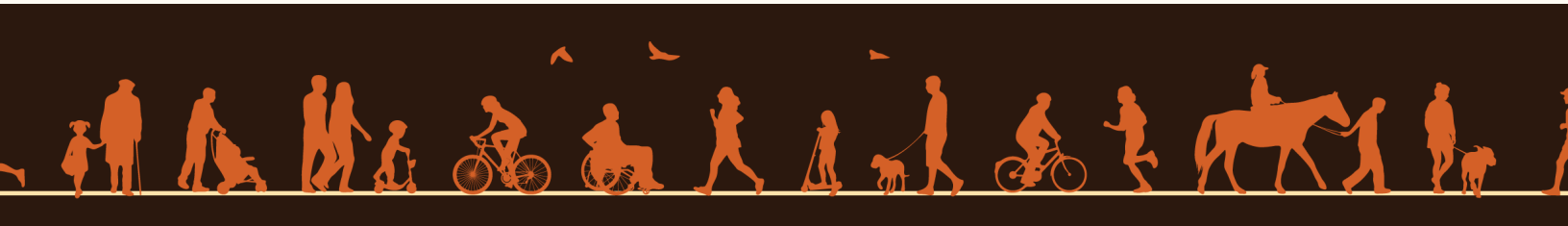
City of Fort Collins

STRATEGIC TRAILS PLAN

D

APPENDIX D:

Quantitative LOS & Crash Analysis Report



Memorandum

Date: October 3, 2024

To: Dave "DK" Kemp, City of Fort Collins; Taylor Broyhill, Logan Simpson

From: Nick VanderKwaak, Maggie Ostwald, Erika Jermé - Fehr & Peers

Subject: Fort Collins Strategic Trails Plan: Trail Analysis and Recommendations

DN24-0814

Overview

The Fehr & Peers team conducted quantitative, desk-based studies to understand existing conditions of Fort Collins' trail system and develop recommendations. The three levels of analysis including a quantitative trail level of service analysis, level of traffic stress analysis, and a preliminary assessment of safety at-grade crossings will inform prioritization of improvements to the trail system.

Quantitative Level of Service Analysis

Methodology

A Level of Service (LOS) analysis was conducted on all designated shared-use trails within the Fort Collins trails network. The methodology used for this analysis followed the FHWA Shared-Use Path Level of Service Calculator User's Guide, which was published in 2006 and remains the industry standard for evaluating shared-use paths. The calculator is rooted in path operations data, user perception surveys, and the theory of traffic flow on a path. It evaluates four criteria (meetings, active passes, passive passes, and delayed passings) based on four inputs from users (volume, mode split, trail width, and presence of a centerline). Equation 1 which incorporates these factors is shown below and is embedded in an excel workbook produced by the FHWA that calculates LOS based on the four user inputs.

$$SUPLOS = 5.446 - 0.00809(E) - 15.86(RW) - 0.287(CL) - (DPF)$$

Where:

E = Events = Meetings per minute + 10 (active passes per minute)
RW = Reciprocal of path width (i.e., 1/path width, in feet)
CL = 1 if trail has a centerline, 0 if trail has no centerline
DPF = Delayed pass factor

Equation 1: Basic SUPLOS Equation

Equation 1 above produces a LOS Grade based on the score received. The scale of grading is shown in Table 1 below.

LOS Score	LOS Grade	
$X \geq 4.0$	A	Best
$3.5 \leq X < 4.0$	B	↓
$3.0 \leq X < 3.5$	C	
$2.5 \leq X < 3.0$	D	
$2.0 \leq X < 2.5$	E	
$X < 2.0$	F	Worst

Table 1: SUPLOS Scale

Inputs into the LOS calculator included mode split, centerline, and volume data that was gathered from City of Fort Collins and other data. More information regarding each of these inputs is included below.

User Volumes

Trail volumes are collected by volunteers annually at 13 locations throughout Fort Collins. The counts used for this study were collected on a Tuesday and Saturday in September of 2022. The count locations are:

- Poudre Trail at Taft Hill Parking Lot
- Poudre Trail at Timberline Road
- Poudre Trail at Lee Martinez Park
- Spring Creek Trail at Lilac Park
- Spring Creek Trail at Creekside Park
- Spring Creek Trail at Edora Park
- Spring Creek Trail at Drake Road and Dunbar Avenue
- Mason Trail at West Horsetooth Road
- Power Trail at East Horsetooth Road

- Mason Trail at Spring Creek Trail
- Fossil Creek Trail at Stanton Creek Trail
- Longview Trail at Trilby Road
- Fossil Creek Trail at Spring Creek Trail

Some trails within the study did not have counts collected near them. For these trails, Strava Metro data was used to estimate trail volumes. Strava Metro provides, among other data, the total number of cyclists who used a specific trail segment while tracking an activity on Strava within a given one-hour period during the entire month of September 2022. This data is also available for pedestrian users. To estimate trail volumes based on Strava Metro data, the number of cyclists and pedestrians using Strava was summed and documented for every City count collection point as well as for locations where counts were not collected, and ratios were calculated at City count collection points to extrapolate volumes for the other segments. The sum of the bicyclists and pedestrians captured on Strava Metro is significantly less than the number of users captured by volunteer counters in the same month because Strava Metro only documents those users that use Strava to track their activity. Strava Metro data is highly recreational and only represents a portion of total users, which is why ratios were used to compare counted locations to unrepresented locations instead of directly utilizing the Strava Metro user counts.

Figure 1 below shows peak one-hour one-way volumes for the studied trails. Unidirectional volumes were assumed to be equal to half of the total one-hour volume.

