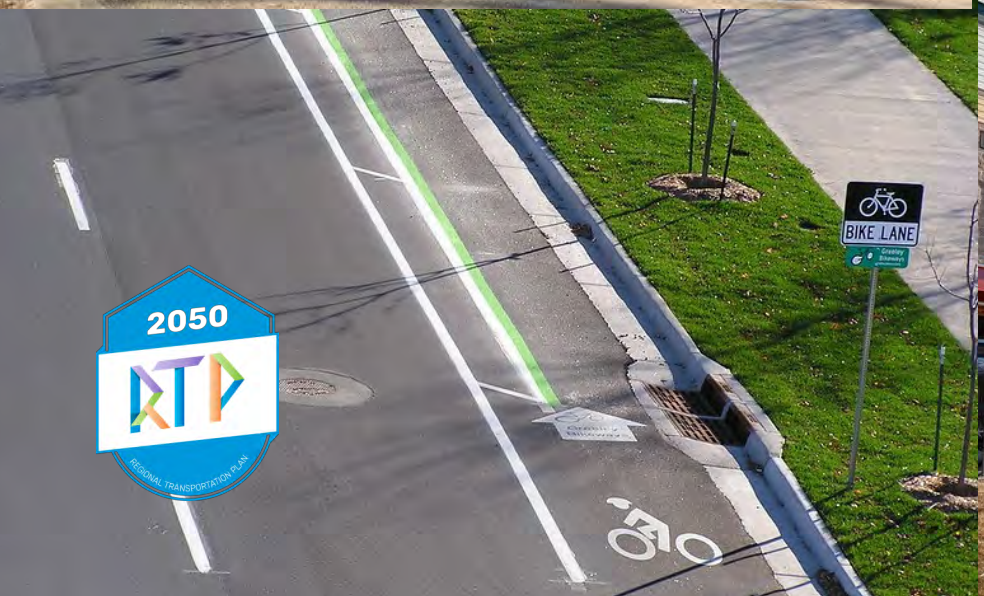
North Front Range
Metropolitan
Planning
Organization

2023

Congestion Management Process



North Front Range Metropolitan Planning Organization

2023 Congestion Management Process

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Introduction

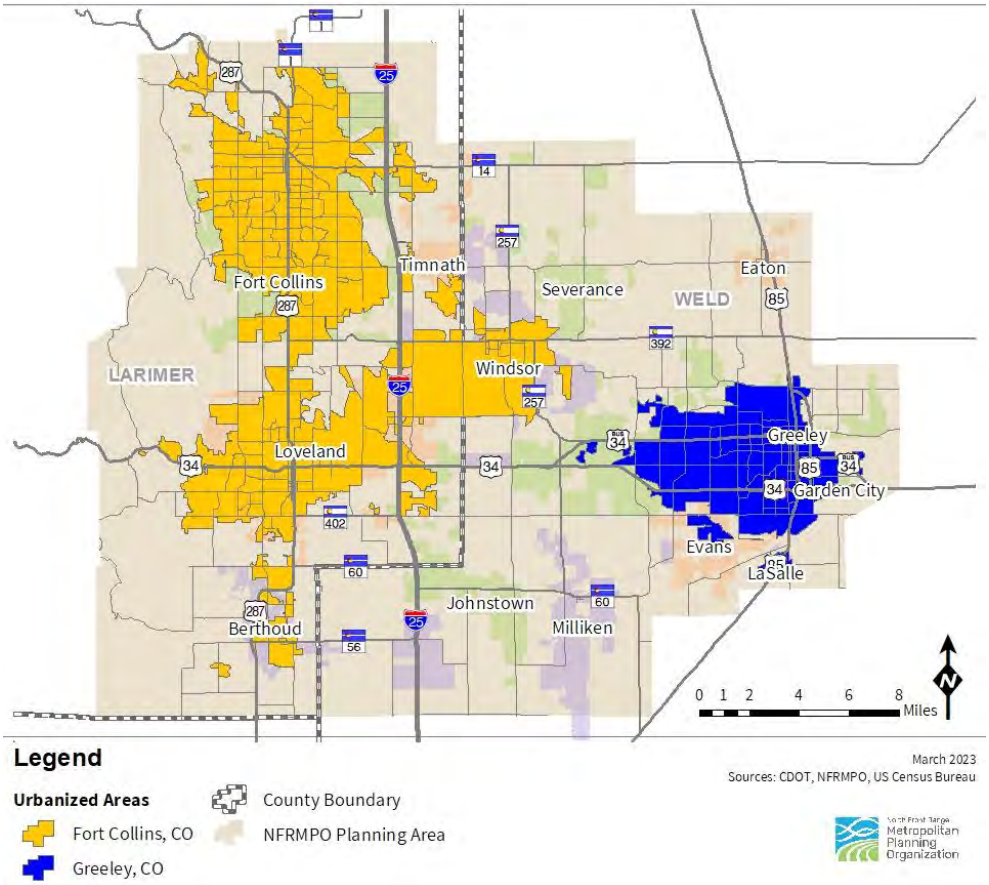
1.1 Purpose

The 2023 Congestion Management Process (CMP) replaces the 2019 CMP and builds on other NFRMPO plans and programs to manage congestion by providing accurate, up-to-date information on transportation system performance. The purpose of the CMP is to assess alternative strategies for congestion management that meet local, regional, and State needs. These strategies are analyzed using objective criteria and existing data.

Congestion management should be addressed in the NFRMPO's federally mandated transportation planning process and result in a safe and effective multimodal transportation system. Strategies laid out in the 2023 CMP apply to new and existing transportation corridors eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53. Funding programs include Surface Transportation Block Grants (STBG), Congestion Mitigation and Air Quality (CMAQ), and Transportation Alternatives (TA), as well as transit funding programs.

CMPs are required for Transportation Management Areas (TMA), which are urban areas (UA) with populations of 200,000 or more as shown in **Figure 1**. The NFRMPO contains two UAs, one of which is considered a TMA: the Fort Collins TMA includes portions of Berthoud, Fort Collins, Johnstown, Loveland, Timnath, and Windsor; and the Greeley UA includes portions of Evans, Garden City, Greeley, and LaSalle. The 2023 CMP applies to the entire NFRMPO planning area.

Figure 1: NFRMPO Urban Areas



The 2023 CMP performance measures and strategies are incorporated into the 2050 Regional Transportation Plan (RTP), the Transportation Improvement Program (TIP), and other NFRMPO plans and programs.

In addition to federal mandates, the 2023 CMP can assist the NFRMPO in addressing other priorities tangentially related to congestion, including:

- Utilizing limited transportation funding, meaning the NFRMPO must be smart and efficient with which projects are funded;
- Transportation safety, including improving opportunities for walking, biking, and rolling; and
- Meeting greenhouse gas emissions reductions and air quality requirements.

1.2 Structure

The 2023 CMP incorporates the structure laid out in 23 CFR § 450.322:

- **Methods** to monitor and evaluate the performance of the multimodal transportation system, identify the underlying causes of recurring and non-recurring congestion, identify and evaluate alternative strategies, provide information supporting the implementation of actions, and evaluate the effectiveness of implemented actions;
- **Objectives** and appropriate performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods;
- **Monitoring** system performance and data collection to define the extent and duration of congestion, to contribute in determining the causes of congestion, and evaluate the efficiency and effectiveness of implemented actions;
- **Evaluation** of the anticipated performance and expected benefits of appropriate congestion management strategies that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures;
- **Implementation** schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation; and
- **Assessment** of the effectiveness of implemented strategies, in terms of the area's established performance measures. The results of this evaluation shall be provided to decision makers and the public to provide guidance on selection of effective strategies for future implementation.

1.3 Plan Integration

The strategies identified within the 2023 CMP address congestion but do not prescribe specific projects for congested corridors. As a living document, the CMP both influences and is influenced by the RTP and TIP. **Table 1** shows the CMP steps laid out in federal guidance and the related plans and programs implementing the federal guidance.

Table 1: CMP Federal Guidance and NFRMPO Implementation

Federal Guidance	NFRMPO Implementation or Source
Develop Regional Objectives	2050 RTP Goals, Objectives, Performance Measures, and Targets (GOPMT)
Define CMP Network	Congested Regionally Significant Corridors
Develop Multimodal Performance Measures	2023 CMP and congestion-related measures from the 2050 RTP Performance Measures
Collect Data / Monitor System Performance	NPMRDS, INRIX, Regional Travel Demand Model (RTDM), Trail Counter Program, Transit Travel Surveys
Analyze Congestion Problems and Needs	2023 CMP, Periodic CMP Report
Identify and Assess CMP Strategies	Calls for Projects: ITS, TDM, TSM, Active Transportation, Transit, Capacity
Program and Implement CMP Strategies	RTP and TIP Development
Evaluate Strategy Effectiveness	Periodic CMP Report

Regional Transportation Plan

Performance measures are developed simultaneously for the long-range plan and for the CMP. This parallel effort ensures congestion is considered in project selection for the long-range plan. The Regional Corridors (Regionally Significant Corridors [RSCs], Regional Transit Corridors [RTCs], and Regional Active Transportation Corridors [RATCs]) were updated as part of the 2050 RTP. These corridors focus limited capacity on corridors serving activity centers and major destinations.

Transportation Improvement Program (TIP)

Biennially, the NFRMPO holds a Call for Projects for federal funds controlled by the agency, including STBG, CMAQ, TA, and Carbon Reduction Program (CRP). The NFRMPO also programs projects using the State-funded Multimodal Transportation & Mitigation Options Funds (MMOF). One of the major functions of the CMP in the NFRMPO is to guide the project selection process for the TIP. As federally required, any project proposed for inclusion in the TIP that adds general-purpose lanes must demonstrate demand and operational management strategies are insufficient to satisfy the need for additional capacity unless the project addresses an established bottleneck or is a safety improvement. If a roadway expansion project is deemed necessary, the CMP must identify all regional demand and operational management strategies to maintain the functional integrity and safety of the project into the future.

1.4 Changes since 2019 CMP

Senate Bill (SB) 21-260 required CDOT to establish the Greenhouse Gas (GHG) Pollution Reduction Planning Standard (GHG Planning Standard)[2]. The GHG Planning Standard requires the State's five Metropolitan Planning Organizations (MPO) to achieve individually set GHG reduction levels at four different time periods – 2025, 2030, 2040, and 2050. The NFRMPO uses its Regional Travel Demand Model to forecast the travel impacts of the RTP and uses the EPA's Motor Vehicle Emission Simulator (MOVES) to analyze emissions based on vehicle miles traveled and speed. The NFRMPO can elect to change the mix of projects in the RTP and/or use GHG Mitigation Measures to achieve compliance. GHG Mitigation Measures are projects and strategies whose GHG and travel benefits cannot be accurately or easily captured and quantified in travel demand models. CMP strategies, like Transportation Demand Management and additional transit and bicycle and pedestrian infrastructure, parallel the types of mitigation measures that can help the NFRMPO achieve its GHG reductions.

1.5 Public Outreach and Coordination

The 2023 CMP is based on feedback from the NFRMPO's Technical Advisory Committee (TAC), Community Advisory Committee (CAC), and the NFRMPO Planning Council. TAC provided feedback and guidance regarding congestion performance measures, congestion-mitigating strategies, selection criteria for identifying congested corridors, and recommendations for congested segments.

In addition, NFRMPO staff integrated guidance from parallel plans and programs. For example, strategies were influenced by feedback from the 2050 RTP Corridor Vision exercise. The 2023 CMP relied on information from community-adopted plans and programs and from projects programmed in the TIP. These plans, programs, and projects were all approved following extensive local outreach.

1.6 Review and Update Process

The CMP is updated every four years in line with the RTP. In the interim, the NFRMPO provides updates and incorporates the CMP into its work.

A periodic CMP performance report will be published to monitor the implemented strategies in terms of the performance measures identified in the 2023 CMP. The performance report will identify effective strategies for congestion management, enabling the region to strategically improve system performance.

