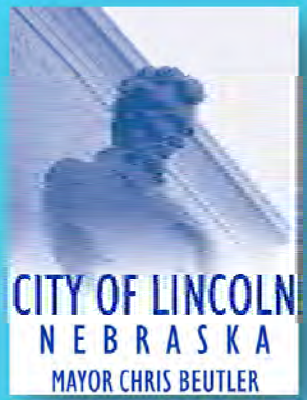
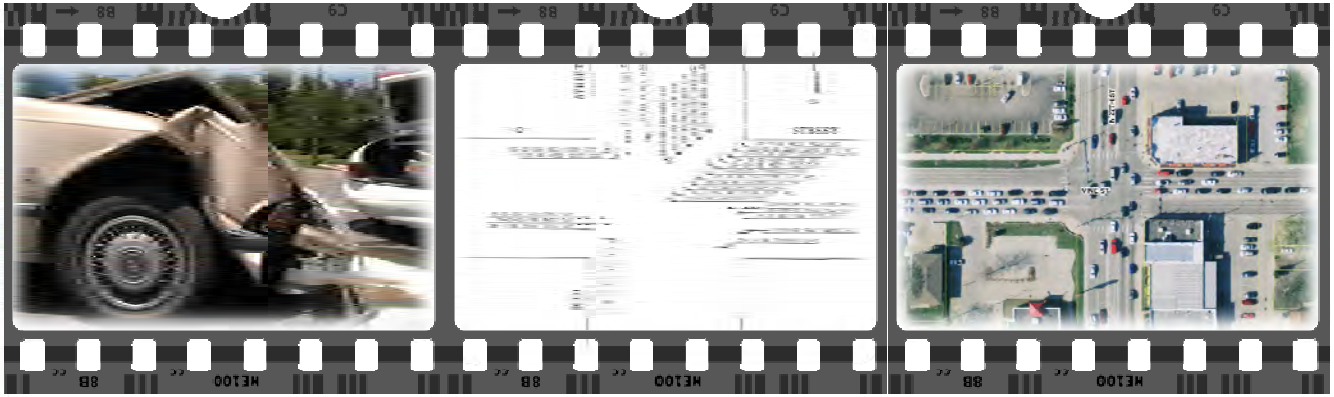
City of Lincoln

2009 Crash Study

Final Executive Summary





Prepared By

ITERIS Innovation for better mobility

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2009 Lincoln Crash Study

Executive Summary

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Section 1

Introduction and Study Process

Introduction

The City of Lincoln conducts Traffic Crash Analyses annually to plan for safety improvements to the City's roadway infrastructure. Effective safety improvements rely on a careful analysis of traffic crash data. The Lincoln Crash Study utilizes crash data from the Lincoln Police Department's database. The crash data is analyzed as part of multiple data sets that include different parameters, such as crash type, time of day the crash occurred, day of week the crash occurred, month of year the crash occurred, severity of the crash, and street classification on which the crash occurred. Individual intersections are also analyzed to determine if any crash patterns are present and what countermeasures can be implemented to address the crash pattern. The annual crash study provides quantifiable results that are used to assist decision makers in objectively selecting, prioritizing and applying safety treatments.

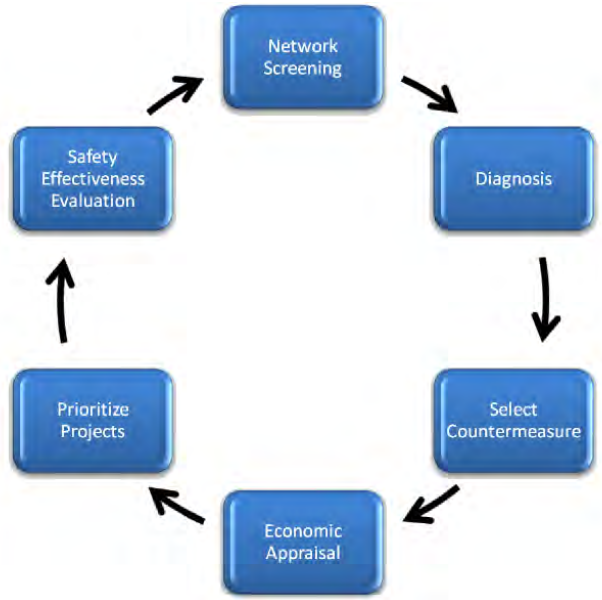
This information will also be useful to those involved in the "four E's" of traffic safety: Engineering, Education, Enforcement, and Emergency Medical Services in reducing the severity and frequency of traffic crashes in the City. Reducing crashes can result in significant cost savings to the City and to the motoring public. The following sections document the procedure used and results of the 2009 Lincoln Crash Study.

Study Process

The 2009 Lincoln Crash Study follows the methodology established in the Highway Safety Manual 2010 (HSM). The HSM establishes the Roadway Safety Management Process, which is a repeatable method for conducting safety analyses that is defined in a six-step roadway safety management process. The six step process as outlined in the HSM is illustrated in **Figure 1**.

The process begins with Network Screening, which establishes the focus of the safety analysis. During this step the specific aspects of the network that are going to be analyzed are identified, which may include intersections, roadway segments, ramps, and at-grade crossings, among other locations. The screening measures used in the analysis are also determined and may include average crash frequency, crash rate, Equivalent Property Damage Only (EPDO), Relative Severity Index, and others. The crash studies the City of Lincoln have been conducting focus on the safety analysis of intersections and use EPDO as an initial primary screening measure. With the network aspect and screening measure established, crash data is evaluated based on

Figure 1: HSM Roadway Safety Management Process



Study Process (continued)

established parameters. Results are then ranked and the intersections with the highest EPDO are deemed most likely to benefit from the implementation of identified countermeasures.

Once the intersections are ranked, a detailed review of the crash data is conducted to diagnose crash patterns at the intersection. The Diagnosis step identifies crash patterns, so appropriate countermeasures can be identified. The identification of crash patterns begins with a review of the crash data which may contain information about crash type, crash severity, road conditions, and time-of-day, among other information. The HSM suggests using three to five years of data to conduct this analysis to improve the reliability of the analysis, as data over short periods of time may fluctuate. This process is evolving in addition to the annual reviews. During this process crash diagrams are constructed. After the review of the data and construction of crash diagrams, a field review is conducted to identify characteristics at the intersection that may be contributing to the crash patterns identified.

With the data reviewed and a site review conducted, countermeasures can be selected. Countermeasures are selected to address the contributing factors for the crash patterns identified during the Diagnosis step. Typically countermeasures are most effective addressing a single contributing factor. Intersections may require multiple countermeasures to address the safety issues at the intersection depending on the contributing factors of the crash patterns identified.

After the countermeasures have been selected an Economic Appraisal of the countermeasures is conducted. The Economic Appraisal compares the cost of implementing the countermeasure to its expected benefit. The greater the benefit is compared to the cost, the higher the potential benefit-cost (B/C ratio of an improvement may be. With the B/C calculated for each countermeasure, projects are able to be prioritized, or at least better compared to one another, which is Step 5 in the roadway safety management process. Regardless of a calculated B/C ratio, engineering judgment and analysis of which countermeasures likely "best fix" a safety deficiency require careful consideration. Each individual intersection and relevant safety enhancements are specific in nature. Balancing the expected improvement potential of standard crash reduction factors with traffic engineering expertise and field experience is desired.

The final step in the roadway safety management process is to conduct a Safety Effectiveness Evaluation. A Safety Effectiveness Evaluation is conducted at intersections where improvements were previously implemented. The analysis focused on the reduction in Crash Rate and EPDO Rate. Based on the changes in the rates, a Benefit-Cost ratio was calculated for each countermeasure reviewed.

> ***"The EPDO method assigns weighting factors to crashes by severity to develop a single combined frequency and severity score per location"***

Section 2

Historic Crash Data

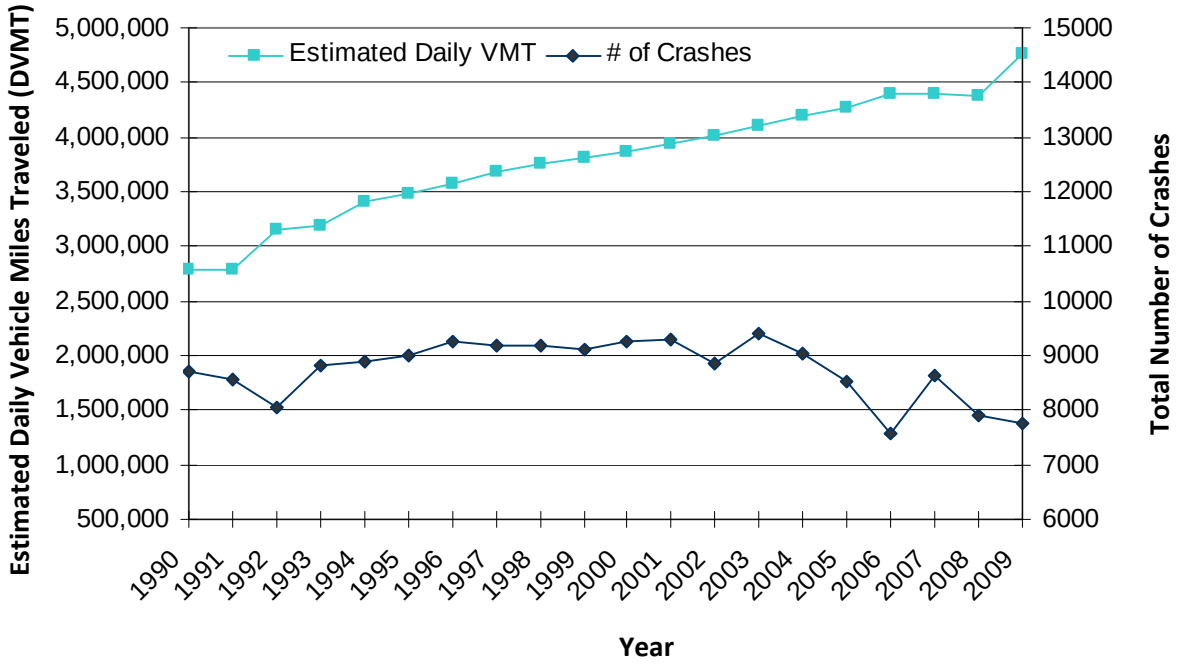
Historic Crash Trends

The 2009 Lincoln Crash Study has established a 20-year historic timeframe for general comparative purposes of the crash data. The 20-year timeframe is used to illustrate long-term trends within the City of Lincoln related to crashes.

Daily Miles Traveled vs. Total Crashes

In 1990 Lincoln's population was approximately 191,972, which had grown to 254,000 in 2009. That growth is equivalent to an annual growth rate of 1.41%. During that same time period the equivalent annual growth in the Estimated Daily Vehicle Miles Traveled outpaced the growth of the population. The Estimated Daily Vehicle Miles Traveled grew from 2,781,000 in 1990 to 4,770,000 in 2009, which is equivalent to an annual growth of 2.73%. **Figure 2** illustrates the growth in the Estimated Daily Vehicle Miles Traveled and shows the Total Number of Crashes. During the 20-year period the Total Number of Crashes was approximately in the 8,000-9,000 range even though the Estimated Daily Vehicle Miles Traveled increased annually.