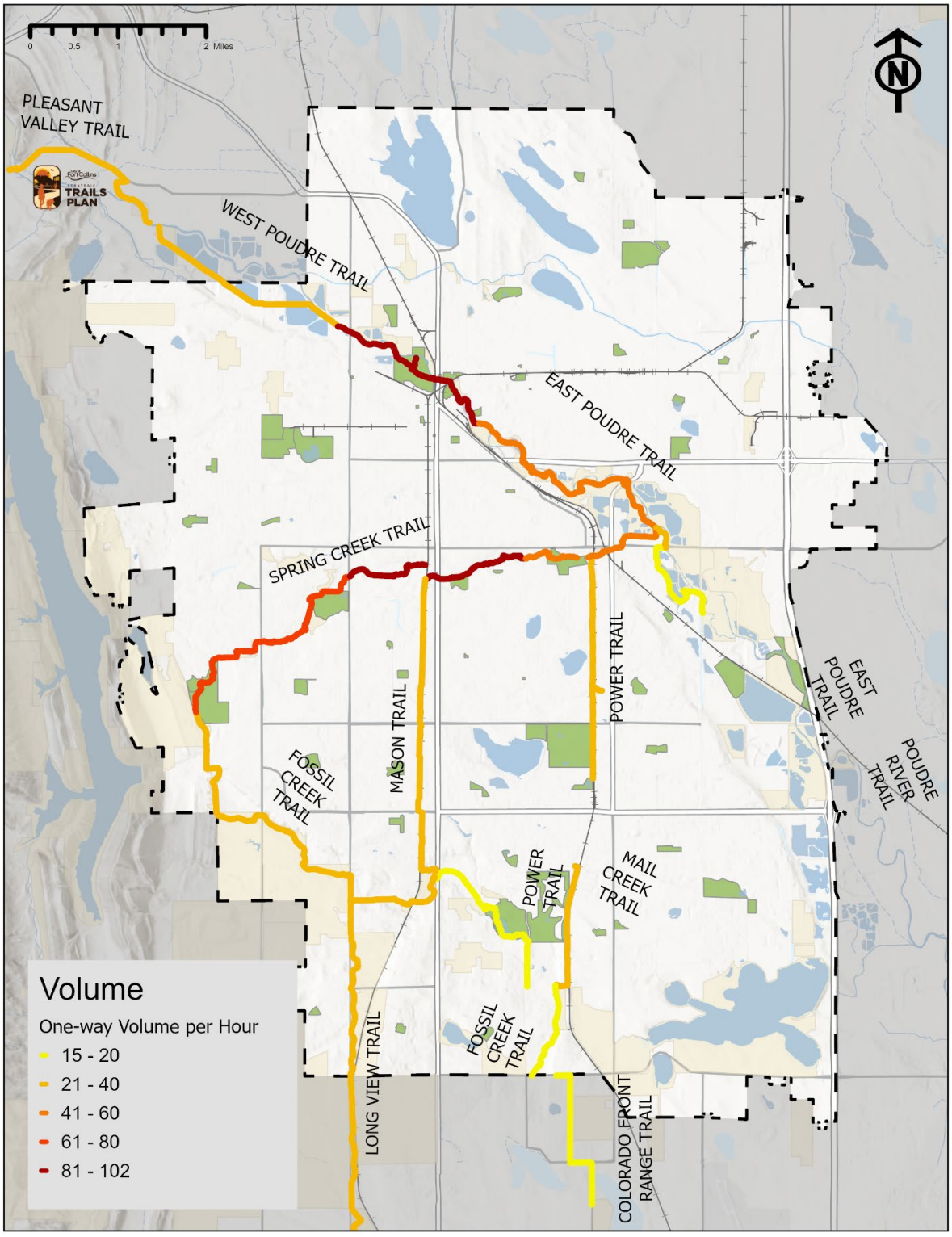


Figure 1: Map of One-Way Trail Volume per Hour

Mode Split

Mode split is defined as the share of a mode of transport in the overall volume of users. Mode split was provided by the City in the trail counts detailed above. The modes documented were all bicyclists, e-bike users, youth cyclists, walker/jogger/stroller, wheel-chair users, e-scooter users, other e-device users, and other. The mode splits incorporated into the LOS Calculator are adult cyclists, pedestrians, runners, in-line skaters, and youth cyclists. The calculations used to process the City mode split counts into the LOS Calculator mode splits are shown in Table 2 below.

Table 2: Comparison of Mode Split Categories

LOS Calculator Mode Split	Fort Collins Mode Splits Included
Adult cyclists	All bicyclists + e-scooter users + other e-device users – youth cyclists
Pedestrians	(Walker/jogger/stroller + wheel-chair users)/2
Runners	(Walker/jogger/stroller + wheel-chair users)/2
In-line skaters	Other
Youth cyclists	Youth cyclists

Figure 2 below shows the mode split for all cyclists (adult cyclists + youth cyclists) on the studied trails.

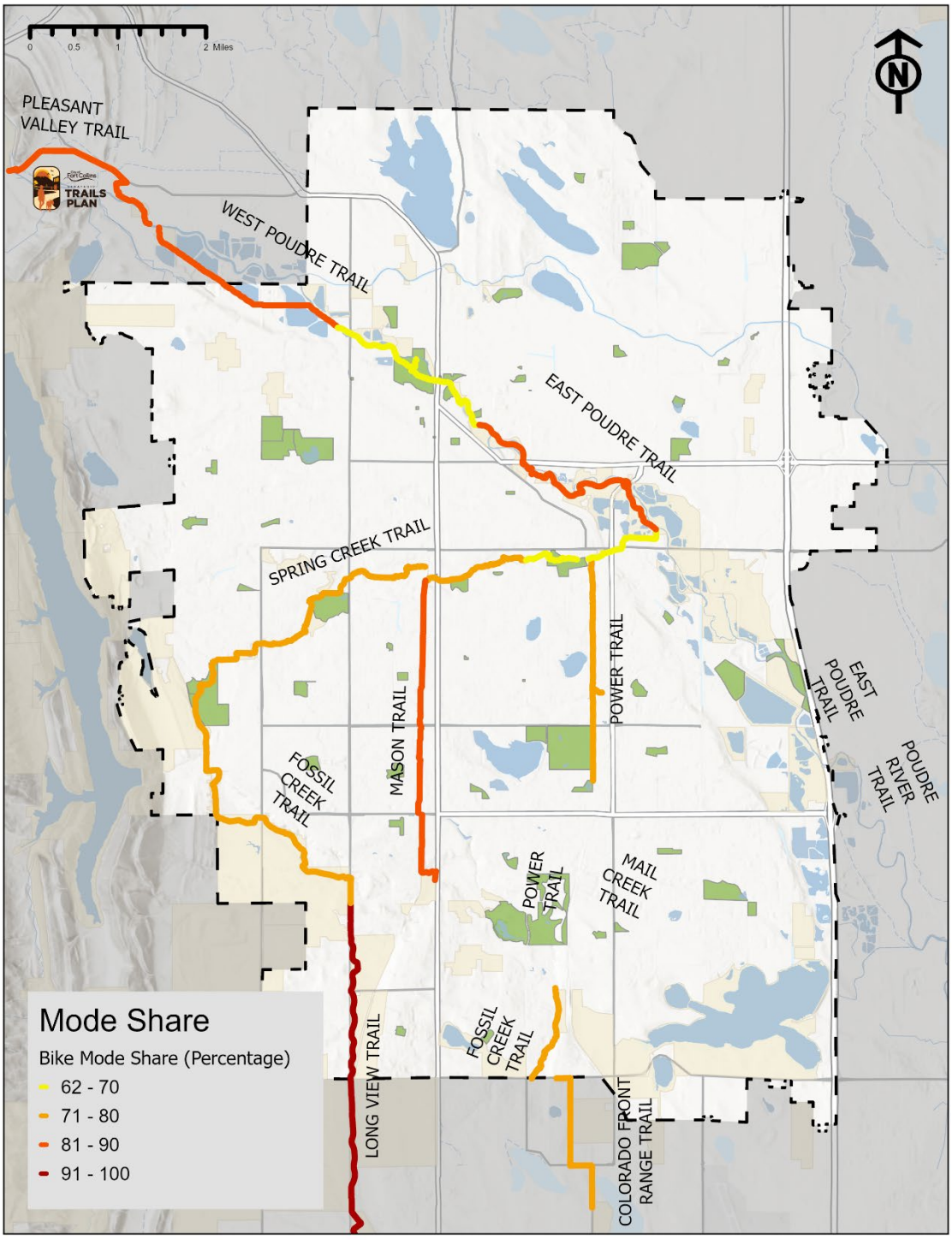


Figure 2: Map of Bicycle Mode Split

Presence of Centerline

The presence of a centerline can improve safety but also reduces trail level of service due to the perceived restriction of movement. Centerline presence data was provided by the City and verified using Google Earth aerial imagery. Figure 3 below shows the trail segments that have a centerline and those that do not.

