Chapter 8

Regional Safety

8.1 Introduction

An average of over 42,000 fatalities occur on the roadways in the United States each year. Every crash, regardless of the severity, costs governments and tax payers money and time in damages, emergency services, and delays. Crashes have become an increasing problem each year and need to be addressed. One of the goals of this plan is to improve travel safety by reducing the risk of crashes on the roadways.

8.2 Safety Management System

Traffic safety programs are relatively uniform from state to state in their approach to make the highway system safer for their users. The typical traffic safety program combines several different features from a Safety Management System (SMS), which all states were mandated to have under the ISTEA in 1991. The SMS should address:

- Coordinating and integrating safety features from the various modes of travel
- Identifying hazardous locations, investigating them, and establishing countermeasures for the safety issues
- Early consideration for safety in all highway projects and programs
- Identifying safety needs of special user groups (handicapped, elderly, etc.)
- Routinely maintaining and upgrading the safety features on the roadways
- Marketing safety programs to encourage community involvement

The SMS mandate was later withdrawn due to the 1995 National Highway System Designation Act. However, SAFETEA-LU Part 450 requires that each state and MPO must have a planning process that addresses the need to "increase the safety of the transportation system for motorized and non-motorized users." A traffic safety program involves several steps, and is relatively uniform throughout the United States. The typical traffic safety program includes:

- A crash record system
- Identification of hazardous locations
- Engineering studies
- Selection of countermeasures

- Prioritization of improvement projects
- Planning and implementation of improvement projects
- Evaluation of the implemented projects

The crash record system should contain the data on individual crashes that occur in the area. This data should include time, date, weather condition, pavement condition, and several other factors (driver, roadway, and environmental) pertaining to the accident. The primary source for this data is usually police reports in the local jurisdiction. In order for this record system to be useful, the data has to be processed and available on a timely basis so that it can be analyzed.

The identification of the hazardous locations should be based on the actual crashes that have occurred, or the potential of an area to have a high amount of crashes. The severity of these crashes must also be established in order to prioritize the locations and develop solutions for them. Once the hazardous locations are identified, engineering studies can be conducted using the data that is in the crash record system. Analysis can be done by crash frequency, crash rate, Equivalent Property Damage Only (EPDO) rates, and other methods. Analysis of the crashes is also conducted by time, date, weather conditions, and other contributing factors. Supplemental data from police comments and citizen complaints can also be used in the analysis process in order to find the cause of the crashes.

Once the cause of the crashes has been determined, countermeasures are proposed and then evaluated. Improvement projects are then selected based on the benefits they provide compared to the cost to implement them. Multiple projects may be needed to solve the problem. Sometimes, enforcement and education may be all that is necessary in order to reduce the crashes.

Once the projects have been selected, they need to be prioritized based on their cost and benefits. Not all of the improvement projects will be able to be implemented due to limits on funding. Once the projects have been prioritized and selected, a plan should be developed in order to implement the projects. This will help ensure that resources and finances are available in order to complete the improvement projects in a timely manner. Implementation of the projects should occur as soon as possible to avoid cost increases and to potentially prevent crashes that may occur without the project in place.

Projects must be evaluated to determine whether they are effective or can be used to address similar problems in the future. This is typically done in a before-and-after method by observing the amount and severity of the crashes several years before the implementation of the project, and then for several years after the project has been completed. Two issues can arise in this method of analysis. The first is that if the conditions (enforcement, education, etc.) change in either of the two phases, it can affect that amount of crashes at the location. The second is that “regression to the mean” (a statistical phenomenon that can make natural variation in repeated data look like real change) must be taken into

account to ensure that the crashes can be monitored. In order to correct these two issues, control sites should be established that are similar to the location, but have not had any changes made to them.

This study focuses on gathering the available crash data, an analysis of the crash data and identification of hazardous locations. This study did not identify location specific recommendations at the identified hazardous locations as these locations require further engineering studies, which are beyond the scope of this study. However, potential countermeasures which could be used to mitigate various crash types have been included in section 8.6.

8.3 Crash Data

Crash records from Assumption, Lafourche, and Terrebonne Parishes that were corrected with LADOTD latitude and longitude data from 2004 to 2008 were used in the crash analysis of the study area. The crash records included the time and location of the accident, severity, and the existing conditions when the accident occurred. Within the study area 25,935 crashes occurred. Table 8-1 shows a breakdown of the crashes by parish.