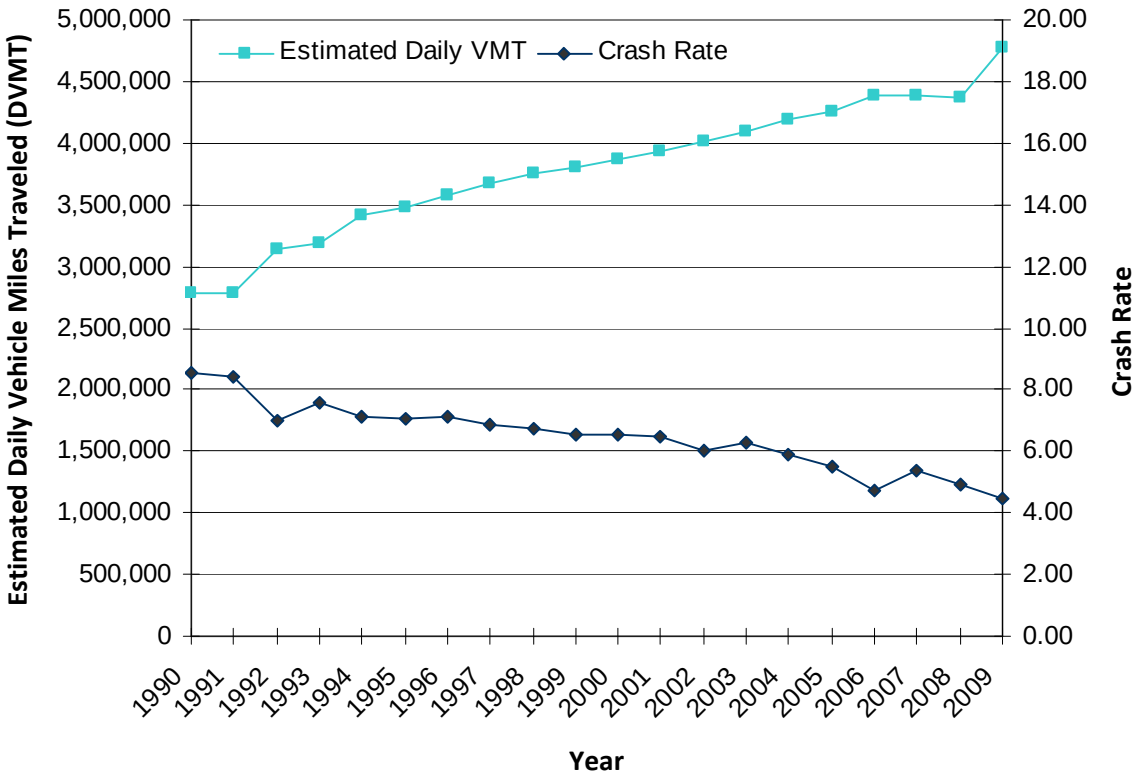
Figure 2: Daily Miles Traveled vs. Total Crashes



Daily Miles Traveled vs. Crash Rate

While the Estimated Daily Vehicle Miles Traveled was increasing during the 20-year time period, the Annual Crash Rate decreased during most years and had an average annual reduction of 3.33%. The increase in Estimated Daily Vehicle Miles Traveled is a large factor in the reduction of the crash rate. Assuming that the total number of crashes remains the same, the increase in Estimated Daily Vehicle Miles Traveled results in a reduction of the crash rate. Since crashes are rare and random events, the total number of crashes is not directly related to the Estimated Daily Vehicle Miles Traveled. **Figure 3** shows the trend of Estimated Daily Vehicle Miles Traveled vs. the Annual Crash Rate over the past 20-years.

Figure 3: Daily Miles Traveled vs. Crash Rate

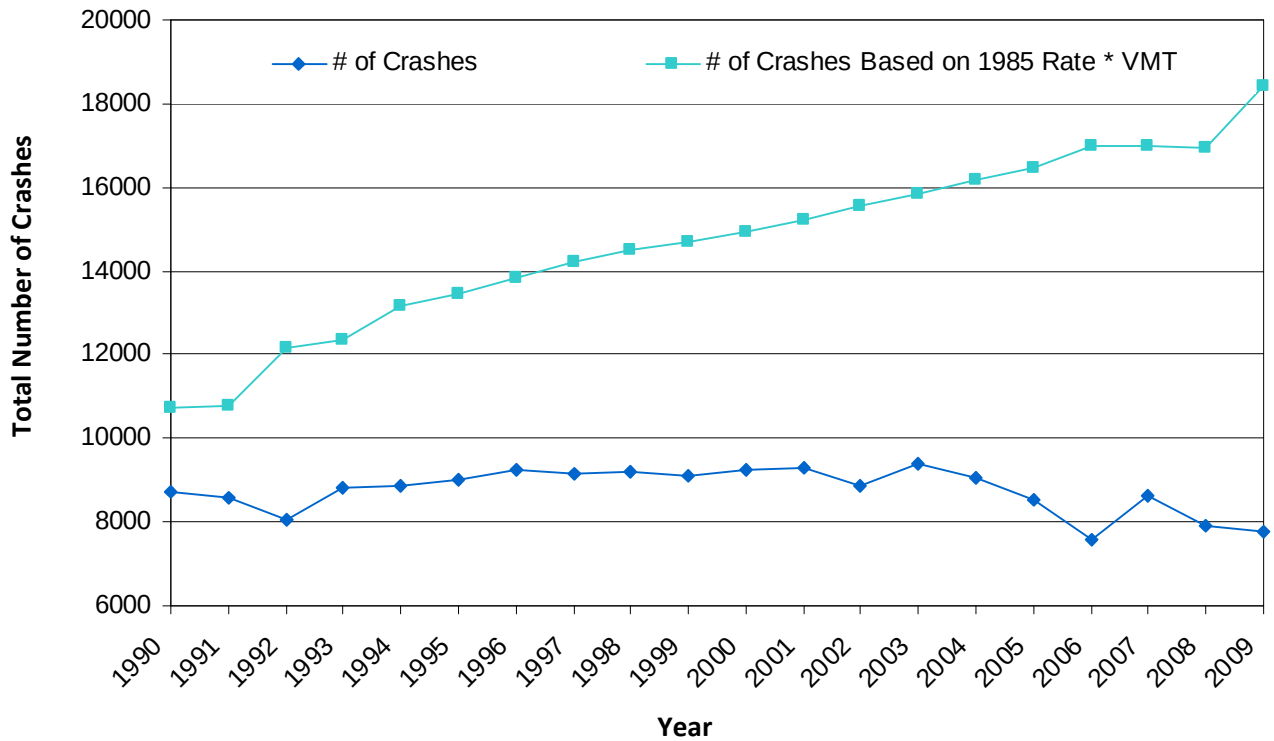


Theoretical vs. Actual Crash Rate Trends

Utilizing the crash rate and the Daily Vehicle Miles Traveled (DVMT) the theoretical crash total was determined for each successive year based on the DVMT for that year. The resulting theoretical crash total along with the actual total crashes for each year is shown in **Figure 4**. During this time the total number of crashers per year was approximately 9,000, with the total crashes declining toward 8,000 in the past five years. During this time the average number of DVMT steadily increased from 2,781,000 in 1990 to 4,770,000 in 2009. The fact that the number of total crashes did not increase in proportion to the increase in DVMT can be attributed to a number of factors including:

- an increase in traffic operations and safety knowledge
- improved design standards
- improved access management standards
- improvement in technology in the transportation industry
- improved safety devices along roadways
- Implemented safety improvements
- traffic enforcement and education

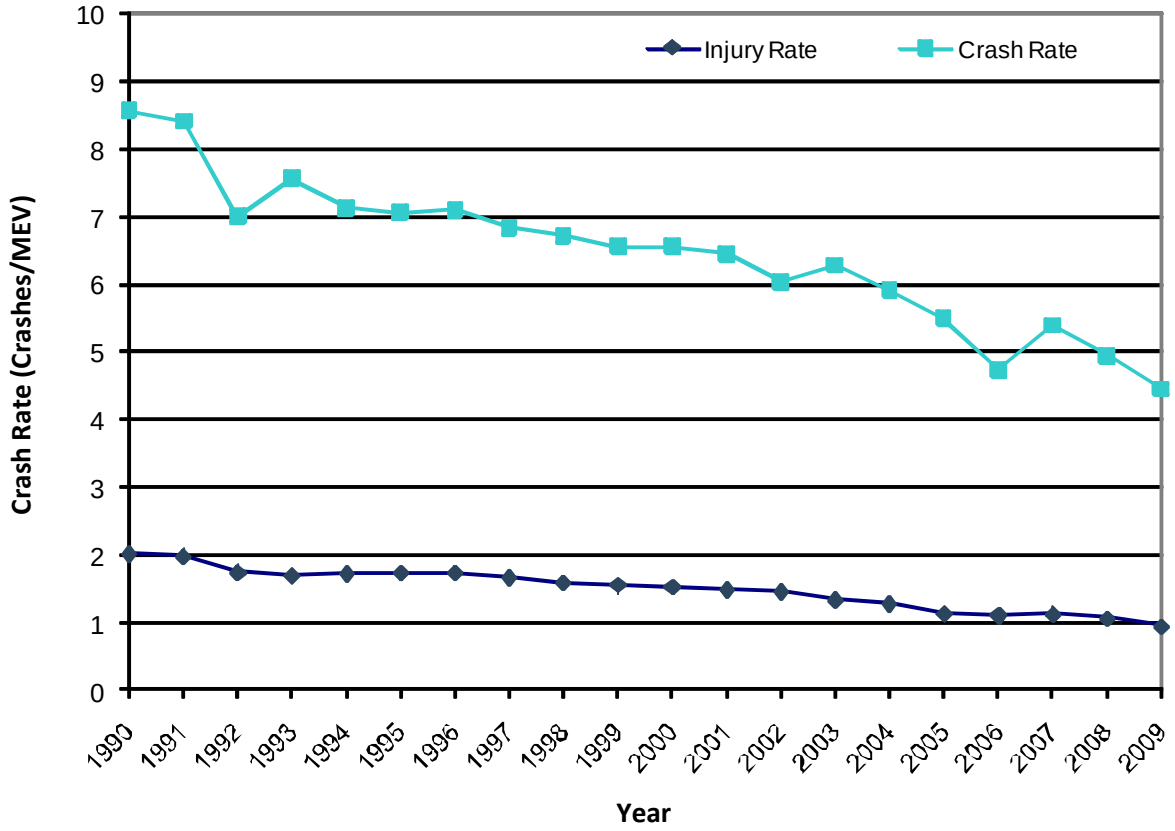
Figure 4: Citywide Total Crashes



Citywide Crash Rate Trends

The citywide crash rate has steadily decreased over the past 20 years. The higher DVMT with similar total crashes partially contributes to the steady decline in the crash rate. The increase in DVMT is not responsible for the decrease alone, as one might expect that the more miles that are traveled the more crashes would occur, but this is not a direct correlation. Some of the potential reasons why the crash rate has declined are the same as the reasons listed in the Theoretical vs. Actual Crash Rate Trends section. **Figure 5** illustrates the citywide crash rate trend.