The NFRMPO approved an updated Goals, Objectives, Performance Measures, and Targets (GOPMT) framework on April 6, 2023. The GOPMT translates the National Goals the NFRMPO must address into focus areas then organizes the federally required and regionally defined performance measures and targets.

[2] GHG Transportation Planning Standard: https://www.codot.gov/programs/environmental/greenhousegas. Accessed February 24, 2023.

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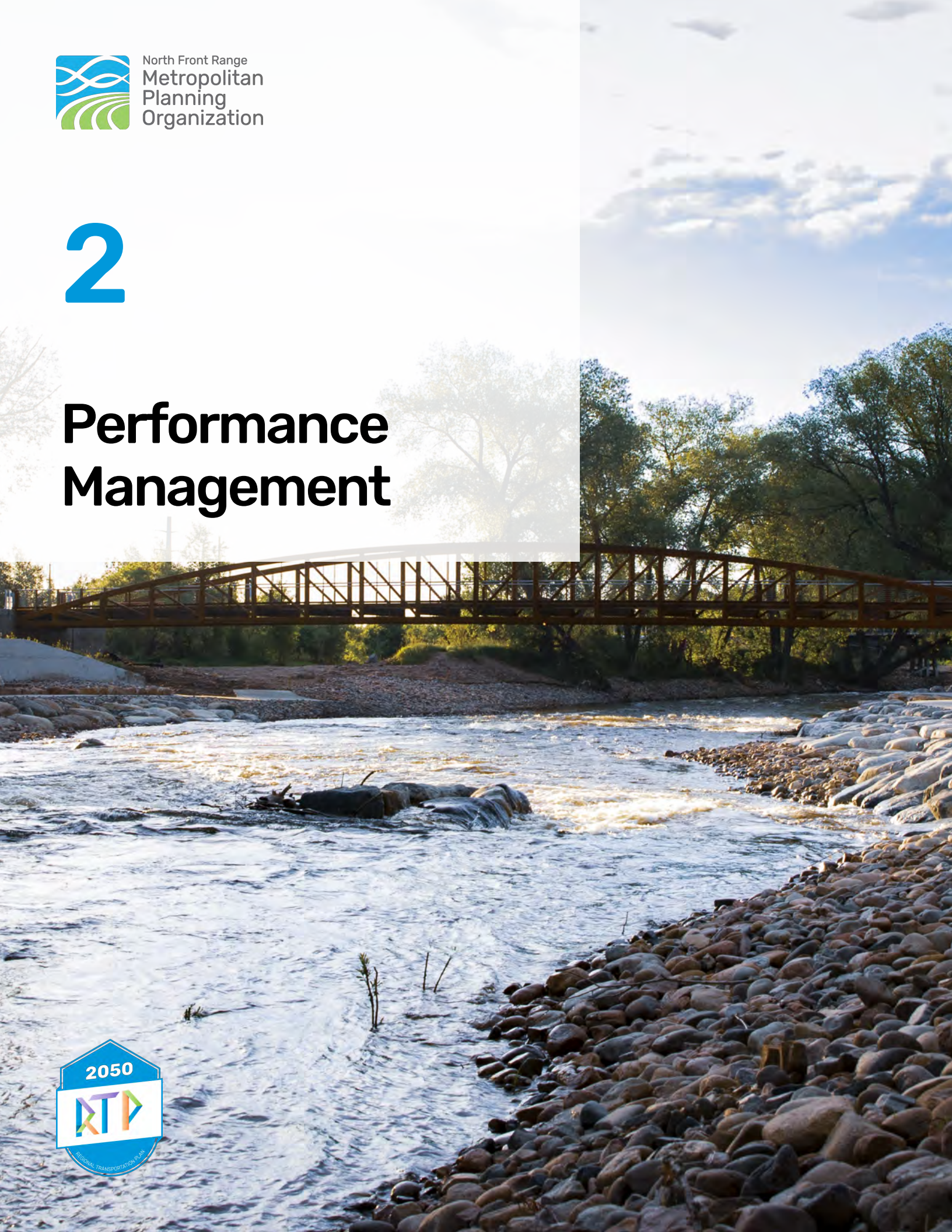
Performance Management



2.1 National Goals

National goals are established in 23 USC 150 §150[3] to focus the Federal-aid highway program as shown in **Table 2**. These national goals are tied directly to the shift toward performance-based planning. These national goals direct the NFRMPO's overall work.

Table 2: National Goals

Goal	Description
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
Infrastructure Condition	To maintain the highway infrastructure asset system in a state of good repair.
Congestion Reduction	To achieve a significant reduction in congestion on the National Highway System.
System Reliability	To improve the efficiency of the surface transportation system.
Freight movement and Economic Vitality	To improve the National Highway Freight Network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
Environmental Sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment.
Reduced project delivery delays	To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices

2.2 2050 RTP Goals and Performance Measures

Building on the national goals, the NFRMPO worked with the local transit agencies, Technical Advisory Committee (TAC), NoCo Bike & Pedestrian Collaborative, Planning Council, and the Community Advisory Committee (CAC) to update goals and performance measures for the 2050 RTP. The Goals and Performance Measures consist of national air quality, infrastructure condition, system performance, transit asset management, and transit safety performance measures, and regionally established performance measures. Many of these performance measures are directly related to congestion. **Table 3** describes the goals, performance areas, and whether they impact or are impacted by congestion.

[3] 23 USC 150 §150. Accessed 3/31/23.

Table 3: NFRMPO Goals, Performance Measures, and Congestion Impact

Goal	Performance Measure	Congestion Impact
Regional Health Improve economic development, residents' quality of life, and air quality	CMAQ Emissions Reductions	✓
	Non-Single Occupancy Vehicle (SOV) Travel	✓
	Peak Hour Excessive Delay (PHED)	✓
	Percent of Non-SOV Commuter Trips	✓
	Daily Vehicle Miles Traveled (VMT) per Capita	✓
Mobility Move people and goods safely, efficiently, and reliably on a continuous transportation system	Number of Fatal Crashes	✓
	Rate of Fatalities per 100M VMT	✓
	Number of Serious Injury Crashes	✓
	Rate of Serious Injuries per 100M VMT	✓
	Number of Non-Motorized Fatalities and Serious Injury Crashes	✓
	Percent of Interstate pavement in Good Condition	
	Percent of Interstate pavement in Poor Condition	
	Percent of Non-Interstate pavement in Good Condition	
	Percent of Non-Interstate pavement in Poor Condition	
	Percent of NHS bridges in Good Condition	
	Percent of NHS bridges in Poor Condition	
	Peak Hour Excessive Delay (PHED)	✓
	Truck Travel Time Reliability	✓
	Total Transit Fatalities	
	Transit Fatality Rate (per 100,000 Vehicle Revenue Miles (VRM)	
	Total Transit Injuries	
	Transit Injury Rate (per 100,000 VRM)	
	Total Transit Safety Events	
	Transit Safety Event Rate (per 100,000 VRM)	
	Transit System Reliability/Major Mechanical Failures (VRM/Failures)	
	Travel Time Index on RSCs	✓

Goal	Performance Measure	Congestion Impact
Multimodal Improve accessibility of and access to transit and alternative modes of transportation	Population served by paratransit	
	Fixed-route Revenue Hours per Capita within Service Areas	✓
	Non-Motorized Facility Miles	✓
	Daily VMT per Capita	✓
Operations Optimize operations, planning, and funding of transportation facilities	Percent Revenue Transit Vehicles Meeting or Exceeding Useful Life Benchmark	
	Percent Service Transit Vehicles Meeting or Exceeding Useful Life Benchmark	
	Percent Passenger and Maintenance Transit Facilities Rated Below Condition 3	
	Travel Time Reliability	✓
	PHED	✓
	Project Delivery	
	Devices Connected by Fiber	✓
	Travel Time Index on RSCs	✓

2.3 2023 CMP Objectives

The objectives of the 2023 CMP build from the goals in the 2050 RTP. The objectives highlight the need to achieve multiple outcomes simultaneously with a constrained set of financial resources. The following objectives guide the 2023 CMP:

- Optimize the transportation system;
- Reduce congestion;
- Improve travel time reliability;
- Increase the availability of viable travel options;
- Enhance transportation equity; and
- Improve safety.

2.4 2023 CMP Performance Measures

In most cases, the congestion-related performance measures established for the 2050 RTP carry over to the 2023 CMP; however, in some cases alternative performance measures were developed. **Table 4** establishes and describes the 2023 CMP-specific performance measures. These performance measures are explored further in **Chapter 3**.

Table 4: 2023 CMP Performance Measures

Performance Measure	Description
Travel Time Index	Ratio of average peak travel time to an off-peak (free-flow) standard. A value of 1.5 indicates that the average peak travel time is 50% longer than off-peak travel times.
VMT per Capita	Miles traveled by vehicles in a specified region over a specified time period. Calculated per person for all trips.
Travel Time Reliability	Measures non-recurring delay for all vehicles by comparing the 80th percentile travel time to the median (50th percentile) travel time. A value of 1.5 or higher indicates the segment is not reliable. A corridor may be congested, but reliable if the congestion is consistent.
Truck Travel Time Reliability	Measures non-recurring delay for trucks by comparing the 95th percentile travel time to the median (50th percentile) travel time. A value of 1.5 or higher is considered unreliable.
Number of Crashes	The number of collisions involving one or more vehicles.
Transit Ridership per Capita	The number of unlinked trips per resident within each provider's service area. Measuring per capita helps account for population growth.
Percent of non-single occupant vehicle commuter trips	Percent of all commute trips completed by any mode other than SOV, including by transit, bicycle, walking, or carpooling.
Percent of devices connected by fiber on RSCs	Percent of devices connected with fiber-optic cables used for transportation management purposes.
Peak Hour Excessive Delay on NHS in Fort Collins UA	Annual hours of excessively delayed travel per capita, with excessive delay defined as travel time at 20 miles per hour or 60% of the posted speed limit travel time, whichever is greater, between 6 a.m. and 10 a.m. and 3 p.m. to 7 p.m. weighted by vehicle volumes and occupancy.

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Measuring Congestion

2050 RTP
REGIONAL TRANSPORTATION PLAN

3.1 Defining Congestion

The Federal Highway Administration (FHWA) has acknowledged congestion as a priority to address. FHWA recognizes congestion as an excess of vehicles on a portion of roadway at a particular time resulting in speeds that are slower than normal or "free flow" speeds.[4] FHWA further explains congestion often means stopped or stop-and-go traffic.

Congestion can be recurring or non-recurring. Recurring congestion often occurs during peak travel periods because the number of vehicles exceeds available capacity.[5] Non-recurring congestion is a temporary disruption that reduces capacity, including traffic incidents, work zones, weather, and special events.[6]

Freight can be impacted by highway-based congestion, as well as on railroads, airports, and ports. The NFRMPO's purview is focused on roadways, meaning highway-based freight congestion is a key consideration in the CMP. In 2015, 204.1M tons of goods were moved by trucks in Colorado, accounting for 77 percent of total tonnage.[7]

Transit congestion refers to how crowded buses, park-n-rides, and other transit facilities are in the region. Overcrowding has lessened overall as an issue because of the pandemic, but transit on-time performance and reliability can be impacted by overall roadway congestion. In addition, the attractiveness of transit as an alternative to driving alone is directly related to the perception of on-time performance, speed, and reliability of the service.

3.2 Data Sources

The primary sources of data used in the 2023 CMP include:

- INRIX generates real-time traffic speeds and travel times across the nation's key roadways using location and movement data anonymously provided by millions of connected vehicles, trucks, and mobile devices.
- National Performance Management Research Dataset (NPMRDS) uses INRIX and other data sources to generate speed and travel time data aggregated in 5-minute, 15-minute, or 1-hour increments.
- The Regional Travel Demand Model (RTDM) estimates travel patterns based on trip generation, trip distribution, mode choice, and route assignment, otherwise known as the Four Step Model. The RTDM estimates traffic volumes and potential reliability issues based on current data, trends, and socioeconomic data.