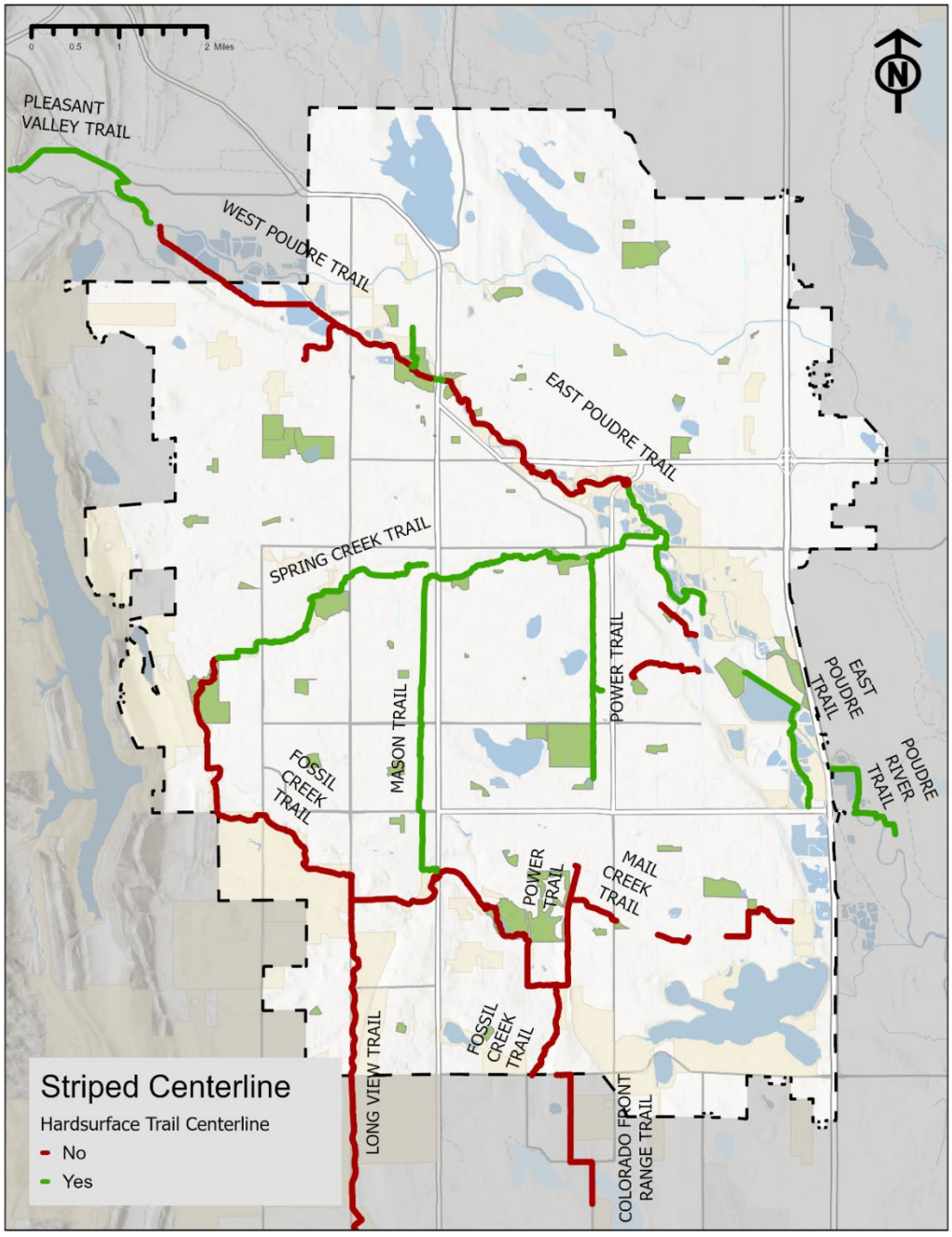


Figure 3: Map of Trail Centerline Presence

Trail Width

Wider trails can accommodate more users comfortably and therefore have a higher level of service. Trail width was provided by the City and spot checked using Google Earth aerial imagery. Figure 4 below shows the widths of trail segments throughout the study area.

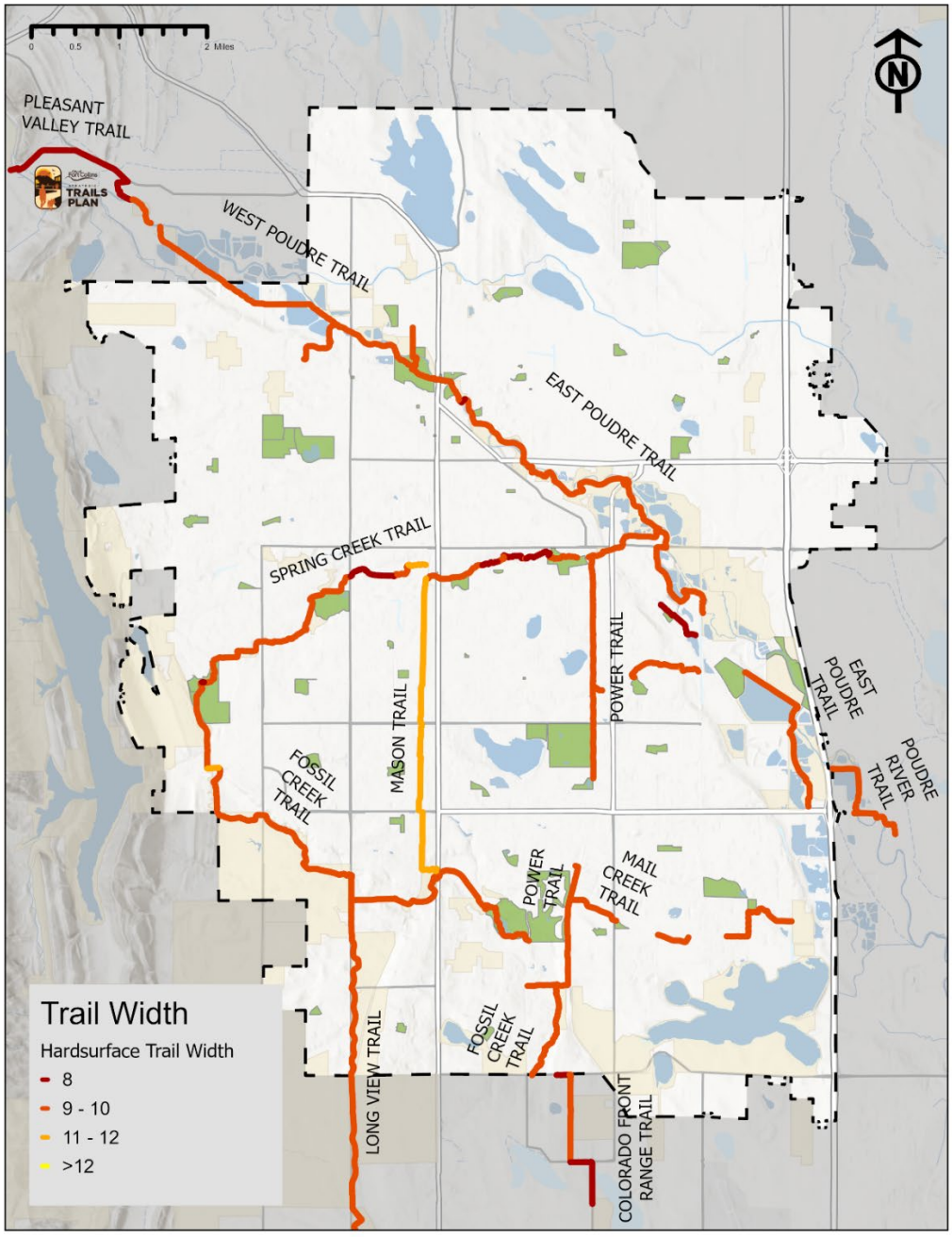


Figure 4: Map of Trail Width

Trail Level of Service (LOS) Results

LOS scores were calculated for 41.5 miles of trail. Figure 6 shows the evaluated LOS of all the trail segments. While this analysis shows that roughly two-thirds of trails already provide an A-grade level of service, another third of the city's trails could use improvement (Table 3). Of the trails studied, the Spring Creek trails perform the poorest, with 5 miles of C- and D-graded trails (Figure 5).

Table 3: LOS Scores by Mileage and Percentage

Score	Miles	Percent
A	26.0	63%
B	7.2	17%
C	7.0	17%
D	1.4	3%

Poorer grades are associated with higher volumes. Of trail segments receiving a score of A, the average hourly one-way volume is 25 users. By contrast, segments receiving C and D scores have an average hourly one-way volume of 83 users. B-graded segments have 57 hourly one-way users, on average. As Fort Collins' population increases, the city will need to improve trails to keep pace with growing demand.

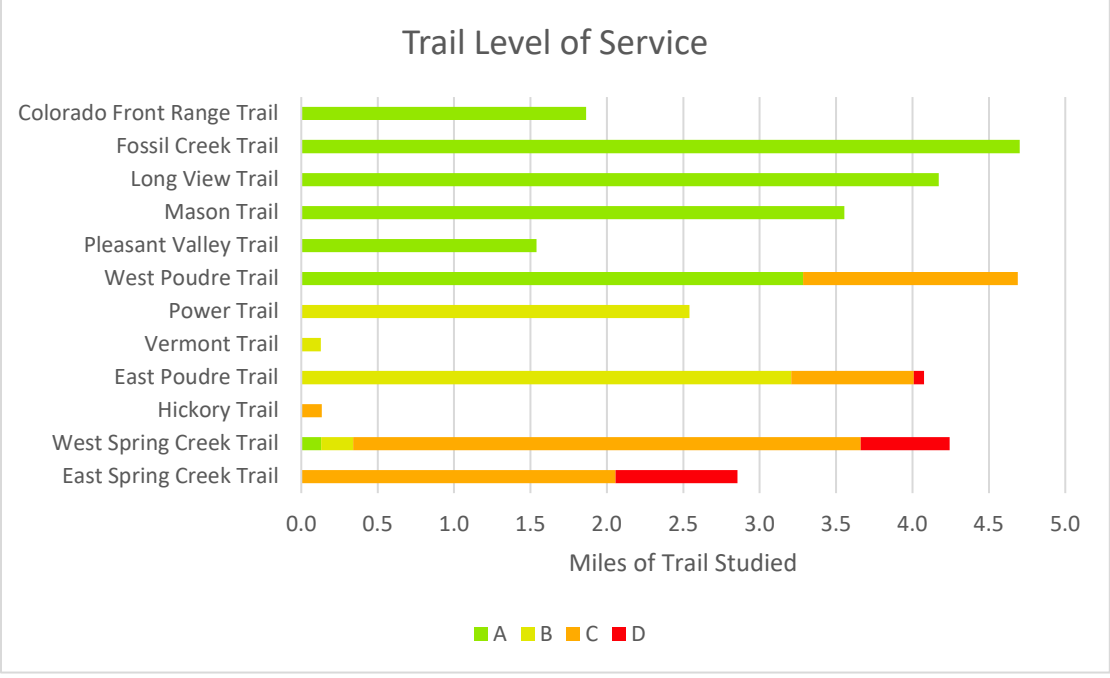


Figure 5: Miles of Each Trail Studied by Level of Service. Note that the Pleasant Valley Trail is often considered to be part of the West Poudre Trail.