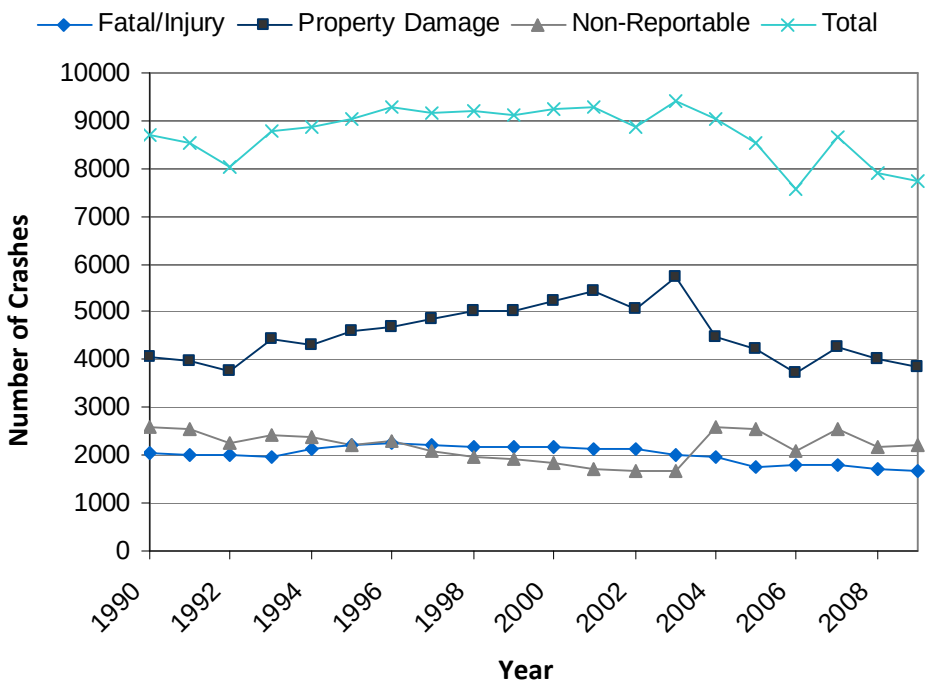
Figure 5: Citywide Crash Rate Trends



Crash Trends by Severity

The City of Lincoln began distinguishing between property damage and non-reportable crashes in 1989. Between 1990 and 2009 the number of total crashes has typically been between 8,000 and 9,000 per year. During this time the number of injury and fatal crashes has remained relatively constant, while the number of property damage and non-reportable crashes have varied based on the total number of crashes. **Figure 6** shows the historic crash rate trends by crash severity within the City of Lincoln.

Figure 6: Crash Trends by Severity



*Note: Property Damage Threshold Increased from $500 to $975 in 2004

*Note: Pre-1988 there was no distinction between Property Damage and Non-Reportable Accidents.

Pedestrian and Bicycle Crashes

Crashes involving pedestrians and bicycles were graphed for the previous two decades to illustrate any general trends in the data, as seen in **Figure 7**. When analyzing the average number of crashes from 1990-1999 compared to 2000-2009, there was an average reduction of approximately 63 bicycle crashes per year and 30 pedestrian crashes per year, as shown by the average crash data for each decade in **Table 1**.

"There was an average reduction of 63 bicycle crashes per year and 30 pedestrian crashes per year over the past decade compared to the previous decade"

(This continued reduction is likely contributed to the overall improved facilities - trails, signing, safer cross-walks, countdown signal heads etc.)

Figure 7: Pedestrian and Bicycle Collision History

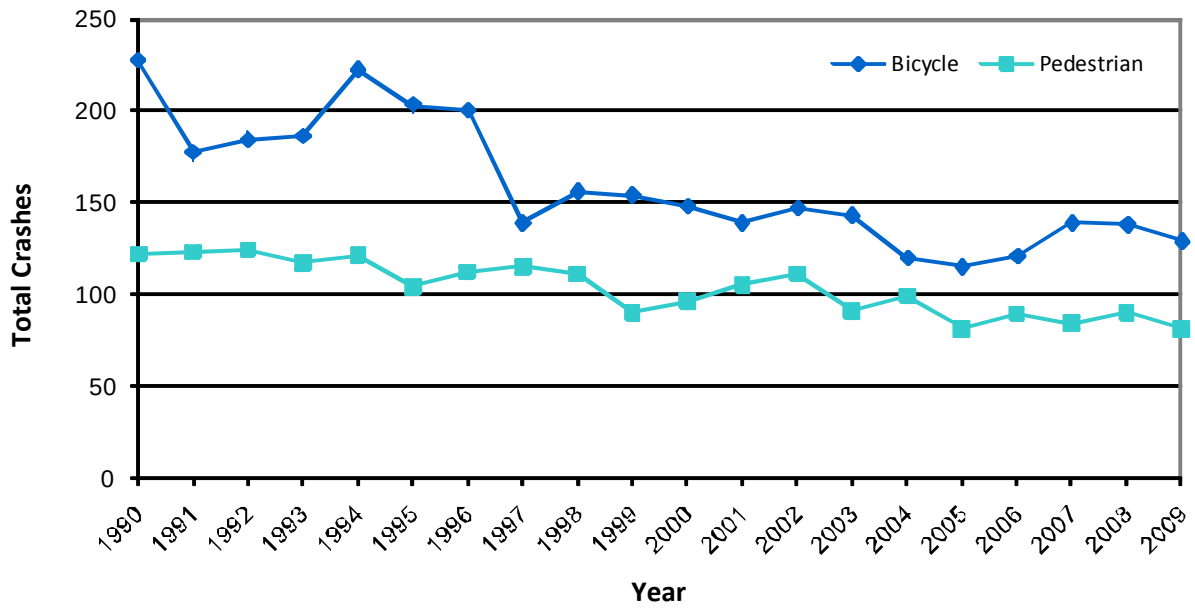


Table 1: Ped/Bike Decade Crash Comparison

	Average Crashes	
Years	Bicycle	Ped
1990 - 1999	184.80	113.90
2000 - 2009	121.73	84.27
Difference	63.07	29.63

Section 3

2009 Crash Data

2009 Crash Data

The 2009 Crash Study focused on crashes that occur at intersections. Crashes that occurred at intersections were analyzed by functional classification. **Table 2** provides a breakdown of the intersection crashes by the functional classification of the two roadways and the type of traffic control at the intersection. There were 1,325 intersections that were included as part of the analysis. Intersections where the primary street was classified as a Major Arterial averaged more crashes than where the primary intersections was classified with the Collector and Local functional classifications, while the lower classifications of Collector and Local roadways had the higher average crash rate. This can be attributed to the volume differences between the roadway classifications. Major Arterial roadways typically are higher traffic volume roadways, which results in more crashes but a lower rate due the higher traffic volumes, while Collector and Local roadways experience fewer crashes because of the lower traffic volumes, but a higher crash rate.

Table 2: Intersection Crash Analysis Summary

Functional Classification	Traffic Control	Number Evaluated	Avg. Number of Crashes	Avg. Crash Rate	Avg. EPDO Rate
Major/Major	Traffic Signal	185	10	0.84	2.3
Major/Major	Stop Sign	26	3.2	0.7	1.77
Major/Major	Yield Sign	5	8	0.91	1.98
Major/Collector	Traffic Signal	117	4.5	0.53	1.5
Major/Collector	Stop Sign	56	2.2	0.47	1.79
Major/Local	Stop Sign	469	1.7	0.34	0.98
Major/Local	Yield Sign	1	3	0.75	0.75
Collector/Collector	Traffic Signal	8	2.9	0.58	1.85
Collector/Collector	Stop Sign	8	1.6	0.96	4.36
Collector/Collector	Yield Sign	1	2	2.74	1.53
Collector/Local	Stop Sign	39	1.6	1.17	3.19
Collector/Local	Yield Sign	12	1.6	1.47	6.27
Collector/Local	No Control	36	1.2	1.31	3.17
Local/Local	Stop Sign	26	1.5	1.66	3.69
Local/Local	Yield Sign	31	1.4	1.85	5.95
Local/Local	No Control	305	1.2	1.93	3.82
	Total	**1325**			

Crash Costs

During 2009 there were 7,748 crashes that were reported to the Lincoln Police Department. Utilizing the total number of crashes by crash type, a monetary value was calculated for the loss that resulted from the crashes. The capital loss was calculated based on the Highway Safety Manual (HSM), which uses crash costs from the Federal Highway Administration's report, *Crash Costs Estimates by Maximum Police-Reported Injury Severity within Selected Crash Geometries.* The report expressed monetary values in 2001 dollars, which have been converted to 2009 dollars according to the process outlined in HSM Appendix 4A – Crash Cost Estimates of the HSM.

The capital costs include all monetary losses related to emergency services, medical care, property damages and lost productivity. Capital losses are those in which the monetary loss can be easily quantified. **Table 3** shows the capital costs calculated for each crash type based on the 2009 crash data. In addition to the calculated capital costs, there are additional societal costs related to crashes. Societal costs are not as easily definable as capital losses, because societal costs include nonmonetary costs associated with the reduction in a person's quality of life resulting from a crash. The loss of quality of life may include effects of permanent physical impairment, emotional trauma to those involved, and emotional trauma experienced by those who knew a victim of a crash, whether the victim was injured or killed.

Table 3: 2009 Capital Crash Costs

2009 Crashes		Capital Costs
Fatal	6	$9,051,876
Injury	1649	$153,088,141
PDO	3870	$29,998,509
NR	2223	$2,167,425
Total	**7748**	**$194,305,951**

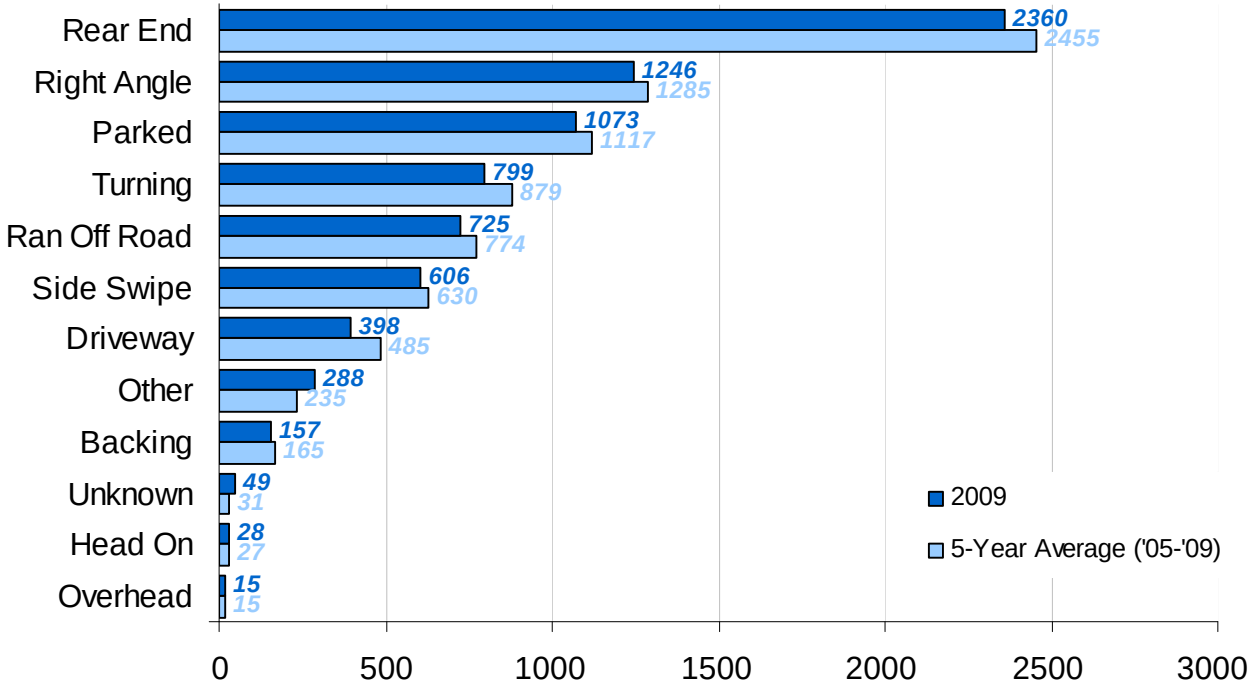
"Crashes that occurred in Lincoln during 2009 resulted in the loss of over $194 Million."

Crash Type

Figure 8 shows a comparison of the 2009 crash data vs. the previous 5-year average. The graph shows that most crash types experienced fewer crashes during 2009 when compared with the previous 5-year average. This can be attributed to the fact that the overall number of crashes was down in 2009 (7748) compared to the previous 5-years, which averaged 8100 crashes per year.