Table 8-1

Crashes By Parish (2004 – 2008)

Parish	Crashes
Assumption	411
Lafourche	11,456
Terrebonne	14,068
TOTAL	**25,935**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

8.4 Crash Trends

The first step in improving travel safety is determining the cause of the crashes. This study looks at the time, surface conditions, lighting, severity, collision type, and whether or not alcohol was involved.

The first factor this study focuses on is the time at which the accidents occurred. Table 8-2 on the following page includes the time the crashes occurred, broken down by parish. The majority of crashes occurred between 7:00 AM and 7:00 PM when people are traveling to work, school, and other various activities. The largest number of crashes occurred between 4:00 PM and 6:00PM, when the traffic is likely the greatest.

Table 8-2

Crashes by Time Of Day (2004 – 2008)

Hour Beginning	Assumption	Lafourche	Terrebonne	Cumulative	Percent of Total Crashes
Midnight	4	213	213	430	1.66%
1:00 AM	6	180	202	388	1.50%
2:00 AM	7	253	248	508	1.96%
3:00 AM	7	187	145	339	1.31%
4:00 AM	5	171	112	288	1.11%
5:00 AM	15	274	243	532	2.05%
6:00 AM	16	419	382	817	3.15%
7:00 AM	22	523	657	1,202	4.63%
8:00 AM	14	415	541	970	3.74%
9:00 AM	16	465	597	1,078	4.16%
10:00 AM	22	561	742	1,325	5.11%
11:00 AM	12	689	911	1,612	6.22%
Noon	21	683	1,085	1,789	6.90%
1:00 PM	27	704	895	1,626	6.27%
2:00 PM	34	737	1,031	1,802	6.95%
3:00 PM	28	876	1,025	1,929	7.44%
4:00 PM	**26**	**867**	**1,163**	**2,056**	**7.93%**
5:00 PM	**32**	**911**	**1,217**	**2,160**	**8.33%**
6:00 PM	19	668	732	1,419	5.47%
7:00 PM	13	414	476	903	3.48%
8:00 PM	12	351	467	830	3.20%
9:00 PM	14	326	408	748	2.88%
10:00 PM	13	279	304	596	2.30%
11:00 PM	26	281	267	574	2.21%
Unlisted	0	9	5	14	0.05%
Total	**411**	**11,456**	**14,068**	**25,935**	**100%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

Another factor to consider is the surface conditions during the time of the crash. A breakdown of the surface conditions by parish is shown in Table 8-3. While nearly 4,000 crashes occurred during wet conditions, the majority of crashes, 84%, occurred during dry conditions.

Table 8-3
Crashes by Roadway Surface Conditions (2004 – 2008)

Roadway Surface Condition	Assumption	Lafourche	Terrebonne	Number of Crashes	Percent of Total Crashes
Dry	**275**	**9,536**	**12,092**	**21,903**	**84.45%**
Wet	56	1,876	1,930	3,862	14.89%
Snow/Slush	0	1	5	6	0.02%
Ice	1	16	24	41	0.16%
Contaminant	0	9	2	11	0.04%
Unknown	1	7	7	15	0.06%
Other	0	5	3	8	0.03%
Unlisted	78	6	5	89	0.34%
Total	**411**	**11,456**	**14,068**	**25,935**	**100.00%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

The lighting at the time of the crash is also taken into account in this analysis. Table 8-4 includes a breakdown of crashes that occurred under various lighting conditions. Over 71% of the crashes occurred during daylight, while about 16% of crashes occurred at night with street lights on. Only 10% of the crashes occurred at night with no street lights or only a traffic signal for light.

Table 8-4
Crashes by Roadway Lighting (2004-2008)

Lighting	Assumption	Lafourche	Terrebonne	Number of Crashes	Percent of Total Crashes
Daylight	**273**	**7,836**	**10,252**	**18,361**	**70.80%**
Dark, no lights	55	1,096	517	1,668	6.43%
Dark, street lights	58	1,498	2,690	4,246	16.37%
Dark, signal only	12	674	274	960	3.70%
Dusk	5	159	197	361	1.39%
Dawn	8	156	108	272	1.05%
Unknown	0	8	7	15	0.06%
Other	0	7	9	16	0.06%
Unlisted	0	22	14	36	0.14%
Total	**411**	**11,456**	**14,068**	**25,935**	**100.00%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

Crash severity is also important to take into consideration. A breakdown of the severity of crash by parish is shown in Table 8-5. Within the study area, there were 213 fatal crashes and a total of 9,200 injury crashes. Only 1% of the total crashes resulted in a fatality or severe injury, while almost 65% had no injuries reported.

