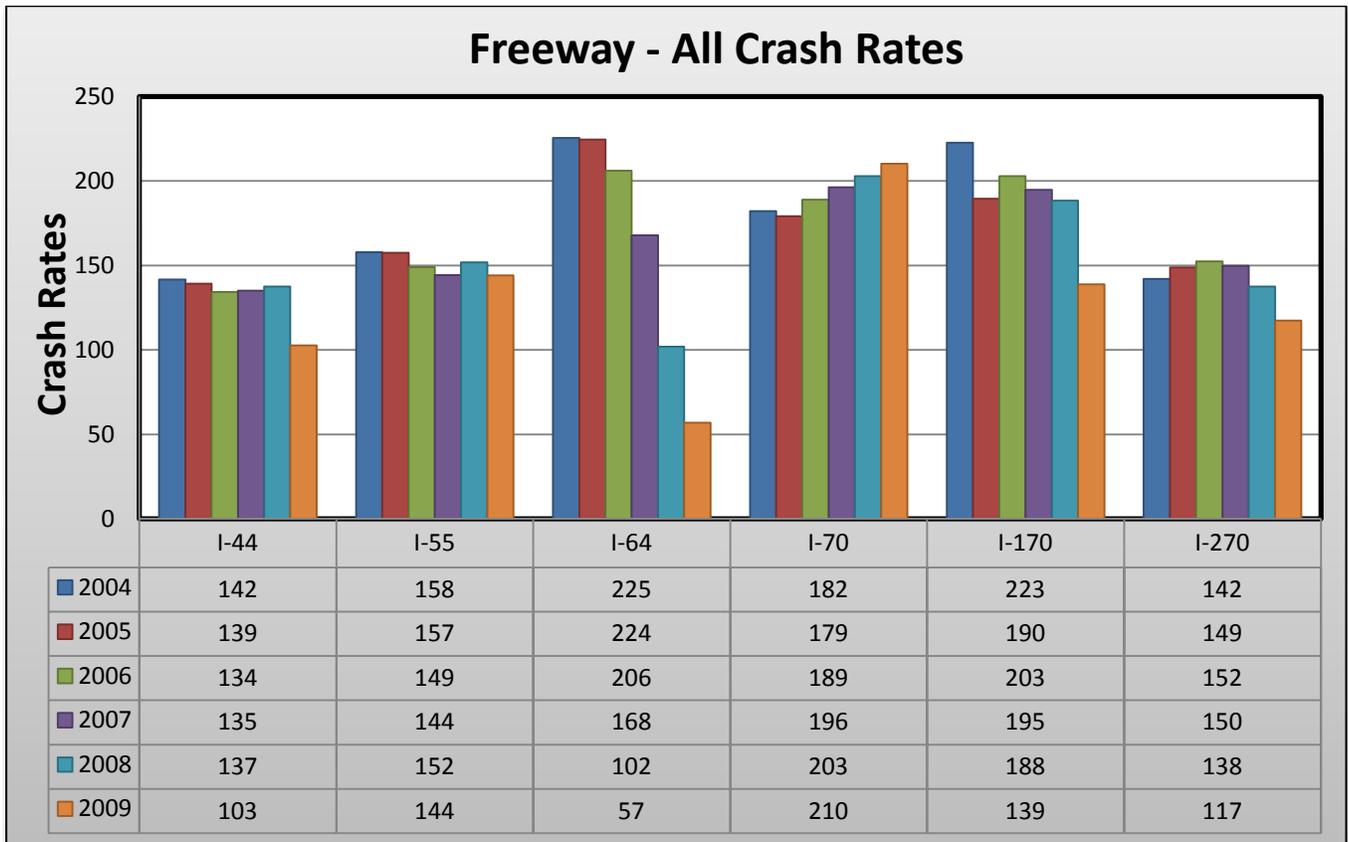


Figure S31 – Expressway All Crash Rates

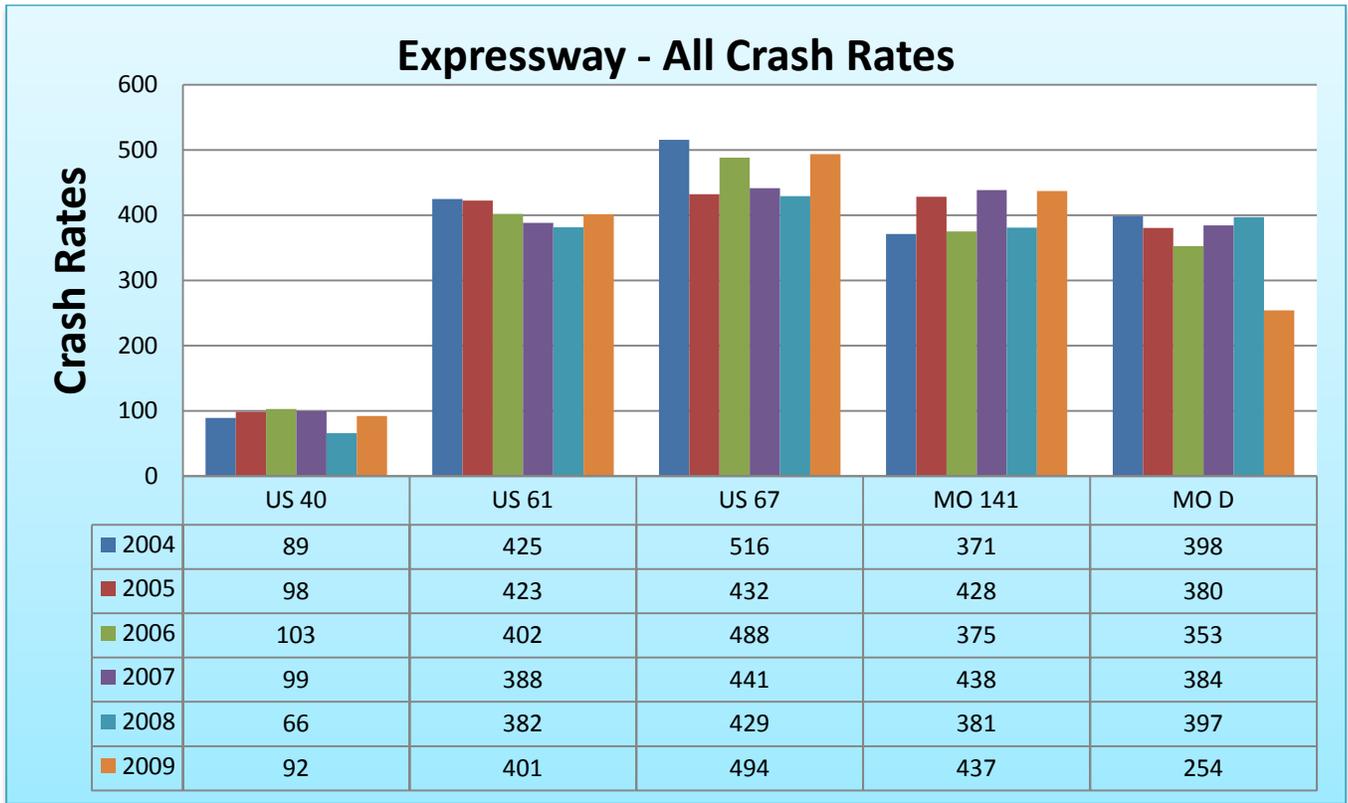


Figure S32 – Major Arterial All Crash Rates

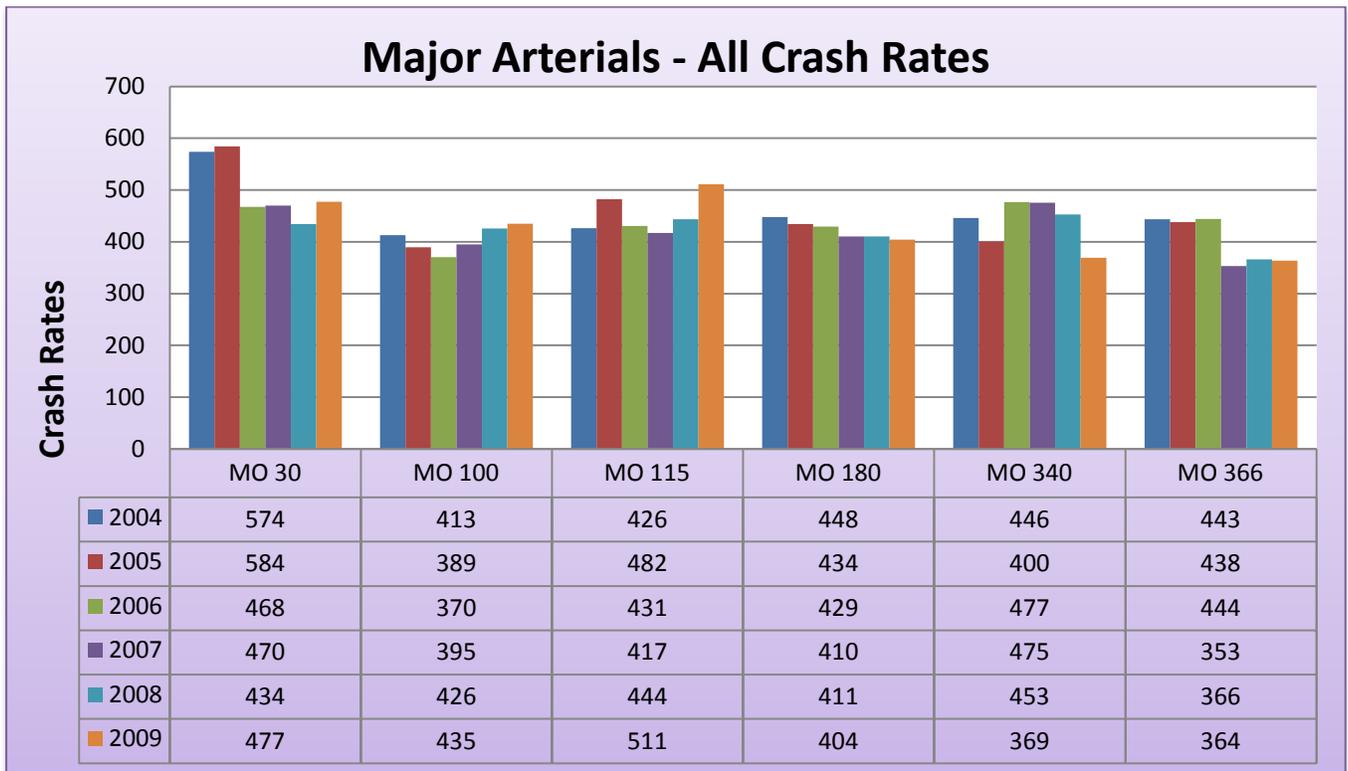


Table S14 Fatal Crash Rates

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	0.6	0.4	1.0	0.8	0.4	0.1	0.5
Freeway	I-55	1.6	1.1	1.1	0.6	0.8	1.1	1.1
Freeway	I-64	0.8	0.6	0.7	0.4	0.1	0.0	0.4
Freeway	I-70	0.2	1.0	0.5	0.6	1.5	0.8	0.7
Freeway	I-170	1.2	0.7	0.5	0.2	1.5	0.2	0.7
Freeway	I-270	0.4	0.5	0.3	0.3	0.0	0.1	0.3
Expressway	US 40	0.4	0.0	0.2	0.2	0.2	0.0	0.2
Expressway	US 61	0.0	0.5	0.5	0.0	0.0	0.5	0.3
Expressway	US 67	2.1	0.0	3.7	1.2	3.7	0.0	1.8
Expressway	MO 141	0.0	0.8	0.0	0.7	0.0	0.7	0.4
Expressway	MO D	1.1	0.6	2.2	0.0	1.7	0.0	0.9
Major Arterial	MO 30	2.2	3.6	1.3	1.3	0.9	0.0	1.6
Major Arterial	MO 100	0.0	0.4	0.0	0.4	0.0	0.4	0.2
Major Arterial	MO 115	0.9	1.1	1.1	0.0	0.0	0.0	0.5
Major Arterial	MO 180	0.5	0.5	0.6	0.6	0.0	1.3	0.6
Major Arterial	MO 340	1.2	0.4	0.4	0.4	0.0	0.0	0.4
Major Arterial	MO 366	0.0	0.0	0.7	1.4	0.0	1.4	0.6

