



Section 4

INTERSECTION EVALUATION

Most of this report is a summary of the numbers, types, and patterns of crashes. This information can be used to identify overall trends. The next element is to use the data to identify specific locations for potential improvements.

Total crash numbers at any location (either in a chart or through crash density maps (heat maps) included in previous sections of this report) identify the locations where the most crashes occur. While helpful, because volumes and other elements at specific locations vary widely, it is difficult to draw relevant conclusions from this data. Therefore, an additional analysis is conducted to identify intersections where there are more crashes than expected considering traffic volumes, roadway geometry, type of traffic control, and crash severity.

INTERSECTIONS BY EXCESS CRASH COST

To identify locations with the most potential for crash reduction, it is important to use methods that account for crash severity, traffic volumes, roadway geometry, and type of control at intersections as those factors have an impact on the number of crashes at a given location.

It is also necessary to acknowledge that even though traffic crashes are partially deterministic (i.e., factors affecting crash potential can be controlled), crashes are, to some extent, random events. This random nature of crashes can make it more difficult to determine if a location is truly a problem versus a location where normal variation led to a high crash frequency during the analysis period. To identify locations that warrant further investigation it is helpful to use a methodology that accounts for the somewhat random nature of crashes.

In 2010 the Transportation Research Board (TRB) and the American Association of State Highway and Transportation Officials (AASHTO) published the *Highway Safety Manual* (HSM). The HSM includes a statistical approach that considers traffic volumes and intersection types while also accounting for the natural fluctuation of data called regression to the mean. The result is the identification of locations that have a higher-than-expected crash frequency even after accounting for random variation.

Crash Prediction Models

The method in the Highway Safety Manual that is applied for this evaluation uses crash prediction models to predict the number of crashes (both property damage only and injury/fatal crashes) at each location given traffic volumes, roadway geometry, and type of control at each intersection. The predictions are then compared to the actual number of crashes at each location (adjusted to account for regression to the mean). The more the actual adjusted number of crashes exceeds the number of predicted crashes (expressed as excess crash cost) the more likely it is that a location might benefit from targeted improvements.

Several crash prediction models were considered including those found in the Highway Safety Manual 1st edition, models developed for the Colorado Department of Transportation (CDOT) in 2009, and models developed for CDOT in 2018. Model results were compared to actual Fort Collins crash data and the models that best matched the data in each intersection category were selected for use (see **Table 10**).

Once the comparison between modal predicted and actual crashes is completed, the numbers can be monetized into 'excess crash costs'. This is the cost of crashes above the model predictions for an intersection and provides an indication of the potential benefit of reducing crashes. Cost costs are weighted by severity and based on information provided in the Highway Safety Manual (Table 4A-1), adjusted to 2022 dollars, and consider Fort Collins' proportion of severe crashes. The costs include monetary losses associated with medical care, emergency services, property damage and lost productivity. They also include costs related to reduction in quality of life that is related to injuries. See **Table 11** for the costs used in this report.



Table 10. Prediction Model Used in Intersection Analysis

Number of Legs *	Type of Control	Model Used
3	Stop Controlled	CDOT 2018
4	Stop Controlled	CDOT 2018
3	Signalized	CDOT 2018
4	Signalized	CDOT 2009 (total crashes) 2018 (injury crashes)
All	Roundabout	NCHRP 888

Table 11. 2022 Crash Costs

Severity of Crash	Cost
Property Damage Only	\$ 12,400 /crash
Fatal / Injury	\$ 213,600 /crash

Source of cost:
Highway Safety Manual

* Legs: Segments of roadway approaching an intersection

Traffic Volumes

Traffic volumes in Fort Collins were down in 2020 by about 20% due to COVID-19. To account for this, three-year average traffic volumes used for analysis at each location were reduced by 7% to account for the reduced volumes in 2020.

$$\text{Average ADT over three years} = (V + V + 0.8V)/3 = 0.93V = -7\%$$

This analysis was completed for about 300 of the most major intersections in Fort Collins using three years of data (2020-2022). The evaluation shows that 42% have an excess crash cost and 58% have a negative crash cost (indicating less crashes than predicted). This means that when aggregated and averaged, intersections in Fort Collins have less crashes and/or severity than what would be predicted compared to similar intersections in the state used to calibrate the crash prediction models.

58% of intersections in Fort Collins have fewer crashes than what would be predicted

Table 12 shows the 50 intersections with the greatest excess crash costs (grey highlighted column). Since injury and fatal crashes have higher crash costs associated with them, the ranking method gives more weight to locations with more severe crashes compared to locations with primarily “fender benders”. A column in the table indicates whether the intersection is on the High Injury Network identified through the Vision Zero action plan (and shown in **Figure 16**). **Figure 50** shows the location of the top 25 on a map.