Table 8-5

Crashes by Severity (2004 – 2008)

Crash Severity	Assumption	Lafourche	Terrebonne	Number of Crashes	Percent of Total Crashes
Fatal	5	112	96	213	0.82%
Severe	1	30	38	69	0.27%
Moderate	27	523	484	1,034	3.99%
Complaint	112	3,517	4,182	7,811	30.12%
No Injury	190	7,274	9,268	16,732	64.52%
Unlisted	76	0	0	76	0.29%
Total	**411**	**11,456**	**14,068**	**25,935**	**100.00%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

Another factor this study considers is the type of collisions that occurred. Table 8-6 shows a breakdown of the collision types by parish. The three highest collision types, making up nearly 75% of the accidents in the study area, were rear end collisions, non-collision with motor vehicle (NCWMV), and right angle collisions.

Table 8-6

Crashes by Collision Type (2004 – 2008)

Collision Type	Assumption	Lafourche	Terrebonne	Number of Crashes	Percent of Total Crashes
Non-collision with motor vehicle	130	3,217	2,109	5,456	21.04%
Read end	122	3,718	5,751	9,591	36.98%
Head-on	12	203	199	414	1.60%
Right angle	50	1,822	2,408	4,280	16.50%
Left turn- angle	26	292	464	782	3.02%
Left turn- opposite	6	427	507	940	3.62%
Left turn- same	8	202	281	491	1.89%

Table 8-6
Crashes by Collision Type (2004 – 2008)

Right turn- same	3	105	221	329	1.27%
Right turn- opposite	0	50	51	101	0.39%
Sideswipe- same	14	479	1,308	1,801	6.94%
Sideswipe- opposite	15	434	285	734	2.83%
Other	23	482	380	885	3.41%
Unlisted	2	25	104	131	0.51%
Total	**411**	**11,456**	**14,068**	**25,935**	**100.00%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

Further analysis on NCWMV crashes showed a trend in the time and the severity of the crashes. 96 of the fatal crashes were NCWMV crashes. . Table 8-7 on the following page gives the NCWMV statistics. According to the data, 45% of the NCWMV crashes occurred at night, between the hours of 8:00 PM and 6:00 AM. The heaviest amounts of these crashes fell between 10:00 PM and 4:00 AM. Despite the NCWMV distribution having less than 50% at night, 65% of the fatal crashes related to NCWMV happened between the same hours, with the peak of these coming between 11:00 PM and 4:00 AM. Also of note is that 18% of the NCWMV crashes were related to alcohol.

Table 8-7
NCWMV Crash Analysis (2004 – 2008)

Hour Beginning	NCWMV Crashes	Fatal	Severe
Midnight	241	9	3
1:00 AM	242	14	1
2:00 AM	320	6	3
3:00 AM	257	4	1
4:00 AM	203	6	0
5:00 AM	248	0	1
6:00 AM	196	2	0
7:00 AM	181	1	0
8:00 AM	180	2	0
9:00 AM	177	2	2
10:00 AM	169	2	0
11:00 AM	193	1	0
Noon	223	3	2
1:00 PM	206	2	1

Table 8-7
NCWMV Crash Analysis (2004 – 2008)

Hour Beginning	NCWMV Crashes	Fatal	Severe
2:00 PM	225	3	0
3:00 PM	244	4	3
4:00 PM	267	2	2
5:00 PM	245	4	1
6:00 PM	227	6	1
7:00 PM	205	3	0
8:00 PM	214	1	2
9:00 PM	252	3	2
10:00 PM	253	7	2
11:00 PM	284	9	2
Unlisted	4	0	0
Total	**5,456**	**96**	**29**
Night	**2,471**	**62**	**16**
% Night	**45%**	**65%**	**55%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

Alcohol is a factor in many types of the crashes across the United States. Table 8-8 includes a breakdown by parish of crashes involving alcohol and crashes where no alcohol was involved. About 8% (1,991) of the crashes that occurred in the study area involved alcohol. Of these crashes, 54 or 3% were fatal crashes.