Figure S33 – Freeway Fatal Crash Rates

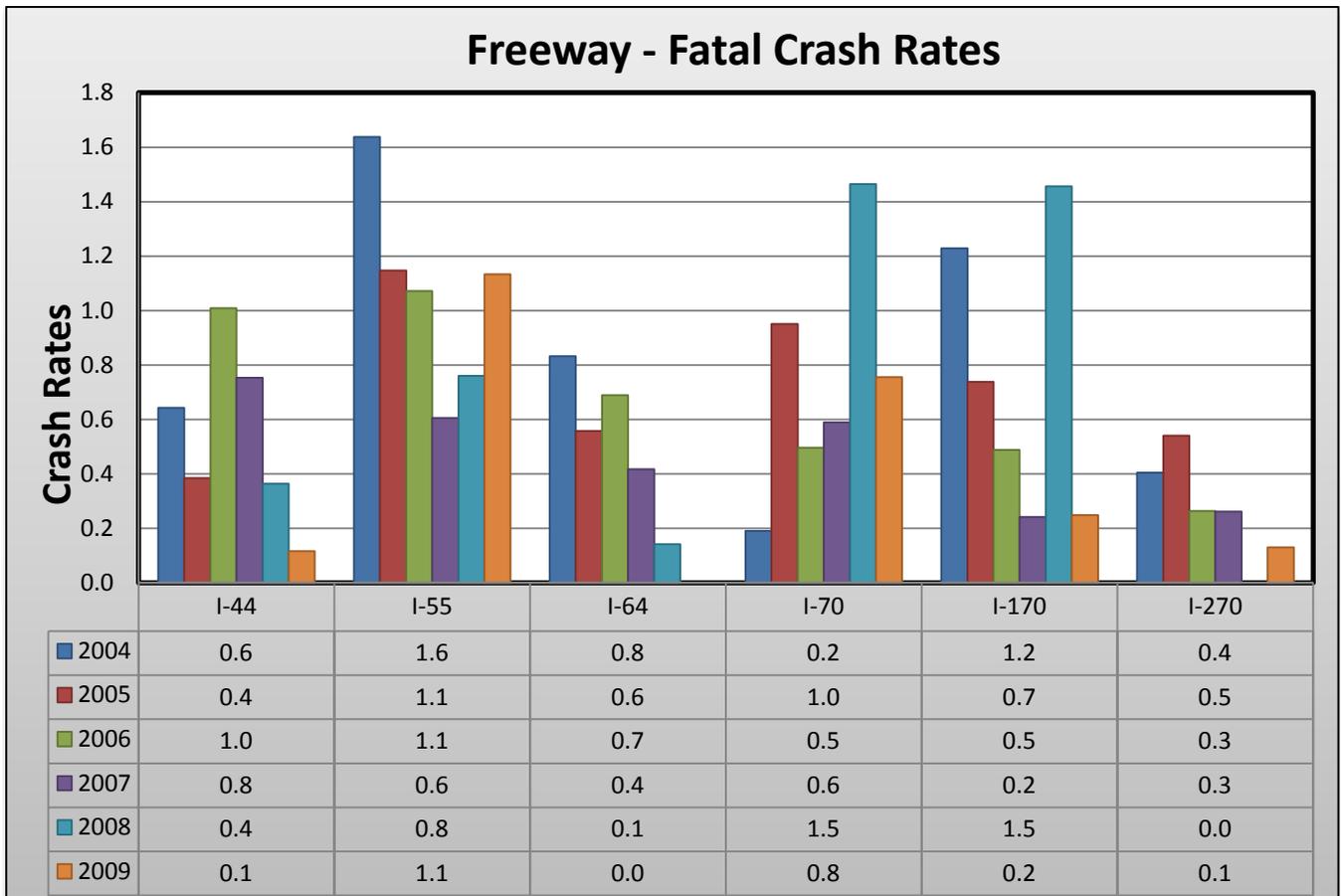


Figure S34 – Expressway Fatal Crash Rates

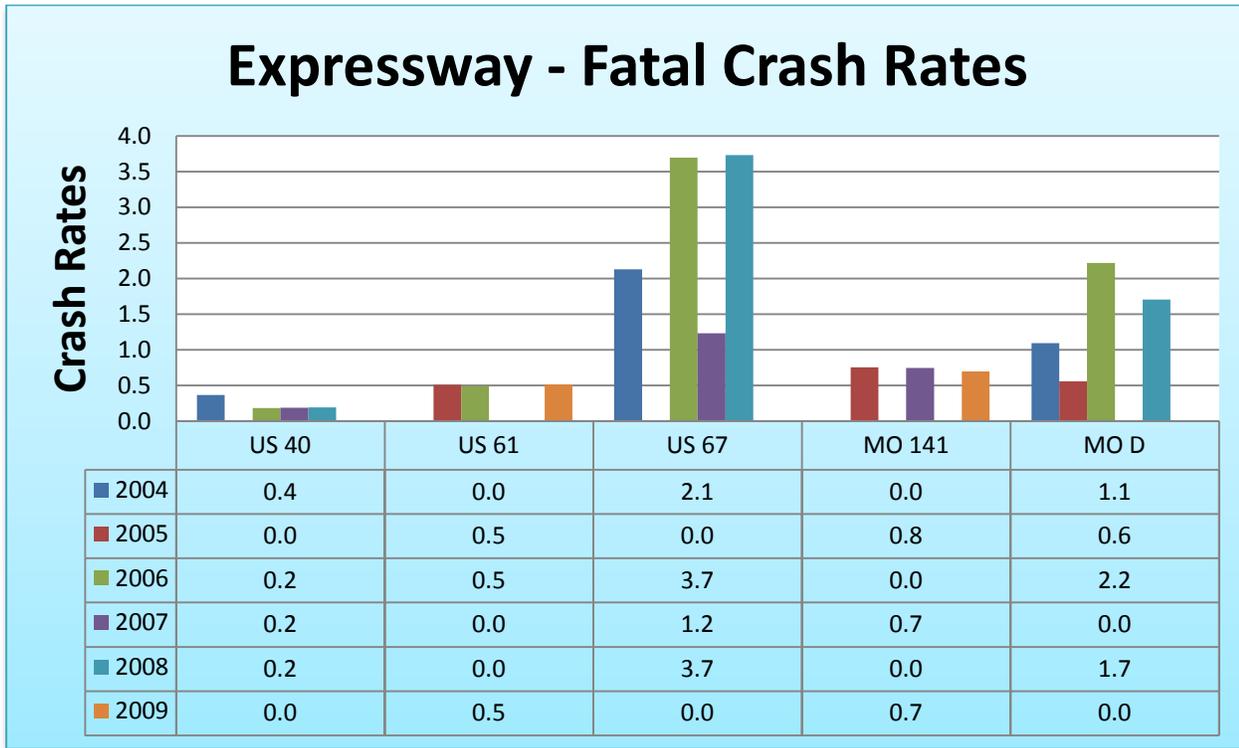


Figure S35 – Major Arterial Fatal Crash Rates

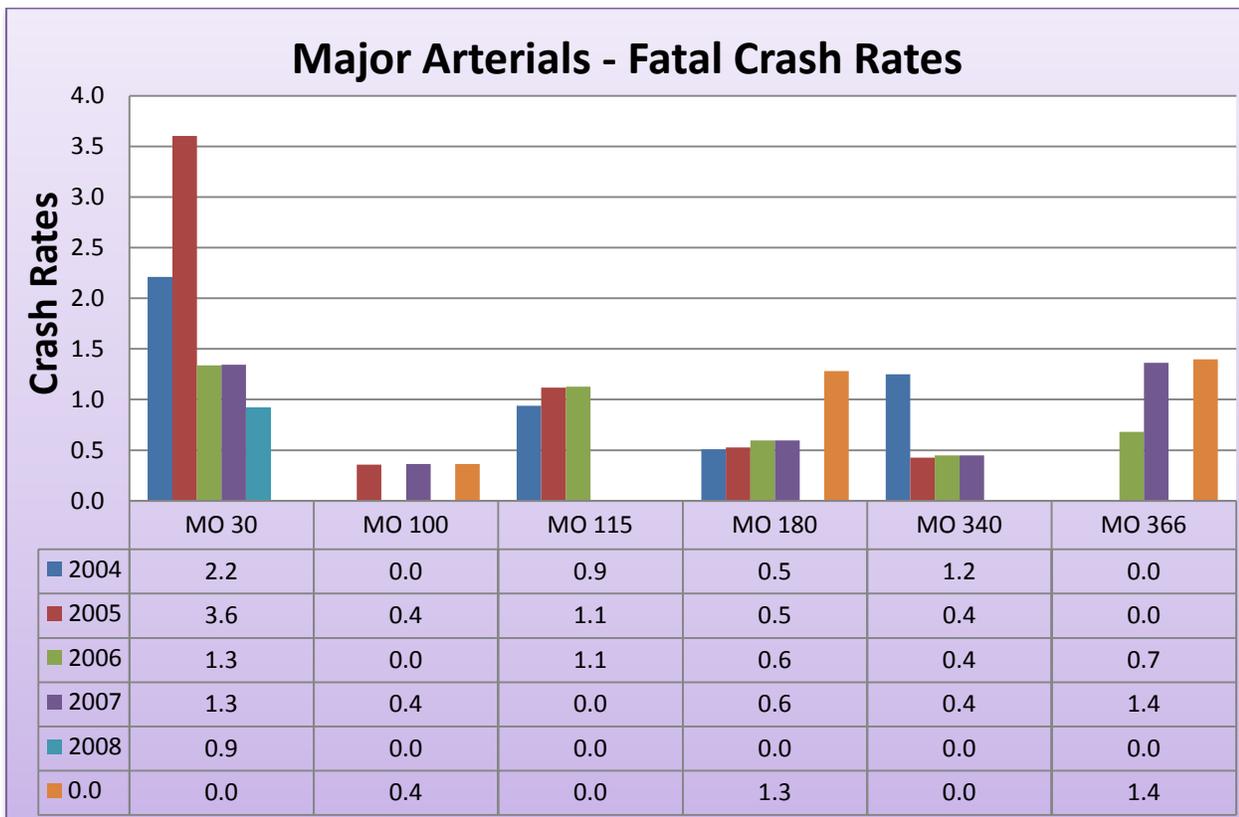


Table S15 Disabling Injury Crash Rates

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	3.22	1.41	2.26	2.38	2.79	2.10	2.36
Freeway	I-55	4.26	5.23	4.88	3.48	3.65	3.39	4.15
Freeway	I-64	3.33	2.22	2.61	1.81	1.14	0.84	1.99
Freeway	I-70	4.78	3.32	4.46	5.78	6.35	4.43	4.85
Freeway	I-170	6.39	4.66	4.63	2.17	3.88	2.98	4.12
Freeway	I-270	3.31	3.30	2.38	2.74	2.71	2.01	2.74
Expressway	US 40	1.46	2.20	1.30	1.69	0.96	0.79	1.40
Expressway	US 61	7.97	6.62	5.38	4.40	5.01	4.11	5.58
Expressway	US 67	9.59	10.88	13.52	8.60	11.20	7.55	10.22
Expressway	MO 141	7.38	6.03	2.23	2.23	2.27	4.19	4.06
Expressway	MO D	7.66	7.23	7.19	4.44	7.38	5.48	6.56
Major Arterial	MO 30	13.26	9.88	10.22	6.71	9.69	6.04	9.30
Major Arterial	MO 100	8.76	5.72	2.90	6.53	5.20	9.42	6.42
Major Arterial	MO 115	4.69	5.57	7.87	6.75	10.37	9.92	7.53
Major Arterial	MO 180	9.68	8.43	5.94	9.50	7.91	5.76	7.87
Major Arterial	MO 340	4.58	8.08	4.93	6.72	8.12	7.53	6.66

Figure S36 – Freeway Disabling Injury Crash Rates

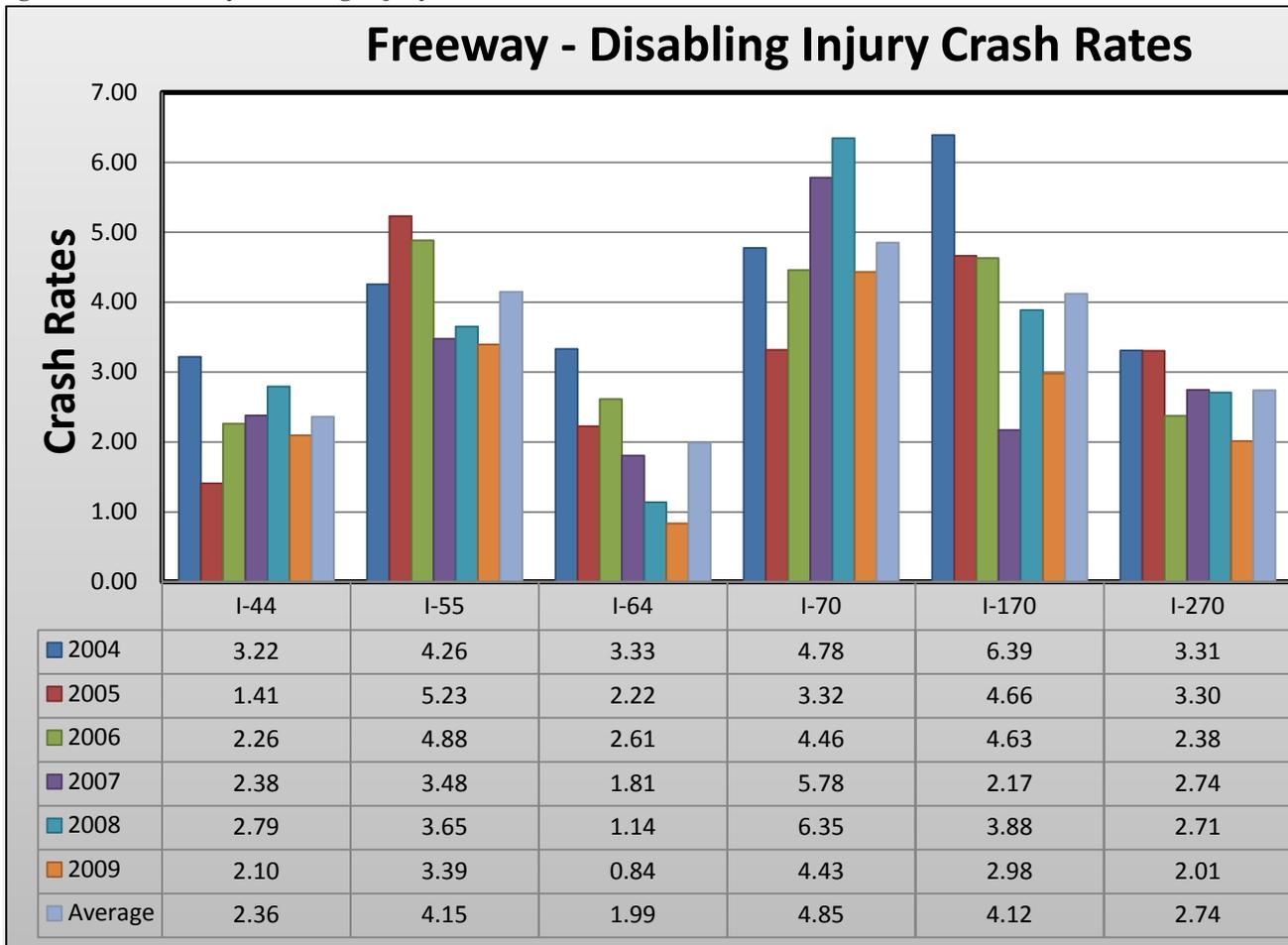


Figure S37 – Expressway Disabling Injury Crash Rates

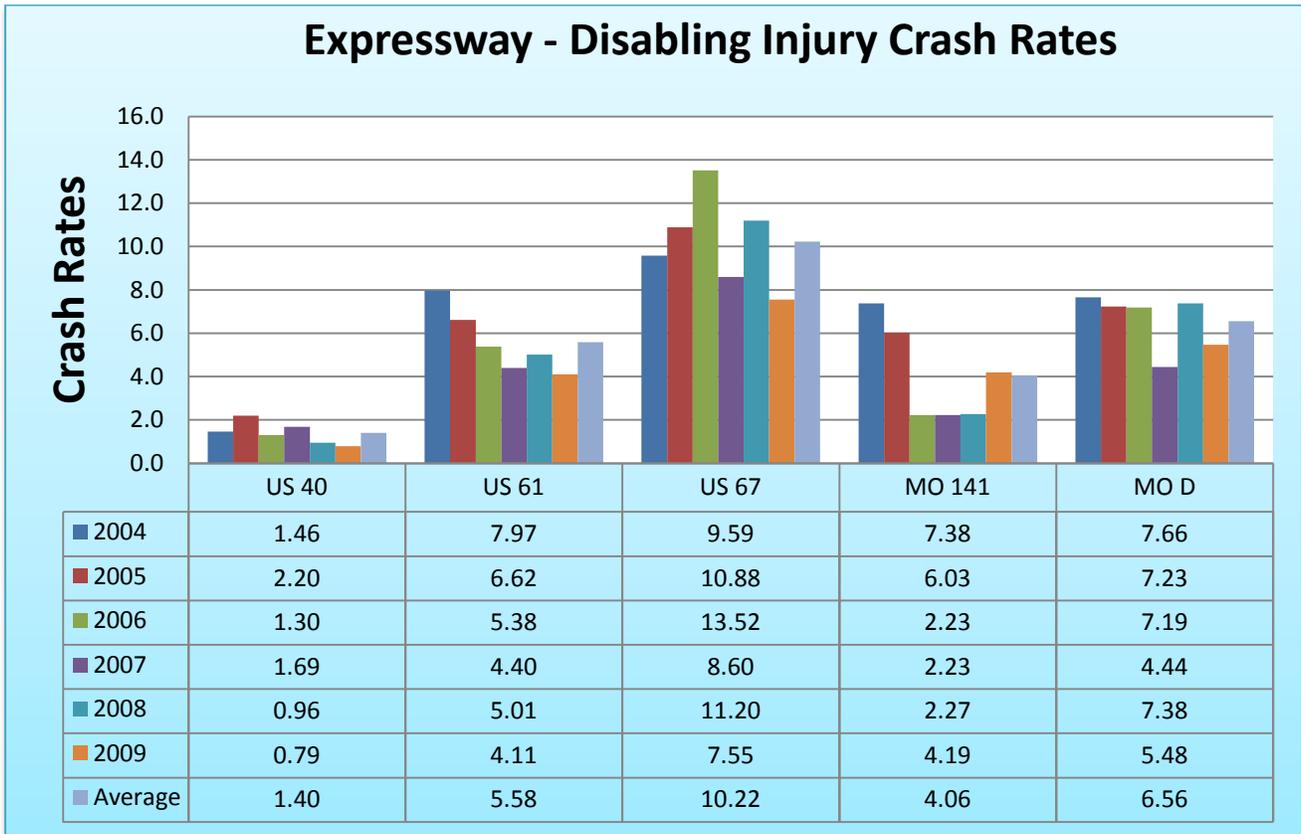


Figure S38 – Major Arterial Disabling Injury Crash Rates

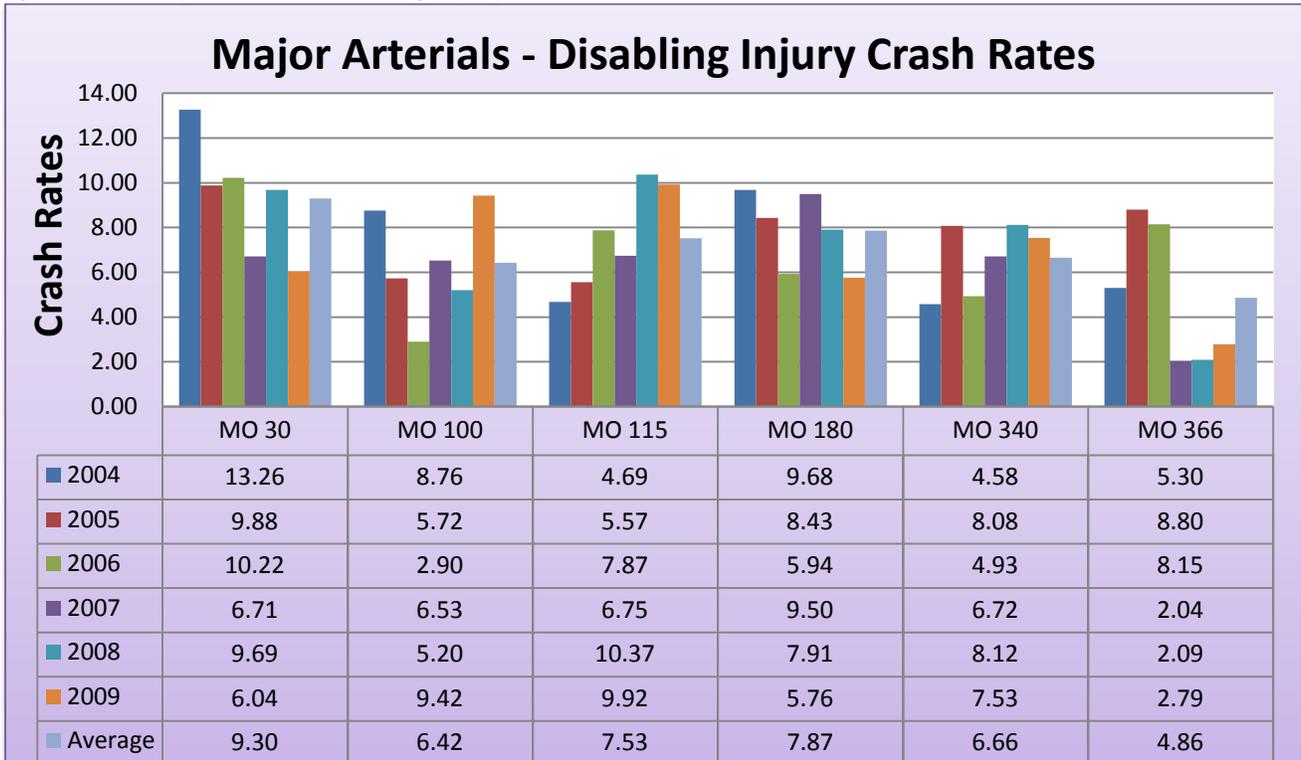


Table S16 Minor Injury Crash Rates

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	31.79	29.97	28.42	29.78	31.11	21.65	29
Freeway	I-55	41.10	35.98	34.96	32.19	34.52	33.61	35
Freeway	I-64	52.60	56.59	44.85	38.35	21.48	14.34	38
Freeway	I-70	46.05	50.94	47.05	49.99	52.13	55.91	50
Freeway	I-170	47.92	47.37	44.84	39.08	39.33	29.53	41
Freeway	I-270	28.02	34.66	34.98	32.47	31.29	24.73	31
Expressway	US 40	24.49	28.57	27.85	20.99	15.47	20.88	23
Expressway	US 61	93.15	82.44	80.25	90.52	79.72	83.74	85
Expressway	US 67	123.56	102.30	106.93	114.30	103.25	103.25	109
Expressway	MO 141	92.26	82.19	77.18	83.86	63.64	70.61	78
Expressway	MO D	79.88	80.65	71.86	82.17	71.54	49.30	73
Major Arterial	MO 30	117.16	132.91	111.14	107.32	102.39	96.16	111
Major Arterial	MO 100	77.75	76.57	74.32	68.88	73.56	83.73	76
Major Arterial	MO 115	87.15	109.10	95.58	110.20	111.77	115.34	105
Major Arterial	MO 180	101.38	115.88	108.03	104.47	102.79	116.40	108
Major Arterial	MO 340	90.74	87.14	91.39	98.94	98.83	73.67	90
Major Arterial	MO 366	87.45	111.66	99.82	93.03	86.98	88.47	95