LEVEL OF SERVICE OF SAFETY (LOSS)

While excess crash cost is a quantitative approach, CDOT uses a similar but more qualitative approach to identify locations with more crashes than expected termed Level of Service of Safety (LOSS). LOSS is a scale from 1 – 4. LOSS 3 and 4 indicate locations with an above average number of crashes and above the 80th percentile number of crashes respectively compared to estimates from a crash prediction model. LOSS 3 and 4 indicate the highest potential for crash reduction with a mitigating project. LOSS 1 and 2 may still have a pattern that can be mitigated but would likely result in lower numbers of overall crash reduction. Calculation of LOSS was completed in this review and results are included in **Table 12**. LOSS is included as it may identify some additional intersections – especially with lower volumes -- that may warrant further investigation. It also gives the City information needed to determine locations that may score favorably in the review process for CDOT safety funds.

TRENDS IN INTERSECTION SAFETY

In addition to identifying intersections with higher-than-expected crash numbers and severity, reviewing crash trends can identify changing conditions and safety at specific locations. **Table 12** lists the change in excess crash costs both positively and negatively. (A larger version of the table is included at the end of the report). As noted earlier, the base calculation includes three years of data (2020-2022) and the comparison is against the previous three years of data (2017-2019). The comparisons take into account the volume changes in the “after” period related to COVID. Locations with more significant improvement in safety trends are shaded green, while locations with increasing excess crash costs are shaded in red. Note that in locations with few crashes, a single injury/fatal crash can create a pronounced swing in excess crash costs. In these cases, judgment is needed to determine whether a trend is significant or not.



Table 12. Top 50 Intersections by Excess Crash Cost (larger table included at end of report)