"The total number of crashes in 2009 was approximately 350 less than the average for the last 5 years."

Figure 8: Crashes by Type

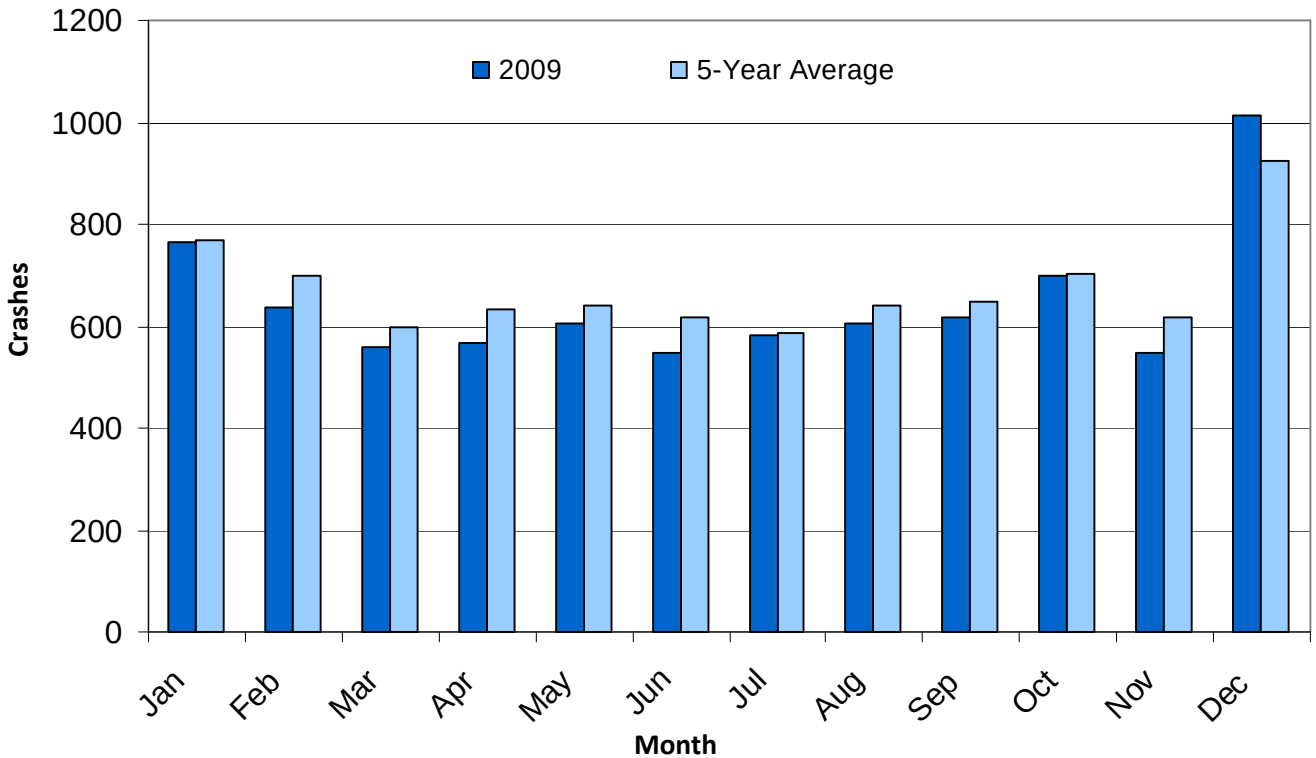


Crashes by Month

Figure 9 provides a comparison of the crashes by month from 2009 versus the previous five year average. Although the total number of crashes in 2009 was lower than the previous years, the same general trend is seen in the monthly crashes. Crashes tend to occur in the winter months (Dec, Jan, Feb) when the weather conditions are more likely to be a contributing factor to a crash occurring. Crashes generally decline during the summer months, which coincide with the time of year when precipitation is at its lowest.

"2009 crashes followed the general pattern seen for the previous 5 years

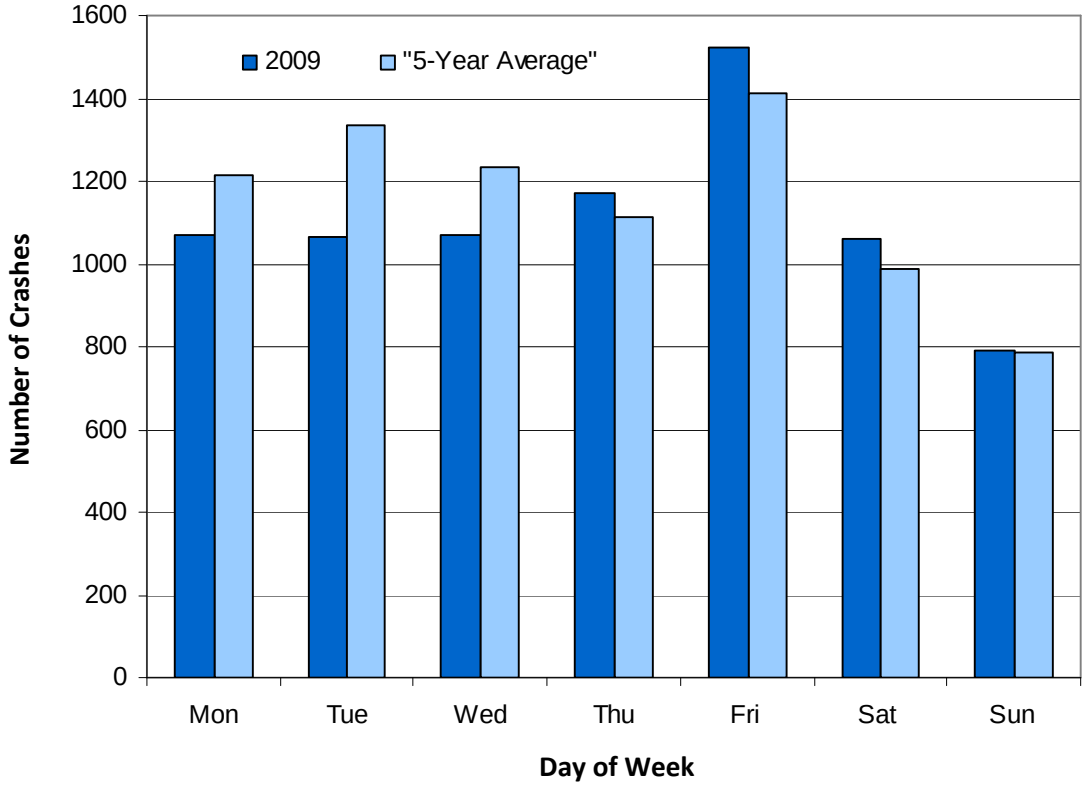
Figure 9: 2009 Crashes by Month



Crashes by Day of Week

A comparison of the crashes by day of the week for 2009 versus the previous five year average is shown in **Figure 10**. The total number of crashes for 2009 was lower than the average number of crashes per year during the last five years. The graph shows that most of the reduction in crashes occurred during the early part of the week, while crashes during the second half of the week increased, with the exception of Sunday, which remained the same. Based on the five year average data, crashes tend to occur more frequently during the standard work week, which also coincides with general average traffic volumes that are typically higher during the week days.

Figure 10: 2009 Crashes by Day of the Week

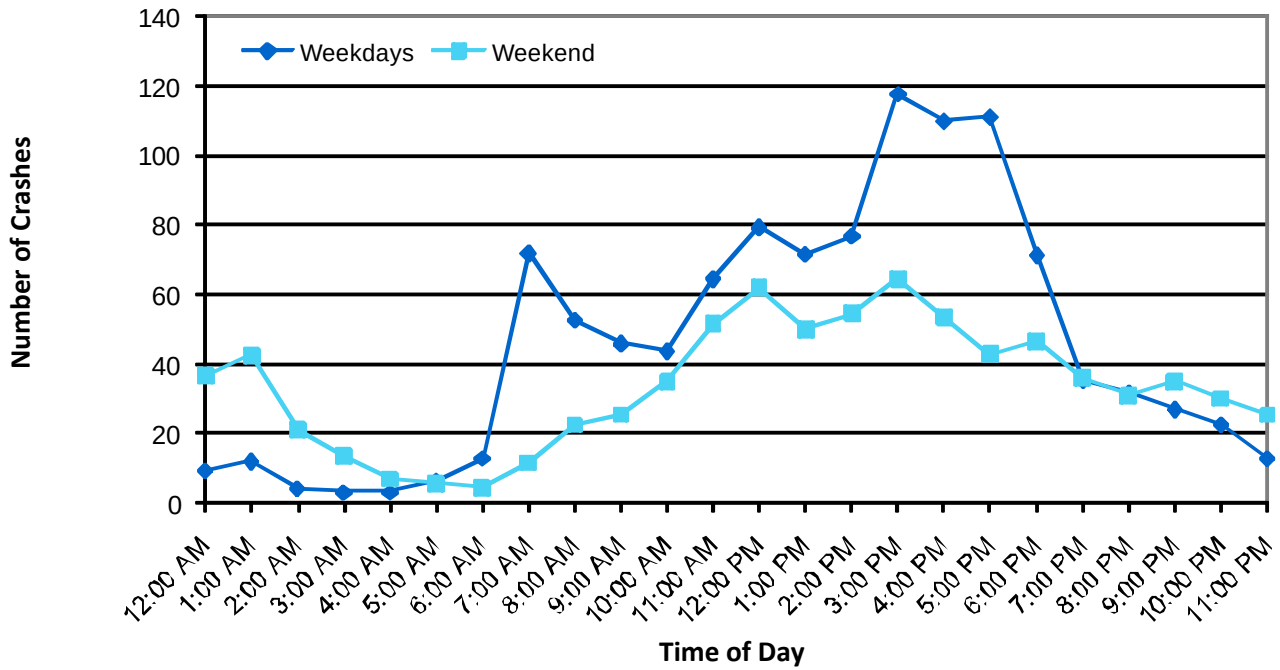


Crashes by Time-of-Day

Crashes by time-of-day were analyzed by weekday and weekend crashes, because of the differing traffic patterns that occur during the week with school and work traffic strongly influencing the traffic patterns. The graph of weekday crashes shown in **Figure 11** is similar to what a typical Average Daily Traffic (ADT) graph looks like during the week, with there being a peak during the morning commute time, a drop right after the morning commute and then a gradual increase throughout the rest of the day until after the evening commute is over, where it gradually tappers off. The weekend graph also shows a graph similar to ADT patterns where traffic peaks in the late morning and early afternoon, as well as a smaller spike during the early morning hours between 11:00 pm and 1:00 am that can associated to the people participating in various nightlife activities, which may involve drinking.