Figure S39 – Freeway Minor Injury Crash Rates

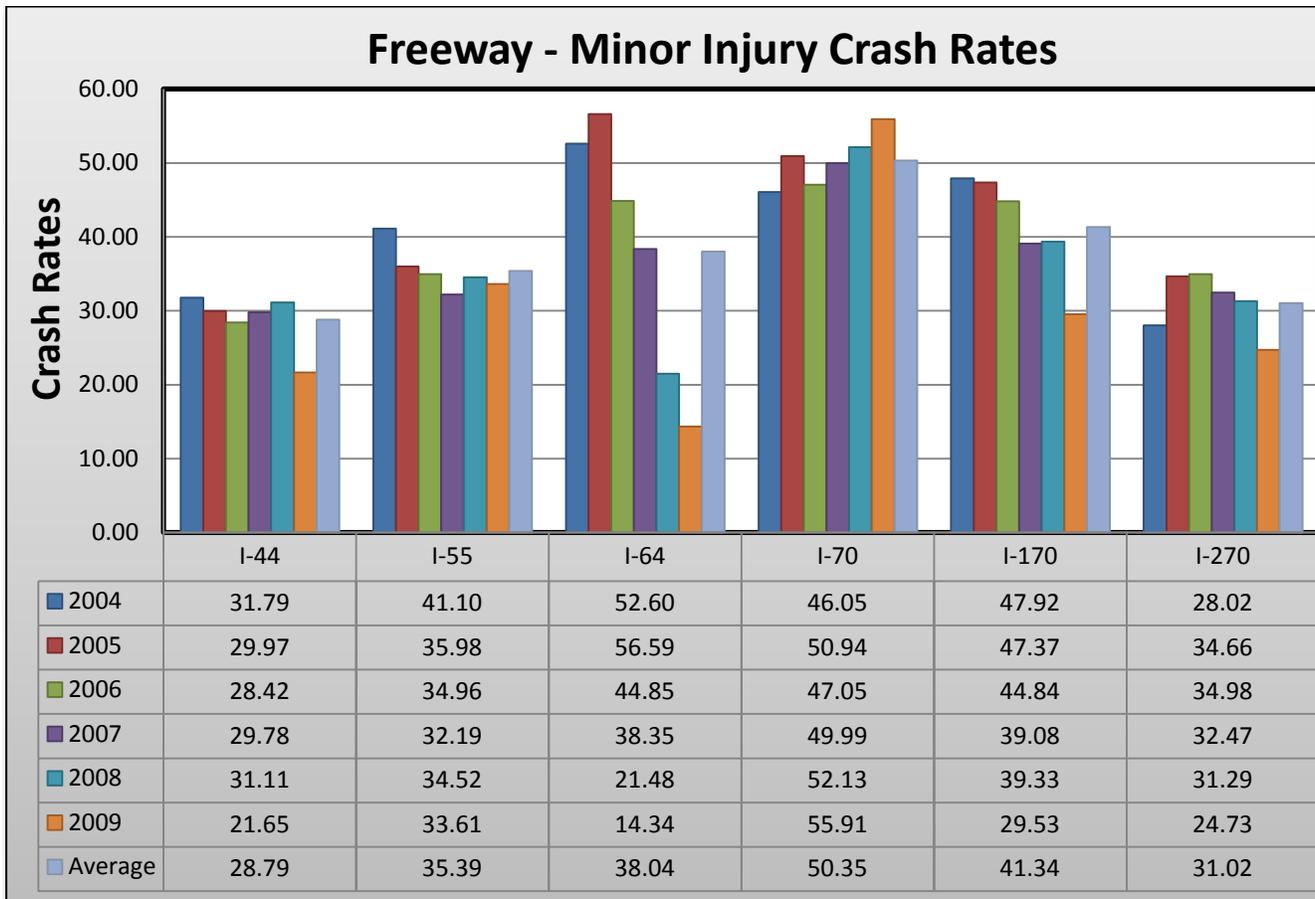


Figure S40 – Expressway Minor Injury Crash Rates

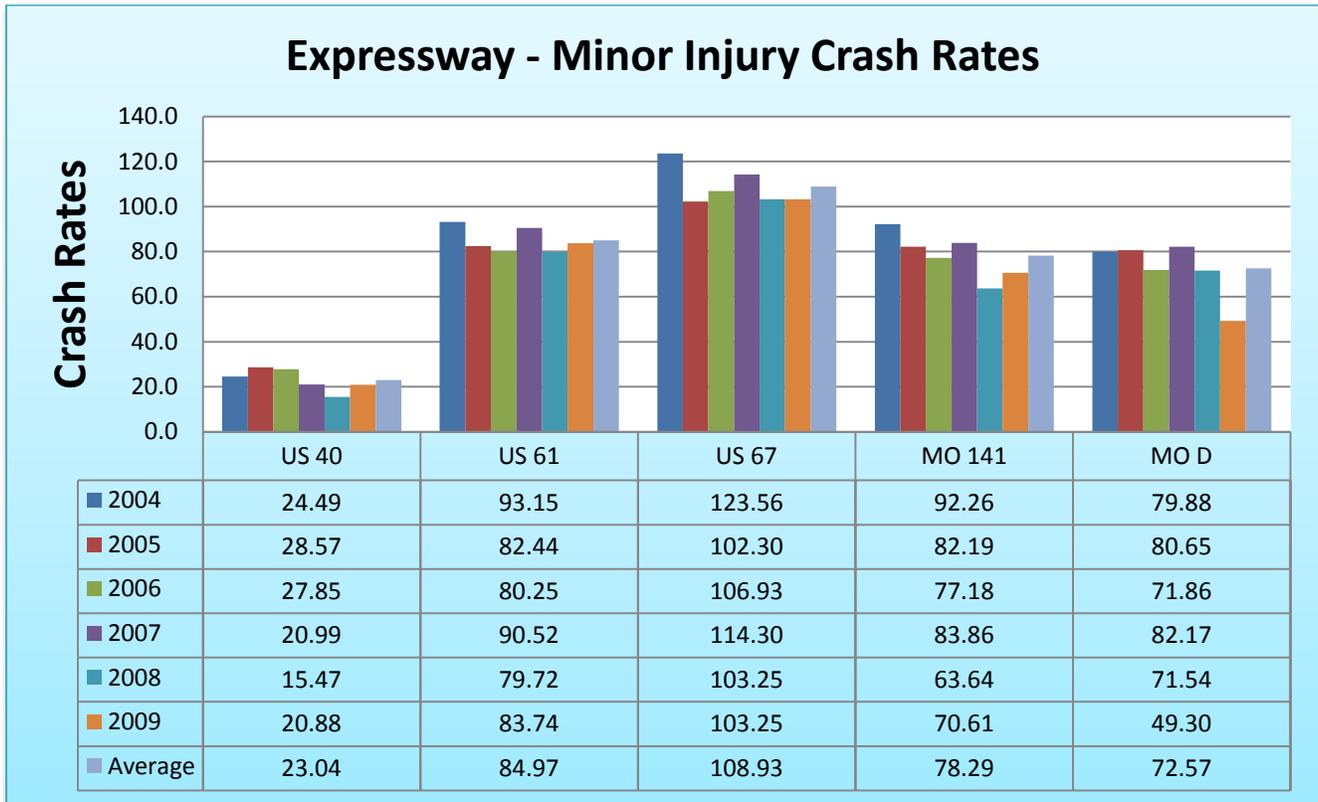


Figure S41 – Major Arterial Minor Injury Crash Rates

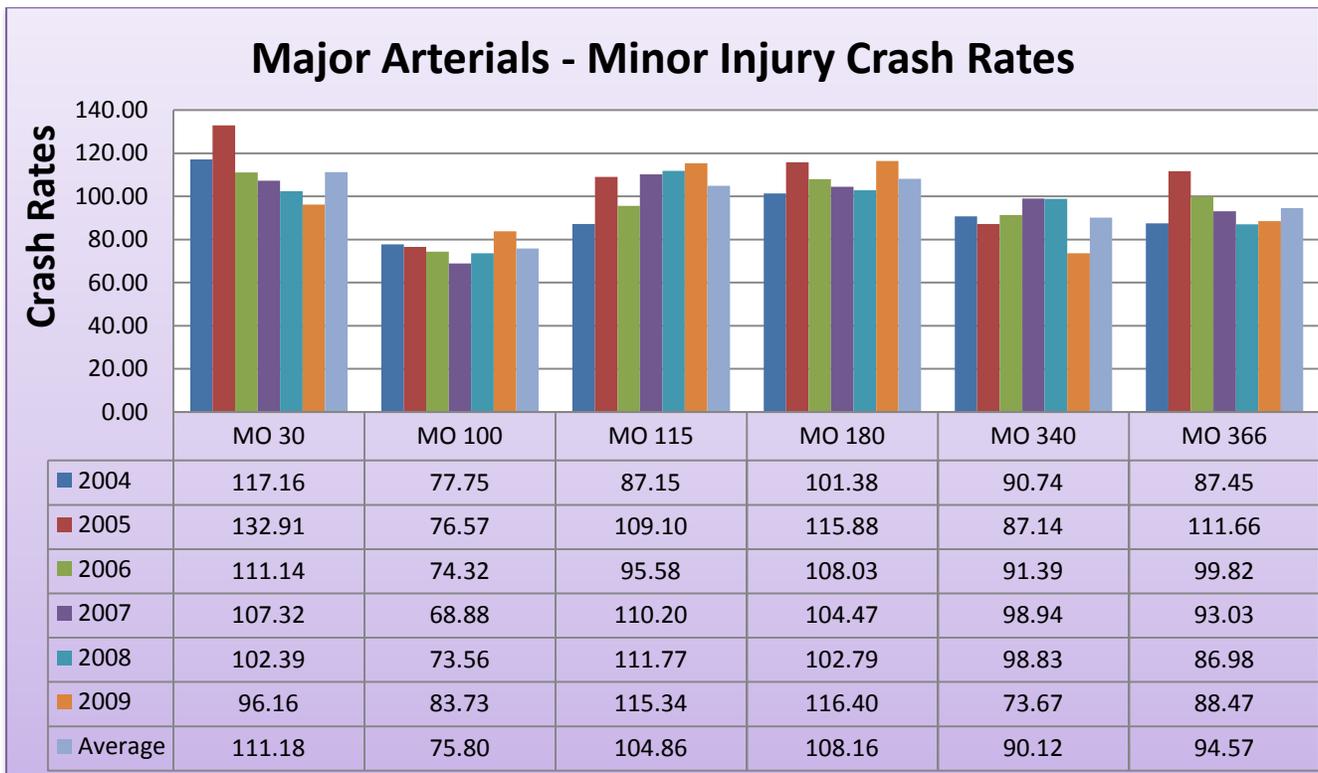


Table S17 Property Damage Only Crash Rates

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	105.92	107.09	102.25	101.87	103.17	78.82	99.85
Freeway	I-55	110.84	114.64	107.77	107.61	112.84	106.31	110.00
Freeway	I-64	168.64	164.49	157.38	126.86	79.39	41.91	123.11
Freeway	I-70	131.18	125.22	136.40	139.29	142.91	148.88	137.31
Freeway	I-170	167.09	136.22	152.30	152.72	143.72	106.45	143.08
Freeway	I-270	110.24	109.91	114.30	113.95	103.51	90.42	107.05
Expressway	US 40	63.06	67.40	73.33	76.29	49.10	71.30	66.75
Expressway	US 61	323.77	331.80	314.63	292.12	296.82	281.02	306.69
Expressway	US 67	380.27	317.77	362.57	328.16	312.25	385.29	347.72
Expressway	MO 141	271.61	337.79	294.62	350.27	315.91	364.25	322.41
Expressway	MO D	309.68	290.89	270.30	296.48	316.26	201.04	280.77
Major Arterial	MO 30	441.21	436.01	343.63	353.25	318.70	373.96	377.80
Major Arterial	MO 100	326.43	305.92	292.21	318.31	346.99	340.01	321.65
Major Arterial	MO 115	333.61	365.15	324.98	299.11	323.79	386.95	338.93
Major Arterial	MO 180	336.24	308.14	313.40	294.41	299.86	294.85	307.82
Major Arterial	MO 340	349.22	303.52	378.54	368.00	345.67	286.71	338.61
Major Arterial	MO 366	341.17	316.03	334.10	256.01	276.95	273.78	299.67