Top 50 Intersections by Excess Crash Cost

Fac ID	North-South Street	East-West Street	Traffic Vol	Model Predicted Crashes/Year	Predicted Crashes/Year	Expected Crashes/Year	Expected Crashes/Year	Excess PDO	Excess Crashes (# and Costs)	LOSS Total Crashes	LOSS Crashes FI	Crash Trends 2017-2019 vs 2020-2022 Δ Crash Cost	Notes	High Injury Network	Type Of Control	Rank
10	College Av	Drake Rd	68,433	27.8	5.1	30.2	8.9	-1.4	3.8	LOSS 3	LOSS 4	-\$250,385	Capital project in design.	Y	4SG	1
162	Lemay	Harmony Rd	60,171	20.5	4.5	24.6	7.4	1.2	2.9	LOSS 3	LOSS 4	-\$409,021	Adaptive signal timing 2019, crashes trending down	Y	4SG	2
119	Shields St	Prospect Rd	46,739	16.2	4.4	22.7	6.8	4.1	2.4	LOSS 4	LOSS 4	-\$58,554	Red Light Cameras in 2020, crashes trending down	Y	4SG	3
59	Lemay	Drake Rd	48,728	16.9	4.6	18.7	7.1	-0.7	2.6	LOSS 3	LOSS 4	-\$356,730	Project planned - HSIP add SBRT lane, red light cam	Y	4SG	4
1	Boardwalk Dr	Harmony Rd	55,037	16.6	4.0	21.3	6.1	2.5	2.2	LOSS 3	LOSS 4	-\$558,999	Protected Lefts in 2019, crashes trending down	Y	4SG	5
34	College Av	Triby Rd	45,174	15.1	3.9	16.4	5.6	-0.4	1.7	LOSS 3	LOSS 4	-\$616,361	Protected Lefts in 2020, capital project in design	Y	4SG	6
55	JFK	Harmony Rd	46,531	11.9	2.8	13.1	4.2	-0.3	1.4	LOSS 3	LOSS 4	-\$212,620		Y	4SG	7
25	College Av	Mulberry St	49,330	17.2	4.6	24.6	5.7	6.4	1.0	LOSS 4	LOSS 3	-\$12,062		Y	4SG	8
118	Shields St	Plum	32,196	7.5	1.8	10.9	3.0	2.2	1.2	LOSS 4	LOSS 4	-\$86,031		Y	4SG	9
143	Timberline Rd	Carpenter	26,800	7.0	2.4	12.2	3.4	4.2	1.0	LOSS 4	LOSS 4	-\$485,037	Funded Project - HSIP funds to install WBRT lane	n	4SG	10
69	Lemay	Riverside	37,663	11.9	3.6	13.1	4.6	0.2	1.0	LOSS 3	LOSS 3	-\$315,593		Y	4SG	11
18	College Av	Kensington	37,260	6.5	2.5	9.4	3.2	2.1	0.7	LOSS 3	LOSS 3	-\$87,069		Y	4SG	12
9402	Lemay	Carpenter	20,940	4.8	1.7	5.6	2.5	-0.1	0.9	LOSS 3	LOSS 4	-\$618		n	4SG	13
35	College Av	Troutman	42,276	10.2	3.1	11.6	3.9	0.6	0.8	LOSS 3	LOSS 3	-\$488,035	Funded Project - signal replacement, add FYA for LT	Y	4SG	14
9994	Taft Hill	Triby	17,548	2.4	1.1	4.2	1.9	1.1	0.8	LOSS 4	LOSS 4	-\$264,713	County improvement project in process, includes new	Y	4ST	15
140	Taft Hill Rd	Prospect Rd	33,579	10.2	3.1	9.8	3.9	-1.3	0.8	LOSS 3	LOSS 3	-\$65,412	Funded Project, signal replacement	Y	4SG	16
8	College Av	Columbia	45,829	8.8	2.9	10.2	3.6	0.7	0.7	LOSS 3	LOSS 3	-\$94,586		Y	4SG	17
240	Timberline Rd	Custer	29,579	4.1	0.8	5.7	1.4	1.0	0.6	LOSS 4	LOSS 4	-\$128,859		Y	4SG	18
145	Timberline Rd	Harmony Rd	82,439	34.9	5.8	36.2	6.5	0.6	0.7	LOSS 3	LOSS 3	-\$187,590	Funded Project - HSIP funds to replace signal	Y	4SG	19
101	Remington	Mulberry St	28,805	6.2	1.7	8.4	2.2	1.7	0.5	LOSS 3	LOSS 3	-\$117,924		Y	4SG	20
8656	Shields	Richmond	31,097	2.0	0.7	4.1	1.2	1.5	0.5	LOSS 4	LOSS 4	-\$151,315		Y	4ST	21
8432	College	Bristlecone	25,180	1.4	0.5	2.1	1.1	0.0	0.6	LOSS 3	LOSS 3	-\$88,352		Y	4SG	22