"Peak traffic hours show peaking of traffic crashes due to higher traffic volume (exposure). NHTSA reports that weekends experience the highest number of fatal crashes"

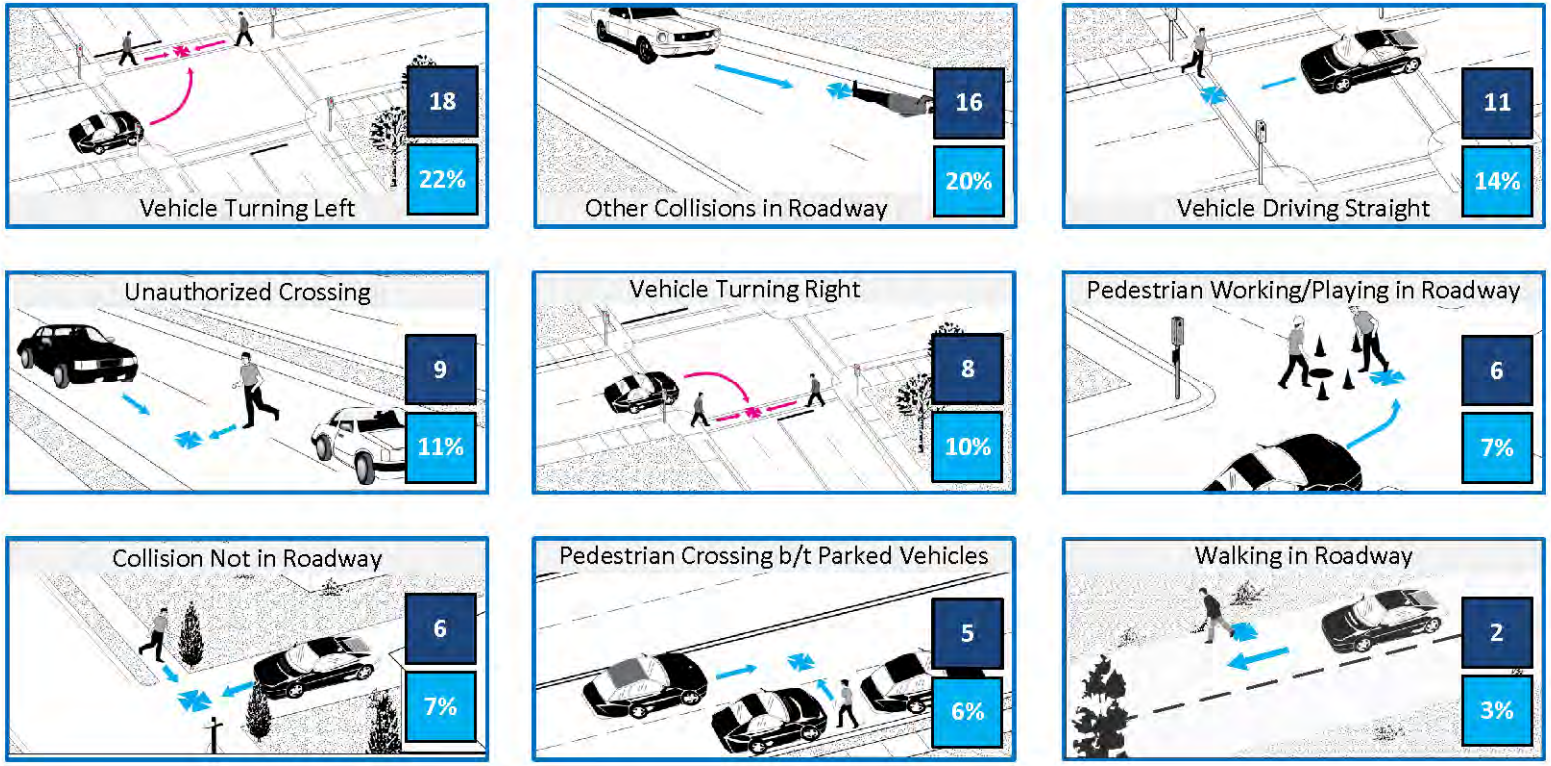
Figure 11: 2009 Crashes by Time-of-Day



Pedestrian and Bicycle Crashes

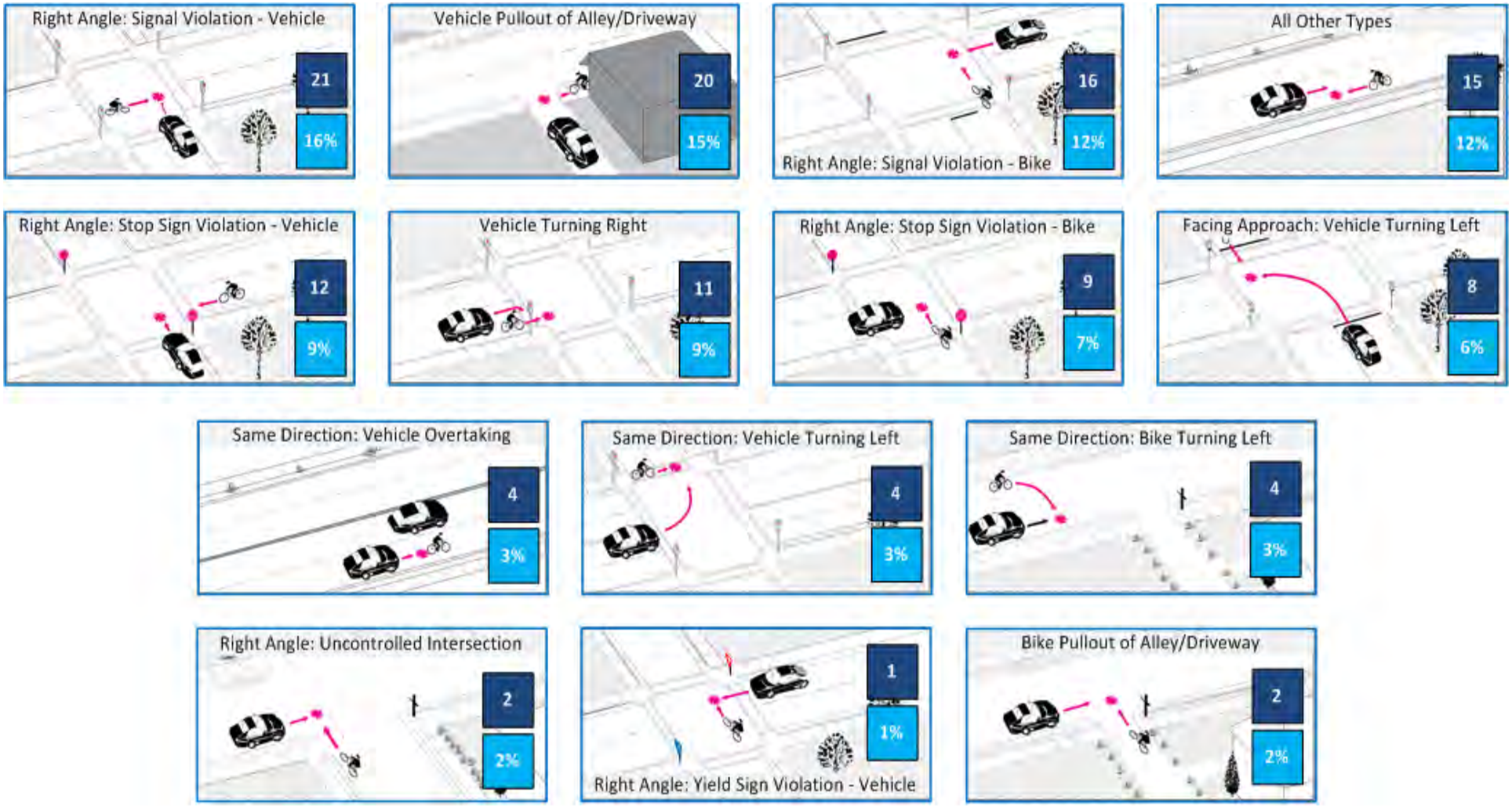
Crashes involving pedestrians and bicycles were summarized graphically by type in **Figures 12 and 13**. The graphs provide an overview of the general pedestrian and bicycle crash trends. The total number of pedestrian and bicycle crashes account for less than 3% (2.71%) of the total number of crashes in the City of Lincoln during 2009. Pedestrian crashes consisted of 1.05% of the total crashes, while bicycle crashes accounted for 1.66% of the total crashes.

Figure 12: Pedestrian Collision Types



Pedestrian and Bicycle Crashes (continued)

Figure 13: Bicycle Collision Types

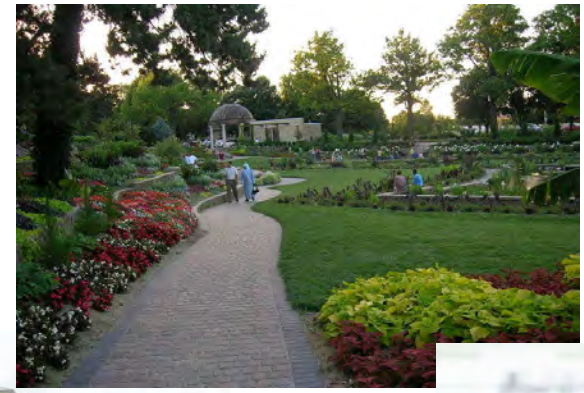


Annual Allstate America's Best Drivers Report

Allstate Insurance Company began ranking America's safest driving cities in 2005. Allstate ranks the largest 200 cities in the United States and releases the information in it's annual *Allstate America's Best Drivers Report.* The report rankings are based on reported property damage claims that the company receives over a two-year period, which was January 2007 through December 2008 for the most recent rankings. Allstate insures approximately 11% of the nation's drivers, which provides a large enough sample size for the results to provide a realistic snapshot of the nation's driving habits.

The reported property damage claims are used to determine the likelihood a driver is to experience a crash compared to the national average. Cities less likely to experience a crash are ranked higher on the list. In the sixth annual rankings Lincoln ranks ninth. Only one city, Colorado Springs, CO, with a population greater than Lincoln ranks higher on the list. The Top 25 cities are shown in **Table 4**.

For comparison purposes, cities with a population within 30,000 people of Lincoln's are shown in **Table 5**, along with the City of Omaha, NE. The table is sorted based on the average ranking each city has received as part of the *Allstate America's Best Drivers Report* over the last six years. Based on the average of the past six year's ranking reports, Lincoln ranks second among its peer cities with populations from 220,000 to 280,000.



Annual Allstate America's Best Drivers Report (continued)

Table 4: Allstate America's Best Drivers Top 25 Ranking

City	2010 Best Driver Rank	2009 Best Driver Rank	Population
Fort Collins, CO	1	2	136,509
Chattanooga, TN	2	3	170,880
Boise, ID	3	9	205,314
Colorado Springs, CO	4	10	380,307
Knoxville, TN	5	5	184,802
Eugene, OR	6	8	150,104
Reno, NV	7	11	217,016
Huntsville, AL	8	16	176,645
Lincoln, NE	**9**	**14**	**251,624**
Cedar Rapids, IA	10	4	128,056
Fort Wayne, IN	11	6	251,591
Dayton, OH	12	12	154,200
Springfield, MO	13	21	156,206
Winston Salem, NC	14	25	217,600
Salinas, CA	15	37	143,640
Chandler, AZ	16	43	247,140
Birmingham, AL	17	22	228,798
Sioux Falls, SD	18	1	154,997
Cary, NC	19	33	129,545
Tucson, AZ	20	26	541,811
Nashville, TN	21	35	596,462
Lexington, KY	22	7	282,114
Mesa, AZ	23	49	463,552
Mobile, AL	24	28	191,022
Gilbert, AZ	25	51	216,449
Omaha, NE	49	24	438,646

Annual Allstate America's Best Drivers Report (continued)

"Comparing Lincoln to other peer cities with similar populations shows Lincoln has some of the safest streets to drive on."