[4] Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation. https://ops.fhwa.dot.gov/congestion_report/chapter2.htm. (Accessed 2/24/2023)
[5] Reducing Recurring Congestion. https://ops.fhwa.dot.gov/program_areas/reduce-recur-cong.htm. (Accessed 2/24/2023).
[6] Reducing Non-Recurring Congestion. https://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm. (Accessed 2/24/2023).
[7] Colorado Freight Plan. https://freight.colorado.gov/sites/freight/files/documents/Colorado-Freight-Plan.pdf. (Accessed 3/6/2023)

- Local input from communities, transit agencies, and other stakeholders informs the NFRMPO about on-the-ground issues that may not show up in other data sources.

3.3 Transportation System

The NFRMPO has identified key roadways, called Regionally Significant Corridors (RSCs), which cross the region and connect major activity centers. These RSCs are evaluated prior to each long-range plan to ensure they are still priorities and include:

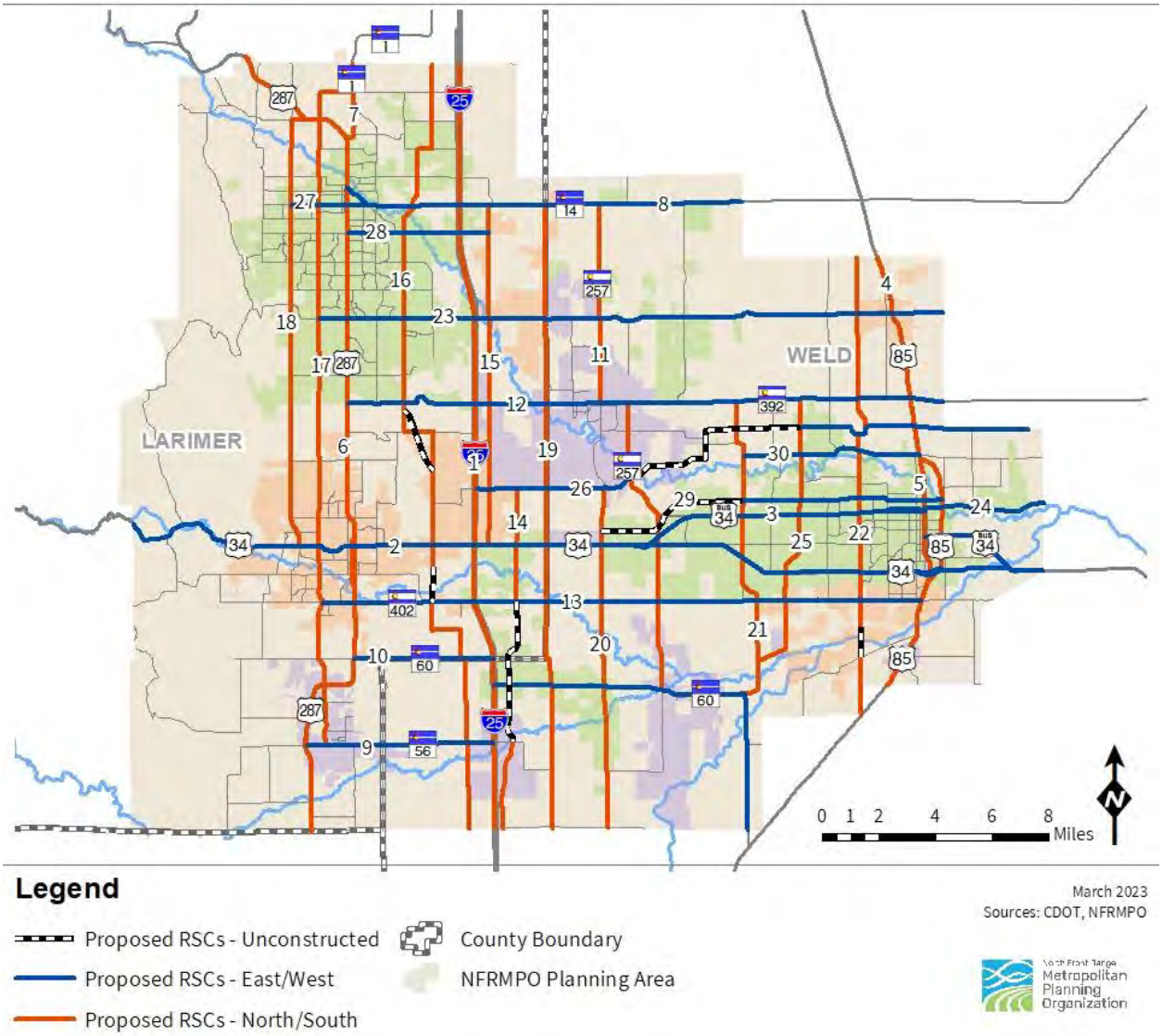
- All interstates, US highways, and State highways
- Corridors that meet the following criteria:
    - Federal-aid eligible roadways;
    - Roadways that go through more than one governmental jurisdiction or connect to an activity center by 2050;
    - Segments of roadways that do not yet exist or are not currently federal-aid eligible but have improvements planned by 2050; and
    - Roadways that serve regional traffic as determined by local knowledge.

The NFRMPO's Planning Council adopted the RSCs for the 2050 RTP on July 7, 2022. These RSCs are described in **Table 5** and shown in **Figure 2**.

Table 5: 2050 RTP Regionally Significant Corridors

#	Corridor	From (North/West)	To (South/East)
1	I-25	Northern MPO Boundary	Southern MPO Boundary
2	US34	Western MPO Boundary	Eastern MPO Boundary
3	US34 Business Route	US34 MP102	US34 MP 115.5
4	US85	WCR70	WCR48
5	US85 Business Route	US85	US34
6	US287	Northern MPO Boundary	Southern MPO Boundary
7	SH1	Northern MPO Boundary	US287
8	SH14	US287	Eastern MPO Boundary
9	SH56	US287	RSC14
10	SH60	US287	Southern MPO Boundary
11	SH257	SH14	SH60
12	SH 392	US287	US85
13	SH402 / Freedom Parkway	LCR17	US85
14	LCR3 / WCR9.5	Crossroads Boulevard	Southern MPO Boundary
15	LCR 5	SH14	US34
16	LCR7 / LCR 9 / Timberline Road	Northern MPO Boundary	Southern MPO Boundary
17	LCR17 / Shields Street / Taft Avenue / Berthoud Parkway	US287	SH56
18	LCR 19 / Taft Hill Road / Wilson Avenue	US287	US34
19	WCR13	SH14	Southern MPO Boundary
20	WCR17	Crossroads Boulevard	Southern MPO Boundary
21	WCR 27 / 83rd Avenue / Two Rivers Parkway	SH14	SH60
22	WCR35 / 35th Avenue	Northern MPO Boundary	US85
23	WCR 74 / Harmony Road	LCR17	Eastern MPO Boundary
24	8th Street	US85	Eastern MPO Boundary
25	59th Avenue / 65th Avenue	SH392	Two Rivers Parkway
26	Crossroads Boulevard / WCR66	I-25	Weld County Parkway
27	Mulberry Street	LCR19	Riverside Avenue
28	Prospect Road	US287	LCR5
29	4th Street	WCR17	US85
30	O Street	83rd Avenue	US85

Figure 2: 2050 RTP Regionally Significant Corridors Map



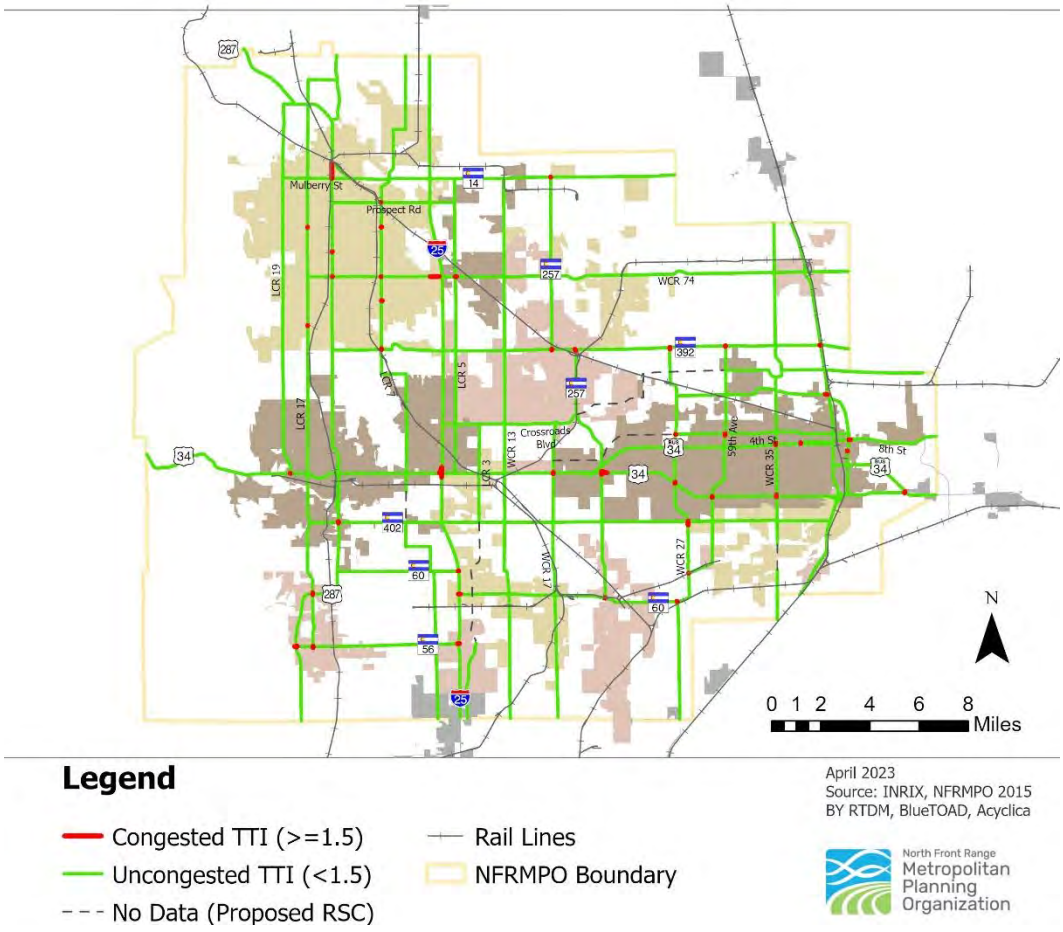
3.4 Measuring Congestion

Travel Time Index (TTI)

TTI measures recurring congestion and is defined as the ratio of the travel time during the peak period to the time required to make the same trip at free-flow speeds. For example, a value of 1.5 indicates a 20-minute free-flow trip requires 30 minutes during the peak period.[8] Typically, roadways with a TTI greater than or equal to 1.5 are considered congested.

Figure 3 highlights the TTI for 2022, which shows much of the network experienced free-flow or near free-flow conditions. Peak period travel times are averaged for all weekdays within the calendar year and represent congested speeds over a two-to-three-hour timeframe. This analysis, therefore, does not identify congestion that occurs for shorter timeframes or does not occur regularly. TTI in 2022 was accessed from the INRIX dataset, the NFRMPO 2015 Regional Travel Demand Model (RTDM), and local travel time datasets such as BlueTOAD and Acyclica. Overall, 0.6 percent of the RSC network was congested in 2022.