Figure S42 – Freeway Property Damage Only Crash Rates

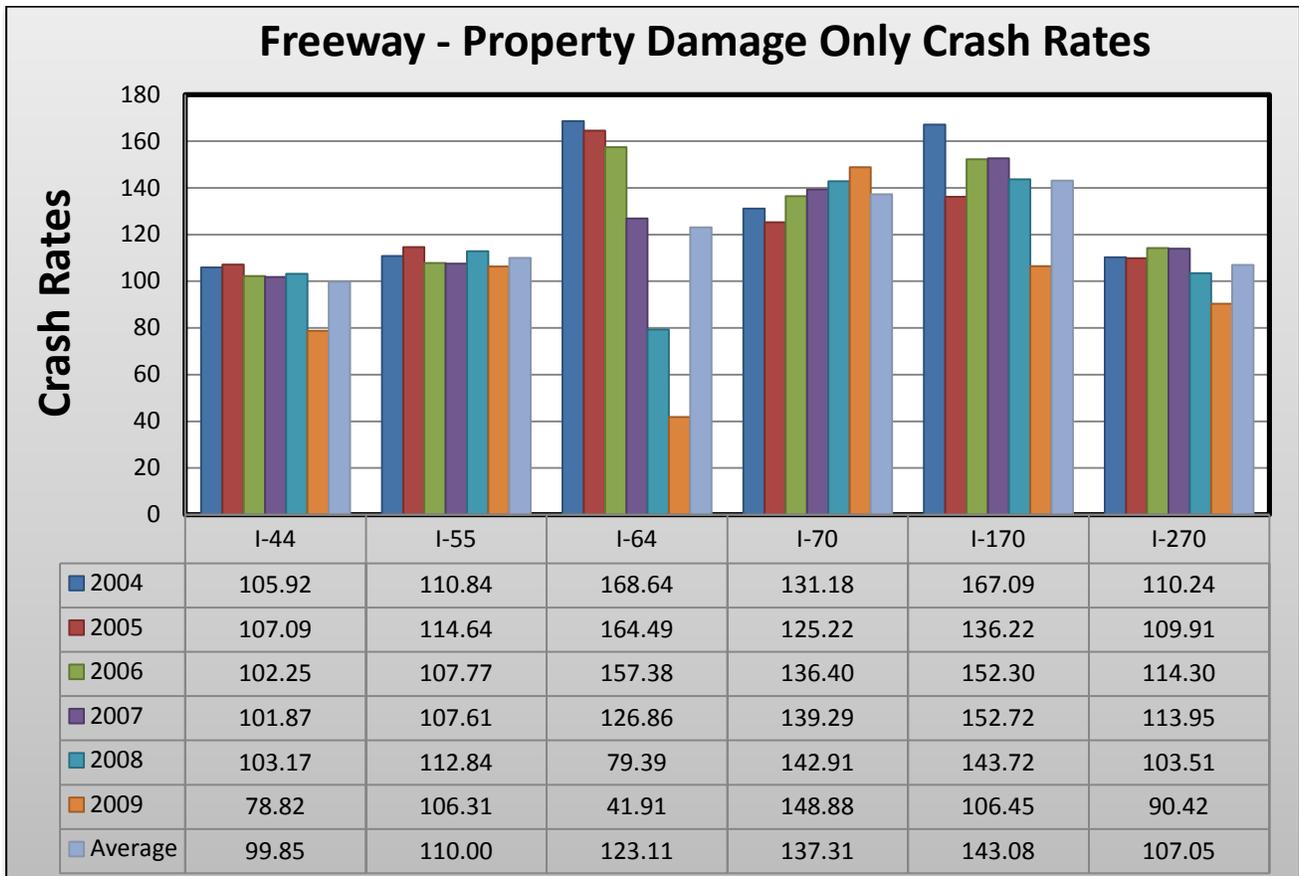


Figure S43 – Expressway Property Damage Only Crash Rates

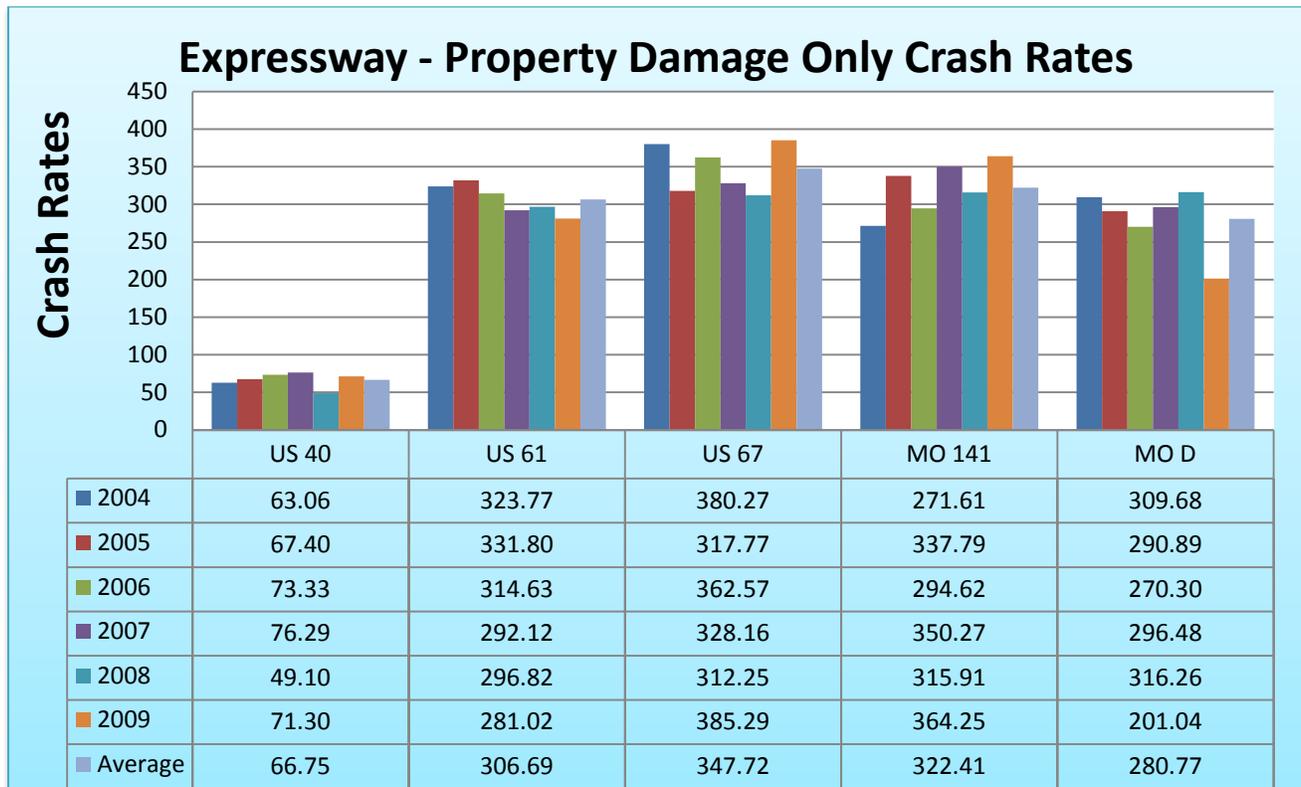


Figure S44 – Major Arterial Property Damage Only Crash Rates

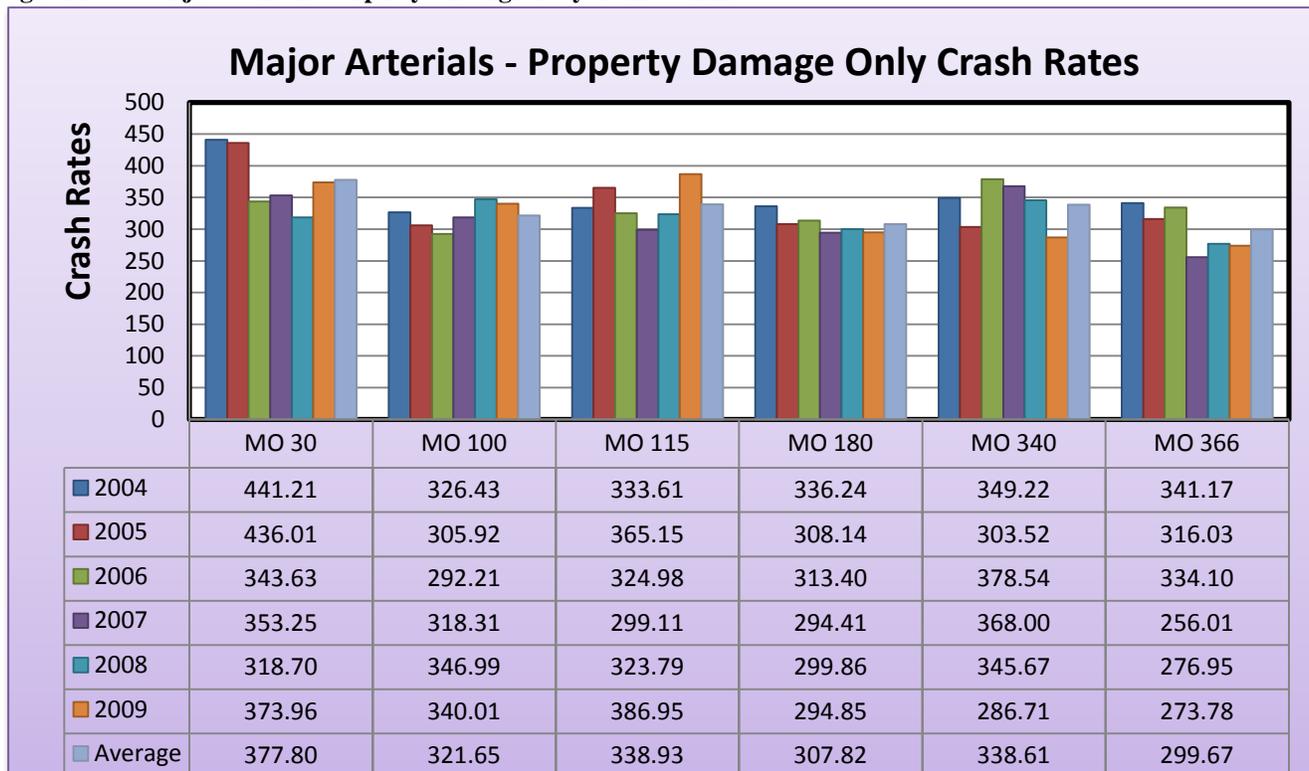


EXHIBIT CRASH TYPE ANALYSIS

Table S18 Rear-end Type Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	472	462	461	478	433	347	442
Freeway	I-55	362	344	363	318	328	286	334
Freeway	I-64	971	844	800	595	308	197	619
Freeway	I-70	691	675	661	656	655	823	694
Freeway	I-170	455	389	466	472	362	296	407
Freeway	I-270	1,151	1,146	1,358	1,387	1,203	1,081	1,221
All	Average	4,102	3,860	4,109	3,906	3,289	3,030	3,716
Expressway	US 40	287	294	337	353	198	318	298
Expressway	US 61	442	418	408	391	401	381	407
Expressway	US 67	272	224	198	195	160	208	210
Expressway	MO 141	301	344	344	393	308	439	355
Expressway	MO D	363	373	334	364	352	189	329
All	All	1,665	1,653	1,621	1,696	1,419	1,535	1,598
Major Arterial	MO 30	518	490	474	444	372	451	458
Major Arterial	MO 100	532	486	448	514	573	600	526
Major Arterial	MO 115	158	143	92	106	97	161	126
Major Arterial	MO 180	386	389	320	313	317	279	334
Major Arterial	MO 340	579	531	552	587	565	467	547
Major Arterial	MO 366	270	249	269	191	203	205	231
All	All	2,443	2,288	2,155	2,155	2,127	2,163	2,222

Figure S45 – Freeway Rear-end Type Crashes

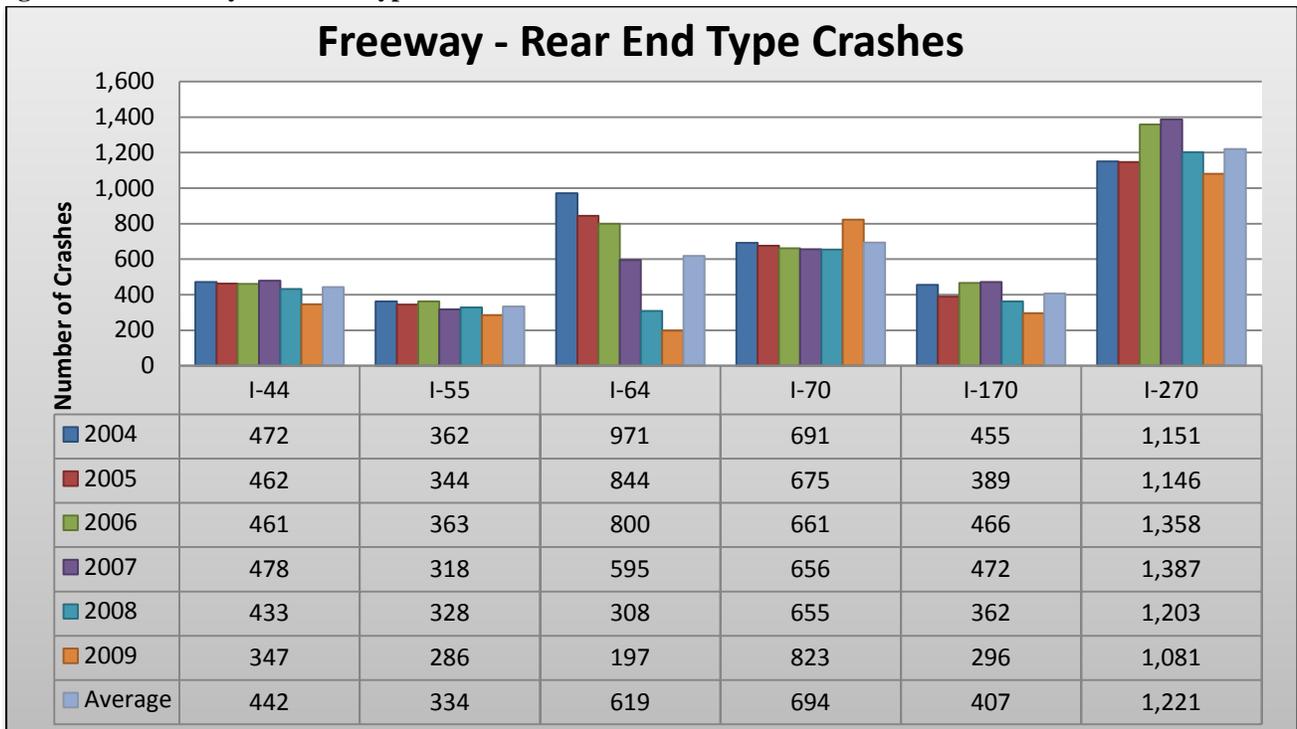


Figure S46 – Expressway Rear-end Type Crashes

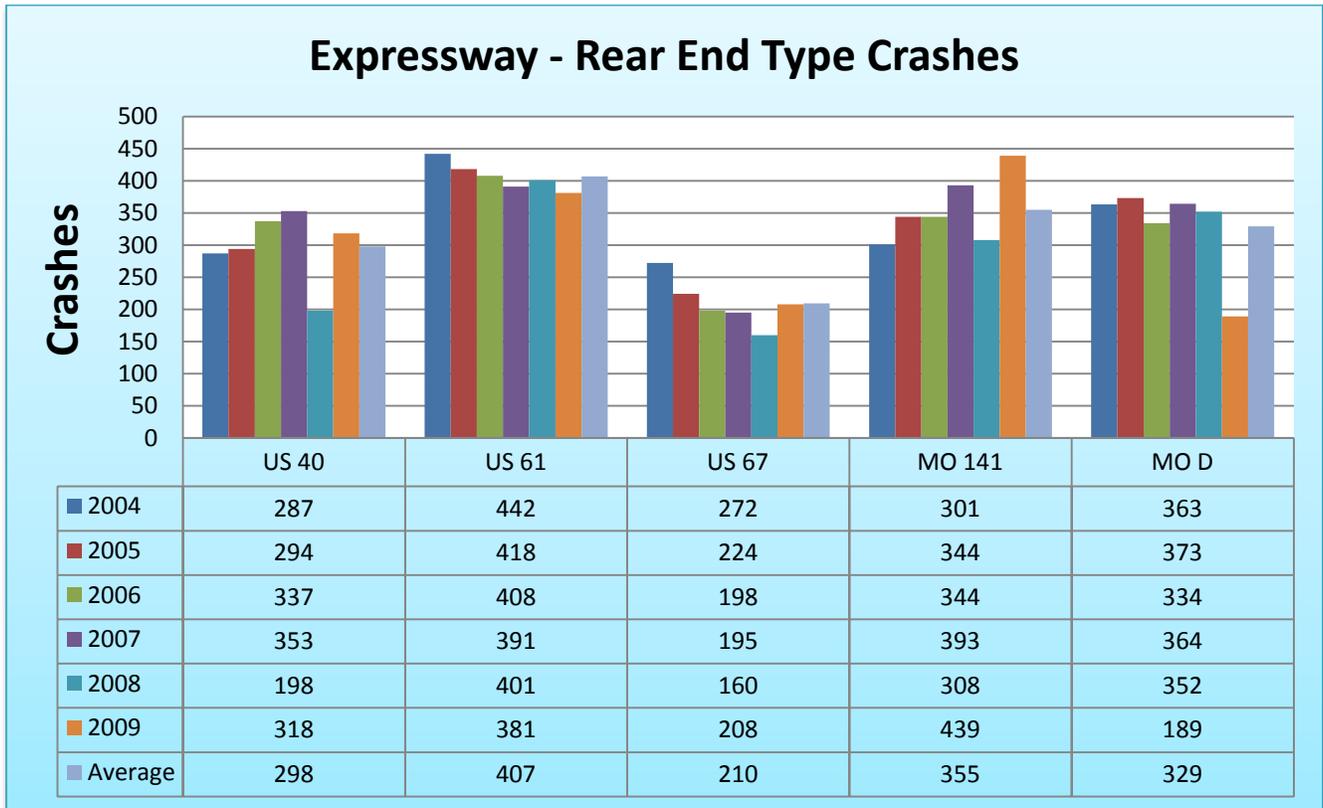


Figure S47 – Major Arterial Rear-end Crashes

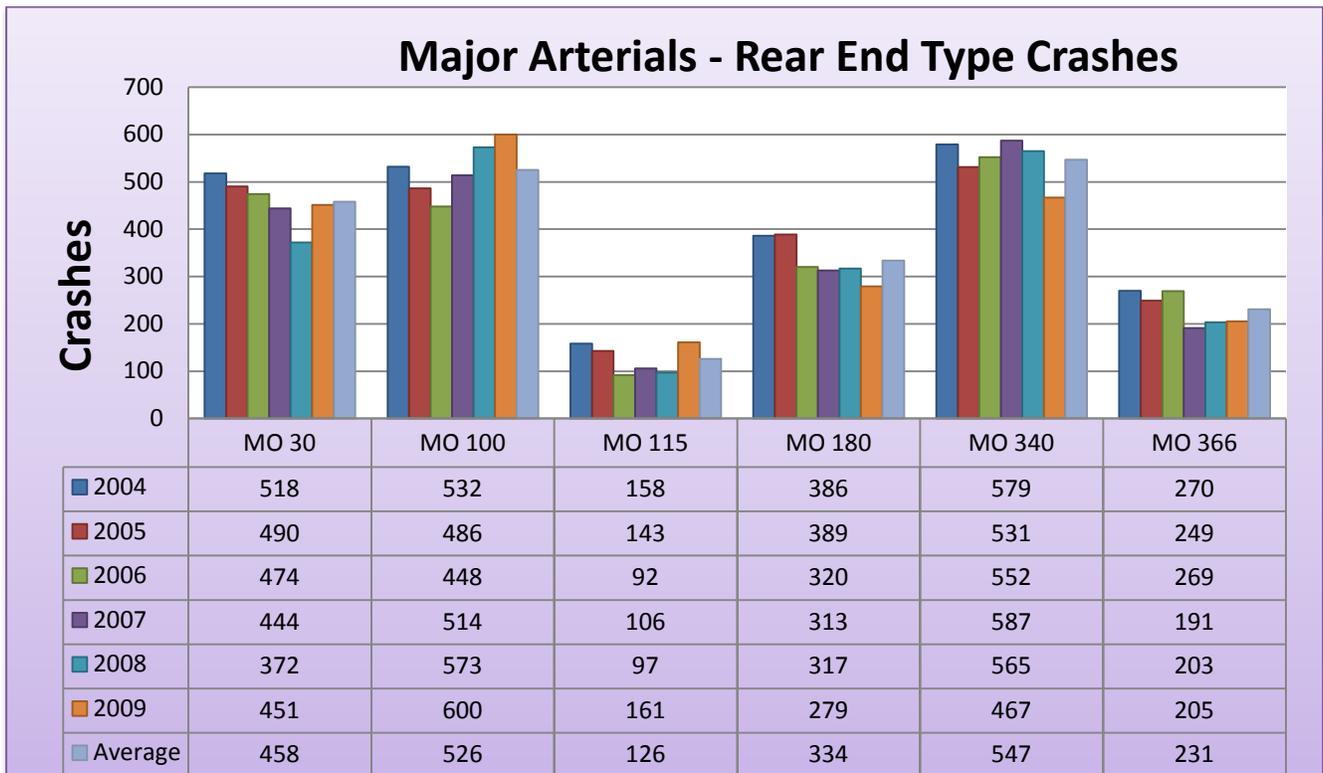


Table S19 Out of Control Type Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	271	235	203	251	302	258	253
Freeway	I-55	249	226	223	275	316	325	269
Freeway	I-64	232	219	208	215	149	115	190
Freeway	I-70	524	528	490	623	720	793	613
Freeway	I-170	191	164	145	151	193	151	166
Freeway	I-270	299	383	286	330	323	298	320
	All	1,766	1,755	1,555	1,845	2,003	1,940	1,811
Expressway	US 40	88	90	70	53	54	60	69
Expressway	US 61	39	32	30	46	32	29	35
Expressway	US 67	32	34	33	34	51	37	37
Expressway	MO 141	43	53	31	44	62	55	48
Expressway	MO D	57	60	51	70	64	56	60
	All	259	269	215	247	263	237	248
Major Arterial	MO 30	78	74	61	78	82	82	76
Major Arterial	MO 100	69	72	50	54	47	66	60
Major Arterial	MO 115	24	32	45	33	43	36	36
Major Arterial	MO 180	36	44	48	58	46	45	46
Major Arterial	MO 340	33	40	59	61	60	50	51
Major Arterial	MO 366	37	45	42	35	40	34	39
	All	277	307	305	319	318	313	307

