

## VI. COSTS AND PRIORITIZATION OF TOP CRASH SEGMENT CONCEPTS

For each of the concepts developed for the top crash segments, a conceptual level cost estimate was also developed. Tabulations for each of the opinions of probable cost can be found in **Appendix L**. Of note, in addition to materials, these estimates also include force account items such as utility relocations and engineering costs as well. **Table 4** shows the probable costs for each segment concept as well as the priority level given to each concept.

**Table 4. Concept Costs and Prioritization**

Segment Number	Road Segment Name	Recommended Concept	Opinion of Probable Cost	Critical Crash Ratio Total (Critical Crash Ratio Severe)	Priority Level	Priority Reasoning
Segment 1	Haines Ave. (Lindbergh to I-90)	Raised median, traffic signal and improved network grid	\$1.6 million	2.43 (1.89)	High	Both critical crash ratios are high. There is a high potential for crash reduction.
Segment 2	Haines Ave. (I-90 to Disk)	Raised median and relocated access	\$475,000	2.30 (1.88)	High	Both critical crash ratios are high. There is a high potential for crash reduction.
Segment 3	St. Joseph St. (5th to East Blvd)	Traffic signal and striping	\$400,000	2.02 (1.39)	High	Both critical crash ratios are high. There is a high potential for crash reduction.
Segment 4	Jackson Blvd. (City Limit to Chapel Ln.)	New signs and improving sight distance	\$8,000	1.87 (0.00)	Low	One of two ratios is below 0.80. The potential for crash reduction is less likely.
Segment 5	W. Main St. (Sheridan Lake Rd. to Mountain View Rd.)	Raised median, traffic signal, bike lane and widened cross section	\$8.3 million	1.66 (1.36)	High	Both critical crash ratios are high. There is a high potential for crash reduction.
Segment 6	N. LaCrosse St. (Anamosa St. to Meridian Ln.)	Modified access (right-in / right-out)	\$38,000	1.42 (0.74)	Low	One of two ratios is below 0.80. The potential for crash reduction is less likely.
Segment 7	NB Highway 16 (Neck Yoke to Busted 5 Ct.)	Wildlife fencing, acceleration / deceleration lanes. Rumble strips and safety edge with resurfacing project	\$1.4 million	0.90 (1.26)	Medium	One of two ratios is less than or nearing 1. The potential for some crash reduction is likely.

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Segment Number	Road Segment Name	Recommended Concept	Opinion of Probable Cost	Critical Crash Ratio Total (Critical Crash Ratio Severe)	Priority Level	Priority Reasoning
Segment 8	LaCrosse St. (E. North St. to Anamosa St.)	Traffic signal, crosswalks, RR crossing gates and modified access	\$1.25 million	1.39 (0.99)	Medium	One of two ratios is less than or nearing 1. The potential for some crash reduction is likely.
Segment 9	W. Omaha St. (Mountain View Rd. to West Blvd.)	Traffic signal	\$370,000	1.11 (1.08)	Medium	One of two ratios is less than or nearing 1. The potential for some crash reduction is likely.
Segment 10	E. St. Patrick St. (Elm Ave. to St. Joseph St.)	Review snow removal. Increase speed enforcement	-	0.77 (1.04)	Low	One of two ratios is below 0.80. The potential for crash reduction is less likely.

As can be seen in this table, there are four high priority concepts, three medium priority concepts and three lower priority concepts among the top crash segments. City staff should consider these priority ratings with regard to implementation of each of these concepts.

Once the crash problems on these top segments are addressed, the methodology presented in the report can be repeated and the next set of top arterial roadway segments can be addressed.

## **VII. CONCLUSIONS AND RECOMMENDATIONS**

### **A. Summary of Project Goals and Objectives**

Rapid City staff, in conjunction with the Rapid City Area Metropolitan Planning Organization (MPO), identified the need to complete an arterial roadway safety assessment within Rapid City. The goal of this safety assessment study was to maximize arterial segment crash reduction within the limitations of available budgets by making arterial roadway safety improvements at locations where it does the most good or prevents the most crashes. The City enlisted FHU and DDI to complete this assessment by determining the top ten crash segments and to conceptualize projects that will help to address the identified crash problems.