110	Shields St	Harmony Rd	38,748	12.2	3.7	14.5	4.1	1.9	0.5	LOSS 3	LOSS 3	-\$81,585		Y	4SG	23
116	Shields St	Mountain	16,251	2.9	0.9	4.1	1.7	0.6	0.5	LOSS 4	LOSS 4	-\$138,655		n	4SG	24
139	Taft Hill Rd	Mulberry St	25,525	6.5	2.2	8.6	2.7	1.6	0.5	LOSS 4	LOSS 3	-\$117,800		Y	4SG	25
8542	College	Smoky St	35,998	1.8	0.6	4.0	1.0	1.8	0.4	LOSS 4	LOSS 4	-\$11,847	Funded Project - development project to limit access	Y	4ST	26
8635	Timberline Rd	Keicher	23,078	5.2	1.5	7.8	1.9	2.2	0.4	LOSS 4	LOSS 3	-\$246,895	Funded Project -corridor completion in 2023	n	4SG	27
5329	College	Plum	36,164	1.8	0.6	3.2	1.0	1.0	0.4	LOSS 4	LOSS 4	-\$48,719		Y	3ST	28
6417	Timberline	Vine	14,151	1.2	0.6	4.5	0.8	3.0	0.3	LOSS 4	LOSS 4	-\$73,019	Funded Project - new signal construction in Q3 2023	n	4ST	29
82	Lemay	Horseshoe (East)	40,597	6.5	2.1	8.2	2.5	1.3	0.4	LOSS 3	LOSS 3	-\$51,689		Y	3SG	30
7290	College	Mason/Palmer	41,645	3.7	1.3	5.2	1.7	1.1	0.4	LOSS 3	LOSS 3	-\$31,418		Y	4ST	31
125	Shields St	Triby Rd	24,445	6.0	2.1	8.1	2.4	1.8	0.3	LOSS 4	LOSS 3	-\$154,398		n	4SG	32
6688	Automation Way	Horseshoe	25,263	1.4	0.5	1.6	0.9	-0.3	0.4	LOSS 3	LOSS 3	-\$68,567		Y	3ST	33
10247	Ridgen	Drake	16,601	0.6	0.2	1.7	0.6	0.7	0.4	LOSS 4	LOSS 4	-\$76,983		Y	3ST	34
111	Shields St	Horseshoe Rd	45,989	15.8	4.3	17.7	4.6	1.6	0.3	LOSS 3	LOSS 3	-\$690,744		Y	4SG	35
7	College Av	Cherry	36,868	10.9	2.9	9.6	3.4	-1.8	0.5	LOSS 3	LOSS 3	-\$16,529		Y	4SG	36
9380	Timberline	Lincoln	16,982	1.2	0.6	5.6	0.8	4.2	0.1	LOSS 4	LOSS 3	-\$141,823		n	4ST	37
33	College Av	Swallow	48,338	13.2	3.6	11.1	4.1	-2.6	0.5	LOSS 3	LOSS 3	-\$88,646	Minor signal imp made. Crashes trending down	Y	4SG	38
4	College Av	Boardwalk	44,966	10.2	3.2	11.0	3.5	0.4	0.3	LOSS 3	LOSS 3	-\$209,018		Y	4SG	39
193	Stover (East Int.)	Prospect	25,463	1.9	0.5	3.9	0.7	1.7	0.3	LOSS 4	LOSS 4	-\$3,733		Y	3ST	40
80	Mason St	Harmony Rd	36,814	10.6	2.8	14.2	2.9	3.4	0.1	LOSS 4	LOSS 3	-\$1,948,392	Safety project completed, positive trend	Y	4SG	41
6171	Edinburgh	Drake	24,457	1.4	0.5	3.0	0.8	1.4	0.3	LOSS 4	LOSS 3	-\$45,751		Y	3ST	42
71	Lemay	Stuart	30,613	6.6	1.6	5.9	2.0	-1.1	0.4	LOSS 3	LOSS 3	-\$77,540		Y	4SG	43
8562	Overland	Drake	14,757	1.6	0.5	2.3	0.7	0.5	0.3	LOSS 4	LOSS 4	-\$14,287	Safety project completed, positive trend	n	3ST	44
8710	College	Swallow	29,477	4.3	1.2	5.3	1.5	0.7	0.2	LOSS 3	LOSS 3	-\$68,163		Y	3SG	45
8710	College	Thunderbird	41,222	2.8	0.8	3.4	1.0	0.4	0.2	LOSS 3	LOSS 3	-\$116,117		Y	4ST	46
99	Remington	Elizabeth	64,86	0.6	0.2	1.3	0.4	0.5	0.2	LOSS 4	LOSS 4	-\$47,275		n	4ST	47
8698	College	Parker	42,333	2.0	0.6	2.5	0.8	0.3	0.2	LOSS 3	LOSS 3	-\$83,755		Y	3ST	48
46	Hoves	Laporte	10,965	1.3	0.5	1.8	0.7	0.3	0.2	LOSS 4	LOSS 4	-\$58,055		Y	4SG	49
137	Taft Hill Rd	Horseshoe Rd	33,013	9.6	2.7	10.5	2.9	0.6	0.2	LOSS 3	LOSS 3	-\$174,167	Funded Project, will add NBRT lane	Y	4SG	50