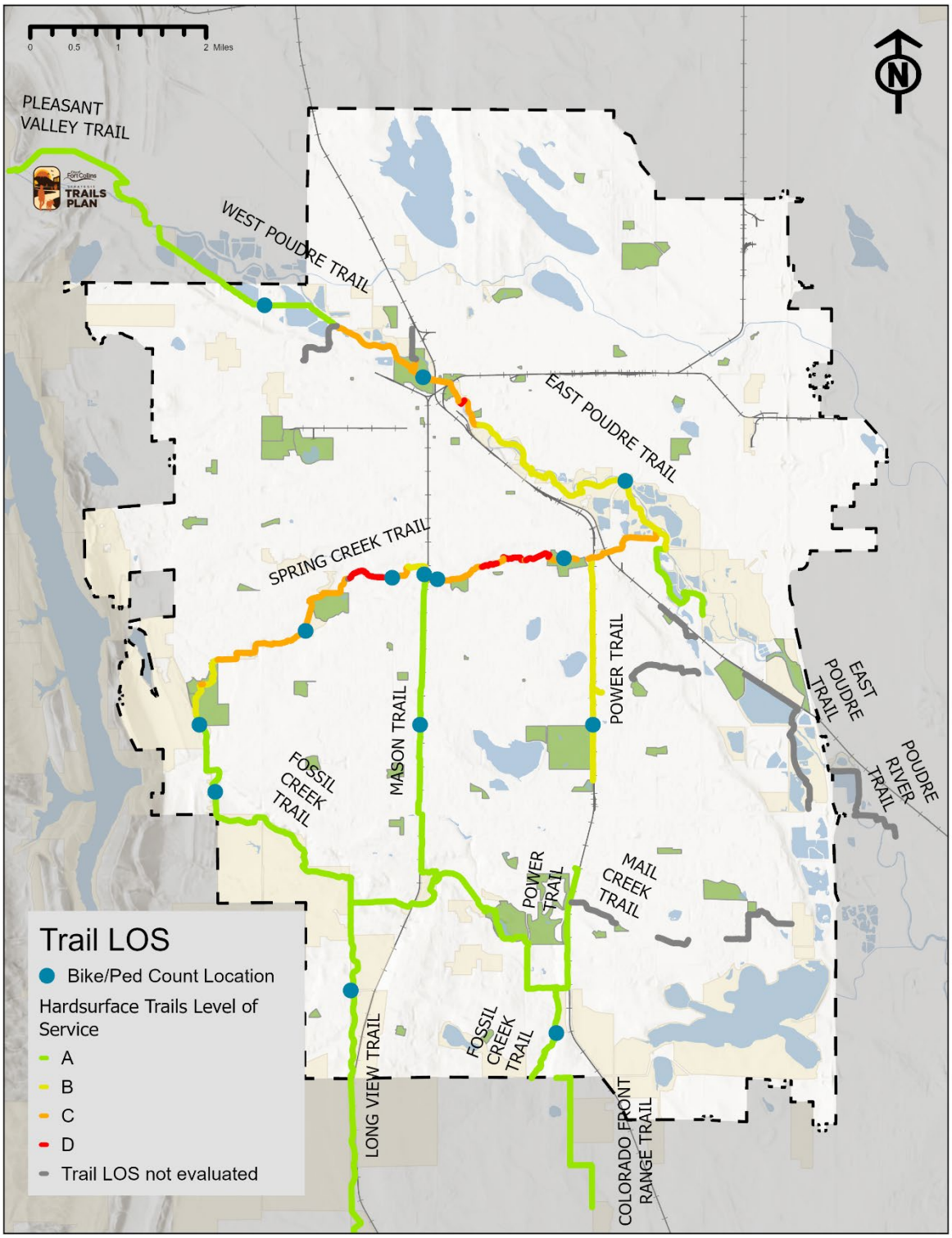


Figure 6: Map of Trail Level of Service Scores

In addition to outputting the LOS score, the FHWA Calculator calculates a user perception LOS Grade based on the surveys they conducted. For some trails, there is a slight discrepancy between the perceived score and the official trail level of service. In all but a handful of segments, the perceived LOS and actual LOS score differ only by one grade. Along the section of Fossil Creek Trail that is adjacent to Lemay Avenue, the scores vary substantially: the user perception LOS grade is F, but the trail LOS grade is A. The "trail" in this section is only a five-foot wide sidewalk with only narrow separation from the roadway, diminishing the user experience of the trail. Yet the volumes on this segment are low enough (only 17 one-way users per hour) that users are unlikely to have difficulty passing each other along this stretch, which explains why the actual score is so much higher. Although this segment of trail receives an A grade, it is narrower than the city's standards and should be considered for upgrading. Moreover, cyclists may choose to switch to on-street bike lanes for this segment. As a result, the recorded volumes on the trail may be artificially low.

Level of Traffic Stress Analysis

A level of traffic stress (LTS) analysis was completed on all trails within Fort Collins that lie parallel to and within 15 feet of a roadway. LTS is a best practice scoring system used to classify the comfort of bicycle facilities, based on the understanding that different segments of the population have different levels of comfort biking in or near traffic. An LTS of 1 is assumed to be comfortable for all users, even children, while an LTS of 4 denotes a bikeway that only the most experienced, committed cyclists will feel comfortable using.

Fehr & Peers has developed a tool (StreetScore+) that integrates the original Level of Traffic Stress methodology developed by Mekuria, Furth, and Nixon[1] with guidance from the National Association of City Transportation Officials' (NACTO's) *Urban Bikeway Design Guide*, 2nd edition. While a traditional LTS gives any off-street bikeway the best possible rating, StreetScore+ can distinguish among off-street bikeways of varying quality and comfort. StreetScore+ also includes a pedestrian module based on the NACTO *Urban Streets Design Guide* (USDG) and engineering judgment.

The project team analyzed 7.5 miles of trail for pedestrian and bicycle LTS, or roughly 14% of the trails in the study area. All other trail segments are assumed to have an LTS of 1, given their greater separation from the nearest roadway. The methodology and findings for each analysis are described in the following sections.

Pedestrian LTS Methodology

The pedestrian LTS was based on Fehr & Peers' StreetScore+ criteria for sidewalks in urbanized areas. The analysis used the following inputs:

- Speed limit of adjacent roadway
- Number of travel lanes on adjacent roadway
- Trail width
- Trail sidewalk quality
- Buffer width
- Presence of landscaping along the buffer (e.g., continuous trees to provide a physical barrier from traffic)
- Buffer quality

[1] Furth, Peter G., Maaza C. Mekuria, and Hilary Nixon. "Network connectivity for low-stress bicycling." *Transportation research record* 2587.1 (2016): 41-49.

Table 4 documents how each of these categories was scored.