Table 5: Peer Cities from the Allstate Annual Average Ranking

Rank	City	State	2009 Population Estimate	2005	2006	2007	2008	2009	2010	Average Ranking
1	Fort Wayne	IN	251,247	20	16	32	10	6	11	15.8
2	**Lincoln**	**NE**	**248,744**	**16**	**22**	**26**	**19**	**14**	**9**	**17.7**
3	Madison	WI	228,775	14	11	22	27	13	26	18.8
4	Birmingham	AL	229,800	10	15	29	24	22	17	19.5
5	Lexington-Fayette	KY	279,044	51	46	16	6	7	22	24.7
6	Omaha	NE	424,482	27	23	19	16	24	49	26.3
7	Scottsdale	AZ	235,677	39	51	45	49	56	34	45.7
8	Chandler	AZ	246,399	45	71	69	51	43	16	49.2
9	St. Paul	MN	277,251	71	54	51	48	41	52	52.8
10	Glendale	AZ	253,152	56	56	53	79	71	50	60.8
11	St. Petersburg	FL	246,407	78	72	71	71	80	80	75.3
12	Chesapeake	VA	219,154	119	129	89	47	57	59	83.3
13	Greensboro	NC	247,183	99	104	85	90	97	70	90.8
14	Henderson	NV	249,386	69	88	120	134	109	96	102.7
15	Anchorage	AK	279,671	101	97	99	128	144	124	115.5
16	Buffalo	NY	272,632	120	108	146	97	126	141	123.0
17	Orlando	FL	227,907	141	144	153	149	146	145	146.3
18	Baton Rouge	LA	227,071	152	147	139	153	163	151	150.8
19	Plano	TX	260,796	145	161	162	159	162	155	157.3
20	Norfolk	VA	235,747	187	185	181	151	159	156	169.8
21	New Orleans	LA	239,124	183	181	180	174	154	148	170.0
22	Jersey City	NJ	242,389	184	191	193	180	182	186	186.0
23	Newark	NJ	280,135	195	197	197	190	189	190	193.0

Section 4

2009 Safety Review

Crash Analysis Summary

Utilizing the 2009 crash data, an Equivalent Property Damage Only (EPDO) crash rate was calculated for every intersection, as part of the Network Screening step of the HSM Roadway Safety Management Process. Based on the results, 45 intersections were identified as having an EPDO crash rate that was higher than the relevant critical rate. These 45 intersections are listed in **Table 6** by street functional class and intersection control type. The intersections are ranked by EPDO rate, and also by crash rate - for lower functional class intersections. The table lists the number of crashes by type where:

- **F+I** is the number of fatal and injury crashes
- **Prop** is the number of property damage crashes of $975 or more
- **NR** is the number of non-reportable crashes with damages less than $975

"45 intersections were identified as having an EPDO crash rate that was higher than the relevant critical rate"

Crash Analysis Summary (continued)

Table 6: 2009 High Crash Intersection Rankings

Rank	Intersection	Number of Crashes				Crash Rate Crash/MEV	EPDO Rate Crash/MEV
		F+I	Prop	NR	TOT		
Major/Major: Signal Controlled							
1	N 27th St & Vine St	21	13	16	50	2.6	9.75
2	S 48th St & "A" St	7	8	1	16	1.57	6.43
3	N 33rd St & Vine St	8	10	1	19	1.48	5.91
4	S 13th St & "A" St	5	6	0	11	1.33	5.67
5	N 27th St & Cornhusker Hwy	13	24	12	49	2.09	5.64
6	S 40th St & Nebr Hwy	9	9	3	21	1.37	5.44
7	N 14th St & Superior St	7	17	8	32	2.27	5.34
8	S 27th St & "A" St	7	8	4	19	1.52	5.29
9	N 48th St & Vine St	9	10	7	26	1.51	4.92
10	S 48th St & Randolph St	5	4	3	12	1.3	4.9
11	33rd St & "O" St	10	8	9	27	1.4	4.71
12	48th St & "O" St	11	13	16	40	1.77	4.65
13	S 56th St & Old Cheney Rd	6	6	4	16	1.32	4.59
14	84th St & "O" St	6	11	3	20	1.51	4.57
15	10th St & "O" St	8	9	9	26	1.52	4.42
16	S 70th St & South St	6	5	9	20	1.55	4.29
17	S 27th St & Nebr Hwy	8	11	19	38	1.93	4.01
18	S 27th St & South St	6	8	7	21	1.43	3.95
19	56th St & "O" St	7	12	2	21	1.19	3.93
20	S 56th St & Normal Blvd	5	9	7	21	1.5	3.64
21	16th St & "O" St	5	8	6	19	1.39	3.63
22	N 48th St & Cornhusker Hwy	4	11	5	20	1.61	3.58
23	27th St & "O" St	7	19	19	45	2.03	3.56
24	S 70th St & "A" St	5	17	9	31	1.84	3.51
25	S 27th St & Old Cheney Rd	4	10	5	19	1.49	3.41
26	N 27th St & Superior St	6	15	6	27	1.34	3.23

Crash Analysis Summary (continued)

Table 6: High Crash Intersection Rankings (continued)

Rank	Intersection	Number of Crashes				Crash Rate Crash/MEV	EPDO Rate Crash/MEV
		F+I	Prop	NR	TOT		
Major/Major: Stop Controlled							
1	N 14th St & Fletcher Ave	2	6	0	8	5.92	16.59
2	S Coddington Ave & W Van Dorn St	3	1	0	4	2.03	12.99
Major/Major: Yield Controlled							
1	N Antelope Valley Ex Rd & Cornhusker Hw	6	9	5	20	1.71	5.03
Major/Collector: Signal Controlled							
1	N 27th St & Old Dairy Rd	3	4	0	7	1.8	7.36
2	N 27th St & Folkways Blvd	6	4	2	12	1.55	6.9
3	N 62nd St & Havelock Ave	3	3	0	6	1.03	4.79
4	S 33rd St & "J" St	2	3	0	5	1.15	4.45
5	S 21st St & N St	2	4	0	6	1.16	3.94
6	N 27th St & Fair St	5	4	1	10	0.85	3.83
7	S 27th St & J St	4	4	2	10	0.99	3.68
8	N 14th St & Salt Creek Rdwy	1	2	2	5	1.65	3.45
9	N 12th St & "Q" St	2	3	1	6	1.01	3.29
10	S 9th St & "M" St	3	6	4	13	1.33	3.48
11	S 27th St & Woods Blvd	3	2	5	10	1.12	3.04
12	Lyncrest Dr & O St	4	8	2	14	0.89	2.61
13	S 56th St & Calvert St	2	6	1	9	0.94	2.36
14	Centennial Mall & "O" St	1	9	6	16	1.92	2.15
Major/Collector: Stop Controlled							
1	N 1st St & Pennsylvania Ave	2	0	0	2	4.06	33.28
2	N 66th St & Fremont St	2	2	0	4	1.09	5.02

Crash Analysis Summary (continued)

Thirty-nine (39) of the intersections listed in **Table 6** were further studied to indentify countermeasures that could be implemented to address the contributing factors for the prevalent crash patterns present at each intersection. Six of the intersections listed in Table 6 were not included for further evaluation, because they have or are being slated for improvements already as part of major projects. Those intersections include:

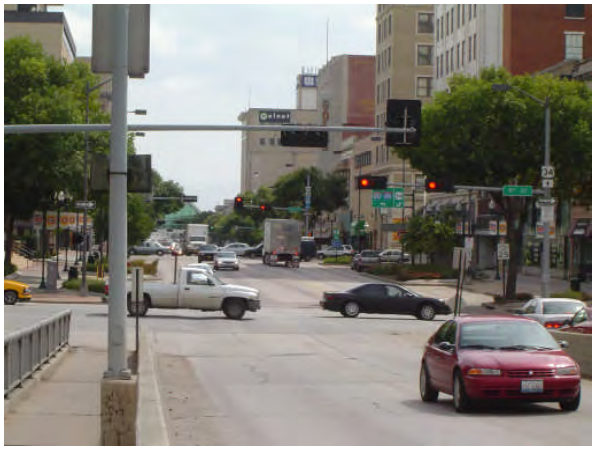
- N 14th St and Superior St
- S 27th St and A St
- S 56th St and Old Cheney Rd
- N 14th St and Fletcher Ave
- N 14th St Ramp and Cornhusker Hwy
- W Coddington Ave and W Van Dorn St

In addition to the previous 45 intersections that were calculated as high crash rate locations, additional intersections were selected for study based upon detailed research and review of the citywide crash database. Additional specific sorting of electronic crash information in the database was conducted to focus on locations that may not "standout" simply based upon crash rate statistics. Primary review of critical crash types and characteristics such as right-angle crashes, a heavy directional and predominant crash pattern, or number of injury based crashes was researched. Based upon this evaluation, an additional intersection listing was developed and is included in **Table 7**.

For all of the relevant intersections evaluated further in the Tables 6 and 7, collision diagrams were developed in accordance with the Diagnosis step of the HSM Roadway Safety Management Process. The completed collision diagrams were used to identify crash patterns. With crash patterns identified for each intersection, a field review was conducted to determine what, if any, contributing factors are present at the intersection related to the crash patterns identified. Identifying the contributing factors completed the Diagnosis step in the HSM Roadway Safety Management Process.

The next step, after diagnosing the contributing factors, was to select countermeasures. Countermeasures were selected to address the safety issues related to the contributing factors for each intersection identified during the field review. Depending on the intersection and contributing factor(s), there may have been more than one countermeasure identified to address a specific contributing factor.

After countermeasures were identified, an economic analysis was conducted. The economic analysis quantified the benefits of each potential improvement option by assigning a monetary value based on data provided by the City of Lincoln for the various improvement options. With each countermeasure assigned a monetary value for the cost of the improvement and expected cost of the benefits received from the implementation of the improvement, a benefit-to-cost ratio was calculated. As previously described, based upon the analysis, engineering judgment, and B/C ratios, a "top" recommendation was also identified within the listings. These are highlighted in the table and represent a likely first step, or best-fix to the intersection. **Tables 8** and **9** identify the countermeasures for both the high crash rate locations, and the additional intersections evaluated in the database.



Crash Analysis Summary (continued)

Table 7: Pattern Specific Intersections

Intersection	Number of Crashes				Crash Rate	EPDO Rate
	F+I	Prop	NR	TOT	Crash/MEV	Crash/MEV
Major/Major: Signal Control						
N 56th St & Adams St	3	3	0	6	1.05	6.92
N 66th St & Vine St	4	2	1	7	0.98	7.15
Cotner Blvd & "O" St	1	9	1	11	0.52	1.00
N 16th St & "P" St	2	9	0	11	1.16	2.16
N 27th St & "P" St	0	5	2	7	0.73	0.55
N 48th St & Adams St	4	0	1	5	0.51	5.00
S 10th St & "L" St	2	5	3	10	0.81	2.42
S 16th St & "K" St	5	3	2	10	0.81	5.19
S 17th St & "K" St	4	3	0	7	0.60	4.47
S 13th St & "K" St	4	1	2	7	0.75	5.35
S 17th St & "A" St	4	0	3	7	0.94	6.75
S 56th St & "A" St	3	2	0	5	0.53	4.09
S 56th St & Van Dorn St	3	1	0	4	0.39	2.58
Major/Collector: Signal Control						
68th St & "O" St	3	4	0	7	0.48	2.77
Major/Local: Stop Control						
50th St & "O" St	5	5	0	10	0.73	3.25
Bair Ave & Superior St	1	3	1	5	0.57	1.75

Crash Analysis Summary (continued)