Figure 3: 2022 Travel Time Index (TTI)



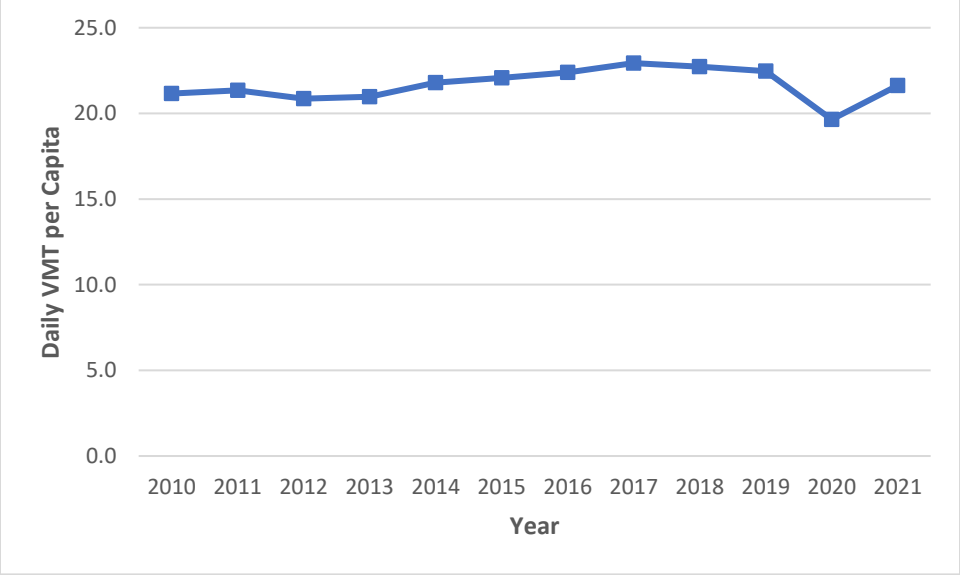
[8] Glossary of Mobility-Related Terms. Texas A&M Transportation Institute. Urban Mobility Information. http://mobility.tamu.edu/ums/media-information/glossary/. Accessed 3/21/19.

Vehicle Miles Traveled (VMT) per Capita

VMT is the number of miles traveled by vehicles within a specified region, during a specified time period. Modeling VMT requires estimates of trip origin and destination. A reduction in VMT provides environmental benefits through reduced emissions, fuel usage, roadway wear, and vehicle wear. Land use planning principles, such as infill development or mixed-use development can be used to help reduce VMT per capita.

According to VMT estimates from the 2015 Regional Travel Demand Model (RTDM), annual VMT estimates on state highways produced by CDOT, and population estimates from the Colorado State Demography Office, daily VMT per capita within the North Front Range peaked in 2017 at 22.9 miles per capita per day, as shown in **Figure 4**. In 2021, VMT per capita rebounded to 21.6 miles per capita per day, similar to VMT levels observed in the early 2010s.

Figure 4: Daily Vehicle Miles Traveled (VMT) per Capita



Travel Time Reliability (TTR) Index

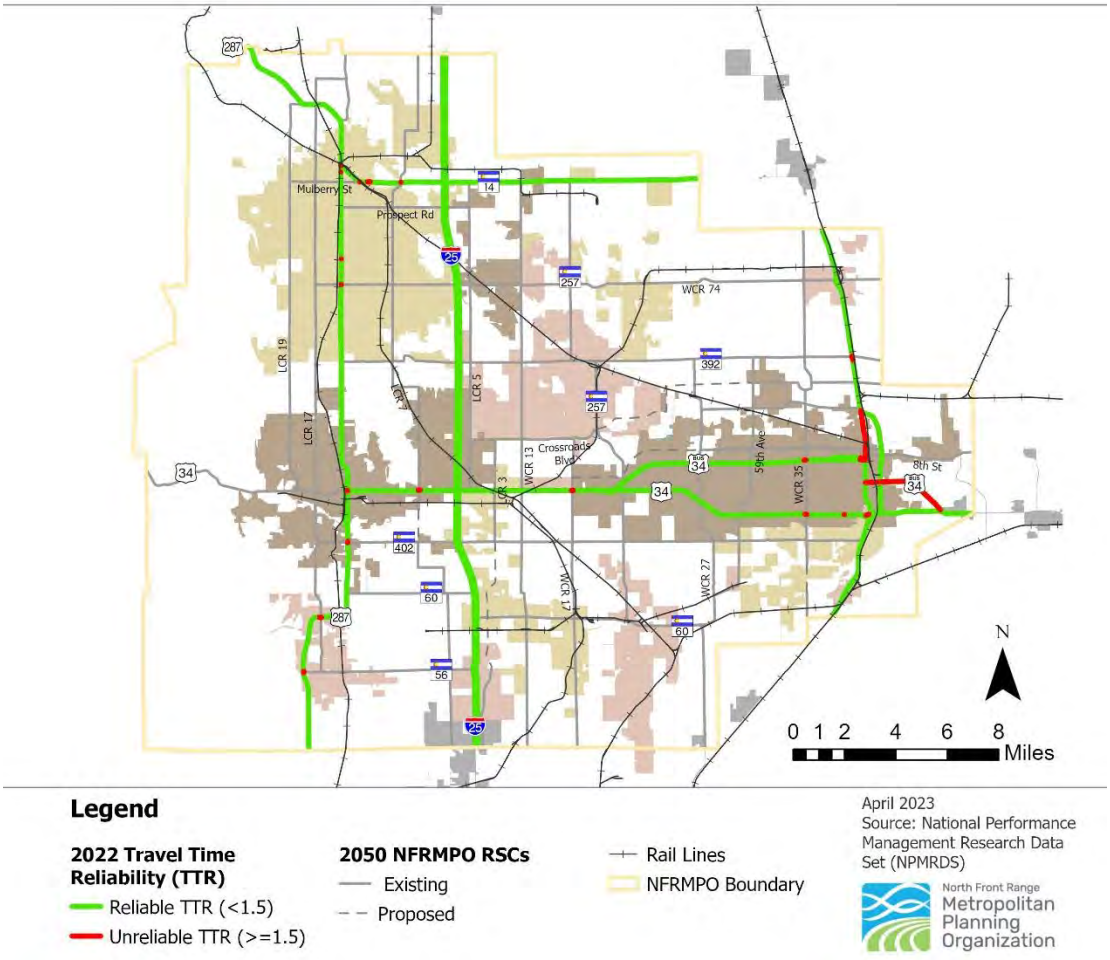
Whereas TTI measures the average travel time during peak periods to assess average levels of congestion, TTR measures the variance in travel times to assess the consistency or dependability in travel times. Reliability is important for both personal and business travelers so they can plan their travel to arrive on time. TTR is measured as the 80th percentile travel time divided by the 50th percentile (median) travel time, with ratios larger than 1.5 considered unreliable. A roadway that typically takes 20 minutes to travel during the evening peak period but sometimes takes over 30 minutes qualifies as unreliable if the longer travel time occurs at least 20 percent of the time.

Data for TTR is available from the National Performance Management Research Data Set (NPMRDS) for the National Highway System (NHS). Roadway segments with a TTR of 1.5 or greater are shown in **Figure 5**. TTR is a federally required performance measure with a federally specified calculation

methodology. TTR provides a way of assessing unreliability on the network; however, other segments of the network may be unreliable according to other methodologies.

In 2022, 1.1 percent of the person-miles traveled on the NHS system in the region were unreliable according to the TTR index. Interestingly, the North I-25 corridor is considered reliable according to this measure. One factor that may be contributing to the apparent reliability of North I-25 is avoidance of the corridor by travelers during the ongoing construction of the North I-25 Express Lanes.

Figure 5: 2022 Travel Time Reliability (TTR)



Truck Travel Time Reliability Index

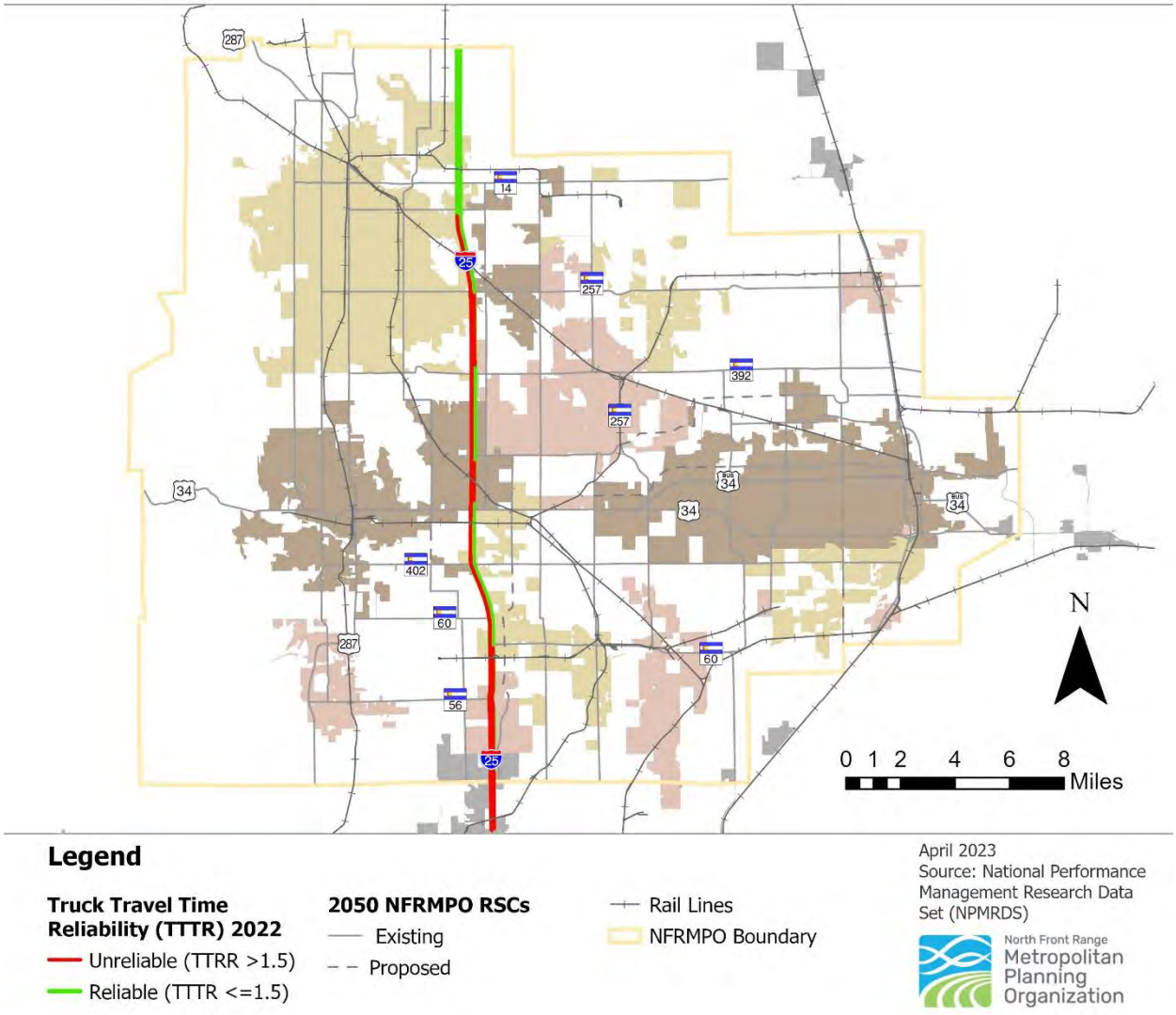
TTTR is a similar measure to TTR but is calculated using only commercial vehicles and with a more stringent measure of success. TTTR measures the variance in truck travel times to assess consistency or dependability. Specifically, TTTR is measured as the 95th percentile travel time divided by the 50th percentile (median) travel time, with ratios larger of 1.5 or greater considered unreliable. A roadway that typically takes 20 minutes to travel during the evening peak period but sometimes takes over 30 minutes qualifies as unreliable if the longer travel time occurs at least 5 percent of the time. By examining the 95th percentile instead of the 80th percentile, TTTR is more stringent than the TTR measure because it requires more of the examined time periods to fall below the 1.5 ratio threshold. TTTR also uses slightly different

reporting time periods than TTR, due to the importance of additional time periods for commercial vehicles.

TTTR is a federally required performance measure with a federally specified calculation methodology. TTTR provides a way of assessing unreliability on the network; however, other segments of the network may be unreliable according to other methodologies.

Data for TTTR is available from the National Performance Management Research Data Set (NPMRDS) for the Interstate portion of the National Highway System (NHS). Roadway segments on I-25 with a TTTR of 1.5 or greater are shown in **Figure 6**. The majority of southbound I-25 and about half of northbound I-25 is considered unreliable for truck traffic. This unreliability is due at least in part to the ongoing construction of the North I-25 Express Lanes project.