Figure S48 – Expressway Out of Control Crashes

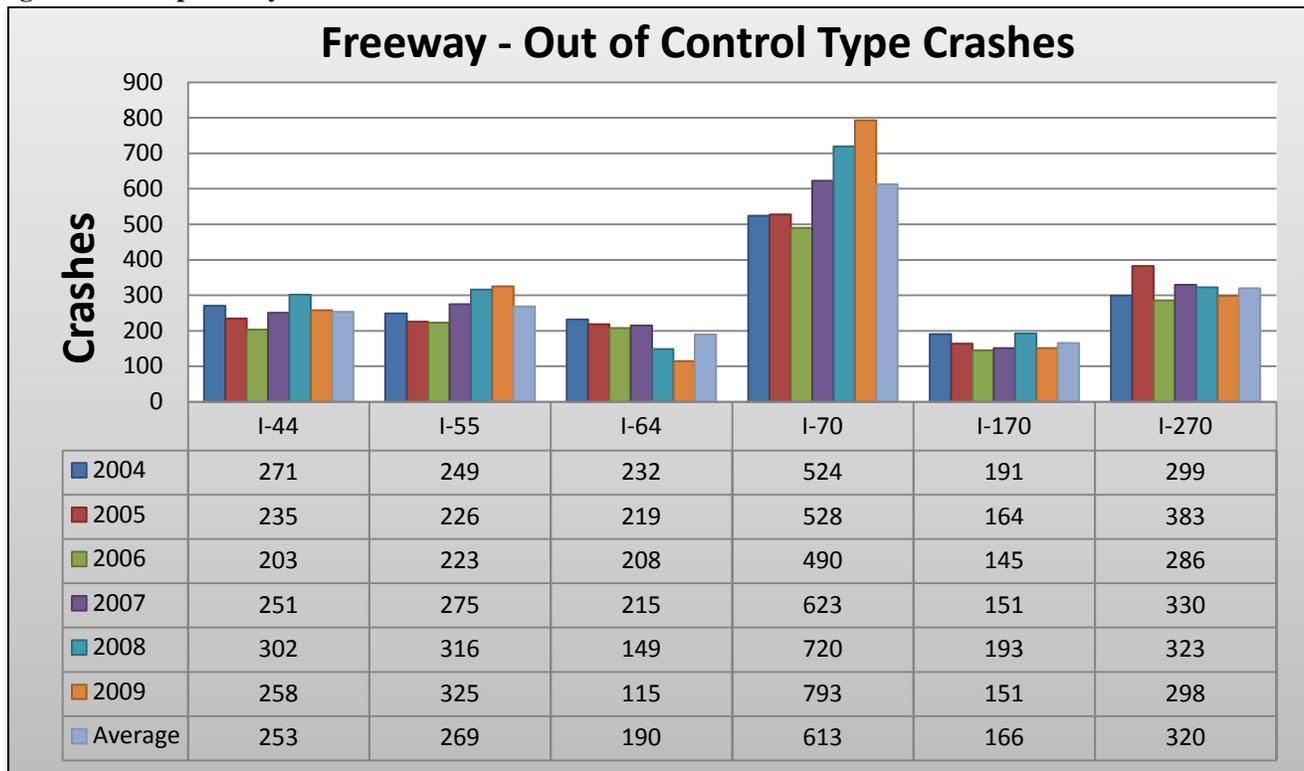


Figure S49 – Expressway Out of Control Crashes

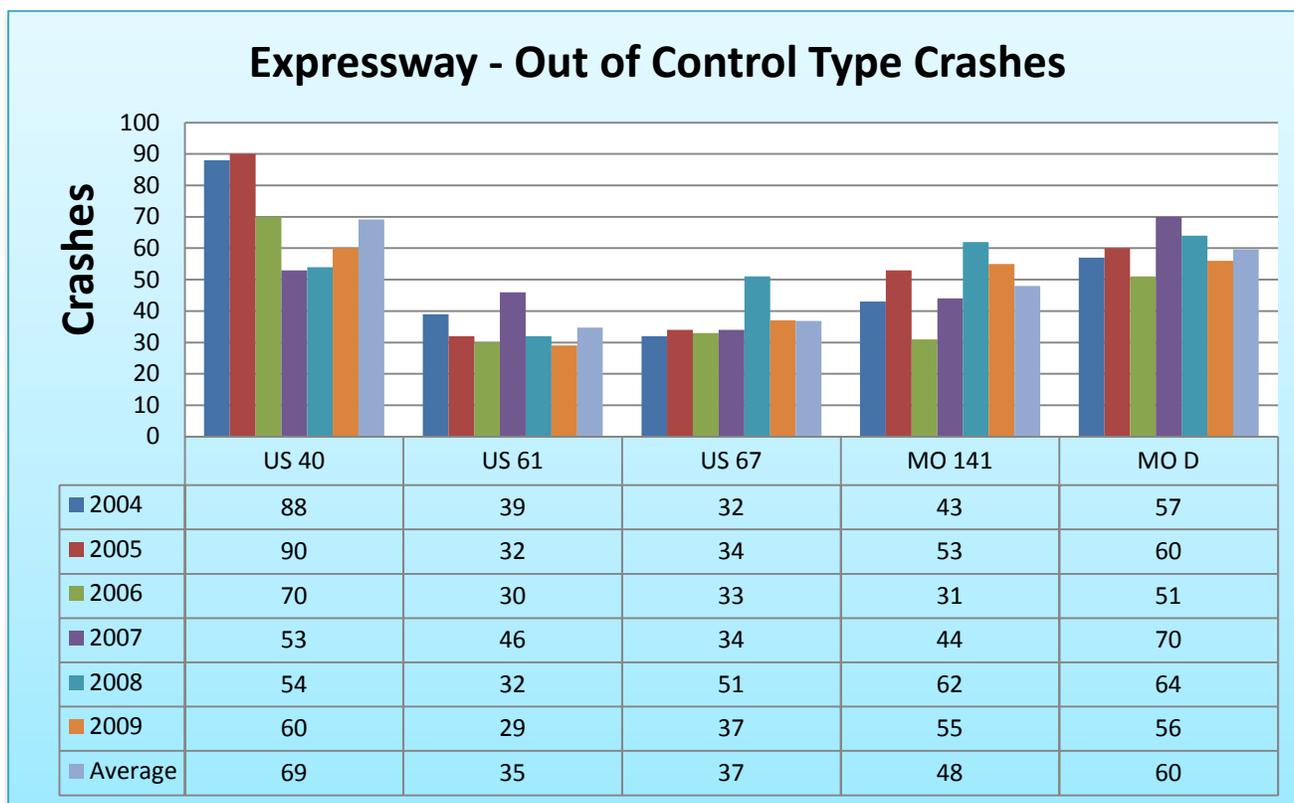


Figure S50 – Major Arterial Out of Control Crashes

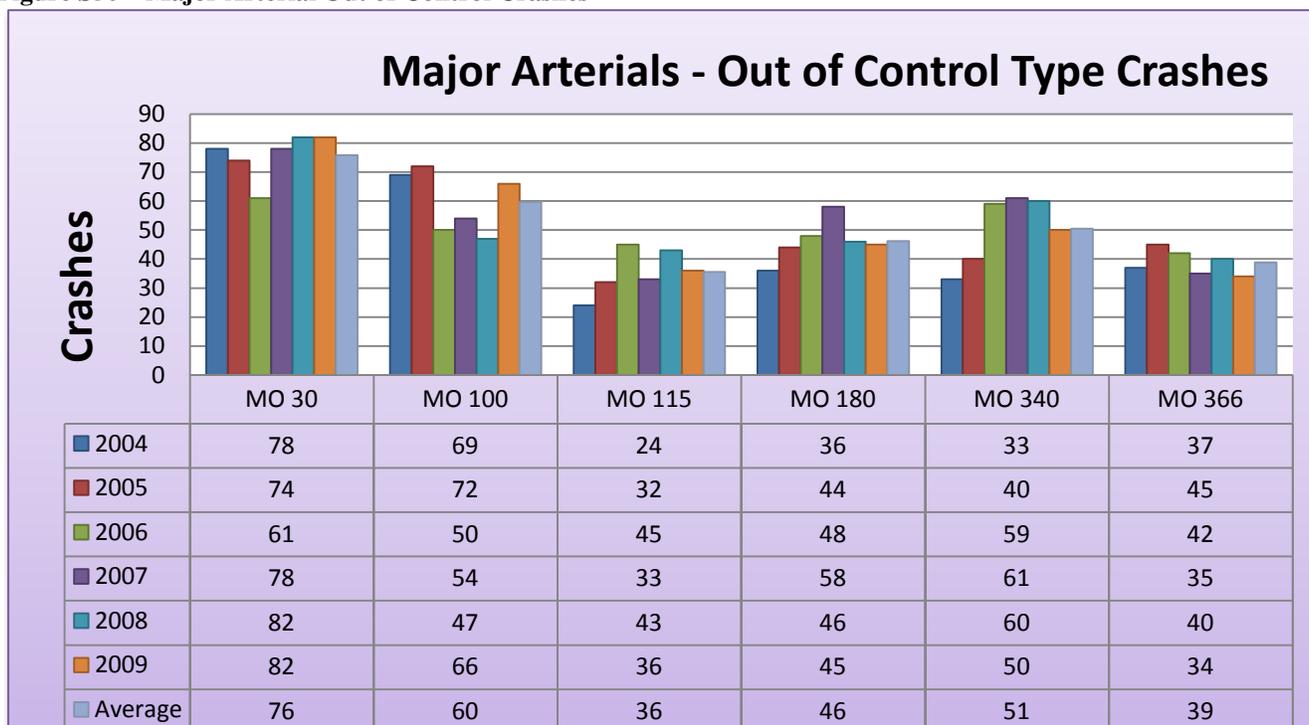


Table S20 Passing Type Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	129	144	174	161	150	116	146
Freeway	I-55	161	155	183	164	153	131	158
Freeway	I-64	201	164	162	148	94	45	136
Freeway	I-70	326	312	383	383	355	297	343
Freeway	I-170	112	85	98	93	89	52	88
Freeway	I-270	250	274	297	276	236	196	255
	All	1,179	1,134	1,297	1,225	1,077	837	1,125
Expressway	US 40	43	48	63	42	33	40	45
Expressway	US 61	53	60	74	56	60	57	60
Expressway	US 67	53	42	41	35	36	41	41
Expressway	MO 141	28	48	30	33	33	30	34
Expressway	MO D	89	60	76	67	71	48	69
	All	266	258	284	233	233	216	248
Major Arterial	MO 30	106	117	86	76	57	69	85
Major Arterial	MO 100	129	81	123	109	113	77	105
Major Arterial	MO 115	55	41	57	50	51	25	47
Major Arterial	MO 180	77	70	58	67	40	48	60
Major Arterial	MO 340	87	90	94	84	56	64	79
Major Arterial	MO 366	48	55	53	48	33	31	45
	All	502	454	471	434	350	314	421