Table 8-8
Alcohol Involvement in Crashes by Parish (2004 – 2008)

	Assumption	Lafourche	Terrebonne	Cumulative	Percent of Total Crashes
Alcohol involved	40	945	1,006	1,991	7.68%
Alcohol not involved	371	10,511	13,062	23,944	92.32%
Total	**411**	**11,456**	**14,068**	**25,935**	**100%**

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne

8.5 Crash Locations

Intersection and intersection related crashes made up 12% of the total crashes in the study area. The total crash numbers at each intersection are based on the assumption that crashes that happened within a 100 ft radius of an intersection were related to the intersection. Table 8-9 shows the top 20 intersections with the highest number of crashes. The table also includes the severity of the crashes. Table 8-10 on the following pages show the collision types that occurred at the top 20 intersections. Figure 8-1 and Figure 8-2 show the locations of these top 20 intersections with the highest number of crashes.

Table 8-9

Top 20 Intersections with High Crash Frequency by Severity (2004 – 2008)

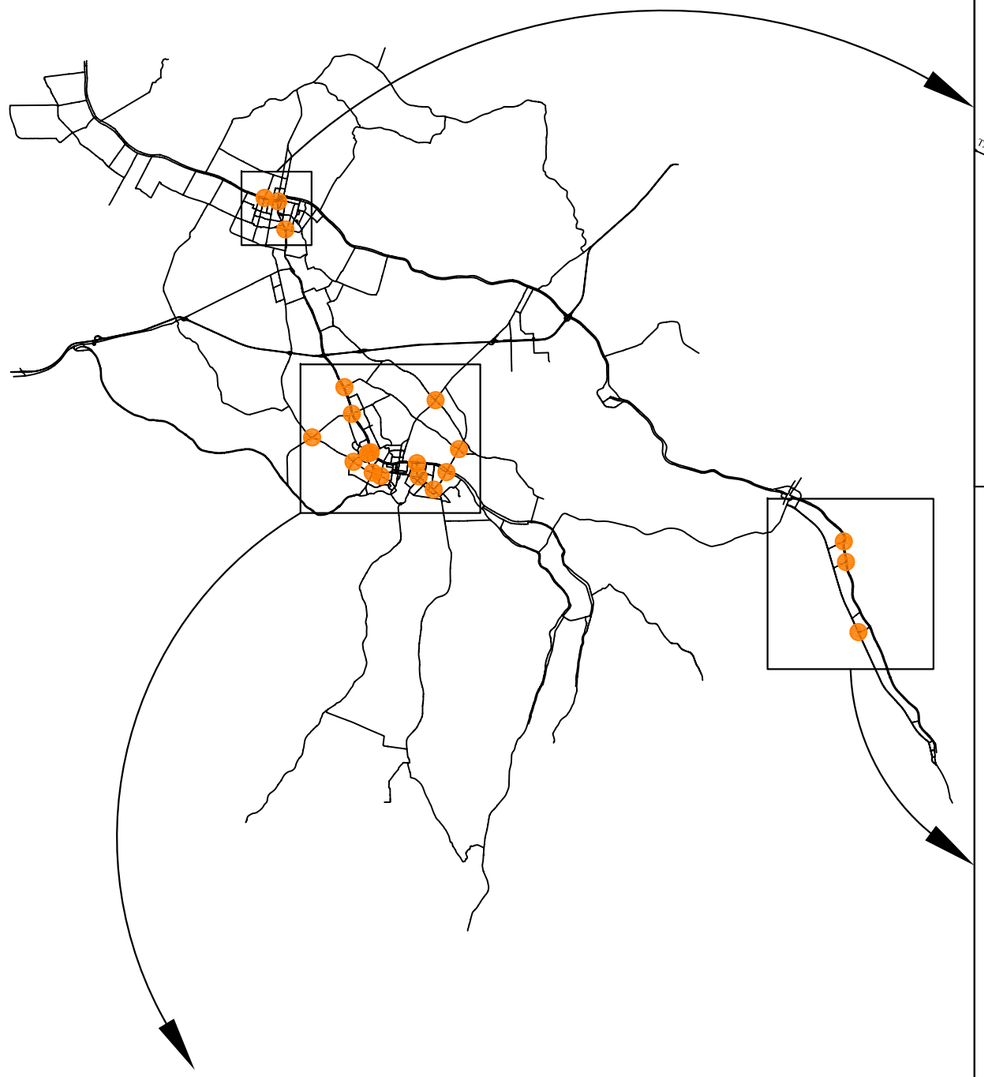
Rank	Location	Crashes	Fatal	Severe	Moderate	Complaint	No Injury
1	Bayou Gardens Blvd and W Park Ave/LA 24	149	1	0	4	37	107
2	New Orleans Blvd and Bayou Blue Rd	92	0	0	3	30	59
3	LA 3162 and LA 3235	79	1	0	8	26	44
4	W Tunnel Blvd and Saint Charles St	77	0	0	2	28	47
5	Main St/LA 24 and Grand Caillou Rd	64	0	0	3	12	49
6	W Park Ave/LA 24 and North Hollywood Rd	64	0	0	2	15	47
7	LA 3162 and LA 1/W Main St	59	0	0	0	14	45
8	W Park Ave/LA 24 and Percy Brown Dr	55	0	0	0	8	47
9	Park Ave/LA 24 and Prospect Blvd	50	0	0	0	16	34
10	St Mary St and Jackson St	50	0	0	0	9	41
11	South Hollywood Rd and West Tunnel Blvd	44	0	0	0	13	31
12	E Main St/LA 308 and W 79th St	43	0	1	2	16	24
13	Coteau Rd and W Park Ave/LA 24	39	0	0	0	14	25
14	Little Bayou Black Rd/LA 311 and St Charles St	38	0	0	1	10	27
15	E Tunnel Blvd and Grand Caillou Rd	37	0	0	1	12	24
16	Tiger Dr/LA 3266 and Bayou Rd	37	0	0	1	11	25
17	Prospect Blvd and Coteau Rd	36	1	0	0	17	18
18	Grand Caillou Rd and Prospect Blvd	35	0	0	1	11	23
19	Savanne Rd and Little Bayou Black Dr	35	0	0	1	9	25
20	Little Bayou Black Dr and South Hollywood Rd	33	0	0	0	9	24