Figure 6: 2022 Truck Travel Time Reliability (TTTR)

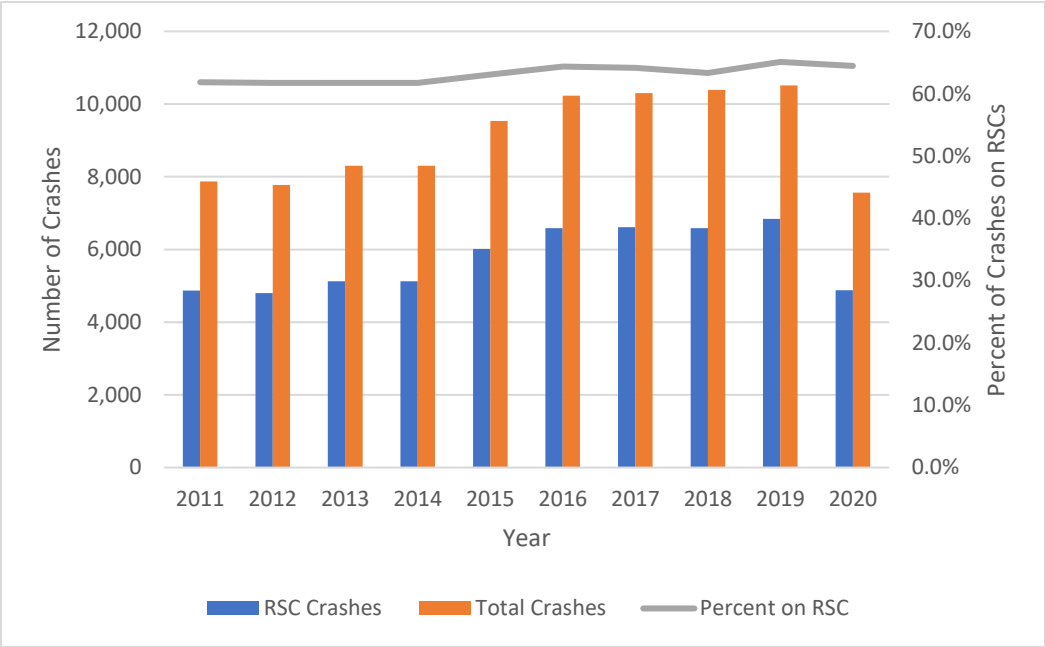


Number of Crashes

Crashes can cause non-recurring congestion; however, not all crashes result in congestion, such as crashes occurring at low-volume time periods and/or in low-volume locations. Crash data is available from CDOT and includes crashes on all public roads. Crashes on state facilities are geocoded by CDOT, while crashes on local and county facilities are geocoded by NFRMPO.

The number of crashes within the North Front Range region have increased between 2011 and 2020, with the ratio of crashes happening on RSCs increasing over the same time period, as shown in **Figure 7**. RSCs account for nearly one-in-three crashes in the region, up from three-in-five early in the decade. Total crashes decreased in 2020, but the ratio of crashes on RSCs remained consistent. NFRMPO staff will continue to monitor post-pandemic recovery.

Figure 7: Number of Crashes and Percent of Crashes on RSCs



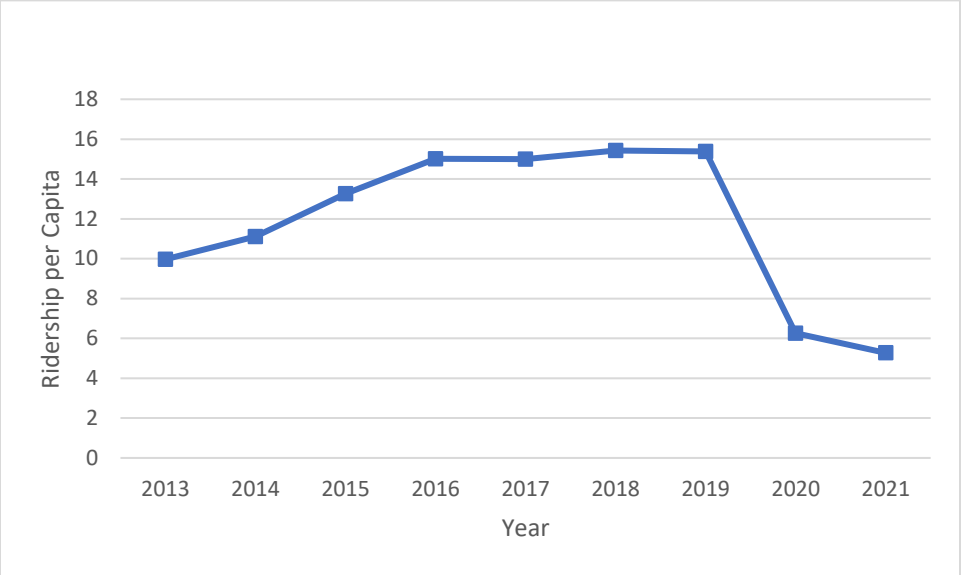
Source: CDOT and NFRMPO

Transit Ridership per Capita

Transit ridership indicates the use of the transit system relative to the population served by the transit system. Data is available from the National Transit Database (NTD) for three of the providers within the region – City of Loveland Transit (COLT), Greeley-Evans Transit (GET), and Transfort – and data for Bustang, the fixed-route transit service operated by CDOT is available from CDOT.

Transit ridership per capita increased every year from 2013 to 2019 as shown in **Figure 8**. Ridership increased from 10.0 transit rides per capita in 2013 to 15.4 transit riders per capita in 2019, a 50 percent increase. New service, such as the Bustang North Line, which began in 2015, contributed to the increase in ridership per capita. A precipitous drop in transit ridership per capita occurred because of the pandemic, with effects lasting into 2021. Transit agencies shut down in March 2020, with service gradually returning as restrictions were reduced.

Figure 8: Transit Ridership per Capita



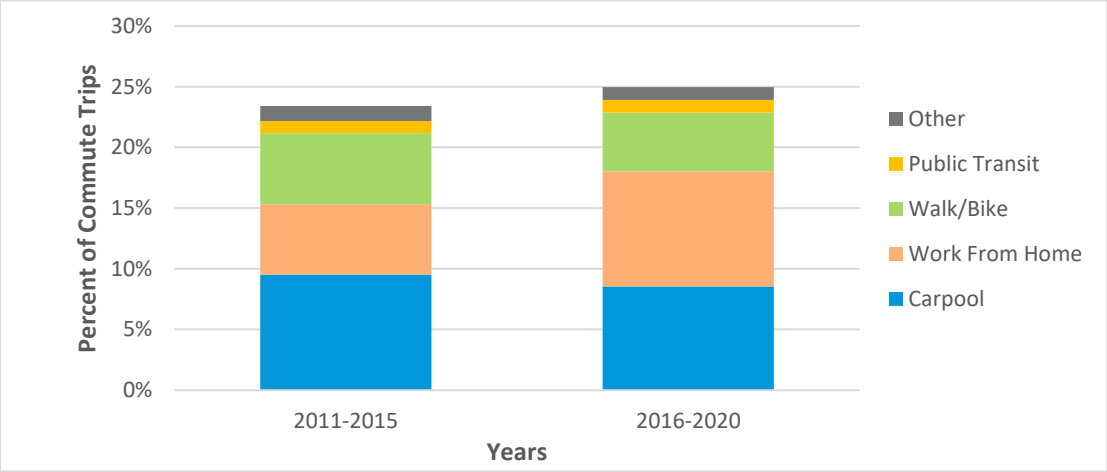
Source: National Transit Database

Percent of non-Single Occupant Vehicle (SOV) commute trips

Travel to work often occurs during peak periods, and most commute trips occur in SOVs, which consume more space on the transportation network than any other mode. This performance measure assesses the percentage of commute trips occurring by non-SOV modes such as bicycling, walking, transit, carpooling, and telework. Survey data on commute modes is available from the U.S. Census American Community Survey (ACS). Data is averaged over a five-year period and reflects the typical commute mode used by the respondent, which means modes used infrequently are likely underrepresented in the dataset.

Within the North Front Range, non-SOV commute trips increased from 23.4 percent for 2011-2015 to 25.0 percent for 2016-2020, reflecting the increase in work from home in 2020 due to the COVID-19 pandemic (**Figure 9**).

Figure 9: Non-SOV Commute Trips, 2011-2015 and 2016-2020



Percent of devices connected by fiber on RSCs

Fiber-optic networks are used to maximize operational efficiency and management of the existing roadway infrastructure through the use of Intelligent Transportation Systems (ITS) and devices. According to data collected for the 2050 RTP, approximately 87 percent of transportation management devices are connected by fiber on RSCs. Prior year data is not available for this measure.

Peak Hour Excessive Delay on NHS in Fort Collins UA

Peak Hour Excessive Delay (PHED) is a measure of travel time at 20 miles per hour or 60percent of the posted speed limit travel time, whichever is greater, between 6 a.m. and 10 a.m. and 3 p.m. to 7 p.m. weighted by vehicle volumes and occupancy. CDOT calculates Peak Hour Excessive Delay for the National Highway System (NHS) using data from NPMRDS, the National Performance Management Research Data Set . Between 2017 and 2021, the Fort Collins UA averaged 3.4 peak hours of excessive delay per capita per year according to CDOT.

3.5 CMP Network

The CMP network is comprised of the RSCs experiencing congestion on at least one segment, also known as the congested RSCs. All RSCs identified in **Table 5** (See page 14) were analyzed for congestion based on the following criteria:

- Travel Time Index (TTI) >= 1.5 for 2022
- Travel Time Reliability (TTR) >= 1.5 for 2022
- Truck Travel Time Reliability (TTTR) >=1.5 for 2022

The segments of congestion from all three measures are displayed in **Figure 10**. Apart from the large stretches of unreliable truck travel on I-25 and unreliable travel on US34 Business and US85 Business in east Greeley, most of the segments of congestion are short and are located near intersections. A listing of each congested RSC is provided in **Table 6**.