Table 8: Countermeasures—High Crash Intersections

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Major: Signal Control									
1	N 27th St & Vine St	NB & SB Rear End	Update signal timing to improve coordination	3	$1,000	$52,885	$354	$52,531	149.6
		Left Turn	Implement flashing yellow arrow signal indications	15	$8,000	$265,482	$670	$264,811	396.0
			Review signal timings for clearance intervals	3	$500	$81,371	$177	$81,194	460.4
2	S 48th St & "A" St	SB Rear End	Trim overhanging trees	1	$500	$51,405	$515	$50,890	99.8
			Install "Signal Ahead" static sign (W3-3)	6	$100	$53,302	$18	$53,284	2887.5
			Update signal timing to improve coordination	3	$1,000	$52,158	$354	$51,805	147.5
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$630,627	$40,320	$590,307	15.6
3	N 33rd St & Vine St	Left Turn & Right Angle	Review signal timings for clearance intervals	3	$500	$42,282	$177	$42,106	239.2
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$644,072	$40,320	$603,752	16.0
4	S 13th St & "A" St	Right Angle	Review signal timings for clearance intervals	3	$500	$12,966	$177	$12,789	73.4
			Implement new mastarm signal upgrade	15	$150,000	$42,302	$12,570	$29,732	3.4
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$300,625	$40,320	$260,305	7.5
5	N 27th St & Cornhusker Hwy	SB Rear End	Update signal timing to improve coordination	3	$1,000	$37,716	$354	$37,362	106.7
			Extend SB right turn lane through access drive north	20	$75,000	$211,710	$5,040	$206,670	42.0
		WB Rear End	Update signal timing to improve coordination	3	$1,000	$32,023	$354	$31,670	90.6
		All Rear End	LED signal indications (all heads) implemented as of November 2010	10	$12,000	$126,398	$1,406	$124,992	89.9
			Implement lane geometric signing for dual left turns	6	$800	$122,939	$148	$122,791	832.5
6	S 40th St & Nebraska Hwy 2	EB Rear End	Update signal timing to improve coordination	3	$1,000	$40,686	$354	$40,332	115.1
			Install near side signal head on SW corner pole	15	$2,000	$44,247	$168	$44,079	264.0
		EB Rear End & Right Angle	Install "Be Prepared to Stop" (W3-4), "When Flashing" (W16-13P), and flashing beacons	10	$4,000	$88,851	$469	$88,382	189.5
		All Rear End	LED signal indications (all heads) implemented as of April 2010	10	$1,000	$74,717	$117	$74,599	637.5
		WB Left Turn	Implement longer mastarm with improved LT signal placement	15	$10,000	$44,247	$838	$43,409	52.8
7	Superior St & N 14th St	All Crash Patterns	Major geometric/capacity project is already planned	0	$0	#N/A	#N/A	#N/A	#N/A

Crash Analysis Summary (continued)

Table 8: Countermeasures—High Crash Intersections (continued)

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Major: Signal Control									
8	S 27th St & "A" St	All Crash Patterns	New signal & intersection improvements complete	0	$0	#N/A	#N/A	#N/A	#N/A
9	N 48th St & Vine St	NB Rear End	Implement exclusive NB right-turn lane	20	$75,000	$170,794	$5,040	$165,754	33.9
			Implement pole mount signal with NB RT overlap	15	$2,000	$33,090	$168	$32,922	197.4
			Access management on NB approach - consolidate	20	$25,000	$34,159	$1,680	$32,479	20.3
		Left Turn	Implement flashing yellow arrow signal indications	3	$8,000	$68,525	$2,828	$65,697	24.2
10	S 48th St & Randolph St	SB Rear End	Install "Signal Ahead" static sign (W3-3)	6	$100	$21,001	$18	$20,983	1137.7
			Update signal timing to improve coordination	3	$1,000	$20,550	$354	$20,197	58.1
		All Rear End	LED signal indications (all heads) implemented as of October 2010	10	$3,000	$33,537	$352	$33,186	95.4
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$446,770	$40,320	$406,450	11.1
11	33rd St & "O" St	EB & WB Rear End	Update signal timing to improve coordination	3	$1,000	$59,743	$354	$59,390	169.0
			Review signal timings for clearance intervals	3	$500	$59,743	$177	$59,566	338.0
12	48th St & "O" St	EB & WB Rear End	Update signal timing to improve coordination	3	$1,000	$61,859	$354	$61,505	175.0
			Review signal timings for clearance intervals	3	$500	$61,859	$177	$61,682	350.0
		NB RT & EB Right Angle	Consider "No Right Turn on Red" during peak periods	10	$6,000	$2,517	$703	$1,813	3.6
13	S 56th St & Old Cheney Rd	All Crash Patterns	Major geometric/capacity project is already planned	0	$0	#N/A	#N/A	#N/A	#N/A
14	84th St & "O" St	EB Left Turn	Review signal timings for clearance intervals	3	$500	$21,940	$177	$21,763	124.1
			Implement longer left turn lane storage length	10	$30,000	$115,258	$3,516	$111,742	32.8
		SB Rear End	Update signal timing to improve coordination	3	$1,000	$1,804	$354	$1,451	5.1
15	10th St & "O" St	WB Right Turn	Install lane control signs on WB mastarm, (2)	6	$200	$6,527	$37	$6,490	176.8
		WB Rear-End	Relocate "Turning Traffic Must Yield to Pedestrians" sign from NB mastarm pole to WB mastarm pole	6	$100	$43,634	$18	$43,616	2363.7
			Update signal timing to improve coordination	3	$1,000	$21,349	$354	$20,995	60.4
		NB & WB Right Angle	Review signal timings for clearance intervals	3	$500	$21,940	$177	$21,763	124.1

Crash Analysis Summary (continued)

Table 8: Countermeasures—High Crash Intersections (continued)

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Major: Signal Control									
16	S 70th St & South St	SB Rear End / Sideswipe	Install "Signal Ahead" static sign (W3-3)	6	$100	$4,504	$18	$4,485	244.0
		NB & SB Rear End	Trim overhanging trees	1	$500	$32,347	$515	$31,832	62.8
17	S 27th St & Nebraska Hwy 2	EB & WB Rear-End	Install "Be Prepared to Stop" (W3-4), "When Flashing" (W16-13P), and flashing beacons	10	$40,000	$133,344	$4,688	$128,656	28.4
		EB & WB Rear End	Update signal timing to improve corrdination	3	$1,000	$63,455	$354	$63,102	179.5
		NB Rear End	Install "Signal Ahead" static sign (W3-3)	6	$100	$1,240	$18	$1,222	67.2
			Implement 2nd NB through lane to Woods Blvd	20	$300,000	$6,812	$20,160	-$13,348	0.3
		SB Rear-End	Install "Signal Ahead" static sign (W3-3)	6	$100	$10,909	$18	$10,890	590.9
18	S 27th St & South St	NB Rear End	Trim overhanging trees	1	$500	$10,418	$515	$9,903	20.2
		NB & WB Right Angle	Trim trees at SE corner	1	$500	$787	$515	$272	1.5
		All Rear End	Review signal timings for clearance intervals	3	$500	$31,432	$177	$31,256	177.8
19	56th St & "O" St	SB & WB Right Angle	Implement "No Right Turn on Red" for SB approach	10	$6,000	$54,802	$703	$54,099	77.9
			Review signal timings for clearance intervals	3	$500	$52,158	$177	$51,982	295.1
20	S 56th St & Normal Blvd	SB Rear End	Trim overhanging trees	1	$500	$10,520	$515	$10,005	20.4
		NB Rear End	Install "Signal Ahead" static sign (W3-3)	6	$100	$20,185	$18	$20,167	1093.5
		NB & SB Left Turn	Review signal timings for clearance intervals	3	$500	$52,158	$177	$51,982	295.1
21	16th St & "O" St	All Angle & Rear End	Review signal timings for clearance intervals	3	$500	$45,891	$177	$45,714	259.6
		EB & WB Rear End	Update signal timing to improve corrdination	3	$1,000	$40,997	$354	$40,643	116.0
		WB Rear End	Eliminate parking within 30' of the intersection	1	$500	$9,733	$515	$9,218	18.9
		SB Right Angle	Implement new mastarm signal upgrade	15	$25,000	$191,297	$2,095	$189,202	91.3
22	N 48th St & Cornhusker Hwy	WB Rear End	All signal indications are LED heads except for yellows; scheduled to implement LED yellow heads this year.	10	$2,000	$13,623	$234	$13,389	58.1
			Implement pole mount signal on nearside pole	15	$2,000	$14,101	$168	$13,933	84.1
		NB Rear End	Implement standard right-turn lane, remove NB to EB RT island	20	$175,000	$68,299	$11,760	$56,539	5.8

Crash Analysis Summary (continued)

Table 8: Countermeasures—High Crash Intersections

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Major: Signal Control									
23	27th St & "O" St	EB & WB Rear End	Implement lane geometric signing for dual left turns	6	$300	$36,626	$55	$36,570	661.3
		WB Rear End	Access management on WB departure - outbound only	20	$25,000	$36,964	$1,680	$35,284	22.0
24	S 70th St & "A" St	NB & SB Rear End	Trim overhanging trees	1	$500	$16,917	$515	$16,402	32.8
		WB & NB Right Angle	Relocate signal cabinet out of sight triangle	15	$10,000	$42,510	$838	$41,672	50.7
		NB Rear End	Install "Signal Ahead" static sign (W3-3)	6	$100	$15,094	$18	$15,076	817.7
			Implement exclusive NB right-turn lane	20	$100,000	$82,909	$6,720	$76,189	12.3
25	S 27th St & Old Cheney Rd	NB Rear End	Implement exclusive NB right-turn lane & signal	20	$100,000	$59,336	$6,720	$52,616	8.8
		NB & SB Rear End	Update signal timing to improve corrdination	3	$1,000	$12,271	$354	$11,918	34.7
		Left Turn	Implement flashing yellow arrow signal indications	3	$8,000	$68,525	$2,828	$65,697	24.2
26	N 27th St & Superior St	SB Rear End	Update signal timing to improve corrdination	3	$1,000	$3,297	$354	$2,944	9.3
		All Rear End	LED signal indications (all heads) implemented as of July 2010	10	$2,000	$38,898	$234	$38,663	165.9
			Implement lane geometric signing for dual left turns	6	$800	$37,833	$148	$37,685	256.2
Major / Major: Stop Control									
27	N 14th St & Fletcher Ave	All Crash Patterns	Major geometric/capacity project is already planned	0	$0	#N/A	#N/A	#N/A	#N/A
28	S Coddington Ave & W Van Dorn St	All Crash Patterns	Major geometric/capacity project is already planned	0	$0	#N/A	#N/A	#N/A	#N/A
Major / Major: Yield Control									
29	N 14th St NB Ramp & Cornhusker Hwy	All Crash Patterns	Major geometric/capacity project is already planned	0	$0	#N/A	#N/A	#N/A	#N/A
Major / Collector: Signal Control									
30	N 27th St & Old Dairy Rd	No Discernable Pattern	Monitor for Development of Crash Patterns	0	$0	#N/A	#N/A	#N/A	#N/A
31	N 27th St & Folkways Blvd	North & South Left Turn	Review signal timings for clearance intervals	3	$500	$19,544	$177	$19,368	110.6
		WB Left Turn	Modify markings on west leg of intersection	3	$500	$78,178	$177	$78,001	442.3
32	N 62nd St & Havelock Ave	WB Rear-End	Remove 1st angle parking stall near crosswalk	10	$500	$44,426	$59	$44,367	758.1
33	S 33rd St & "J" St	NB Right Angle	Trim overhanging trees	1	$500	$38,524	$515	$38,009	74.8
		Right Angle & Rear End	Review signal timings for clearance intervals	3	$500	$21,940	$177	$21,763	124.1

Crash Analysis Summary (continued)

Table 8: Countermeasures—High Crash Intersections (continued)