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes

Table 8-10
Top 20 Intersections with High Crash Frequency by Collision Type (2004 – 2008)

	Intersection	Crashes	NCWMV	Rear End	Head On	Right Angle	Left Turn-Angle	Left Turn-Opposite	Left Turn-Same	Right Turn-Angle	Right Turn-Opposite	Sideswipe-Same	Sideswipe-Opposite	Other	Unlisted
1	Bayou Gardens Blvd and W Park Ave/LA 24	149	3	67	0	36	6	8	6	2	0	18	0	1	2
2	New Orleans Blvd and Bayou Blue Rd	92	1	39	2	34	1	3	3	2	1	5	1	0	0
3	LA 3162 and LA 3235	79	1	30	1	25	5	9	0	0	0	1	0	2	5
4	W Tunnel Blvd and Saint Charles St	77	2	50	2	12	2	1	0	4	1	2	0	0	1
5	Main St/LA 24 and Grand Caillou Rd	64	5	29	1	11	1	3	3	0	2	4	1	0	4
6	W Park Ave/LA 24 and North Hollywood Rd	64	0	16	1	21	6	3	2	3	0	12	0	0	0
7	LA 3162 and LA 1/W Main St	59	2	25	0	11	1	8	1	2	0	5	0	1	3
8	W Park Ave/LA 24 and Percy Brown Dr	55	2	25	1	15	0	4	0	1	1	6	0	0	0
9	Park Ave/LA 24 and Prospect Blvd	50	2	29	1	5	0	3	2	0	0	7	0	0	1
10	St Mary St and Jackson St	50	3	20	3	9	1	5	0	1	0	1	0	2	5
11	South Hollywood Rd and West Tunnel Blvd	44	1	21	1	12	1	1	0	0	0	5	0	1	1
12	E Main St/LA 308 and W 79th St	43	5	8	2	13	2	6	2	0	1	0	2	1	1
13	Coteau Rd and W Park Ave/LA 24	39	2	24	0	8	1	0	1	2	0	1	0	0	0
14	Little Bayou Black Rd/LA 311 and St Charles St	38	3	21	1	7	0	1	0	1	1	3	0	0	0
15	E Tunnel Blvd and Grand Caillou Rd	37	0	21	2	3	4	2	0	0	0	5	0	0	0
16	Tiger Dr/LA 3266 and Bayou Rd	37	4	13	1	12	2	3	0	0	0	0	2	0	0
17	Prospect Blvd and Coteau Rd	36	2	9	0	9	2	10	0	2	0	1	1	0	0
18	Grand Caillou Rd and Prospect Blvd	35	0	25	0	4	0	3	0	0	0	3	0	0	0
19	Savanne Rd and Little Bayou Black Dr	35	1	9	3	14	4	2	0	1	0	0	0	0	1
20	Little Bayou Black Dr and South Hollywood Rd	33	0	18	0	7	0	2	0	0	0	5	0	0	1