Table 4: StreetScore+ Criteria for Sidewalks

Criteria		StreetScore+ 1	StreetScore+ 2	StreetScore+ 3	StreetScore+ 4
# of Travel Lanes	***Buffer width >=14 feet***	2-3 lanes	4-5 lanes	6+ lanes	(no effect)[2]
	Buffer width <14 feet	2-3 lanes	(no effect)	4-5 lanes	6+ lanes
Usable Sidewalk Width		>=10 feet	8 to 9 feet	6 to 7 feet	< 6 feet
Sidewalk Quality		Even, Smooth Surface	(no effect)	Some Cracks and Upheavals, but usable sidewalk width is maintained	Cracks, Failing Pavement, such that usable sidewalk width is not maintained
Posted Speed Limit	***Buffer scorewidth >=14 feet***	<= 30 MPH	31-35 MPH	36-40 MPH	>40 MPH
	Buffer width <14 feet	<= 25 MPH	26-30 MPH	31-35 MPH	>=36 MPH
	Buffer width = 0	<=20 MPH	21-25 MPH	26-30 MPH	31-35 MPH
Landscape Buffer and Street Trees		Yes, Continuous	Yes, Discontinuous[3]	No Landscaping	(no effect)
Buffer Quality		High quality buffer such as lush landscaping or parklet	Physical barrier such as modest landscaping, parked cars, or bicycle parking	Width buffer such as painted bike lane or bus lane	(no effect)

Trail quality was assumed to be "Even, Smooth Surface" (score of 1). Fieldwork was not performed to verify quality; the analysis can be updated for areas known to have poorer surfaces. If trail quality is worse than all other evaluated factors it would degrade the score. Similarly, buffer width was based on measurements of imagery in Google Earth, while qualitative attributes of the buffer are subject to analyst interpretation. Scores were calculated in ArcGIS Pro 3.1 using simple Python scripts. The lowest characteristic score became the final LTS score for each segment, following the "weakest link" principle of the LTS methodology.

[2] "No effect" signifies that there is no further decrease in comfort for that variable.

[3] Discontinuous is defined as not having a consistent effect on street life. Regularly spaced street trees may still feel like a "continuous" buffer and should receive a score of 1.

Bike LTS Methodology

The bike LTS was based on Fehr & Peers' StreetScore+ criteria for two-way protected bike lanes. The analysis used the following inputs:

- Speed limit of adjacent roadway
- Number of travel lanes on adjacent roadway
- Trail width
- Buffer width
- Barrier type (e.g., raised curb, grass, etc.)

Table 5 documents how each of these categories was scored. As with the pedestrian LTS, buffer width and barrier type were determined using Google Earth.

Table 5: StreetScore+ Criteria for Protected Bike Lanes

Criteria		StreetScore+ 1	StreetScore+ 2	StreetScore+ 3	StreetScore+ 4
Buffer Width		>=6 feet OR continuous barrier[4]	3 to 6 feet	(no effect)	<3 feet
Barrier Type	***<25 mph***	Raised curb + grass buffer, raised curb only, grass buffer only	Paint only	(no effect)	(no effect)
	25 – 30 mph	Raised curb + grass buffer	Raised curb only, grass buffer only	Paint only	(no effect)
	31 – 35 mph	Raised curb + grass buffer	Raised curb only, grass buffer only	(no effect)	Paint only
	>=36 mph	Raised curb + grass buffer	(no effect)	Raised curb only, grass buffer only	Paint only
Bicycle Lane Width		>=10 feet	8 to <10 feet	(no effect)	<8 feet

Scores were calculated in ArcGIS Pro 3.1 using simple Python scripts. The lowest characteristic score became the final LTS score for each segment, following the "weakest link" principle of the LTS methodology.

[4] A continuous barrier can be a continuous raised curb/median, continuous landscape planters, parking stops, or similar continuous physical barrier.

LTS Results

Of the 7.5 miles of trail that lie parallel to and are within 15 feet of a road, the majority scored an LTS 1 for bicyclists, but performed poorly (LTS 3 or 4) for pedestrians. Table 6 shows trail mileage by LTS score for the two user types. The difference in scores by user type reflects pedestrians' lower tolerance for proximity to higher speed traffic as well as a desire for a physical barrier provided by landscaping (e.g., trees, shrubs). A map showing the pedestrian LTS scores is shown in Figure 7 and a maps showing bicycle LTS is shown in Figure 8

Table 6: Miles of Trail by LTS Score and User Type.

LTS Score	Miles of Trail - Pedestrian	Miles of Trail - Bike
1	0.2 (2.7%)	4.2 (56.0%)
2	0.6 (8.0%)	1.2 (16.0%)
3	3.2 (42.7%)	1.4 (18.7%)
4	3.5 (46.7%)	0.7 (9.3%)