Legend:
 10 high priority locations for review
 Additional 15 locations with potential for crash reduction
 Recently improved - safety being monitored
 Project in Process
 AADT Annualized Average Daily Traffic
 PDO Property Damage Only
 FI Fatal or Injury
 LOSS Lovelord Service of Safety
 Shading reflects LOSS 4
 Range of -\$50k to +\$50k unshaded
 Red shading notes increasing crash trend
 Green shading identifies improving safety trend

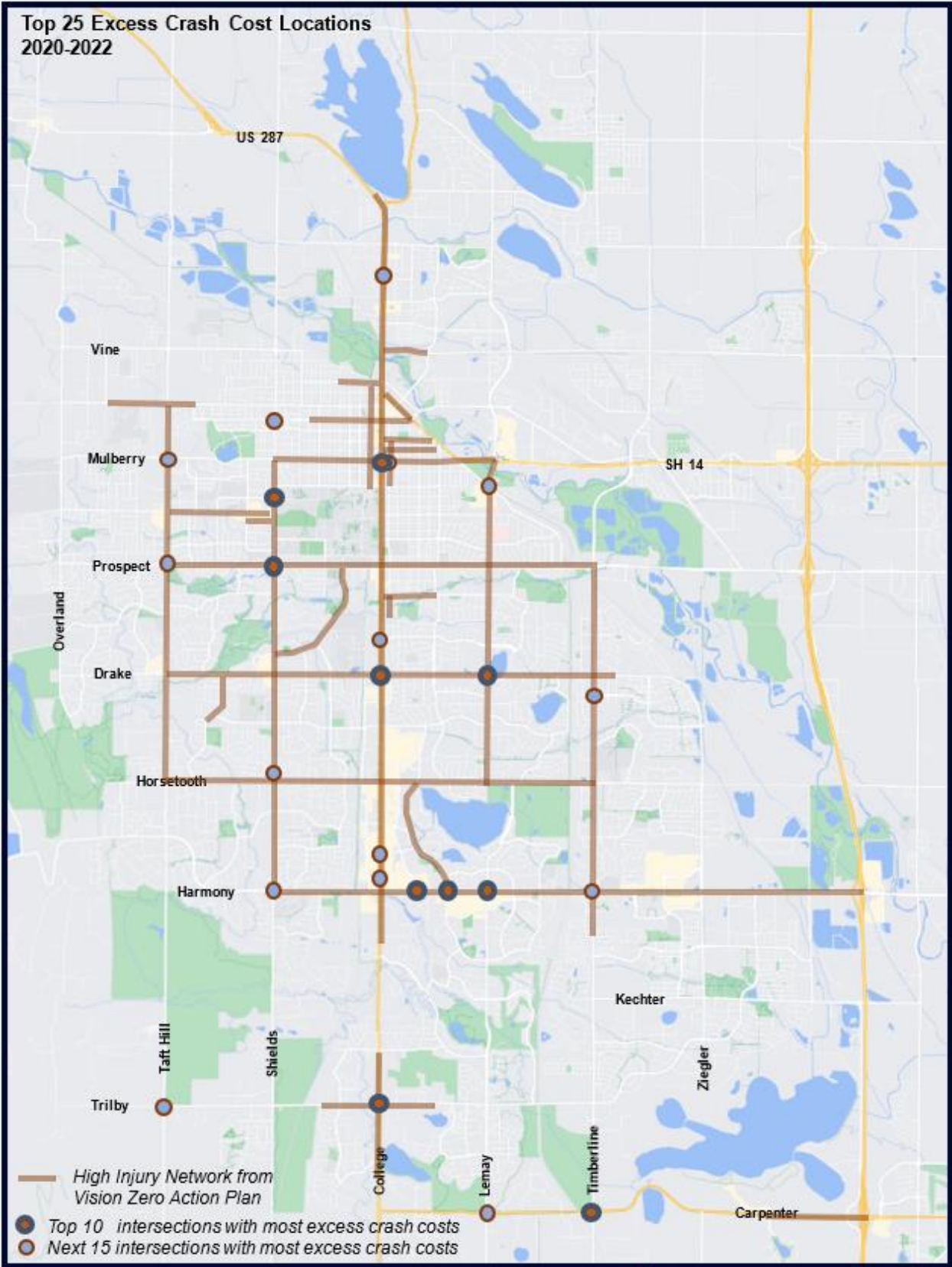


Figure 50. Top 25 Intersections With Most Excess Crash Costs (2020-2022)



Tables 13 and 14 summarize the trend information for those intersections with improving safety, and those with increasing crash trends.

Table 13. Top 15 Intersections with Improving Safety Trends

Facility ID	Intersection		Current Crash Information			Crash Trends 2017 - 2019 vs. 2020 - 2022 Δ Crash Cost	Type of control
	North - South Street	East - West Street	Excess PDO Crashes	Excess FI Crashes	Excess Expected Crash Value (\$)		
66	Lemay Avenue	Mulberry St	19.4	4.0	-\$220,420	-\$425,556	4 leg signal
28	College Avenue	Prospect Rd	23.2	4.0	-\$216,364	-\$428,234	4 leg signal
149	Timberline Rd	Prospect Rd	21.4	5.0	\$33,950	-\$436,352	4 leg signal
74	Lemay Avenue	Vine Dr	7.0	1.6	\$38,327	-\$479,884	4 leg signal
143	Timberline Rd	Carpenter Rd	12.2	3.4	\$262,340	-\$485,037	4 leg signal
35	College Avenue	Troutman	11.6	3.9	\$184,052	-\$489,035	4 leg signal
157	Ziegler	Harmony Rd	18.9	2.4	-\$517,701	-\$503,751	4 leg signal
91	McMurry	Harmony Rd	10.8	2.2	-\$195,974	-\$516,042	4 leg signal
1	Boardwalk	Harmony Rd	21.3	6.1	\$499,099	-\$558,999	4 leg signal
34	College Avenue	Trilby Rd	16.4	5.6	\$366,002	-\$616,361	4 leg signal
20	College Avenue	Laurel St	10.3	2.6	-\$114,104	-\$625,590	4 leg signal
111	Shields St	Horsetooth Rd	17.7	4.6	\$84,205	-\$690,744	4 leg signal
14	College Avenue	Harmony Rd	30.3	5.7	-\$16,647	-\$1,011,840	4 leg signal
80	Mason St	Harmony Rd	14.2	2.9	\$73,801	-\$1,048,302	4 leg signal
16	College Avenue	Horsetooth Rd	22.1	4.2	-\$132,111	-\$1,714,637	4 leg signal