SOURCE: Louisiana Highway Safety Commission, 2004-2008 Crash records for Assumption, Lafourche, and Terrebonne Parishes



SEE FIGURE 8-2

Houma-Thibodaux
Metropolitan Transportation Plan
2035

Figure 8-1
Intersections With
High Crash Frequencies

Thibodaux and Galliano

LEGEND

- Intersection With High Crash Frequency
- Roadway Network

Sources:
NSI
Louisiana Highway Safety Commission

N
W E
S

Prepared For:

Prepared By:

In Association With:

Houma-Thibodaux
Metropolitan Transportation Plan
2035

Figure 8-2
Intersections With
High Crash Frequencies

Houma

LEGEND

- Intersection With High Crash Frequency
- Roadway Network

Sources:
NSI
Louisiana Highway Safety Commission

N
W E
S

Prepared For:

DOTD — Louisiana's On the Move — Builds the Way
Houma-Thibodaux MPO

Prepared By:

NEEL-SCHAFFER
Solutions you can build upon

In Association With:

ALLIANCE Transportation Group, Inc.
TBS T. BAKER SMITH, INC. Professional Consultants Since 1913

8.6 Conclusions and Recommendations

Within the study area, a total of 25,935 crashes occurred between 2004 and 2008. The majority of these crashes took place between the hours of 8:00 AM and 8:00 PM, with the most crashes occurring during the 5:00 PM and 6:00 PM hours. These crashes could likely be attributed to the roadway not being designed to withstand large traffic volumes and may be reduced by adjusting signal timings or adding lane(s). Approximately 84% of crashes in the study area occurred during dry roadway surface conditions; therefore, roadway surface conditions do not play a major factor in the crashes. About 71% of the crashes occurred during the daylight, while 10% occurred when it was dark outside with no street lights or only a traffic signal for light. The crashes that occurred under these conditions could be attributed to poor lighting and can be reduced by providing proper lighting at intersections with no lighting.

Within the study area, there were 213 fatal crashes and about 9,200 injury crashes. About 8% of the crashes that occurred in the study area involved alcohol; therefore, alcohol is not assumed to be a main cause of crashes. The three highest collision types, making up nearly 75% of the accidents in the study area, were:

- Rear end collisions
- Non-collision with motor vehicle (NCWMV)
- Right angle collisions

Recommendations of how to reduce these types of crashes are outlined below:

Rear End Collisions

In the study area, rear end crashes account for the largest amount of crashes. These crashes can be attributed to a number of factors. One main cause of rear end accidents is drivers being inattentive. Other potential causes include large turning volumes, slippery pavement, inadequate roadway lighting, crossing pedestrians, poor visibility of a traffic signal, inadequate signal timing and/or an unwarranted signal.

The recommendations for reducing rear end crashes include:

- Analyze turning volumes to determine if a right turn lane or left turn lane is warranted. Providing a turning lane separates the turning vehicles from the through vehicles, preventing through vehicles from rear ending turning vehicles. If a large right turn volume exists, increasing the corner radius for right turns is an option.
- Check the pavement conditions. Rear end collisions caused by slippery pavement can be reduced by lowering the speed limit with enforcement, providing overlay pavement, adequate drainage, groove pavement, or with the addition of a “Slippery When Wet” sign.