Figure 10: Congested RSCs

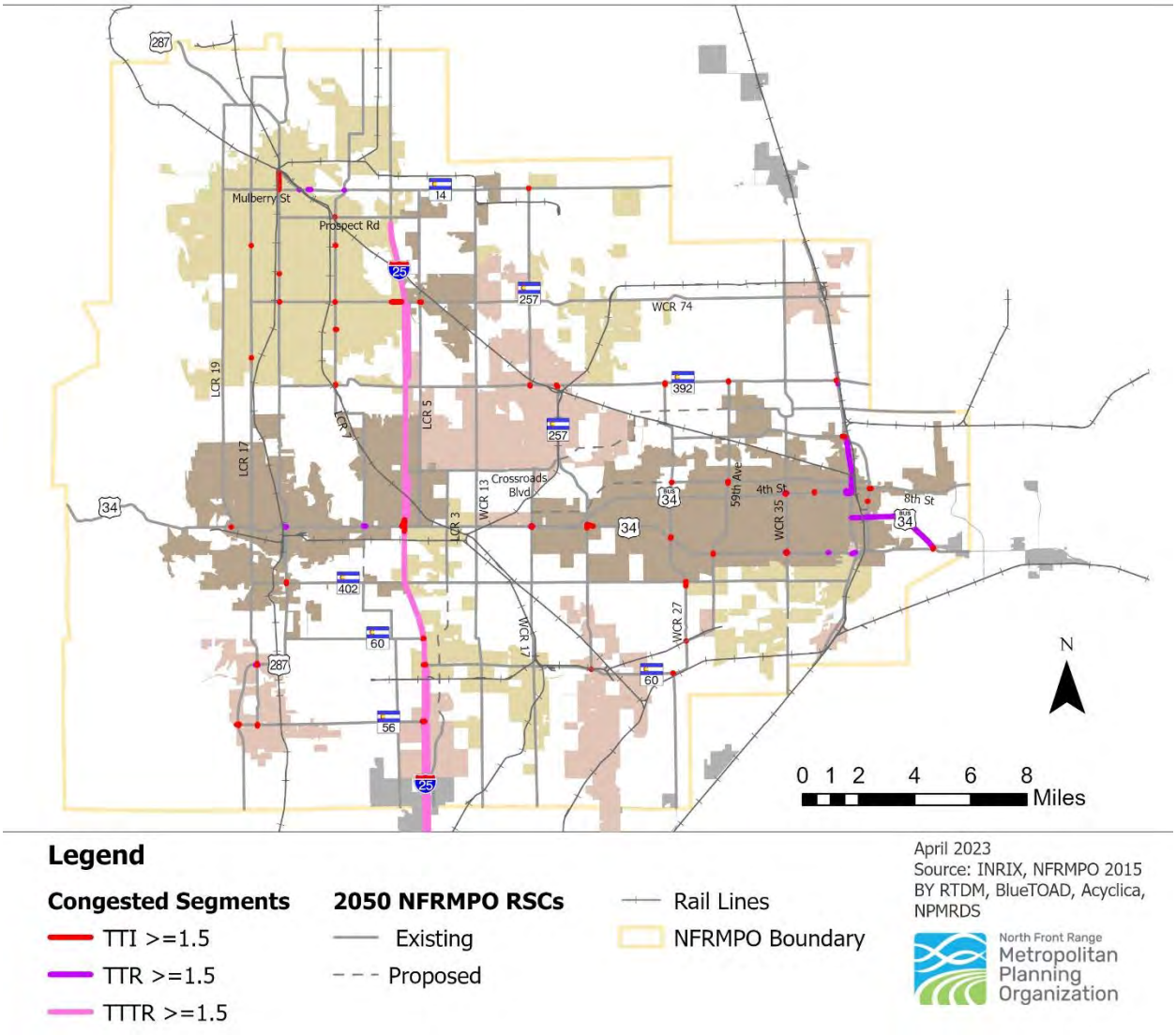


Table 6: Congested RSCs

#	Corridor	Congested RSC
1	I-25	✓
2	US34	✓
3	US34 Business Route	✓
4	US85	✓
5	US85 Business Route	✓
6	US287	✓
7	SH1	
8	SH14	✓
9	SH56	✓
10	SH60	✓
11	SH257	✓
12	SH 392	✓
13	SH402 / Freedom Parkway	
14	LCR3 / WCR9.5	
15	LCR 5	
16	LCR7 / LCR 9 / Timberline Road	✓
17	LCR17 / Shields Street / Taft Avenue / Berthoud Parkway	✓
18	LCR 19 / Taft Hill Road / Wilson Avenue	
19	WCR13	
20	WCR17	
21	WCR 27 / 83rd Avenue / Two Rivers Parkway	✓
22	WCR35 / 35th Avenue	✓
23	WCR 74 / Harmony Road	✓
24	8th Street	✓
25	59th Avenue / 65th Avenue	✓
26	Crossroads Boulevard / WCR66	
27	Mulberry Street	✓
28	Prospect Road	
29	4th Street	✓
30	O Street	✓

North Front Range
Metropolitan
Planning
Organization

4

Addressing Congestion

4.1 Strategies

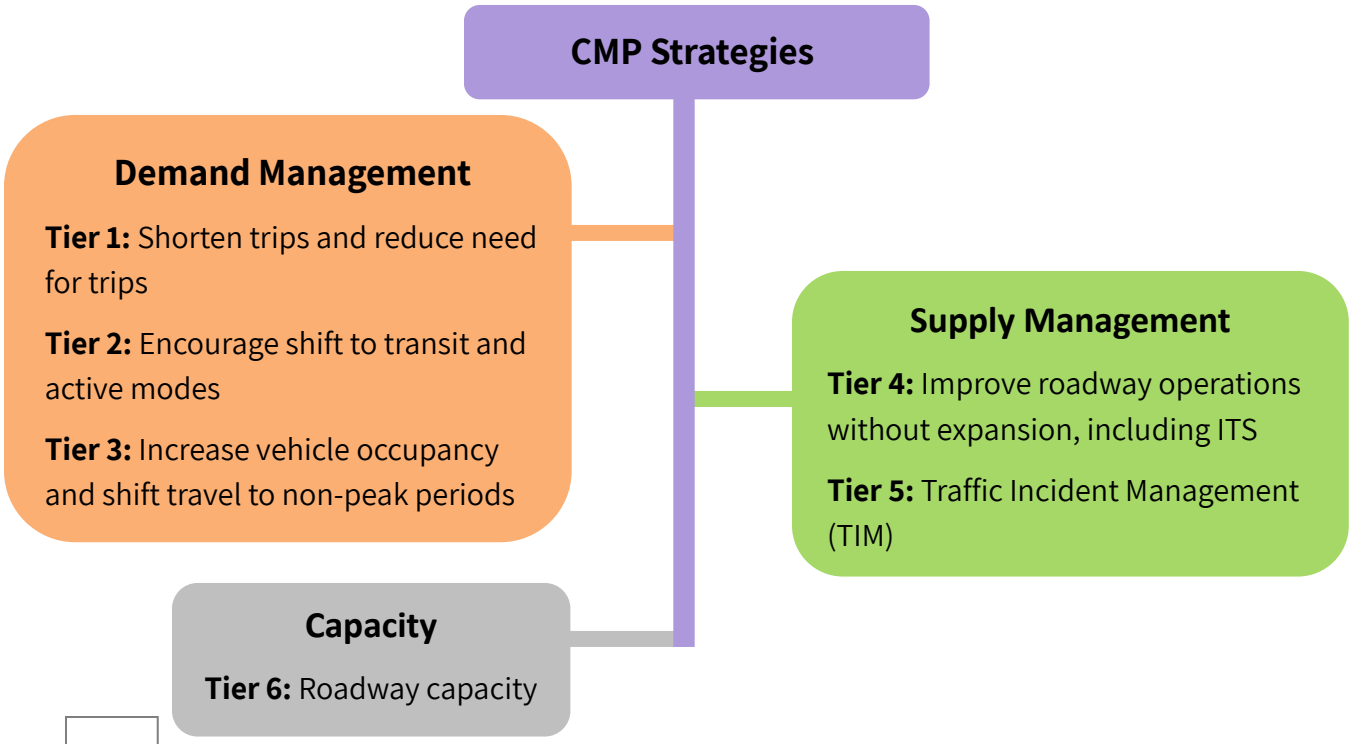
Effectively managing congestion over time requires a multi-faceted approach. Though roadway expansion increases capacity in the short term, it also induces Single Occupant Vehicle (SOV) travel demand for the treated corridor in the long-term and therefore should not be considered as a stand-alone solution. Longer-term congestion-management strategies include reducing transportation demand and improving system operations.

The 2023 CMP identifies 40 strategies for reducing congestion. These strategies, detailed in the following sections, are not an exhaustive list of strategies for managing congestion nor are they expected to be effective in every context. Instead, these strategies are intended as a starting place when considering options for managing congestion in locations throughout the region.

The CMP strategies are organized into three categories, as shown in **Figure 11**, which include Demand Management, Supply Management, and Capacity. Demand Management strategies reduce the demand for vehicle trips, either overall or during peak travel periods, and implement the NFRMPO's TDM Action Plan, while Supply Management strategies improve the efficacy of the existing transportation system. The strategies are further organized into six tiers to reflect the variance in long-term efficacy of mitigating congestion. Within each tier, strategies are presented in alphabetical order.

As discussed in **Chapter 1,** federal regulations specify all reasonable transportation demand management (TDM) and operational congestion management strategies must be evaluated and deemed insufficient prior to the approval of a "project that will result in a significant increase in capacity for SOVs." The regulations further specify if an SOV capacity project is deemed necessary, supplementary TDM and operational efficiency measures must be identified through the CMP to preserve the function of the capacity project into the future.

Figure 11: CMP Strategy Categories and Tiers



Additionally, many CMP strategies help the NFRMPO make progress toward achieving safety, congestion, and air quality goals set out in various plans and programs. To highlight the strategies that make progress toward these goals, refer to the legend in **Table 7**.

Table 7: CMP Strategy Impact Legend

	**Proven Safety Countermeasure**
	FHWA developed 28 countermeasures and strategies effective in reducing roadway fatalities and serious injuries.[9] A traffic cone symbol means the strategy is also a Proven Safety Countermeasure.
	**Air Quality Projects**
	FHWA analyzed CMAQ-eligible projects by cost-effectiveness for reducing pollutants.[10] The darker the sun and cloud, the more cost effective the air quality strategy.

[9] Proven Safety Countermeasures: https://highways.dot.gov/safety/proven-safety-countermeasures. Accessed April 21, 2023.

[10] CMAQ Program 2020 Cost-Effectiveness Tables Update: https://www.fhwa.dot.gov/ENVIRonment/air_quality/cmaq/reference/cost_effectiveness_tables/fhwahep20039.pdf. Accessed April 21, 2023.

Tier 1: Shorten Trips and Reduce Need for Trips

Tier 1 strategies reduce travel demand by either directly or indirectly removing the need for a trip or shortening the length of trips. Reducing travel demand has the greatest potential for producing long-lasting, high impact on congestion for the least cost.

Efficient Land Use and Development Practices

Land use and development falls outside of the NFRMPO's purview but is directly related to how many trips and the types of trips people take. More efficient land use and development practices may include infill development, mixed-use developments, and transit-oriented developments (TOD). Infill development is focused on areas already served by the transportation network, utilities, and municipal services in most cases. Mixed-use developments feature commercial, residential, and other land uses in the same building or in close proximity. TOD tends to be infill and mixed-use and are co-located with premium transit services like bus rapid transit (BRT).

Pros

- Can leverage private dollars
- May increase density to a level that supports transit
- Reduces need for investing in new general-purpose transportation infrastructure

Cons

- May require investment in maintenance, rehabilitation, or expansion of existing infrastructure and utilities

Other Factors or Considerations

- Outside of NFRMPO purview, must be planned and implemented by local planning agencies
- Often driven by external-market forces.
- Implementation may be limited by political or social factors.

Examples:

North College MAX TOD Overlay Zone: Fort Collins adopted the North College MAX BRT Plan in February 2023, which includes recommendations for a new TOD Overlay Zone on North College. The new TOD Overlay District could feature decreased parking requirements, increased building heights, and increased requirements for public and open spaces.

	Current City of Fort Collins Land Use Code Parking Requirement		Proposed City of Fort Collins Land Development Code Parking Requirement[a]	Proposed North College Ave TOD Overlay Parking Requirement	
	Non-TOD	Existing Mason TOD Overlay	Non-TOD	TOD Overlay	Any Project with Affordable Housing (applies to all units)
1-Bedroom	1.5	0.75	1	0.75	0.5
2-Bedroom	1.75	1	1.5	1	.75
3-Bedroom	2.0	1.25	2.0	1.25	1
4+-Bedroom	3.0	1.5	3.0	1.5	1.25
All Bedrooms	-	0.75	-	0.75	0.75

Source: North College MAX Final Report

Downtown Greeley near UNC: The US85 Business/8th Avenue corridor near the University of Northern Colorado (UNC) has attracted denser developments. Students and young professionals are within walking and bicycling distance of UNC and downtown Greeley.

Image sources: Apartments at Maddie Facebook, Google Maps

Telecommuting

Telecommuting, also known as working from home, has increased in popularity because of the COVID-19 pandemic. CDOT, for example, held a Call for Projects for the CanDo Community Telework Program to support communities in the creation of innovative TDM programs and tools. This funding opportunity has evolved into the TDM Seed Grant program and the Revitalizing Main Streets program.

Pros

- Very inexpensive to implement
- Directly reduces commute trips, the biggest contributor to recurring congestion
- May result in significant reduction of Ozone precursors and better air quality in the nonattainment area

Cons

- Many jobs, like construction, require in-person attendance
- May be challenging to implement where in-person meetings are frequent and electronic attendance reduces efficacy of meetings
- Technical difficulties may prevent efficient communication

Other Factors or Considerations

- Some workplaces offer flexible telecommuting, encouraging employees to telecommute when interpersonal communications are not required.
- Optional telecommuting during extreme weather events may increase the safety of employees and reduce the risk of crashes.

Example:

Estes Park CanDo Colorado Grant: The Town of Estes Park received a CanDo Colorado grant to purchase software and wireless hotspot devices for the town's information technology staff to support employees remotely.