Table 14. Top 15 Intersections with Increasing Crash Trends

Facility ID	Intersection		Current Crash Information			Crash Trends 2017 - 2019 vs. 2020 - 2022 Δ Crash Cost	Type of control
	North - South Street	East - West Street	Excess PDO Crashes	Excess FI Crashes	Excess Expected Crash Value (\$)		
69	Lemay Avenue	Riverside Ave	13.1	4.6	\$215,636	\$315,563	4 leg signal
55	JFK	Harmony Rd	13.1	4.2	\$302,378	\$212,620	4 leg signal
4	College Avenue	Boardwalk	11.0	3.5	\$78,993	\$209,018	4 leg signal
9994	Taft Hill	Trilby	4.2	1.9	\$174,576	\$193,038	4 leg stop
19	College Avenue	LaPorte Ave	7.6	2.0	\$18,055	\$154,779	4 leg signal
8432	College	Bristlecone	2.1	1.1	\$130,950	\$151,315	3 leg stop
27	College Avenue	Pitkin St	5.5	2.4	-\$51,654	\$144,355	4 leg signal
40	Corbett	Harmony Rd	14.1	3.7	-\$20,218	\$141,868	4 leg signal
8656	Shields	Richmond	4.1	1.2	\$131,580	\$117,924	4 leg stop
8710	College Avenue	Thunderbird	3.4	1.0	\$53,931	\$116,117	4 leg stop
78	LOOMIS	Mulberry St	2.7	1.0	\$26,120	\$108,812	4 leg signal
105	Riverside Ave	Mulberry St	12.9	3.5	-\$117,723	\$106,188	4 leg signal
15033	College Avenue	Rutgers	9.6	2.4	-\$2,114	\$97,419	4 leg signal
9976	College Avenue	Hickory	3.9	1.0	\$24,350	\$91,186	3 leg stop
68	Lemay Avenue	Prospect Rd	19.9	4.2	-\$121,359	\$90,025	4 leg signal

PDO: Property Damage Only

FI: Fatal / Injury



PATTERN RECOGNITION

Table 15 identifies intersections where a pattern of a particular crash type is identifiable. The evaluation is a statistical analysis developed by the Colorado Department of Transportation and compares the prevalence of a particular crash type at an intersection against the typical expected proportion of that crash type at the intersection. The table indicates the control type, the location, and the number of that type of crash in three years (2020 – 2022).

Only intersections with at least three crashes in three years (average one per year) are included (except for the bicycle and pedestrian crash categories - those locations with a pattern of these crashes and two crashes or more in three years are included). Judgment is needed with this analysis as a higher-than-normal proportion of one type of crash may be caused by a lower-than-normal proportion of another type of crash. Thus, some locations that are listed, especially those with fewer crashes, may not be of concern.

Some intersections may be listed in more than one category. For instance, the intersection of College and Cherry is listed in both the serious injury and red light running. The intersection of Timberline and Drake is listed under approach turn crashes and bicycle crashes. The causes of these crashes may or may not be related.

This more detailed information about the types and patterns of crashes should be combined with other elements of analysis to gain a complete picture and greater understanding of the safety performance of an intersection to identify subsequent mitigation measures.

Table 15. Intersections with Statistical Pattern of Particular Crash Types (continued on next page)

Control	North - South Street	East - West Street	# crashes in 3 years	Control	North - South Street	East - West Street	# crashes in 3 years
Approach Turn				Right Angle			
4 leg signal	Shields St	Prospect Rd	20	4 leg signal	College Ave	Kensington	14
4 leg signal	College Ave	Troutman	19	4 leg signal	College Ave	Columbia	12
4 leg signal	Shields St	Horsetooth Rd	18	4 leg signal	Mason St	Harmony Rd	12
4 leg signal	Lemay Ave	Drake Rd	18	4 leg signal	Taft Hill Rd	Prospect Rd	11
4 leg signal	Shields St	Drake Rd	15	4 leg signal	College Ave	Cherry St	10
4 leg signal	Timberline Rd	Drake Rd	15	4 leg signal	Remington St	Prospect Rd	9
4 leg signal	Lemay Ave	Riverside Ave	14	4 leg signal	Remington St	Mulberry St	9
4 leg stop	College Ave	Mason/Palmer	12	4 leg signal	Taft Hill Rd	Horsetooth Rd	9
4 leg stop	College Ave	Lake	11	4 leg stop	Mason	Magnolia St	8
4 leg signal	College Ave	Boardwalk	11	4 leg signal	Shields St	Mulberry St	8
4 leg signal	College Ave	Swallow	10	4 leg signal	Howes St	LaPorte Ave	7
4 leg stop	College Ave	Thunderbird	9	4 leg signal	JFK	Boardwalk	7
4 leg signal	Taft Hill Rd	Prospect Rd	9	3 leg stop	Rigden	Drake Rd	7
3 leg signal	Lemay Ave	Horsetooth (west Int)	8	4 leg stop	Redwood	Conifer St	7
4 leg signal	Lemay Ave	Magnolia	7	4 leg signal	Remington St	Elizabeth St	6
3 leg stop	College Ave	Plum	7	4 leg stop	Worthington	Centre	6
4 leg signal	Riverside Ave	Mountain Ave	6	4 leg signal	Research / Meadowlark	Drake Rd	6
4 leg stop	Tulane	Drake	4	4 leg signal	College Ave	Olive	6
Pedestrian				3 leg stop	NW Frontage Road	Vine Dr	6
4 leg signal	College Ave	Stuart	3	4 leg stop	Meldrum	LaPorte Ave	6
4 leg signal	College Ave	Laurel	3	4 leg signal	Shields St	Swallow	6
4 leg signal	College Ave	Mulberry St	3	4 leg signal	Whedbee	Mulberry St	5
4 leg stop	City Park	Plum	2	4 leg stop	Linden	Vine Dr	5
4 leg signal	College Ave	Magnolia	2	3 leg stop	Timberline	Milestone	4
4 leg signal	Mason St	Mulberry St	2	3 leg stop	Lemay Ave	Stoney Hill	3
				4 leg signal	Taft Hill Rd	Valley Forge	3
				4 leg stop	Lemay	Haxton	3
				4 leg stop	Taft Hill Rd	Bronson	3