Figure S51 – Freeway Passing Type Crashes

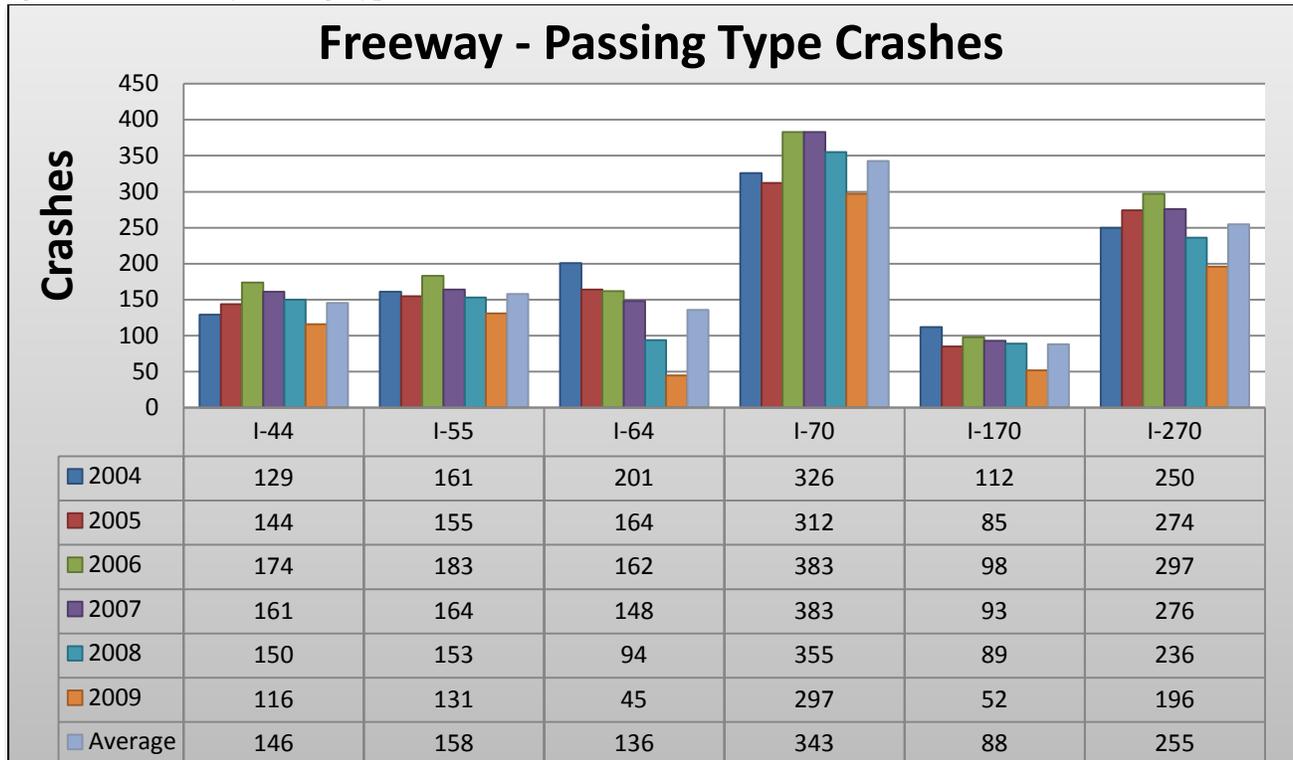


Figure S52 – Expressway Passing Type Crashes

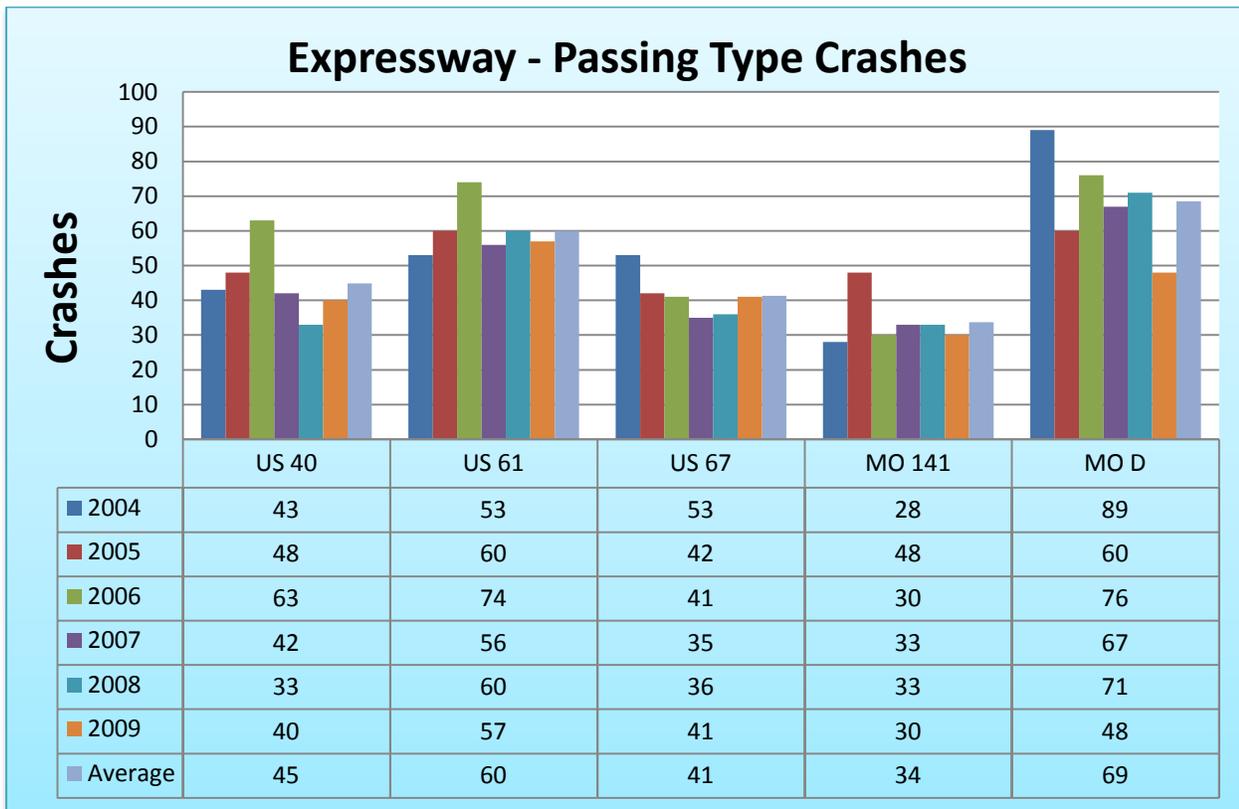


Figure S53 – Major Arterial Passing Crashes

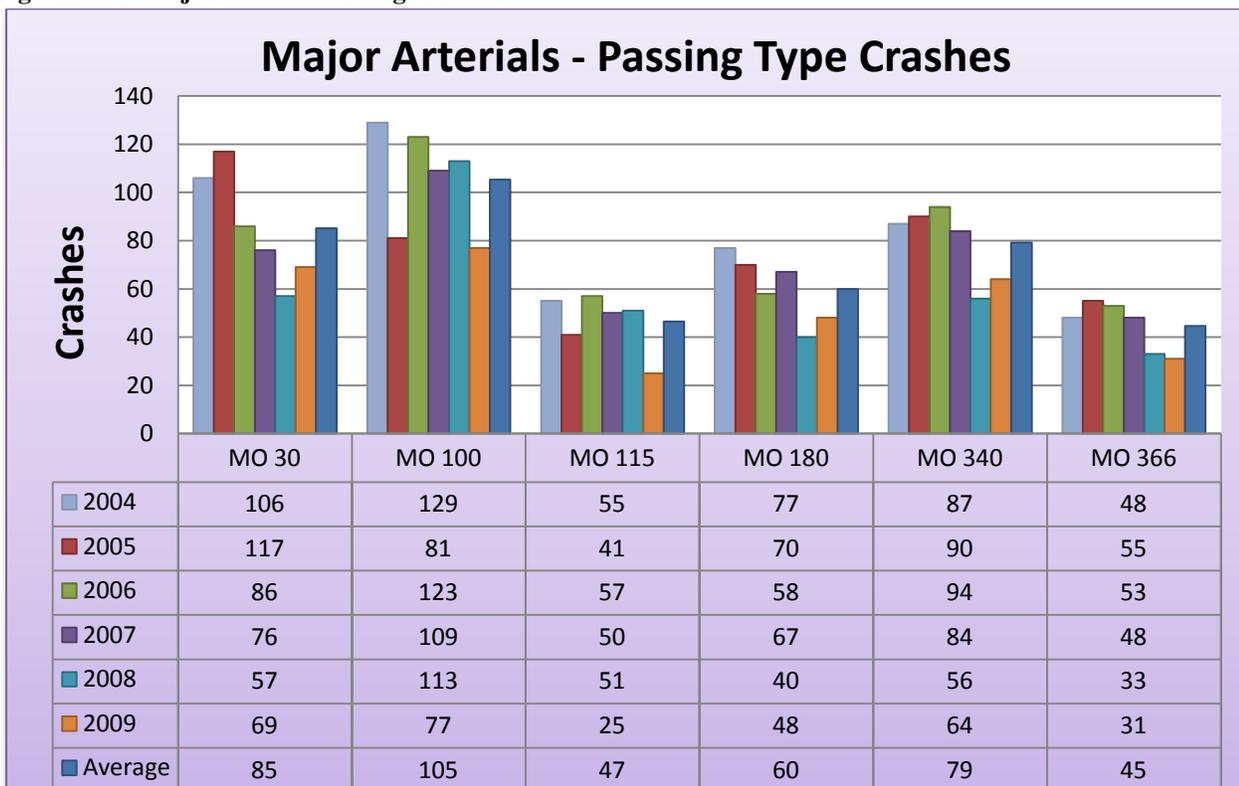


Table S21 Other Type Crashes

Classification	Route	2004	2005	2006	2007	2008	2009	Average
Freeway	I-44	228	247	234	187	246	158	217
Freeway	I-55	192	235	205	195	201	148	196
Freeway	I-64	220	353	324	247	166	51	227
Freeway	I-70	366	369	368	334	348	310	349
Freeway	I-170	148	132	121	89	132	59	114
Freeway	I-270	403	398	361	294	321	229	334
	All	1,557	1,734	1,613	1,346	1,414	955	1,437
Expressway	US 40	71	104	83	84	59	51	75
Expressway	US 61	319	318	307	298	268	246	293
Expressway	US 67	127	96	124	94	98	88	105
Expressway	MO 141	131	121	99	119	100	101	112
Expressway	MO D	219	189	202	189	212	171	197
	All	867	828	815	784	737	657	781
Major Arterial	MO 30	596	616	428	450	430	423	491
Major Arterial	MO 100	449	446	398	409	416	453	429
Major Arterial	MO 115	228	216	188	181	194	189	199
Major Arterial	MO 180	380	319	295	251	272	298	303
Major Arterial	MO 340	372	278	356	327	322	298	326
Major Arterial	MO 366	300	296	288	245	250	250	272
	All	2,325	2,171	1,953	1,863	1,884	1,911	2,018