Image credit: Microsoft

Tier 2: Encourage Shift to Transit and Active Modes

If a trip must be made, encouraging the use of transit or active transportation modes, such as walking or biking, is the next best strategy. Evolving modes like micromobility fall into this category, as do e-bikes, scooters, skateboards, and mobility-assistance devices. Buses themselves are considered vehicles but allow for more efficient use of limited roadway capacity. Because many people commute across the region, some trips may not make sense using transit or active modes.

Bicycle Infrastructure

Bicycle infrastructure may look different across the region, either via protected bicycle lanes on the street or off-road trails. Improvements make active transportation like bicycling more attractive and safer, and can include wayfinding, bicycle lane striping, physical barriers to provide a dedicated space for cyclists within the road's right-of-way, or completely separate facilities.

Pros

- Increased safety for cyclists and pedestrians by reducing bicycle-automobile conflicts on roads and bicycle-pedestrian conflicts on sidewalks
- Pavement striping and markings and signage help maintain safe automobile speeds by providing visual cues to drivers

Cons

- Site constraints may limit design possibilities
- Construction and maintenance can be costly depending on the project
- Redistributing space among road users can be unpopular

Other Factors or Considerations

- Improvement type depends on a combination of traffic volumes, speed differential, available space, destinations along the corridor, and more. See the NFRMPO's 2021 Active Transportation Plan or National Association of City Transportation Officials' (NACTO) Urban Bicycleway Design Guide for information on design considerations.
- Including improvements as part of other road construction or maintenance projects may yield cost savings.
- Promotional and educational events can encourage use of facilities and improve understanding of their positive impacts.
- Conflict points at intersections and other locations with weaving motor vehicle traffic may require special attention

Example

Loveland Recreational Trail: Loveland completed the Loveland Recreational Trail in 2021, a 21-mile trail that encircles the city. The trail includes nine grade-separated crossings across arterials, enhanced and consistent signage, and acts as the backbone for other local and regional trails.

Image credit: City of Loveland, NFRMPO staff

Bicycle and Scooter Share Service

Micromobility includes options like electric bicycles and scooters, which can be rented for short periods to complete first-mile and last-mile trips.

Pros

- Offers a comfortable and accessible entry for people unfamiliar with biking or scootering
- Allows users to access bicycles without buying their own
- Bicycle and scooter fleets are maintained and repaired professionally

Cons

- Systems have geographic limitations
- Requires a certain level of population and employment density to make the system sustainable
- If the system is not managed well, bicycles and scooters may be neglected and can obstruct public rights-of-way

Other Factors or Considerations

- The appropriate system model depends on the user base (students, tourists, residents, etc.).
- Public and private partnerships and advertisement opportunities can help kickstart and maintain the system.

Example

Spin: Fort Collins has a dockless system of 400 e-bicycles and 500 e-scooters. Bicycles and scooters can be located and rented using a smartphone app at pay-as-you-go rates. Fort Collins offers cash cards for unbanked individuals or those without a credit card. Spin began operating in Fort Collins in July 2021, supporting over 30,000 riders to take a quarter of a million trips and 400,000 miles.

Image credit: City of Fort Collins Flickr, NFRMPO staff

Bus Rapid Transit (BRT)

Bus rapid transit (BRT) features infrastructure that provides high-quality bus service. Infrastructure may include upgrades like bus lanes, improved stations and amenities, specialized branding, off-vehicle payment. Additionally, stops are usually level with buses to allow easier access and faster boarding and alighting. BRT is often considered a lower-cost option for premium transit when compared to rail options.

Pros

- BRT can have different features depending on the corridor, which can be phased in over time
- Marketing can effectively portray BRT as an upscale or specialized service
- Dedicated lanes and transit signal priority mean transit does not need to wait when traffic is heavy
- Focused on speed and reliability

Cons

- Very costly to implement when compared to operating a bus in mixed traffic
- BRT can be watered down ("BRT creep"), losing its luster and become an expensive but simple limited bus service
- Relies heavily on marketing more than substance in many cases
- Potentially reduces service on local routes
- Potentially reduces funding for local routes as the focus is on the specialized services

Other Factors or Considerations

- BRT features are not one-size-fits-all and can be adjusted to fit the community and land use in the surrounding area. Los Angeles plans to upgrade the existing G Line (Orange) with grade separations, better signal priority, electronic bus connectivity, and grade-crossing investments. https://www.metro.net/projects/orangeline/
- The Institute for Transportation & Development Policy (ITDP) advises on BRT and what constitutes a BRT route or system: https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/what-is-brt/

Example

MAX: City of Fort Collins-Transfort operates MAX, a BRT line along the Mason Corridor. MAX connects downtown Fort Collins with Colorado State University (CSU), Midtown Business Improvement District (BID), and the South Transit Center. Extensions are currently being planned along North College Avenue, West Elizabeth Street, and Harmony Road. Prior to the pandemic, MAX ran at 10-minute headways and averaged 5,000 riders per weekday.

Image credit: City of Fort Collins Flickr, Nick Armstrong Flickr

Car Sharing

Through a membership, participants pay to rent vehicles for personal trips from a third party. Ownership costs such as car payments, insurance, maintenance, are spread among the user base.

Pros

- Reduces individual car ownership and may incentivize more trips by foot or bike because users have more flexibility to determine the mode choice that most effectively meets their needs
- A diverse fleet reduces the need for people to own larger, less fuel efficient vehicles for specific occasions
- Dedicated parking reduces the time spent by car owners looking for parking in urban areas

Cons

- Availability of the fleet is uncertain
- Requires planning and time to book a rental and travel to and from the car's location
- Certain age groups and people with a poor driving record may not qualify for membership
- May require certain types of denser land use and population to be cost-effective and useful

Other Factors or Considerations

- Dedicated on-street or off-street parking is required.
- Discounts through schools or employers can encourage alternative transportation choices.

Example

ZipCar: CSU partners with ZipCar to maintain cars on CSU's campus. ZipCar is part of the University's Guaranteed Ride Home (GRH) program with multiple cars and dedicated parking on campus. As on March 2023, there are three hubs for ZipCar, two located on campus and one location on West Elizabeth Street. Membership plans range from $35 to $90 per year with an additional hourly and daily rate.[11]

Image credit: CSU Parking & Transportation Services

[11] ZipCar at Colorado State University. https://www.zipcar.com/universities/colorado-state-university (Accessed 3/28/2023).

Complete Streets Policies

Complete Streets are streets designed to enable safe access for users of all ages and abilities, including pedestrians, bicyclists, motorists, and transit riders. The adoption of a Complete Streets policy by communities encourages the routine design and operation of the entire right-of-way to enable safe access for all users.

Pros

- Encourages appropriate roadways depending on usage and users
- Institutionalizes design considerations and standards into road projects
- See "Bicycle Infrastructure Improvements" and "Pedestrian Infrastructure Improvements"

Cons

- See "Bicycle Infrastructure Improvements" and "Pedestrian Infrastructure Improvements

Other Factors or Considerations

- The NFRMPO is required to use a minimum of 2.5 percent of its Consolidated Planning Grant (CPG) funds on Complete Streets efforts. Complete Streets efforts can include developing standards or policies; developing a Complete Streets prioritization plan that identifies a specific list of Complete Streets projects to improve the safety, mobility, or accessibility of a street; or developing active transportation plans, transit plans, intercity passenger rail plans, and transit-oriented development plans.[12]

Example

Fort Collins: Fort Collins adopted a Complete Streets Policy in the City's 2004 Transportation Master Plan. Each subsequent Transportation Master Plan has incorporated and expanded on this policy, noting the need to incorporate bicycle lanes and sidewalks into newly constructed streets. The Colorado Transportation Commission has also adopted a Bicycle and Pedestrian Policy Directive 1602.0, highlighting the need to accommodate bicyclists and pedestrians.

Image credit: Greeley Public Works Flickr

[12] Infrastructure Jobs and Investment Act, Section 11206. https://www.congress.gov/bill/117th-congress/house-bill/3684/text (Accessed 3/28/2023).

Mobility Hubs

Mobility hubs seek a seamless connection between transit and other modes of transportation and have been strategically located where the transit network intersects other major components of the layered transportation network.[13] In these cases, vanpools, carpools, and buses make up the transit system. Smaller hubs can be bus stops with co-located micromobility options, while larger ones may include park-n-rides, multiple transit routes, and larger micromobility stations.

Pros

- May incentivize ridesharing, transit, and micromobility
- Reduces congestion associated with circulating for parking
- Can range in size depending on need

Cons

- May not be appropriate for every community

Other Factors or Considerations

- May only be necessary where parking spaces are limited.
- To further incentivize ridesharing, designated parking should be made as convenient as possible to the final destination.

Example

Centerra-Loveland and SH56 Mobility Hubs: CDOT is constructing two mobility hubs as part of the North I-25 Express Lanes project north of US34 and at SH56. These mobility hubs will include transit slip lanes, bicycle and pedestrian connections, and a park-n-ride lot. Intercity buses will be able to use the transit slip lanes and avoid timely and circuitous detours off I-25, reducing trip times and reducing conflicts with other traffic. The ability to add micromobility is available as local communities implement that strategy in the coming years.

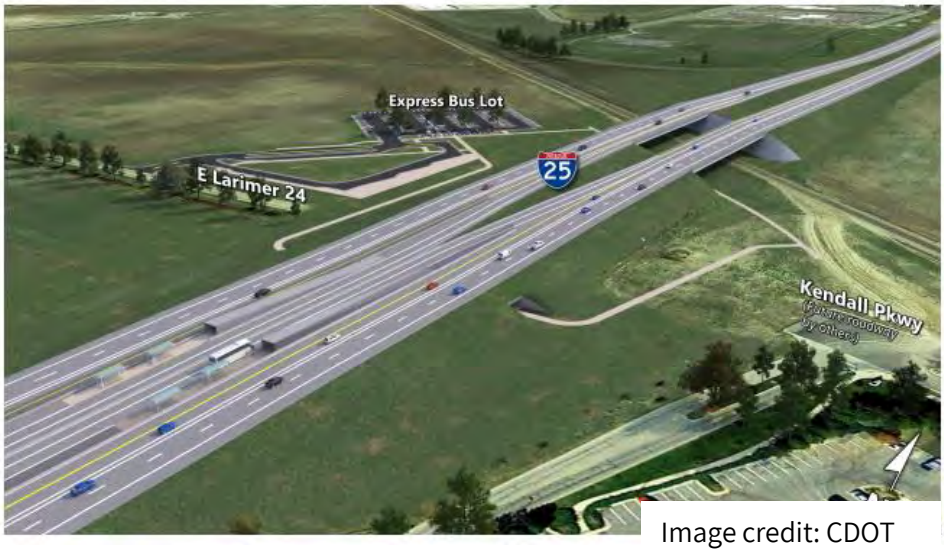


Image credit: CDOT

[13] Fort Collins Transit Master Plan. https://www.fcgov.com/cityplan/files/transit-mobility-hubs.pdf?1577727141 (Accessed 3/28/2023).

Parking Pricing or Parking Restrictions

Parking restrictions limit the amount of time a vehicle is allowed to remain in a space. Parking restriction may also mean limiting the number of available parking spaces. Parking pricing refers to the price associated with the use of a parking space. Pricing can be fixed or variable depending on time of day/week or demand.

Pros

- Encourages the use of other modes
- Increases parking turnover, benefiting local businesses
- Reducing parking facility costs
- Collected funding may be used to support active transportation options

Cons

- May have limited political viability
- Necessitates access to other options besides driving and may not be appropriate in all cases

Other Factors or Considerations

- Pricing may fluctuate to ensure a certain percentage of parking spaces are vacant.
- To maximize the efficacy of parking restrictions and pricing, other modes of travel, such as transit or bicycling, must be made accessible, convenient, and intuitive.

Example

CSU: CSU manages parking demand through a parking permit system while incentivizing active modes of transportation. Parking permits help offset the cost of transit, bicycle infrastructure, shared micromobility, and TDM programming and engagement.