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Collector: Signal Control									
34	S 21st St & "N" St	All Crash Patterns	New stop control & improvements complete	0	$0	#N/A	#N/A	#N/A	#N/A
35	N 27th St & Fair St	WB Right Angle	Trim/remove tree on SE corner	1	$500	$3,147	$515	$2,632	6.1
		SB Rear End	Update signal timing to improve corrdination	3	$1,000	$30,115	$354	$29,762	85.2
			Implement exclusive SB right-turn lane	20	$75,000	$169,046	$5,040	$164,006	33.5
36	S 27th St & "J" St	EB Right Angle	Trim/remove shrubs on NW corner	1	$500	$19,467	$515	$18,952	37.8
37	N 14th St & Salt Creek Rdwy	No Discernable Pattern	Monitor for Development of Crash Patterns	0	$0	#N/A	#N/A	#N/A	#N/A
38	N 12th St & "Q" St	No Discernable Pattern	Monitor for Development of Crash Patterns	0	$0	#N/A	#N/A	#N/A	#N/A
39	9th St & "M" St	SB Left Turn / Sideswipe	Convert SB shared Thru/LT lane to Thru only lane, Improve exclusive SB LT lane by parking removal north of "M", and bulb-out construction south of "M", Associated markings/signs	20	$30,000	$42,082	$2,016	$40,066	20.9
40	S 27th St & Woods Blvd	NB & SB Rear End	Trim overhanging trees	1	$500	$21,143	$515	$20,628	41.1
		SB Rear End	Install "Signal Ahead" static sign (W3-3)	6	$100	$11,724	$18	$11,706	635.1
		NB Rear End	Implement 2nd NB through lane to Woods Blvd	20	$50,000	$55,437	$3,360	$52,077	16.5
41	Lyncrest Dr & "O" St	EB Rear End / Sideswipe	Implement lane geometric signing for dual left turns	6	$200	$34,888	$37	$34,851	945.0
			Trim back landscape in median, LT taper	1	$500	$21,143	$515	$20,628	41.1
42	S 56th St & Calvert St	NB & SB Left Turn & Rear End	Implement NB and SB left turn lanes	20	$550,000	$179,506	$36,960	$142,546	4.9
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$281,332	$40,320	$241,012	7.0
43	Centennial Mall & "O" St	EB Rear-End	Update signal timing to improve progression	3	$1,000	$4,303	$354	$3,950	12.2

Crash Analysis Summary (continued)

Table 8: Countermeasures—High Crash Intersections (continued)

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Collector: Stop Control									
44	**N 1st St & Pennsylvania Ave**	EB Rear-End	Install advanced intersection warning signs (W2-1)	6	$100	$9,987	$18	$9,968	541.0
		SB	Install advanced intersection warning signs (W2-1)	6	$100	$9,987	$18	$9,968	541.0
		WB	Trim / remove vegetation on SE corner	6	$500	$19,973	$92	$19,881	216.4
45	**N 66th St & Fremont St**	NB & SB Right Angle	Trim trees on NB and SB approaches	1	$500	$41,672	$515	$41,157	80.9
			Relocate Stop Ahead (W3-1) sign further in advance of intersection on NB and SB approaches	6	$200	$21,605	$37	$21,568	585.2
		EB & WB Right Angle	Install advanced intersection warning signs on EB and WB approaches (W2-1)	6	$200	$21,605	$37	$21,568	585.2
		EB & WB	Restripe Fremont as a 3-lane section - tie into existing	3	$10,000	$42,282	$3,535	$38,747	12.0
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$178,009	$40,320	$137,689	4.4

Crash Analysis Summary (continued)

Table 9: Countermeasures—Additional Intersections

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Major: Signal Control									
R	Capitol Pkwy / Normal Blvd & "A" Street	EB & WB Left Turn	Geometric improvement project is in progress	0	$0	#N/A	#N/A	#N/A	#N/A
R	N 56th St & Adams St	Right Angle	Review signal timings for clearance intervals	3	$500	$30,913	$177	$30,737	174.9
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$267,013	$40,320	$226,693	6.6
R	N 66th Street & Vine St	Right Angle	Review signal timings for clearance intervals	3	$500	$40,789	$177	$40,613	230.8
			Implement new mastarm signal upgrade	15	$150,000	$133,080	$12,570	$120,510	10.6
R	Cotner Blvd & "O" Street	Right Angle	Review signal timings for clearance intervals	3	$500	$14,666	$177	$14,490	83.0
			Update signal timing to improve coordination	3	$1,000	$14,666	$354	$14,313	41.5
R	N 10th St & "Q" St	NB & WB Right Angle	Review signal timings for clearance intervals	3	$500	$12,271	$177	$12,094	69.4
			Implement new mastarm signal upgrade	15	$150,000	$40,036	$12,570	$27,466	3.2
R	N 16th St & "P" St	SB & EB Right Angle	Review signal timings for clearance intervals	3	$500	$16,263	$177	$16,086	92.0
			Implement new mastarm signal upgrade	15	$150,000	$53,060	$12,570	$40,490	4.2
R	N 27th St & "P" St	SB & EB Right Angle	Review signal timings for clearance intervals	3	$500	$3,297	$177	$3,121	18.7
			Implement new mastarm signal upgrade	15	$150,000	$10,758	$12,570	-$1,812	0.9
			Trim overhanging trees	1	$500	$3,250	$515	$2,735	6.3
			Update signal timing to improve coordination	3	$1,000	$3,297	$354	$2,944	9.3
R	N 48th St & Adams St	Left Turn	Review signal timings for clearance intervals	3	$500	$29,420	$177	$29,244	166.5
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$330,002	$40,320	$289,682	8.2
R	S 10th St & "L" St	NB & WB Right Angle	Review signal timings for clearance intervals	3	$500	$22,738	$177	$22,561	128.6
			Implement new mastarm signal upgrade	15	$150,000	$74,185	$12,570	$61,615	5.9

Crash Analysis Summary (continued)

Table 9: Countermeasures—High Crash Intersections (continued)

Rank	Intersection	Crash Pattern	Countermeasures	Service Life	Estimated Initial Cost	Uniform Annual Benefit	Uniform Annual Cost	Net Annual Benefit	Benefit Cost Ratio
Major / Major: Signal Control									
R	S 16th St & "K" St	SB & EB Right Angle	Review signal timings for clearance intervals	3	$500	$39,887	$177	$39,710	225.7
			Update signal timing to improve coordination	3	$1,000	$39,887	$354	$39,534	112.8
			Consider "No Left Turn on Red" during peak periods	10	$6,000	$41,909	$703	$41,206	59.6
		SB Left Turn	Implement lane geometric signing - MA	6	$200	$11,830	$37	$11,794	320.4
			Improved dotted turning markings for LT lane	6	$500	$11,830	$92	$11,738	128.2
			Install curb node on S 16th Street I SE corner	20	$7,000	$12,997	$470	$12,526	27.6
R	S 17th St & "K" St	NB & EB Right Angle	Review signal timings for clearance intervals	3	$500	$41,484	$177	$41,307	234.7
			Consider "No Right Turn on Red" during peak	10	$6,000	$43,587	$703	$42,884	62.0
R	S 13th St & "K" St	SB Right Angle	Review signal timings for clearance intervals	3	$500	$40,095	$177	$39,918	226.8
			Implement new mastarm signal upgrade	15	$150,000	$130,813	$12,570	$118,243	10.4
R	S 17th St & "A" St	NB Right Angle	Review signal timings for clearance intervals	3	$500	$39,296	$177	$39,120	222.3
			Implement new mastarm signal upgrade	15	$150,000	$128,209	$12,570	$115,639	10.2
			Install near side signal heads EB/WB on poles	15	$4,000	$42,736	$335	$42,401	127.5
R	S 56th St & A St	Right Angle	Review signal timings for clearance intervals	3	$500	$30,913	$177	$30,737	174.9
		All Crash Patterns	Consider Roundabout Implementation	20	$600,000	$260,291	$40,320	$219,971	6.5
R	S 56th St & VanDorn St	NB Left Turn	Review signal timings for clearance intervals	3	$500	$21,141	$177	$20,964	119.6
			Offset NB LT lane with markings	3	$500	$84,565	$177	$84,388	478.4
Major / Collector: Signal Control									
R	N 68th St & "O" St	EB & WB Left Turn	Review signal timings for clearance intervals	3	$500	$12,966	$177	$12,789	73.4
			Implement protected only, LT phasing EB & WB	15	$7,500	$70,503	$629	$69,875	112.2
Major / Local: Stop Control									
R	N 50th St & "O" St	WB Left Turn	Modify WB LT median & alignment	10	$10,000	$269,271	$1,172	$268,099	229.8
			Close WB LT movement access, fill median	20	$20,000	$575,437	$1,344	$574,093	428.2
R	Bair Ave & Superior St	SB Right Angle	Implement larger stop sign w /(look again)	6	$200	$11,724	$37	$11,687	317.6
			Pavement markings along Bair (100')	20	$20,000	$12,880	$1,344	$11,536	9.6

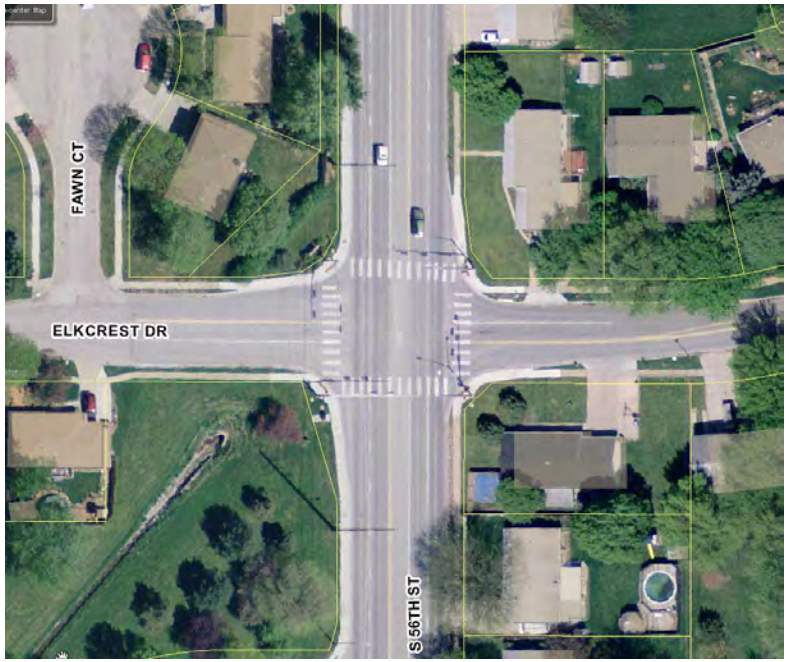
Section 5

Safety Effectiveness Evaluation

Safety Effectiveness Evaluation

The final step in the HSM Roadway Safety Management Process is to conduct a Safety Effectiveness Evaluation. The City of Lincoln provided a group listing of intersections, where countermeasures had been previously identified and implemented. The crash history of each intersection was evaluated for before and after the intersection improvements were identified. The before and after time periods consisted of the same duration of time, and the analysis consisted of a comparison of crash type specifically related to the improvement implemented, the total number of crashes at the intersection, the EPDO Crash Rate, and a benefit-to-cost comparison. The intersections included as part of the safety effectiveness evaluation included:

- S 56th St and Elkcrest Dr
- N 56th St and Cornhusker Hwy
- N 27th St and Whitehead Dr
- N 84th St and Havelock Ave



The specific results and analysis results of the safety effectiveness evaluation for each intersection are contained in Appendix D. In general, all of these intersections indicated an improvement in their before/after crash statistics. The locations along 56th Street showed significant reduction in both numbers and severity of crashes, while all locations indicated improvements to the reduction of injury and property damage crashes.

Continued monitoring and documentation of intersections that undergo improvements to help mitigate deficiencies is a pro-active way for the City of Lincoln to illustrate a successful safety program. By spending study, design, and construction dollars to help eliminate life-changing crashes for the City of Lincoln residents, positive benefits will continue to justify expenditures.

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