Figure S54 – Expressway Other Crashes

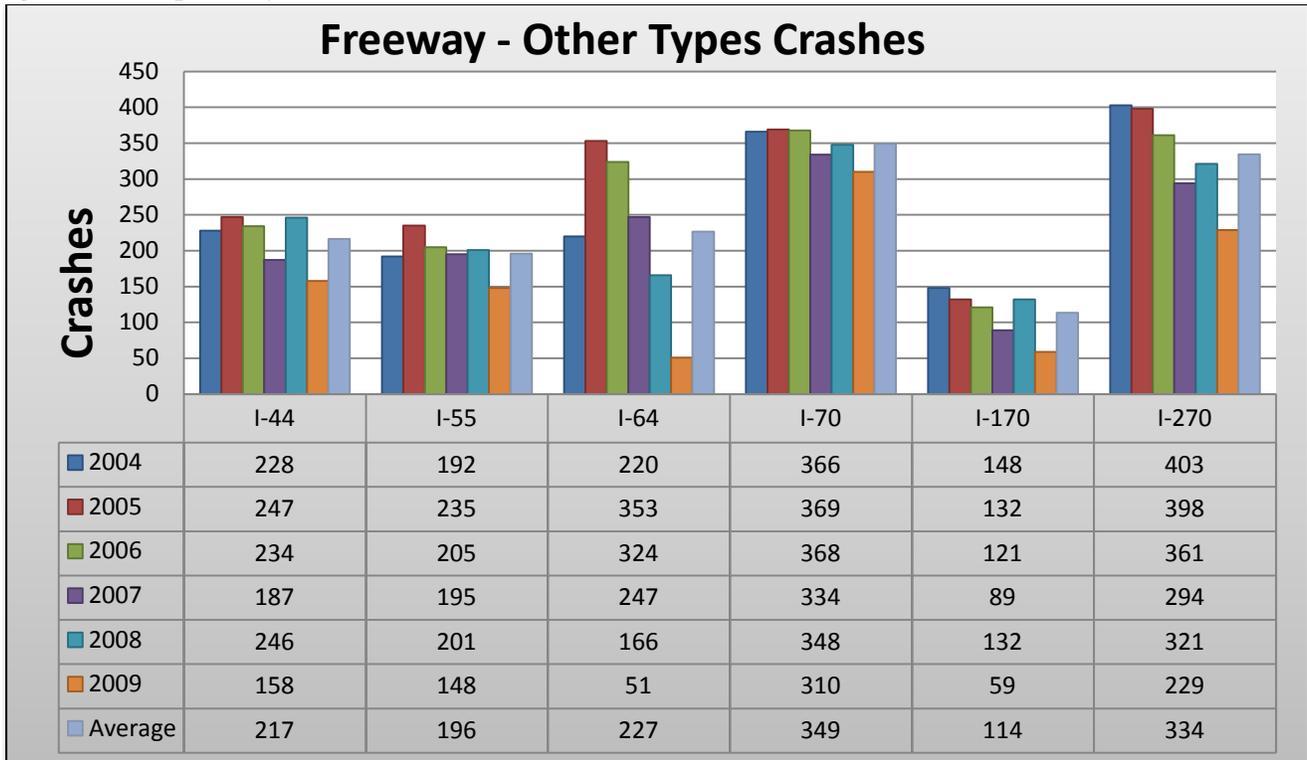


Figure S55 – Expressway Other Crashes

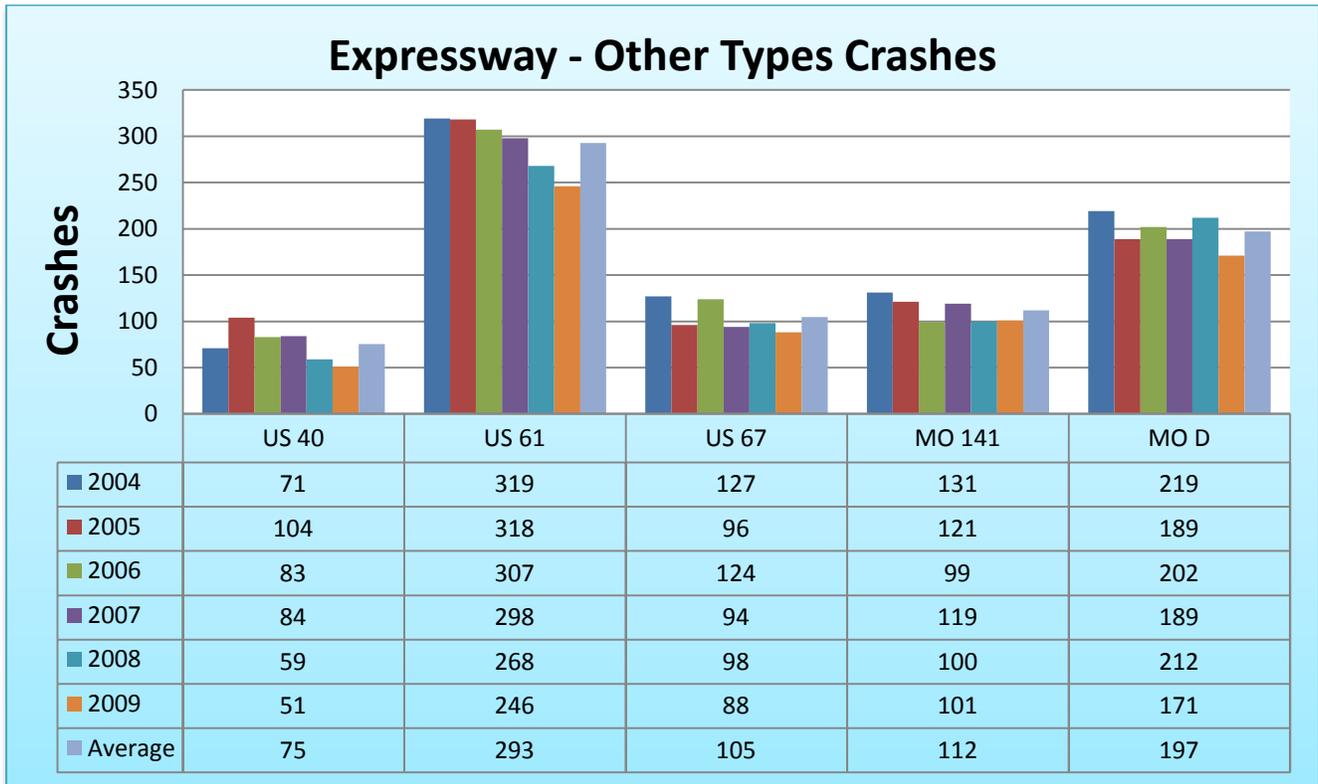


Figure S56 – Major Arterial Other Crashes

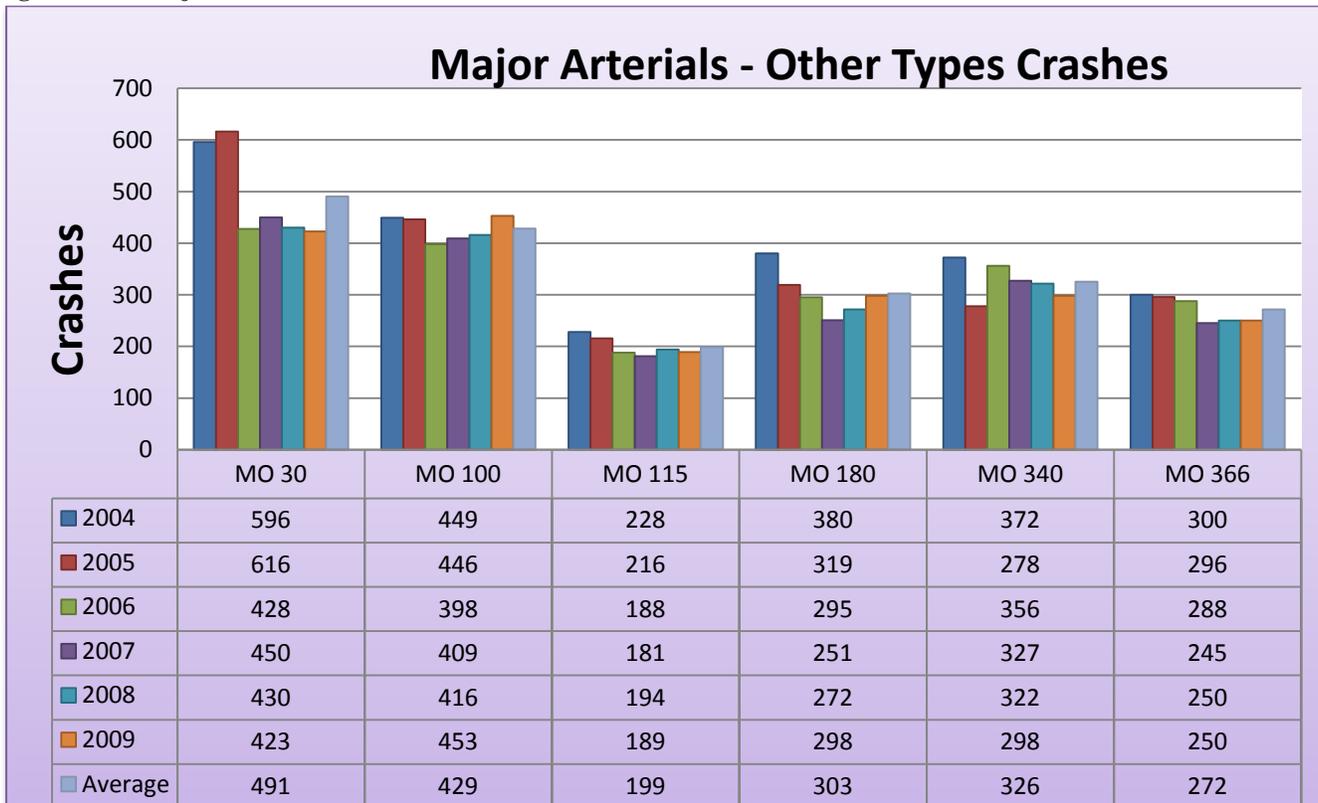


Figure S57 – Freeway - Percent of Rear-end Type Crashes to All Crashes

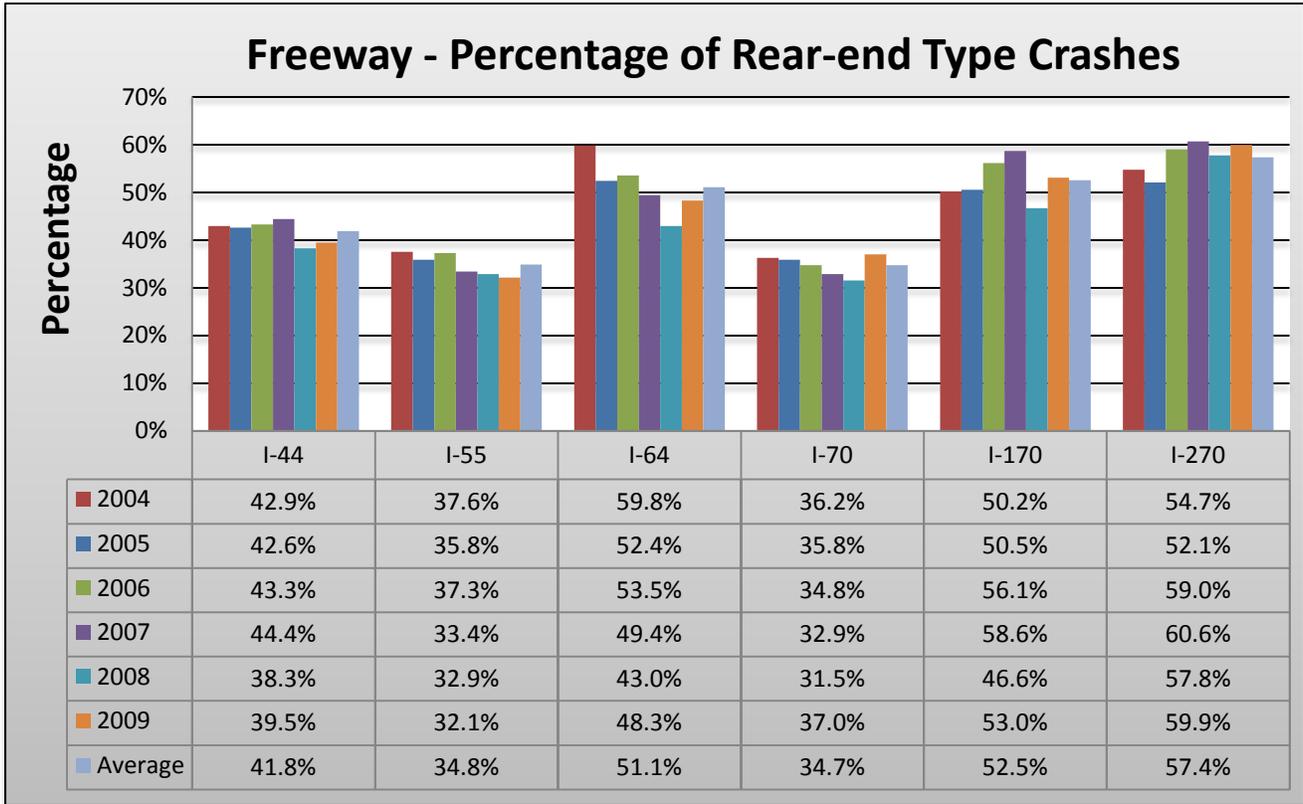


Figure S58 – Expressway - Percent of Rear-end Type Crashes to All Crashes

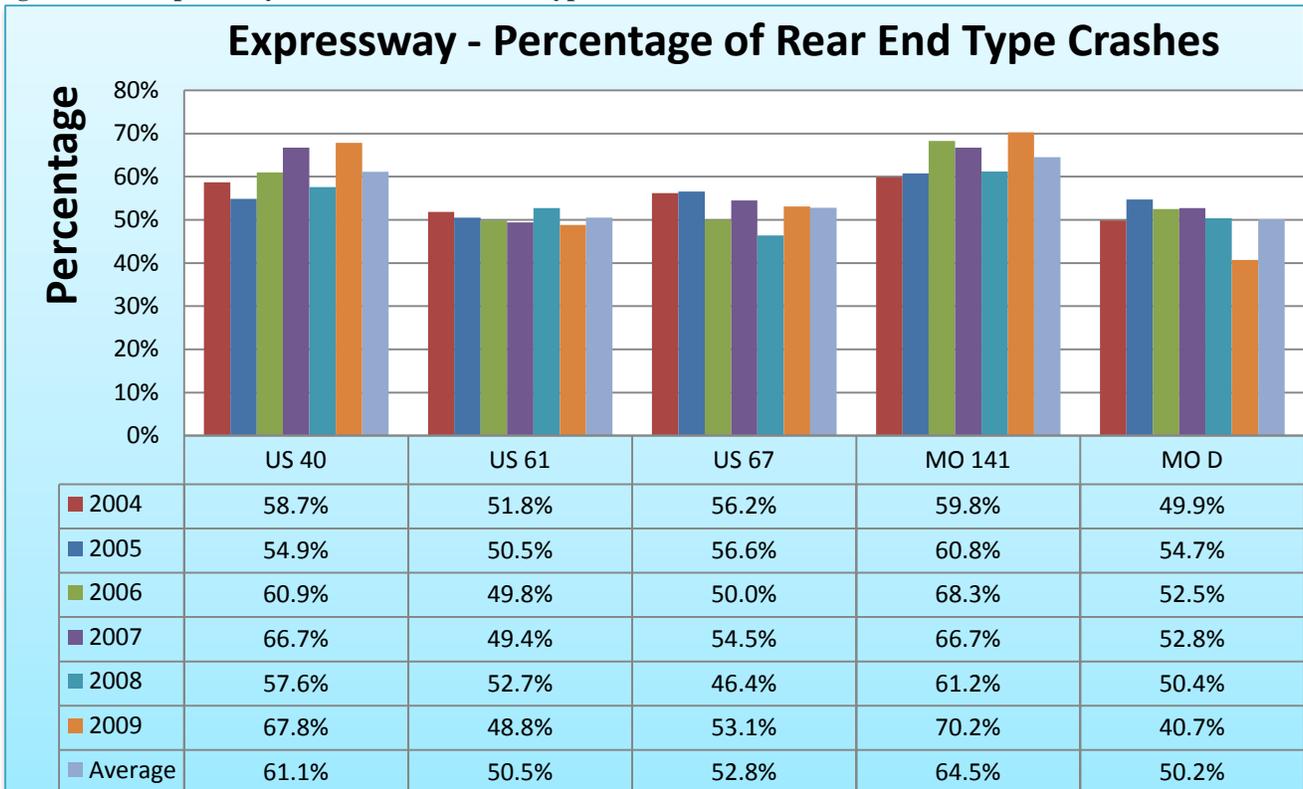


Figure S59 – Major Arterials - Percent of Rear-end Type Crashes to All Crashes

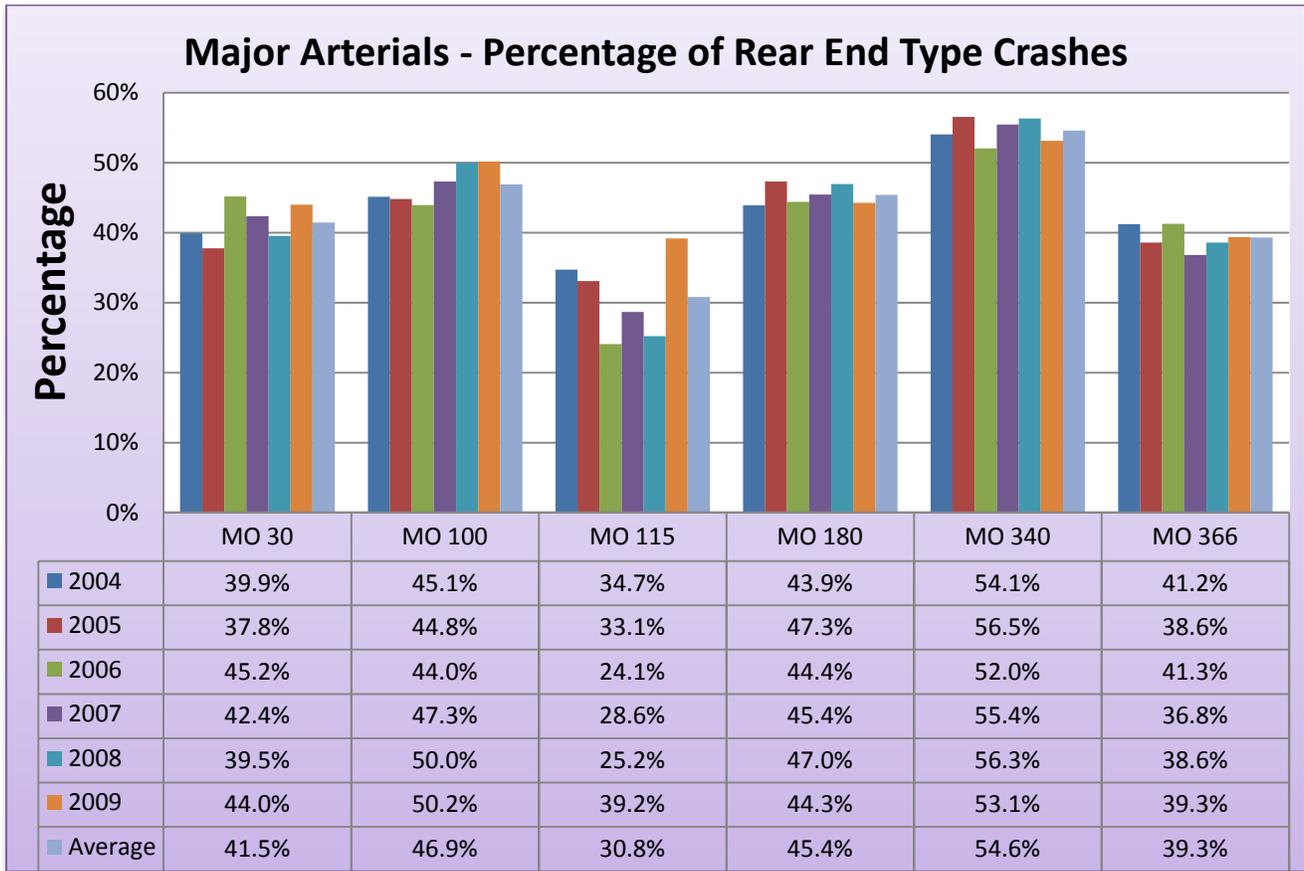


Figure S60 – Freeway - Percent of Out of Control Type Crashes to All Crashes

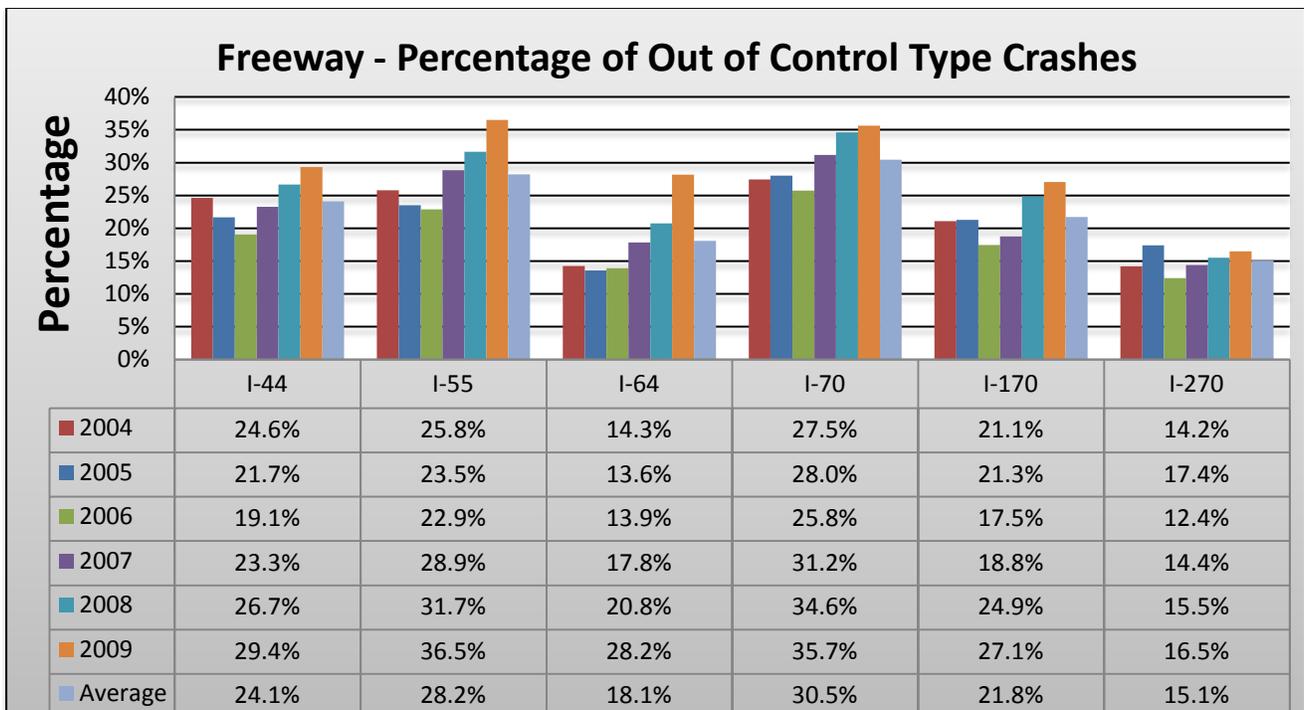


Figure S61 – Expressway - Percent of Out of Control Type Crashes to All Crashes

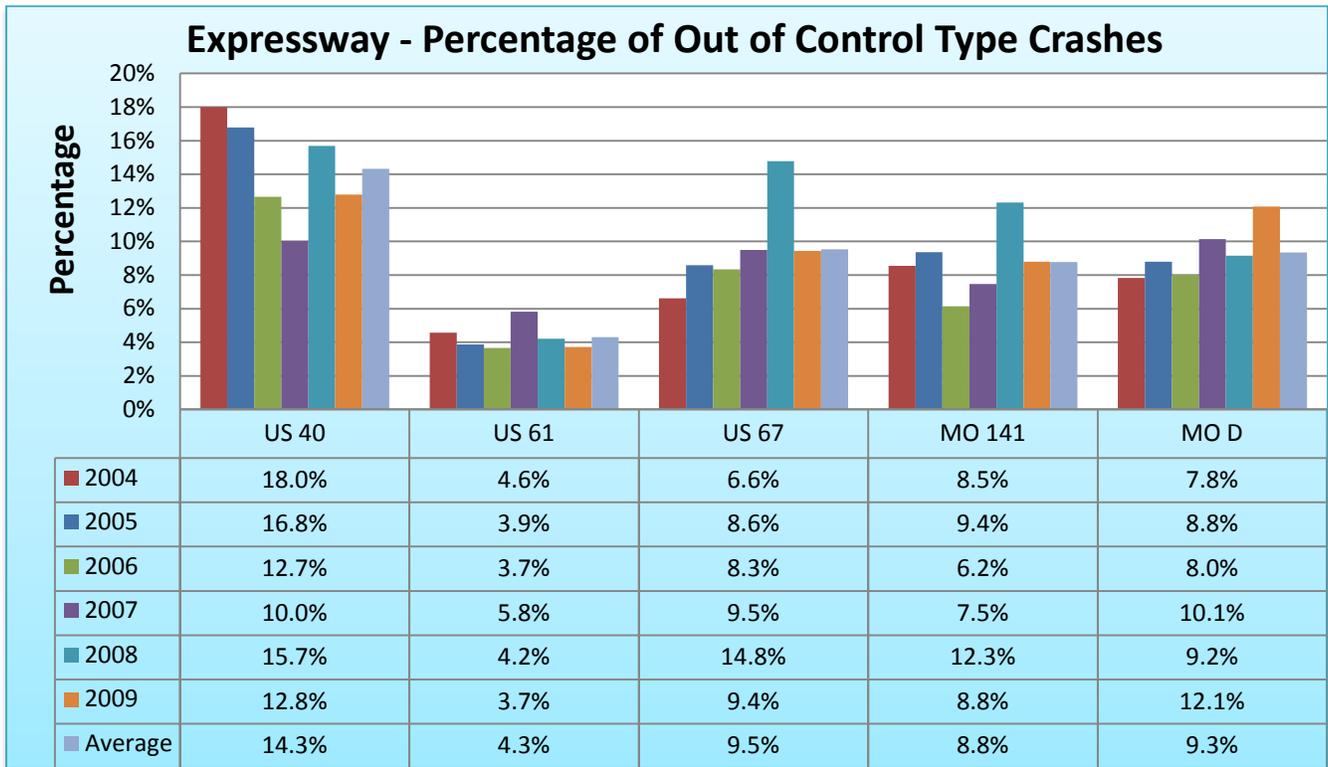


Figure S62 – Major Arterials - Percent of Out of Control Type Crashes to All Crashes