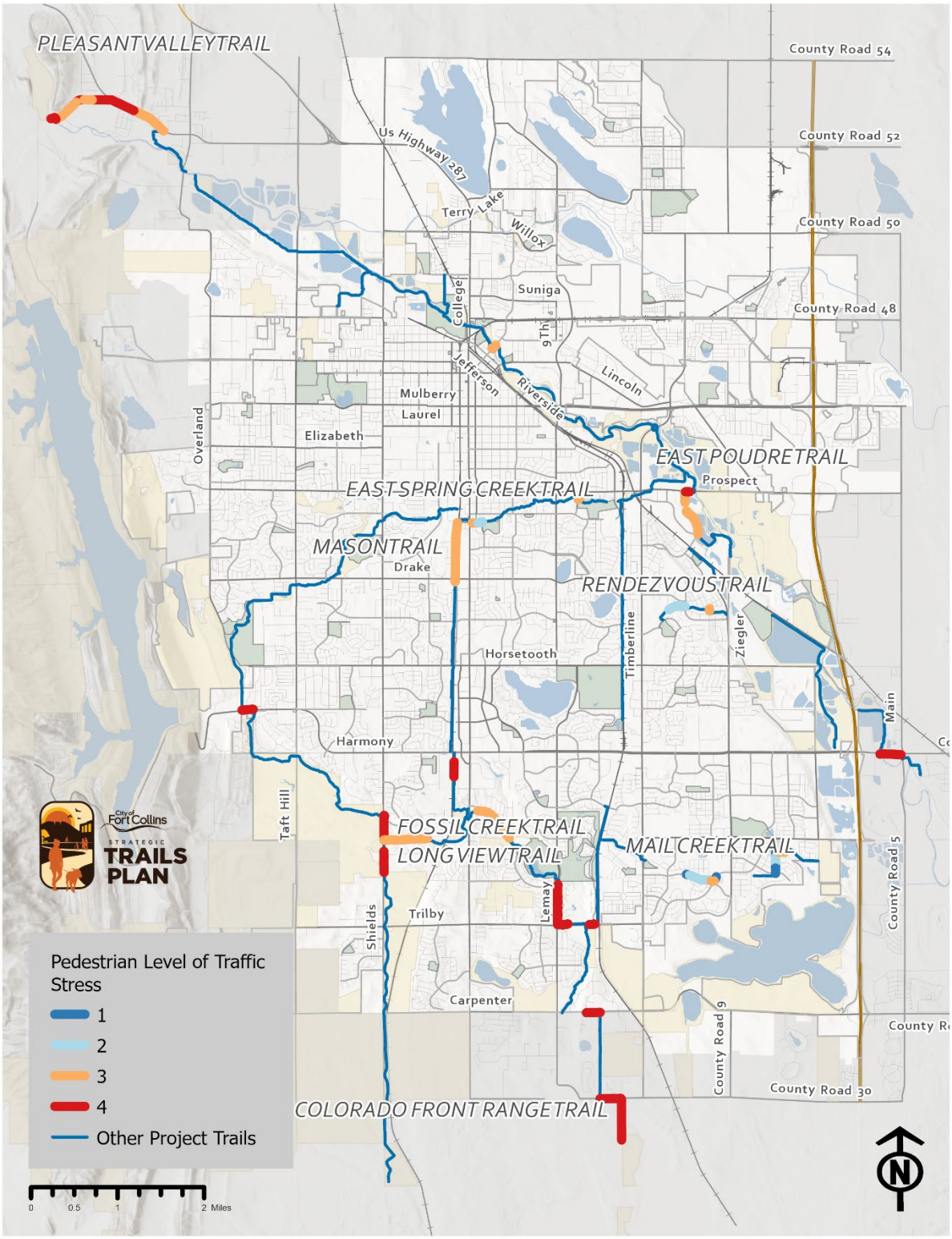


Figure 7: Pedestrian LTS Analysis Results

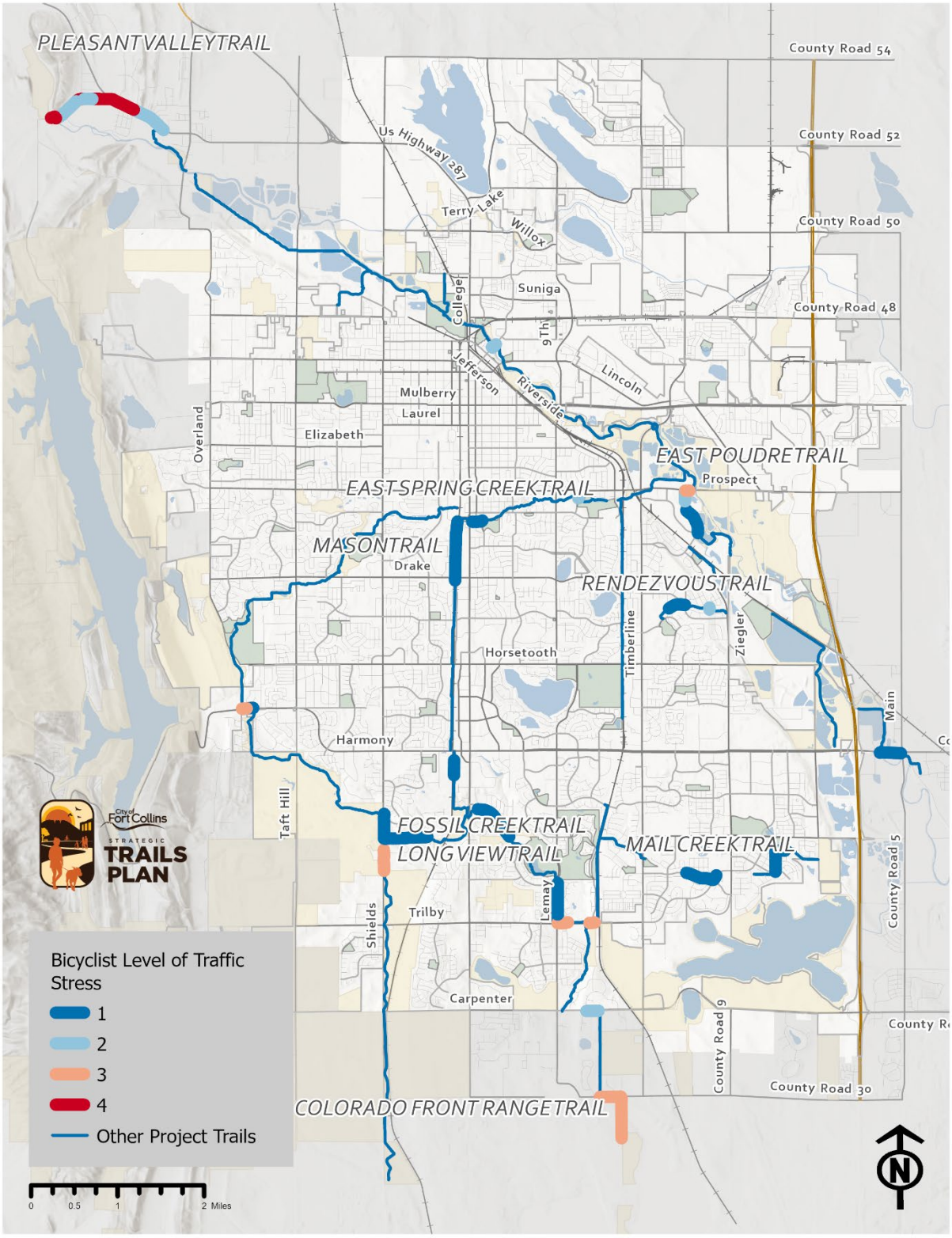


Figure 8: Bike LTS Analysis Results

Crash Activity at Trail Crossings

Of the 41.5 miles of paved trails included in the analysis, the trail crosses a roadway at grade at 58 locations. Fehr & Peers studied pedestrian and bicycle crash history at these trail crossings using eleven years of crash data (2012 through 2023) pulled from DiExSys. A subset of crashes involving pedestrians or bicyclists was spatially joined to the crossings, using a 250-foot search radius. Of the 58 locations where a trail intersects a road at-grade, only seven had a bike or pedestrian crash within 250 feet, with nine crashes total.

Based on crash reports, six of the nine crashes were omitted from further study because they were not related to the trail they were located near. The three remaining crashes all involved a bicyclist and resulted in injury.

Table 7: Bicycle and Pedestrian-Involved Crashes within 250 Feet of an At-Grade Trail Crossing, 2012 – 2023

Trail	Intersecting Road	Severity	Description	Relevant to Trail?
Mason Trail	W Harmony Road	Injury (B)	Car ran red light and hit cyclist in trail crosswalk.	Yes
Mason Trail	W Harmony Road	Fatal (K)	Pedestrian was lying in the road, not at a crosswalk, and was hit by a car.	No
Power Trail	E Drake Road	Injury (B)	Car ran red light and hit cyclist in trail crosswalk, potentially due to glare.	Yes
Power Trail	E Drake Road	Serious Injury (A)	Pedestrian on a scooter was hit while using a sidewalk/crosswalk.	No
West Poudre Trail	N Taft Hill Road	Serious Injury (A)	Bicyclist in bike lane veered into travel lane.	No
East Poudre Trail	Linden Street	Injury (B)	Cyclist in bike lane was hit by car backing out of parking space.	No
Fossil Creek Trail	Fossil Creek Drive	Injury (B)	Cyclist was hit in the crosswalk by a car that ran the stop sign.	Yes
Mason Trail	W Drake Road	Injury (B)	Car hit bike in the bike lane.	No
Fossil Creek Trail	Hawkeye Street	Serious Injury (A)	Pedestrian was hit by a car in the dark in a crosswalk	No - located in the Lemay Street trail gap

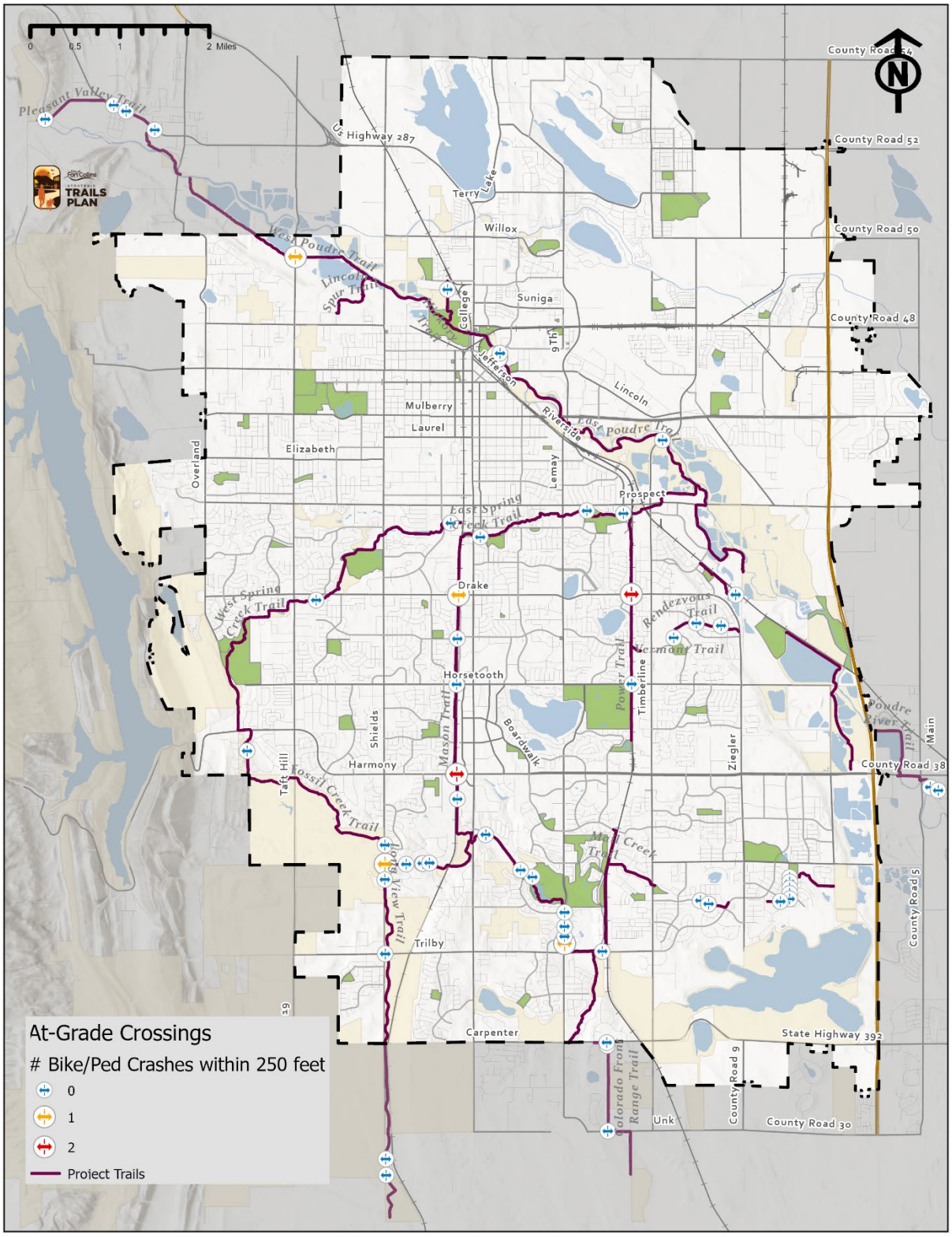


Figure 9: At-Grade Crossings with Nearby Bike or Pedestrian Crashes

All but one of these crashes occurred at a crossing with an arterial or collector. Table 3 below shows which trails have the most at-grade crossings, including a breakdown of crossings by functional classification.