Table 15 Continued. Intersections with Statistical Patterns of Particular Crash Types

Control	North - South Street	East - West Street	# crashes in 3 years	Control	North - South Street	East - West Street	# crashes in 3 years
Rear End				Bicycle			
4 leg signal	Timberline Rd	Harmony Rd	68	3 leg stop	Overland	Drake	4
4 leg signal	College Ave	Harmony Rd	64	3 leg signal	Shields St	Lake St	4
4 leg signal	Lemay Ave	Harmony Rd	54	4 leg signal	Timberline Rd	Drake Rd	3
4 leg signal	Boardwalk Rd	Harmony Rd	45	4 leg signal	Shields St	Prospect Rd	3
4 leg signal	College Ave	Horsetooth Rd	41	4 leg signal	College Ave	Mulberry St	3
4 leg signal	Timberline Rd	Carpenter Rd	31	4 leg signal	Remington St	Pitkin	2
4 leg signal	Riverside Ave	Mulberry St	30	4 leg signal	Remington St	Elizabeth St	2
4 leg signal	JFK	Harmony Rd	30	4 leg signal	Timberline Rd	Caribou	2
4 leg signal	Shields St	Plum	29	3 leg stop	Shields St	University	2
4 leg signal	Corbett	Harmony Rd	29	Single Vehicle Crashes			
4 leg signal	Lady Moon	Harmony Rd	27	4 leg signal	Timberline Rd	Harmony Rd	16
4 leg signal	College Ave	Monroe	21	4 leg signal	College Ave	Willox	7
4 leg signal	Taft Hill Rd	Harmony Rd	19	3 leg stop	Strauss Cabin	Horsetooth Rd	6
4 leg signal	College Ave	Foothills	19	4 leg signal	Taft Hill Rd	Drake Rd	6
3 leg signal	McClelland	Horsetooth Rd	14	3 leg signal	Lemay Ave	Horsetooth (east Int)	6
3 leg stop	Stover (east int.)	Prospect	13	4 leg stop	Timberline Rd	Vine Dr	6
4 leg signal	Shields St	Raintree / Centre	12	4 leg signal	Timberline Rd	Custer	5
4 leg stop	Welch	Prospect	11	4 leg signal	Timberline Rd	Timberwood	4
3 leg signal	McClelland	Drake Rd	10	4 leg signal	Manhattan	Horsetooth Rd	3
4 leg stop	Shields St	Richmond	9	Snow and Ice			
4 leg signal	College Ave	Fossil Creek	9	4 leg signal	Ziegler Rd	Harmony Rd	10
4 leg stop	Taft Hill Rd	Lake St	8	4 leg signal	Riverside Ave	Prospect Rd	6
3 leg stop	Timberline	Mountain Vista	7	4 leg signal	Shields St	Swallow	5
4 leg stop	Ponderosa	Elizabeth St	5	4 leg signal	Taft Hill Rd	Elizabeth St	5
3 leg stop	Heatheridge	Prospect	5	3 leg signal	Constitution Ave	Drake Rd	4
4 leg signal	Howes	Laurel	5	4 leg signal	Lemay Ave	Boardwalk	3
3 leg stop	College	Oak	4	Serious Injury			
Red Light Running				4 leg signal	Timberline Rd	Carpenter Rd	9
4 leg signal	College Ave	Columbia	12	4 leg signal	Lemay Ave	Carpenter Rd	8
4 leg signal	McMurry	Harmony Rd	9	4 leg signal	Taft Hill Rd	Prospect Rd	8
4 leg signal	College Ave	Kensington	9	4 leg signal	College Ave	Cherry St	7
4 leg signal	Shields St	Mulberry St	8	4 leg signal	Timberline Rd	Custer	6
4 leg signal	Remington St	Mulberry St	8	4 leg signal	Timberline Rd	Caribou	4
4 leg signal	College Ave	Cherry St	8	Additional locations with at least 10+ Serious Injury crashes in last 3 years			
4 leg signal	Taft Hill Rd	Prospect Rd	8	4 leg signal	Timberline Rd	Harmony Rd	12
4 leg signal	Howes St	LaPorte Ave	7	4 leg signal	College Ave	Drake Rd	10
4 leg signal	Remington St	Prospect Rd	7				
4 leg signal	JFK	Boardwalk	6				
4 leg signal	Timberline Rd	Custer	6				
4 leg signal	Research/Meadowlark	Drake Rd	5				
4 leg signal	Taft Hill Rd	Valley Forge	3				
Additional locations with at least 10+ RLR crashes in last 3 years							
4 leg signal	Mason St	Harmony Rd	10				
4 leg signal	Taft Hill Rd	Drake Rd	10				
4 leg signal	Lemay Ave	Mulberry St	11				
4 leg signal	College Ave	Mulberry St	12				
4 leg signal	Shields St	Prospect Rd	11				
4 leg signal	Timberline Rd	Harmony Rd	11				