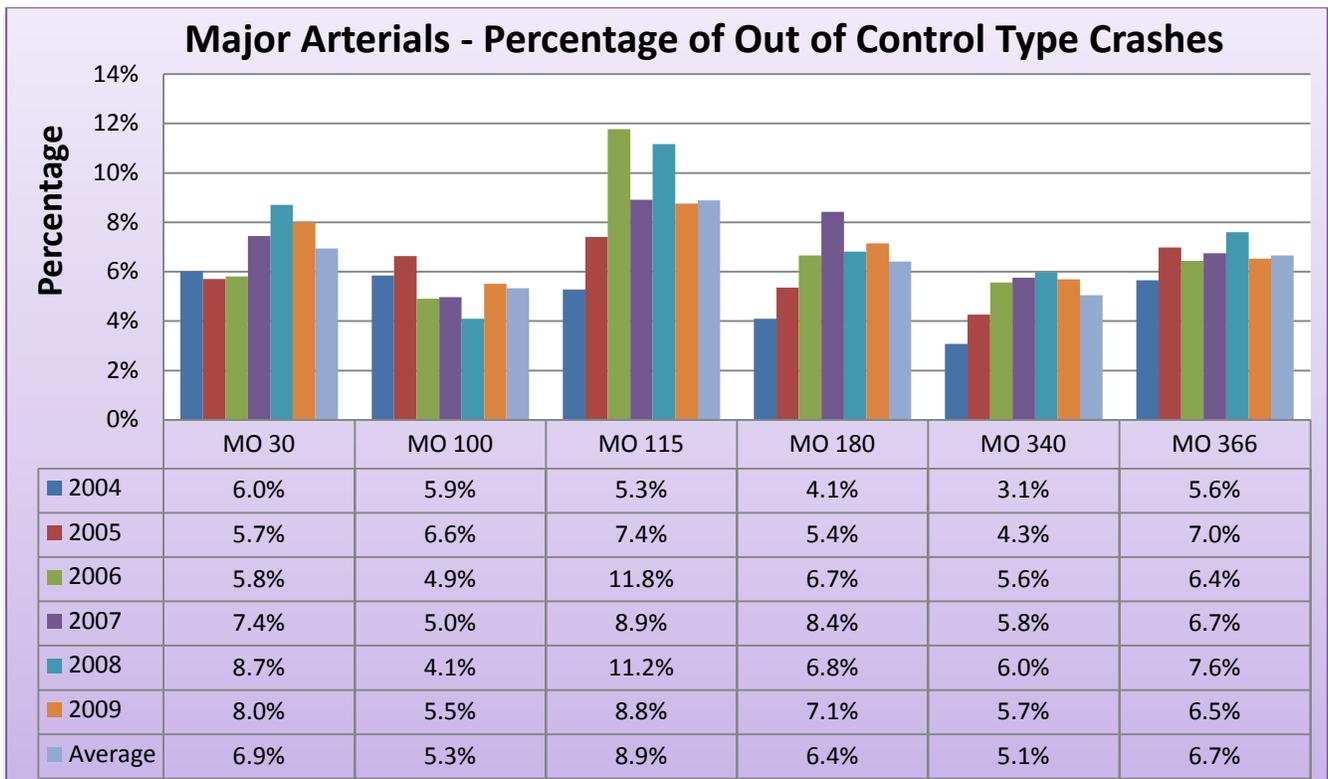


Figure S63 – Major Arterials - Percent of Passing Type Crashes to All Crashes

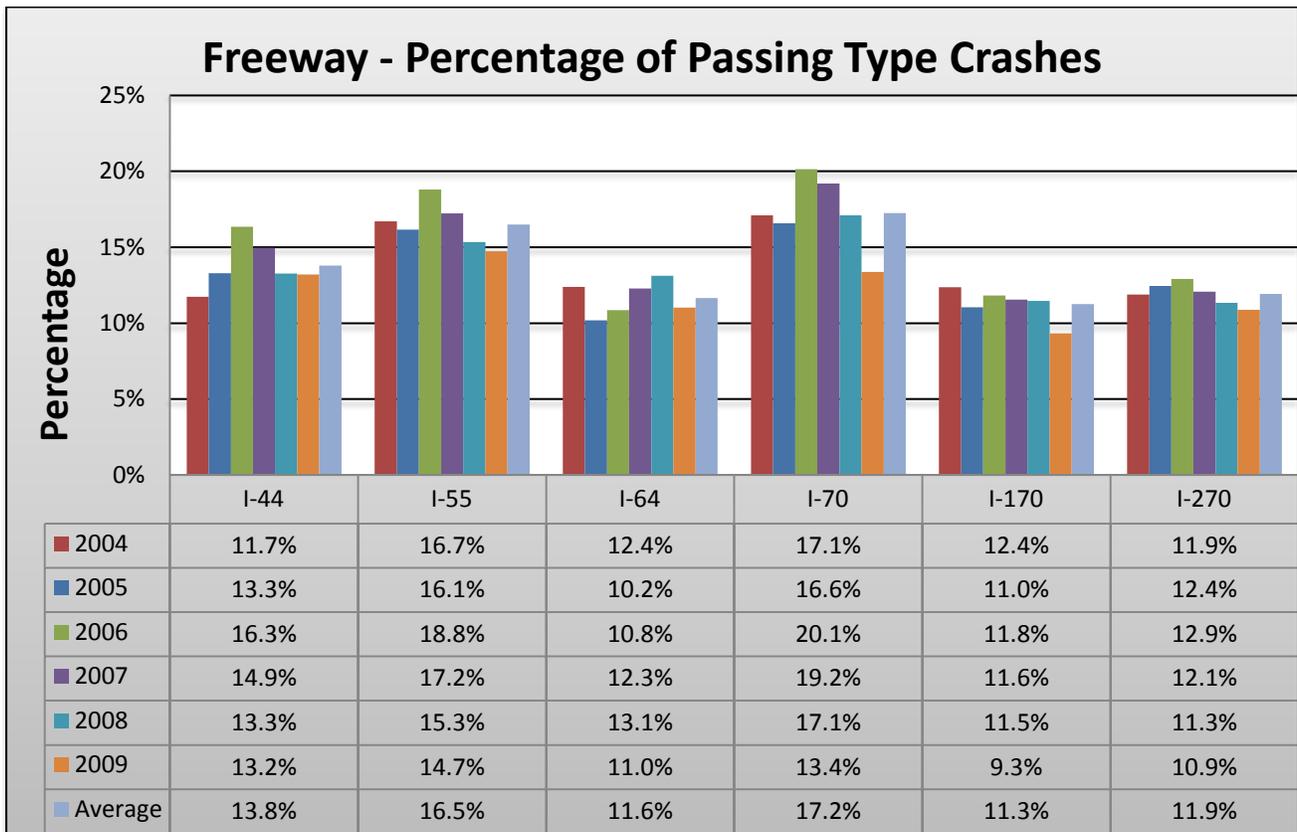


Figure S64 – Major Arterials - Percent of Passing Type Crashes to All Crashes

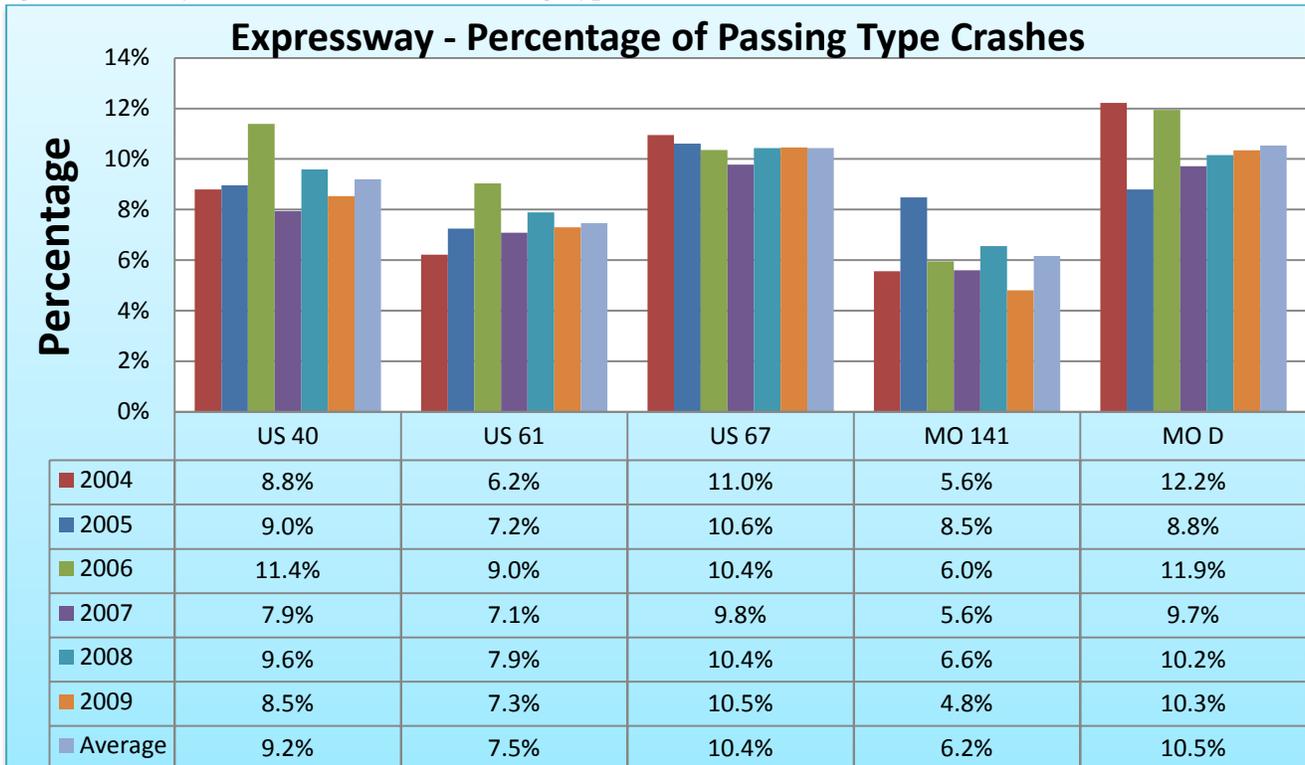


Figure S65 – Major Arterials - Percent of Passing Type Crashes to All Crashes

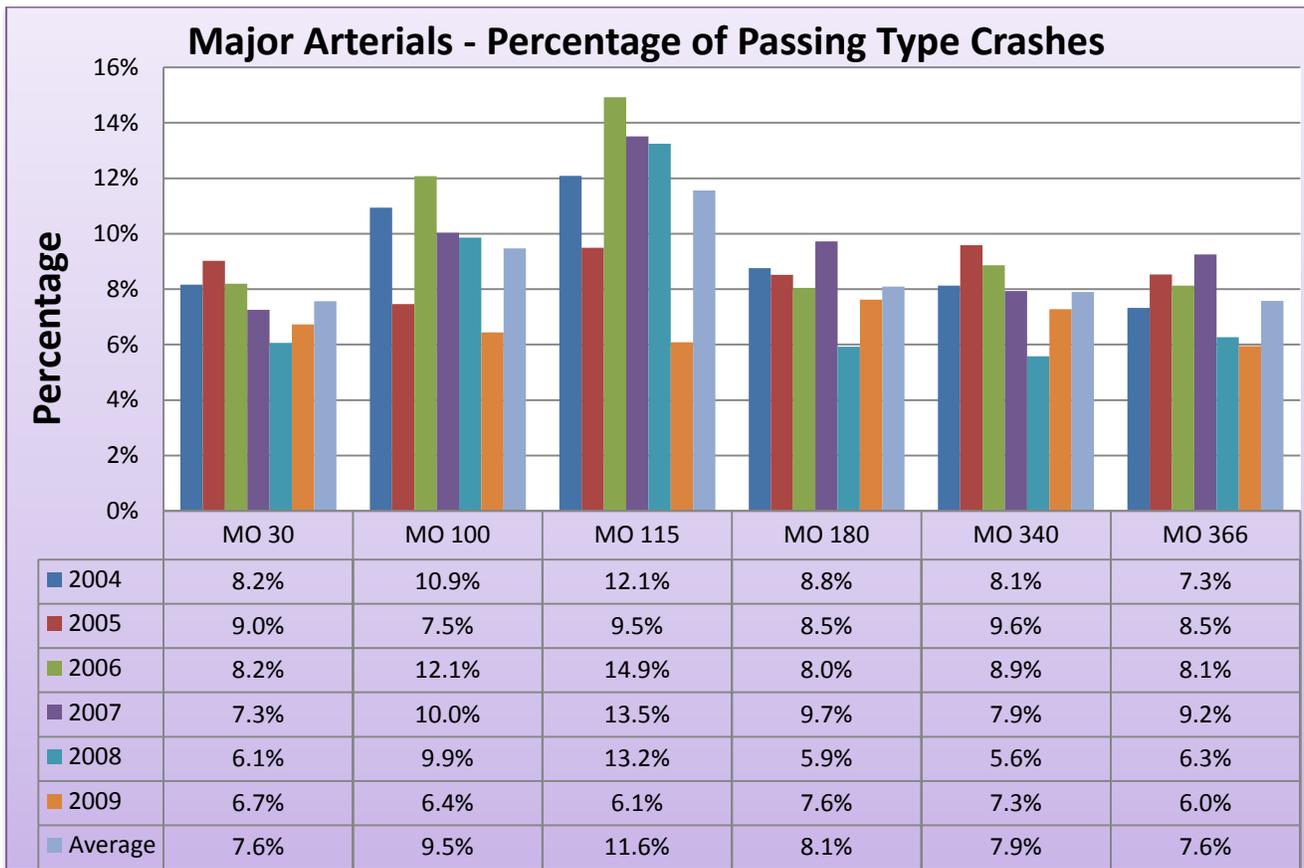


Figure S66 – Major Arterials - Percent of Other Type Crashes to All Crashes

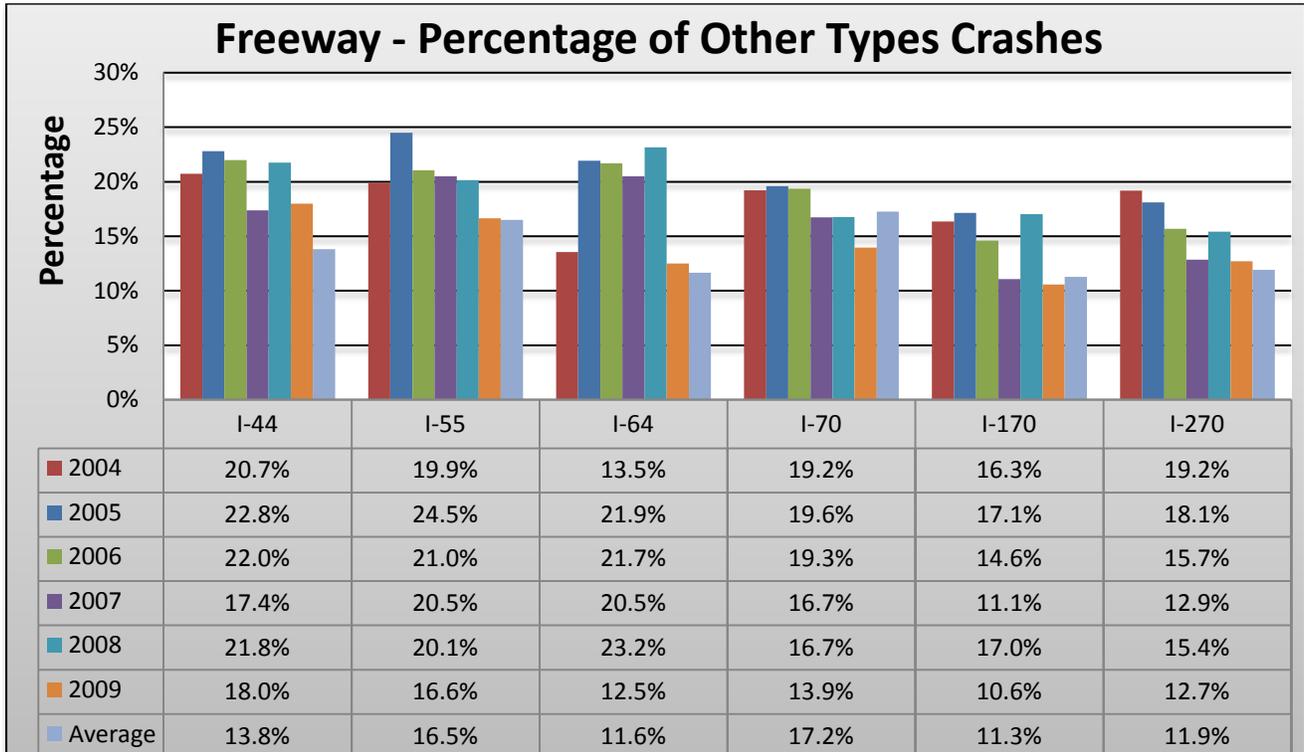


Figure S67 – Major Arterials - Percent of Other Type Crashes to All Crashes

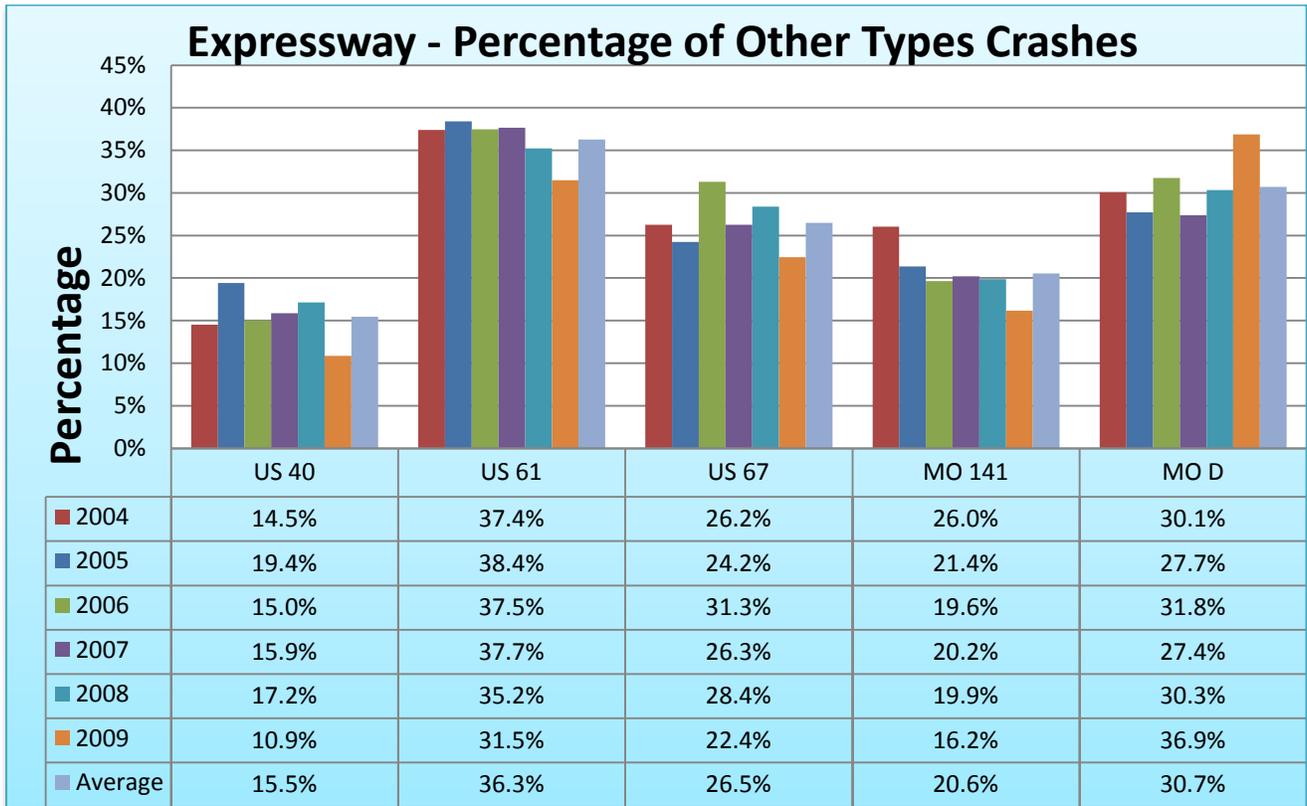


Figure S68 – Major Arterials - Percent of Other Type Crashes to All Crashes