Table 8: Number of At-Grade Crossings Along each Trail, by Roadway Functional Classification

Trail	Total At-Grade Crossings	Arterial Crossings	Collector Crossings	Guideway Crossings	Local Crossings
Colorado Front Range Trail	3	1			2
Dovetail Spur	1				1
East Poudre Trail	3	1	2		
East Spring Creek Trail	3		3		
Fossil Creek Trail	14		2		12
Hickory Trail	1				1
Mail Creek Trail	2				2
Mason Trail	5	3	1	1	
Pleasant Valley Trail	4				4
Poudre River Trail	3	1			2
Power Trail	3	2	1		
Rendezvous Trail	3		2		1
West Poudre Trail	1	1			
West Spring Creek Trail	2				2
Unnamed (Radiant Park area)	6		1		5

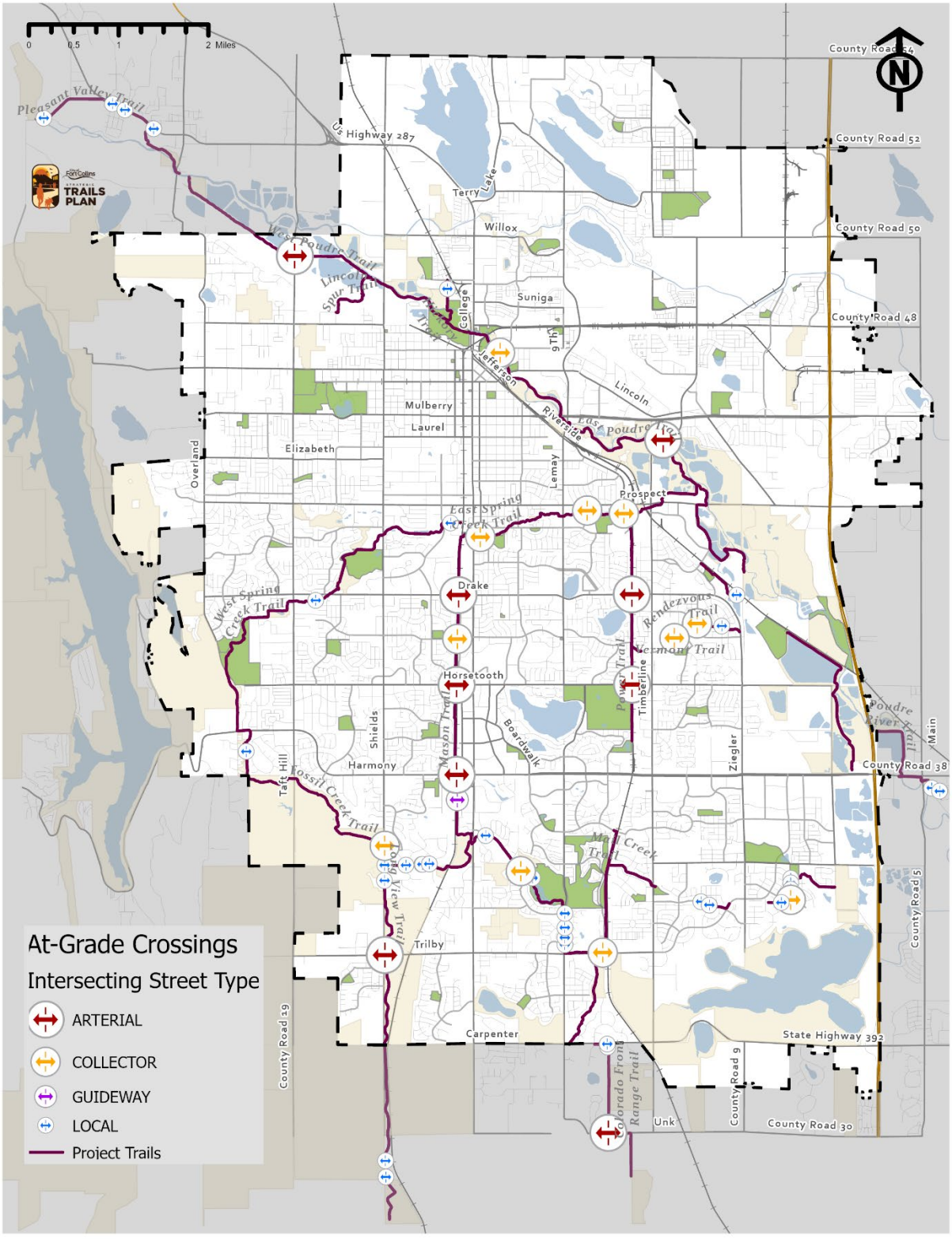


Figure 10: Functional Classifications of the Roadways Crossed at Grade by Project Trails

Recommended Trail Improvements

Analyzing the Level of Service (LOS) calculations, the crash history for at-grade crossing locations, and the Level of Traffic Stress for bicyclists and pedestrians at trail locations parallel to a roadway helped to identify some citywide trail recommendations and specific spot level recommendations in the areas of analysis. These recommendations are not exhaustive but help to frame potential investments at existing locations, some locations for consideration of grade separation, and help to define trail standards that will apply to future trails and existing trail improvements.

Centerline Striping Recommendation

The shared-use path LOS calculator incorporates presence of trail centerline as a factor in the calculation of LOS. Intuitively, it might make sense to include a centerline on all trails, but the LOS calculator shows that doing so may be a detriment to trail LOS if applied uniformly without considering context. Recommendations regarding centerline striping in Fort Collins are made in the Strategic Trails Plan Design Standards and Details. Future trail projects should consider and incorporate these centerline guidelines.

Trail Width

Trail width recommendations for new or updated trails are made in the Strategic Trails Plan Design Standards and Details. The updated details show a standard ten-foot width (eight-foot minimum) for trails with no gravel sidepath and a standard twelve-foot width (ten-foot minimum) for trails with a gravel sidepath. Trails with widths less than recommended standards are likely to have a lower Level of Service, especially with typical volume growth.

Some cases warrant a trail to be wider than the standard recommendation, such as:

- When a trail runs adjacent to a wall (10-foot minimum width, 12-foot width preferred)
- When a trail utilizes an overpass (12-foot minimum width, 14-foot width preferred)
- When a trail utilizes an underpass (14-foot minimum width)

Lowering Traffic Stress

Pedestrian Level of Traffic Stress (LTS)

The most stressful trail segments for pedestrians are along roadways with speed limits of 35 MPH or higher. Where possible, the city should move trails further from roadways with high speeds and provide additional landscaping or other vertical barriers to increase separation between pedestrians and vehicle traffic. In all cases where a trail lies within 15 feet of a roadway, pedestrians will benefit from high quality landscaping, such as regularly spaced trees or shrubs. This type of landscaping provides a physical barrier between pedestrians and vehicles, reduces traffic noise, and shades pedestrians. Recommendations to improve pedestrian LTS for areas that score LTS 3 or 4 are shown in Table 9.