Note: the additional locations shown in the Red Light Running and Serious Injury categories are locations where the number of crashes do not show a statistical pattern (due to a high number of other crashes), but because the red light running or serious injury crash numbers are high, they are listed here for information and consideration for future review.



ROUNABOUT SAFETY REVIEW

Fort Collins has several roundabouts in the City. Roundabouts are often lauded for their roadway safety benefits due to slow speeds, and assumed reduced approach turn and right angle crashes. Reviewing crash data at the roundabouts in Fort Collins could help verify whether these claims are accurate in Fort Collins and could help direct roundabout policy in the future.

Four roundabout intersections in Fort Collins were reviewed as part of the intersection evaluation process described earlier in this report utilizing a crash prediction model developed for the National Transportation Research Board using crash data from roundabouts throughout the United States. **Table 16** shows the results for those four roundabout intersections. As shown in the table three of the four roundabouts reviewed had more crashes than expected (positive excess crash costs).

It's important to clarify that the expectation for roundabouts is that they will have less crashes than other types of intersections (STOP signs or traffic signals). Thus, the three roundabouts with an excess crash cost are higher than typical **when compared to other roundabouts**. While the excess crash cost may indicate an opportunity for improvement, it should not be misconstrued that the roundabouts are less safe than other types of intersections with lower excess crash costs because the basis for those excess crash costs is different.

Table 16. Roundabout Intersection Comparison by Excess Crash Cost

Fac ID	Intersection		Traffic Vol Total AADT	Model Predicted Crashes		Actual Adjusted Crashes		Excess Crashes (# and Costs)			LOSS		Crash Trends 2017-2019 vs 2020-2022 Δ Crash Cost	Type Of Control
	North-South Street	East-West Street		Predicted Crashes/Year	Predicted FI Crashes/Year	Expected Crashes/Year	Expected FI Crashes/Year	Excess PDO	Excess FI	Excess Expected Crash Value (\$)	LOSS Total Crashes	LOSS FI Crashes		
162	Remington	Laurel	7,673	1.4	0.2	2.0	0.4	0.5	0.1	\$37,325	LOSS 3	LOSS 4	\$9,265	RND
10	Ziegler	Horsetooth	25,367	7.4	1.4	13.7	1.1	6.6	-0.3	\$14,628	LOSS 4		-\$296,827	RND
119	Ziegler	Kechter	14,804	2.3	0.4	2.1	0.5	-0.3	0.1	\$11,056		LOSS 3	-\$78,743	RND
59	Shields	Vine	13,027	2.0	0.4	2.8	0.3	0.8	-0.1	-\$12,954	LOSS 3		-\$193,360	RND

AAADT: Annualized Average Daily Traffic
 PDO: Property Damage Only
 FI: Fatal or Injury
 RND: Roundabout

To compare safety at the roundabouts relative to other types of intersections the crash prediction models for signalized or unsignalized intersections can be used to estimate the number of crashes under other types of control. **Table 17** shows the predicted number of crashes and injury crashes at the four analyzed roundabout intersections if they were converted to traffic signals or, in the case of Remington/Laurel, STOP sign control.

The analysis shows that for the three intersections that could potentially be converted to traffic signals it would be predicted that they would have more crash costs with signal control than they currently do as roundabouts. This is due to the higher number of injury crashes that would be expected with signal control. Note that Remington and Laurel is not outperforming STOP control. Crashes would be expected to be about the same or even less there with STOP control.

Table 17. Roundabout Intersection Crash Comparison with Change in Traffic Control

Facility ID	North - South Street	East - West Street	Expected Crashes/Year w/RBT	Expected FI Crashes/Year w/RBT	Predicted Crashes/Year w/Signal or STOP	Predicted FI Crashes/Year w/Signal or STOP	Expected Additional Crash Cost w/change
6473	Ziegler	Horsetooth	13.7	1.1	6.4	1.9	\$58,320
559	Shields	Vine	2.8	0.3	2.0	0.7	\$73,065
11282	Ziegler	Kechter	2.1	0.5	2.4	0.9	\$68,439
100	Remington	Laurel	2.0	0.4	1.1	0.3	-\$30,164

PDO: Property Damage Only
 FI: Fatal / Injury
 RBT: Roundabout