The analyses completed in this report utilize crash data from January 2007 through December 2009. The focus of this analysis and report is on the arterial roadway segments between major arterial to arterial intersections. City staff closely monitors the major intersections within Rapid City so this report does not include analyses for the major intersections within the City. As discussed in the introduction, the objectives of this study are as follows:

- Develop a citywide safety perspective to set localized crash frequency and severity in the context of other similar facilities in Rapid City.
- Identify the top ten arterial crash segments within Rapid City using the Critical Crash Rate Method as outlined in the Highway Safety Manual (AASHTO, 2010). This method utilizes past crash totals, daily traffic volumes and arterial segment lengths to calculate crash rates.
- Review each of the fatal crashes that occurred during the study period on arterial segments, to understand the circumstances surrounding each crash and determine if any measures can be taken to improve the safety of the arterial segments that each fatal crash occurred along
- Develop solutions with the greatest potential to improve arterial traffic safety for the top crash locations.
- Prioritize future safety improvements to make sure that limited improvement funding is spent in the right places.
- Provide the City of Rapid City with a repeatable methodology for analyzing arterial safety in the future using Geographic Information Systems (GIS) based methods.

### **B. Summary of Data and Methods**

The data used in this analysis was provided by both City and SDDOT staff. The data utilized in this analysis was either provided in or imported to GIS. The data used in this analysis includes:

- Crash data (January 2007 to December 2009)
- Daily traffic volumes
- Arterial roadway laneage
- The 3-mile platting jurisdiction and 1.5 mile airport boundary used to define the study limits

- The City arterial roadway network
- The City intersection locations
- The City traffic signals locations

The arterial segments included in this study were then selected and segmented within ArcGIS. Section IIC of this report provides a step by step discussion of this process. Once defined, the Critical Crash Rate method as outlined in the Highway Safety Manual (AASHTO, 2010) was applied and the worst arterial crash segments within the study area were determined. The following is a portion of the table from Section IIIA of this report.

**Table 5. Analyzed Crash Segments**

Segment Number	Road Segment Name	From	To
Segment 1	Haines Ave	Lindbergh	I-90
Segment 2	Haines Ave	I-90	Disk
Segment 3	Saint Joseph St	5th	East Blvd
Segment 4	Jackson Blvd	City Limit	Chapel
Segment 5	W Main St	Sheridan Lake	Mountain View
Segment 6	N LaCrosse St	Anamosa	Meridian
Segment 7	S Highway 16 NB	Neck Yoke	Busted 5 Ct
Segment 8	N LaCrosse St	E North	Anamosa
Segment 9	W Omaha St	Mountain View	West Blvd
Segment 10	E Saint Patrick St	Elm	St Joseph

**C. Summary of Recommendations for Top Segments and Fatal Crash Locations**

A more in depth review of the crashes on each of the top segments was then completed in an attempt to identify correctable patterns. This was done by reviewing every crash report for the top crash segments. Both crash diagrams showing the locations of each crash on the top segments and conceptual designs were completed. **Appendix B** through **Appendix K** of this report contains both the segment crash diagrams and the conceptual designs for each of the top arterial segments.

In addition, each of the fatal crashes that occurred during the study period was also reviewed. This was done to obtain a better understanding of the circumstances surrounding each fatal crash and to determine if any measures can be taken to improve the safety of the arterial segment that each of these crashes occurred on. Upon review, there were a few segments identified for minor improvements.

**Table 6** provides a brief summary of the recommended concepts for the top crash segments as well as the recommendations from the fatal crash analysis.