Table 9: Recommendations to Improve Pedestrian LTS

Trail	Extent	LTS Score	Primary Issue	Recommendation
Fossil Creek Trail	Along Lemay from just north of Fossil Creek Parkway to Trilby and St. Thomas Drive	4	High vehicle speeds and volumes	Where possible, increase barriers between pedestrians and vehicles
Fossil Creek Trail	Fossil Creek Drive to Shields underpass	4	High vehicle speeds	Where possible, increase barriers between pedestrians and vehicles
Fossil Creek Trail	Shields to Pleasant Hill Lane	3	Limited buffer width with empty amenity zone	Consider adding vertical barrier such as fencing or bollards where buffer is narrowest
Fossil Creek Trail	Red Fox Road to County Road 38 underpass	4	High vehicle speeds	Where possible, increase barriers between pedestrians and vehicles
Fossil Creek Trail	Snead Drive to Mail Creek Lane	3	Empty amenity zone	Add trees or other landscaping to provide separation from vehicles and shade
Long View Trail	Midway Drive to Scenic Drive	4	High vehicle speeds	Where possible, increase barriers between pedestrians and vehicles
Colorado Front Range Trail	Vantage View Place to Golden Prairie Court	4	High vehicle speeds and volumes	Where possible, increase barriers between pedestrians and vehicles
Colorado Front Range Trail	County Road 30 crossing to County Road 11c crossing	4	High vehicle speeds with poor buffer	Where possible, increase barriers between pedestrians and vehicles
Pleasant Valley Trail	Cedar Court to Poudre River	4, 3	High vehicle speeds with poor buffer	Where possible, increase barriers between pedestrians and vehicles
Mason Trail	South Transit Center to County Road 38	4	High vehicle speeds	Where possible, increase barriers between pedestrians and vehicles
Mason Trail	Drake Road to Bay Road	3	No buffer	Add bollards to create a barrier between pedestrians and vehicles
Power Trail	Fossil Creek to Southridge Greens Boulevard	4	High vehicle speeds	Where possible, increase barriers between pedestrians and vehicles
Poudre River Trail	Harmony Road underpass to County Road 5	4	High vehicle speeds and volumes with poor buffer	Add bollards to create a barrier between pedestrians and vehicles
East Poudre Trail	Half block east of Sharp Point Drive	4	High vehicle speeds with poor buffer	Where possible, increase barriers between pedestrians and vehicles
East Poudre Trail	Prospect Road to Midpoint Drive	3	Limited buffer width with empty amenity zone	Consider adding vertical barrier such as fencing or bollards where buffer is narrowest
East Poudre Trail	Linden Street bridge over Poudre River	3	No buffer and narrow trail	Move trail under Linden with future GS crossing

Trail	Extent	LTS Score	Primary Issue	Recommendation
East Spring Creek Trail	Welch Street bridge over Spring Creek	3	No buffer and narrow trail	Widen trail when bridge is rebuilt in future
East Spring Creek Trail	Remington Street to College Avenue	3	Narrow trail with parking buffer	Widen trail and move away from parking lane
Mail Creek Trail	Trilby Road and Zephyr Road	3	Empty amenity zone	Add planters or other barriers between cars and pedestrians
Rendezvous Trail	Chase Drive bridge over Foothills Channel	3	No buffer	Consider adding pedestrian trail over channel
Unnamed Trail at Radiant Park	Radiant Park along Muskrat Creek Drive	3	No buffer	Reroute trail behind existing trees

Bike Level of Traffic Stress (LTS)

All trail segments with an LTS 3 or 4 score would benefit from an improved barrier between the trail and vehicle traffic. The Pleasant Valley Trail (northwest extension of the Poudre River Trail) along W County Road 54G and Rist Canyon Road has the greatest need for improvement. Much of the trail here is separated from 35+ MPH traffic by paint only. Adding bollards or cement barriers to protect cyclists here would significantly increase comfort and reduce traffic stress. Additional recommendations for segments with LTS 3 or 4 are provided in Table 10.

Table 10: Recommendations to Improve Bike LTS

Trail	Extent	LTS Score	Primary Problem	Recommendation
Pleasant Valley Trail	McConnell Drive to the Poudre River	4	No buffer or barrier between cyclists and vehicles	Add bollards or other physical barrier separating cyclists from car traffic
Long View Trail	Midway Drive to Fossil Creek Drive	3	No vertical barrier between cyclists and vehicles	Provide vertical barrier through landscaping or bollards
Fossil Creek Trail	Lemay Avenue & Trilby Road intersection to Saint Thomas Drive	3	No vertical barrier between cyclists and vehicles	Provide vertical barrier through landscaping or bollards
Fossil Creek Trail	Red Fox Road to Highlands West Drive	3	No vertical barrier between cyclists and vehicles	Provide vertical barrier through landscaping or bollards
Power Trail	Fossil Creek to Southridge Greens Boulevard	3	No vertical barrier between cyclists and vehicles	Provide vertical barrier through landscaping or bollards
Colorado Front Range Trail	County Road 30 crossing to County Road 11c crossing	3	No vertical barrier between cyclists and vehicles	Provide vertical barrier through landscaping or bollards

East Poudre Trail	Half block east of Sharp Point Drive	3	No vertical barrier between cyclists and vehicles	Provide vertical barrier through landscaping or bollards

At-Grade Crossing Improvements

The three trail intersections that saw pedestrian or bicycle crashes during 2012-2023 were:

- Mason Trail at Harmony Road
- Power Trail at East Drake Road
- Fossil Creek Trail at Fossil Creek Drive

These intersections represent two high-risk intersection types that should be improved proactively for pedestrian and bicycle safety, in addition to the necessary improvements at these three intersections specifically.

Mason Trail at Harmony Road and Power Trail at East Drake Road are four-leg intersections that involve a major road, a trail crossing, a railroad crossing, and in some cases also a minor road parallel to the trail and railroad. The intersection of the Mason Trail and Harmony Road is shown in Figure 11 as an example.

Figure 11: Intersection of Mason Trail & Harmony Road

This type of intersection is seen in many locations along the Power Trail and Mason Trail, and many of these instances are already signalized. Recommendations to improve these intersections include:

- Aligning the trail such that it travels directly across the road instead of approaching at different locations on either side of the major road
- Installing an RRFB or HAWK, as warranted
- Installing advance warning signage and striping about the presence of the trail
- Introducing a grade-separated trail crossing

Fossil Creek Trail at Fossil Creek Drive, shown in Figure 12, is a three-leg intersection where the trail crosses the minor road, which is a stop-controlled approach.

Figure 12: Intersection of Fossil Creek Trail and Fossil Creek Drive

This can be a safety concern for trail users because they have the right-of-way but are not always noticed by drivers. Trail users have a point of conflict with both vehicles turning onto the minor road and vehicles coming to a stop on the minor road approach, who may stop on the trail crossing instead of behind it. Recommendations to improve these intersections include:

- Installing advance warning signage and striping about the presence of the trail for vehicles turning onto the minor road
- Moving the trail alignment such that the crossing is further away from the intersection on the minor road
- Installing an RRFB facing the minor approach and the major approach turning lanes, as warranted
- Reducing the curb radius of the right turn onto the minor road such that vehicles slow down as they approach the turn

- Signalizing the intersection, as warranted
- Introducing a grade-separated trail crossing

Service Improvements

Spring Creek Trail

The Spring Creek Trail has several segments that do not meet City standards for trail width and sees some of the highest volumes in Fort Collins. At a minimum, the trail should be widened to be at least ten feet wide throughout the trail corridor, but further widening is necessary to accommodate the current and future volumes comfortably. The LOS Calculator shows that some segments would have to be widened to up to 18 feet to achieve an LOS score of A, so any widening that is feasible is recommended. Although a centerline can improve safety, the volumes are low enough on the Spring Creek Trail to consider removing the centerline to further improve LOS, except at constrained locations specifically mentioned in the proposed trail standards updates.

The most constrained segments of the Spring Creek Trail are west of Lilac Park and Edora Park where the trail width is only eight feet. Further trail widening near junctions in these areas could help improve the flow of traffic along the trail, such as near underpasses and park trails or sidewalks.

Poudre Trail

The Poudre Trail generally meets City standard trail widths but sees very high user volumes, especially near Lee Martinez Park. The LOS Calculator shows that trail segments need to be widened to 16-18 feet to achieve an LOS score of A. Additionally, there are many trail junctions in and near the park, creating opportunities to improve the trail by widening specifically at trail junctions in addition to throughout the corridor. These sections do not currently have centerlines, and it is recommended to maintain the Poudre Trail without a centerline except at constrained locations specifically mentioned in the proposed trail standards updates.