- Ensure roadway lighting is sufficient for drivers to see the roadway and surroundings.
- Determine if there is a large amount of pedestrian traffic. Pedestrians crossing the roads may impede traffic and force drivers to stop suddenly. If crossing pedestrians are an issue, options include installing or improving crosswalk devices and providing pedestrian signal indications.
- Check the visibility of the traffic signal at all approaches. In order to provide better visibility of the traffic signal, options include installing or improving warning signs, overhead signal heads, installing 12" signal lenses, visors and back plates, or relocating/adding signal heads.
- Verify that the signal timing is adequate to serve the traffic volumes at the trouble intersections. Options include adjusting phase-change interval, providing red-clearance interval, providing progression, and providing signal actuation with dilemma zone protection.
- Verify that a signal is warranted at the given intersection.

Non-Collision with Motor Vehicles (NCWMV)

Approximately 45% of the fatal crashes were NCWMV crashes. NCWMV accounts for three times more fatal crashes than any other crash type, making these crashes the deadliest in the area. Almost half of the NCWMV crashes occur at night and 65% of the fatal NCWMV crashes occur at night. A number of factors could be the cause for NCWMV crashes including speeding, pavement surface conditions, lighting and markings, roadway geometry, and signal timing. One item to note is that the top 20 intersections with the most NCWMV crashes had little or no shoulders.

The recommendations for reducing NCWMV crashes include:

- Conduct speed studies to determine whether or not speed was a contributing factor.
- Ensure roadway lighting is sufficient for drivers to see the roadway and surroundings during dark hours.
- Ensure proper application of traffic control devices.
- Verify proper signal head alignments as well as condition of signal head indications (i.e. lens burn through, L.E.D. usage, etc.)
- Verify that pavement markings are visible during day and night hours.
- Verify that the roadway geometry can be safely maneuvered by drivers.
- Provide and/or increase the shoulder width.

Right Angle Collisions

Right angle crashes are the third most prevalent crashes that occurred in the study area. They can be caused by a number of factors including restricted sight distance, excessive speed, inadequate roadway

lighting, poor visibility of a traffic signal, inadequate signal timing, inadequate advance warning signs, and large traffic volumes.

The recommendations for reducing right angle crashes include:

- Verify that the sight distance is not restricted at all intersection approaches. Options to alleviate restricted sight distance include removing the sight obstruction and installing or improving warning signs.
- Conduct speed studies to determine whether or not speed was a contributing factor. In order to reduce crashes caused by excessive speeding, the speed limit can be lowered with enforcement, the phase change interval can be adjusted, or rumble strips can be installed.
- Ensure roadway lighting is sufficient for drivers to see roadway and surroundings.
- Check the visibility of the traffic signal at all approaches. In order to provide better visibility of the traffic signal, options include installing or improving warning signs, overhead signal heads, installing 12" signal lenses, visors and back plates or relocating/adding signal heads.
- Verify that the signal timing is adequate to serve the traffic volumes at the trouble intersections. Options include adjusting phase change interval, providing red-clearance interval, providing progression, and providing signal actuation with dilemma zone protection.
- Verify that the intersection is designed to handle the traffic volume. If the traffic volumes are too large for the intersection's capacity, options include adding a lane or lanes and retiming the signal.

Other Collision Types

In the study area, there are a number of other collision types that are prevalent, including left turn-angle, left turn-opposite, left turn-same, right turn-same, right turn-opposite, sideswipe-same, and sideswipe-opposite. There are a number of recommendations to improve the safety of all intersections in the study area and reduce the number of crashes.

The recommendations for increasing the safety of all the study intersections include:

- Determine if the speed limit is too high or if vehicles in the area are traveling over the speed limit. Reducing the speed can reduce the severity of the crashes and make drivers more attentive to their surroundings, thus reducing collisions.
- Verify the clearance intervals for all approaches and ensure that there is an all red clearance. For larger intersections, it is particularly important to have a long enough clearance interval for vehicles to safely make it through the intersection before the light turns red.

- Check for proper signage around the intersection, especially if the roadway geometry may be confusing for the driver. Verify that all one-way streets are marked “One-Way” and “No Turn” signs are placed at appropriate locations.
- Verify that pavement markings are visible during day and night hours.
- Verify that the roadway geometry can be easily maneuvered by drivers.
- Evaluate left and right turning volumes to determine if a right turn and/or left turn lane is warranted.
- Ensure roadway lighting is sufficient for drivers to see roadway and surroundings
- Check the visibility of the traffic signal from all approaches.
- Verify that lanes are marked properly and provide turning and through movement directions on lanes as well as signage that indicates lane configurations. This will prevent cars from dangerously switching lanes at the last minute.