**Table 6. Summary of Recommendations**

Segment Number	Road Segment Name	Recommended Concept
Segment 1	Haines Ave. (Lindbergh to I-90)	Raised median, traffic signal (if warranted) and improved network grid
Segment 2	Haines Ave. (I-90 to Disk)	Raised median and relocated access
Segment 3	St. Joseph St. (5th to East Blvd)	Removal of parking, traffic signal (if warranted) and striping
Segment 4	Jackson Blvd. (City Limit to Chapel Ln.)	New signs and improving sight distance
Segment 5	W. Main St. (Sheridan Lake Rd. to Mountain View Rd.)	Raised median, traffic signal (if warranted), bike lane and widened cross section
Segment 6	N. LaCrosse St. (Anamosa St. to Meridian Ln.)	Modified access (right-in / right-out)
Segment 7	NB Highway 16 (Neck Yoke to Busted 5 Ct.)	Wildlife fencing, acceleration / deceleration lanes. Rumble strips and safety edge with resurfacing project
Segment 8	LaCrosse St. (E. North St. to Anamosa St.)	Traffic signal (if warranted), RR crossing gates and modified access
Segment 9	W. Omaha St. (Mountain View Rd. to West Blvd.)	Traffic signal (if warranted)
Segment 10	E. St. Patrick St. (Elm Ave. to St. Joseph St.)	Review snow removal. Increase speed enforcement
Fatal Crash Location	US Highway 16 at Enchantment Road	Relocate existing private driveway, install oversized stop signs and additional stop sign on left side of Enchantment Rd. westbound approach
Fatal Crash Location	Deadwood Avenue south of North Plaza Drive	Consider additional speed enforcement
Fatal Crash Location	SD Highway 44 west of Falling Rock Road	Closely monitor due to top 20 severe crash ranking

**D. Summary of Central Business District Findings**

The crashes that occurred in the downtown area were reviewed separately from the other arterial crashes within the study. The primary reason for this is that the downtown area has unique geometric and travel conditions not typical of the other arterials in the study. The crashes in the downtown area were reviewed as a group in an effort to identify correctable patterns. Based on the review, rear end and angle crashes were the most common crash types in the downtown area with the majority of these crashes classified as property damage only crashes. This pattern is not uncommon due to the lower travel speeds and one way roadways common to a downtown area. No recommendations have been made to address crashes within the Rapid City central business district.

**E. Summary of Costs and Priorities for Top Crash Segments**

Opinions of cost were developed for each of the top crash segments and based on the potential for crash reduction; each segment was given a high, medium or low priority. **Table 7** provides a

summary of the costs and priority levels associated with each segment. More information can be found in Section IV of this report.

**Table 7. Segment Concept Costs and Priorities**

Segment Number	Road Segment Name	Opinion of Probable Cost	Priority Level
Segment 1	Haines Ave. (Lindbergh to I-90)	\$1.6 million	High
Segment 2	Haines Ave. (I-90 to Disk)	\$475,000	High
Segment 3	St. Joseph St. (5th to East Blvd)	\$400,000	High
Segment 4	Jackson Blvd. (City Limit to Chapel Ln.)	\$8,000	Low
Segment 5	W. Main St. (Sheridan Lake Rd. to Mountain View Rd.)	\$8.3 million	High
Segment 6	N. LaCrosse St. (Anamosa St. to Meridian Ln.)	\$38,000	Low
Segment 7	NB Highway 16 (Neck Yoke to Busted 5 Ct.)	\$1.4 million	Medium
Segment 8	LaCrosse St. (E. North St. to Anamosa St.)	\$1.25 million	Medium
Segment 9	W. Omaha St. (Mountain View Rd. to West Blvd.)	\$370,000	Medium
Segment 10	E. St. Patrick St. (Elm Ave. to St. Joseph St.)	-	Low

**F. Next Steps - Arterial Safety Study Project**

It is recommended that City staff use the findings of this study to prioritize, plan, design and implement the safety projects deemed most effective in an effort to improve arterial roadway safety within Rapid City. In addition, the methods provided in this report provide City staff with the ability to reevaluate and reprioritize additional safety projects in the future as traffic volumes and crash occurrences change throughout the City. This reevaluation could be done at regular intervals as part of an ongoing arterial safety improvement program.