Greeley: The City of Greeley has instituted parking changes in the downtown area, including developing the Orange Zone. People looking to park for longer than two hours in this zone can pay using an app or must move their vehicle at least two blocks away.

Image credit: City of Greeley

Pay-As-You-Drive Insurance

Vehicle insurance premiums vary according to the number of miles driven. This gives drivers who drive less an opportunity to pay a lower variable cost rather than a higher, fixed-cost insurance.

Pros

- Encourages non-SOV travel including carpooling, taking transit, biking, and walking both for commute trips and mid-day trips

Cons

- May only reward drivers who would have had low-mileage either way
- Drivers must be active OnStar subscribers and opt-in to the Colorado Low-Mileage Discount Program
- Drivers may feel any level of in-vehicle data collection is too invasive

Other Factors or Considerations

- There must exist a significant difference in the cost of insurance between Pay-as-You-Drive and traditional insurance to encourage a shift towards less driving.
- As Colorado considers moving away from a gas tax, Pay-as-You-Go data collection systems could serve as a model for tracking roadway-usage.

Pedestrian Infrastructure

Improving pedestrian infrastructure can enhance safety, ensure American with Disabilities Act (ADA) compliance, and boost the pedestrian experience, encouraging more people to choose active transportation for short trips and improving access to transit or other alternative modes.

Pros

- Improves safety and comfort of the pedestrian environment for both transportation and recreation
- Provides better access to various destination and other transportation modes, encouraging alternative transportation choices

Cons

- Construction and maintenance can be costly depending on the project
- Site constraints may limit design possibilities

Other Factors or Considerations

- ADA compliance should be a top consideration for pedestrian improvements.
- Improvement type depends on a combination of traffic volumes, speed differential, available space, destinations along the corridor, and more. See the NFRMPO's 2021 Regional Active Transportation Plan or National Association of City Transportation Officials' (NACTO) Urban Street Design Guide for information on design considerations.
- Including improvements as part of other road construction or maintenance projects may yield cost savings.
- Promotional and educational events can encourage use of facilities and improve understanding of their positive impacts.

Example

Bus Stop Improvement Program: Fort Collins has invested local sales tax and federal funds to upgrade and fix bus stops in the city. Specifically, the improvements are focused on ADA accessibility guidelines, and include a 5' x 8' landing pad, 4' path connection to adjacent sidewalks, and other amenities.

Keep Greeley Moving: Residents of Greeley approved the Keep Greeley Moving sales tax that will allow the City to maintain more than 700 miles of curb, gutter, and sidewalk. Greeley will prioritize the worst damaged concrete first, while also ensuring sidewalks and curbs are upgraded to ADA standards.

Image credit: Fort Collins, Greeley, NFRMPO staff

Transit Incentives

Incentives may be offered to students, employees, or residents to help reduce the cost of transit to the user. Examples of incentives include free or discounted public transportation passes, employer-provided subsidies, or pre-tax payroll reductions.

Pros

- Additional transit ridership can incentivize investment in more routes, increased infrastructure, and other tangential benefits
- Riding transit can improve health
- Riding transit reduces automobile usage, which frees up limited parking
- Riding transit can be tied to a multimodal commute, meaning the use of bicycles or walking to commute

Cons

- Incentives must be paid by fees or businesses
- Transit can be a divisive issue for individuals who do not like subsidizing government programs
- Transit is relatively cheap in the NFRMPO region already ($1.25/ride for City of Loveland Transit (COLT), $1.50/ride for GET)

Other Factors or Considerations

- Transit access is limited in much of the NFRMPO region, especially outside the cities of Fort Collins, Greeley, and Loveland.
- The NFRMPO region is in nonattainment for ozone. Transportation emissions is one of the largest sources of ozone precursors, which may be reduced through non-SOV investments.
- Transit ridership is known to fluctuate with the price of gas, availability of parking, and other factors which may not be addressed by incentives.

Example

Transfort: Transfort began offering free transit during the pandemic. Additionally, Fort Collins is completing a funding study and has decided to keep transit free until its completion. This applies to the FLEX route, as well.

Ride Free with ID: Students in the Greeley-Evans School District 6 can ride GET buses for free, which has allowed students to access more afterschool activities, jobs, and extracurriculars.

Image credit: Screen capture from GET on the BUS Rap

Transit Service Quality Factors

Improving transit convenience and experience by adding transit stop amenities, off-board fare collection, on-board cleanliness and comfort, providing efficient route structures, clear bus scheduling information and schedule reliability, station and in-route safety, and customer service.

Pros

- Service quality can be improved gradually and in phases, meaning limited funding can be used over time
- Reduces travel time for transit users
- Reduce congestion and VMT by encouraging a mode shift to transit
- Can have health improvements as people walk to the bus and rely less on their cars

Cons

- Many improvements require long-term funding
- Many improvements require meeting a certain ridership threshold
- Improvements can take time to catch on with riders

Other Factors or Considerations

- Other quality factors, like sidewalk connectivity or snow removal, may be outside of the transit agency's purview but should be considered

Example

Spot: COLT uses the Spot app for its riders to see where buses currently are. Spot uses up-to-the-second arrival prediction, route planning, and system alerts to provide information to riders. Spot is available as an app and mobile-friendly website.

Bustang: Bustang provides mobile ticketing for both its intercity and Outrider routes using the Masabi platform. Riders can purchase their Bustang tickets from their phone. The app allows users to purchase single ride, 10-ride, 20-ride, or 40-ride passes and keep them in the ticket wallet. Tickets can be purchased up to 180 days in advance of using them. Tickets are activated prior to boarding and presented to the driver for validation.

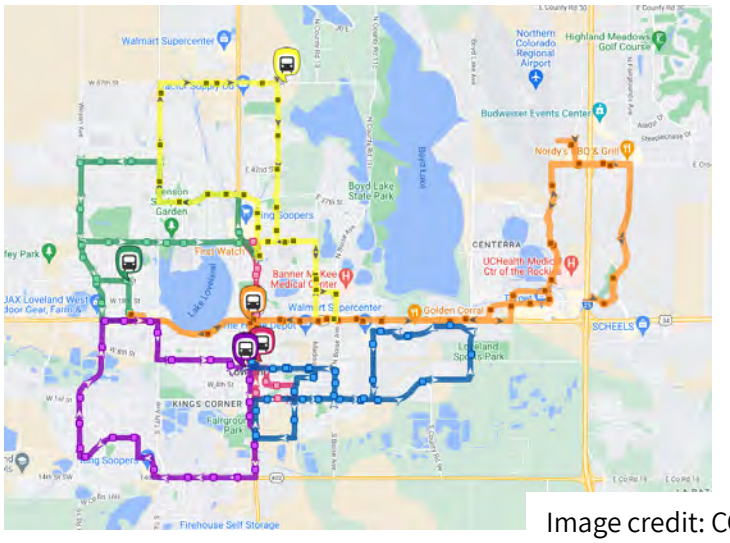


Image credit: COLT Spot App

Transit Service Quantity Factors

Adding key local and regional routes, increasing service hours, reducing the time between transit vehicles, reducing transfer time, prioritizing transit vehicles at traffic signals, and focusing routes on high density corridors or locations.

Pros

- Improved frequencies attract more choice riders
- Additional service hours can reduce the need for SOVs because errands can be run at more times of day with less wait-time between buses
- Could benefit non-commuters and those relying solely on transit with additional service

Cons

- Increasing service hours requires additional funding or cuts in service elsewhere
- Improvements to transit service can take time to reap the benefits

Other Factors or Considerations

- Changes to transit service face an issue of frequency versus coverage – should you focus on where ridership is or make less frequent routes go to more places?

Example

COLT Peak Hour Service: COLT operates additional service on Routes 4 and 5 during peak hours during the Thompson School District school year. This is in addition to year-round half-hourly service on Routes 1, 2, and 6. This provides more frequent service to importation destinations like the city's high schools, transfer points, and shopping destinations.

Image credit: COLT Facebook

Tier 3: Increase Vehicle Occupancy and Shift Travel to Non-Peak Periods

Increasing vehicle occupancy and shifting travel to non-peak travel periods contributes to a reduction in travel demand, especially during key peak periods. As vehicle-centric strategies, they do not address congestion as directly as Tier 1 and Tier 2 strategies. However, increasing vehicle occupancy and shifting travel times may serve a broader audience, reducing vehicle miles traveled during peak periods, while affording more flexibility in both trip length and destination than Tier 1 and Tier 2 strategies.

Alternative/Flexible Work Schedules

Adding key local and regional routes, increasing service hours, reducing the time between transit vehicles, reducing transfer time, prioritizing transit vehicles at traffic signals, and focusing routes on high density corridors or locations.

Pros

- Reduces demand during peak-travel periods
- Could result in significant improvements to air quality
- Inexpensive to implement
- Saves commuter time and money, and can improve morale and work-life balance

Cons

- May be difficult to implement for some industries that require employees be present during core hours
- May reduce teamwork or team morale

Other Factors or Considerations

- Work schedules are under the control of each individual organization.
- Education may help employers unsure about flexible work schedules to understand the significant benefits.

Congestion Pricing

A fee system implemented during peak periods. Depending on the size of the fee, drivers have an incentive to shift their travel time, mode, or route. There are five main types of pricing strategies:

1. **Variably priced lanes**: Variable tolls on separated lanes within a highway, such as express/managed lanes or High Occupancy Toll (HOT) lanes.
2. **Variable tolls on entire roadways**: Both on toll roads and bridges, as well as on existing toll-free facilities during rush hours.
3. **Zone-based (area or cordon) charges**: Either variable or fixed charges to drive within or into a congested area within a city.
4. **Area-wide charges**: Per-mile charges on all roads within an area that may vary by level of congestion.
5. **Pricing that does not involve tolls**: This includes innovative parking-pricing strategies (e.g., surcharges for entering or exiting a parking facility during or near peak periods) and a range of parking cash-out policies, in which cash is offered to employees in lieu of subsidized parking.

Pros

- May increase travel time reliability
- Helps provide funding mechanism for other congestion-managing projects and programs

Cons

- Variably priced lanes, such as express lanes, may encourage SOV travel
- May possibly include an equity issue to charge low-income individuals

Other Factors or Considerations

- High-Occupancy Vehicle travel may be encouraged by offering smaller fees or free travel for vehicles with more than one occupant.
- CDOT is building Express Lanes on I-25, which use variably priced lanes to ensure toll-users and high-occupancy vehicles can bypass traffic.

Example

I-70 Express Lanes: The eastbound I-70 Mountain Express Lane runs adjacent to the free general purpose lanes for 12 miles from Empire through the Veterans Memorial Tunnels, passing Idaho Springs. The westbound I-70 Mountain Express Lane runs adjacent to the free general purpose lanes from the Veterans Memorial Tunnels to Empire. The lanes are open only during peak travel times, mostly on weekends and holidays. When not open to traffic, the lane is used as an emergency shoulder for vehicle breakdowns and emergency services.

Image credit: Google Maps

Guaranteed Ride Home

Used to encourage ridesharing, the Guaranteed Ride Home service provides a free or inexpensive taxi for emergencies for employees who rideshare.

Pros

- Provides more flexibility within vanpooling programs
- Peace-of-mind for vanpoolers or transit riders in case of emergency or special circumstances

Cons

- May be costly to implement
- Requires education and awareness of program
- Has been underused in existing regional programs

Other Factors or Considerations

- Guaranteed Ride Home programs vary widely, from the number of available rides per person, to the mechanism for transporting the person, to the cap on reimbursement per ride.
- More robust programs provide greater assurance to vanpoolers but are more costly to implement.

Example

Poudre Express: As part of the Poudre Express service, GET offers a Guaranteed Ride Home (GRH) program. GRH is for those unexpected emergencies during Poudre Express operating times. Registered passengers are eligible for reimbursement for the cost of a ride home based on participation guidelines.

High Occupancy Vehicle (HOV) Lanes

HOV lanes incentivize ridesharing by offering travelers who rideshare a less congested travel lane at reduced or no cost. Though HOV may be paired with an Express/Toll Lane, they may also be implemented as a stand-alone strategy. CDOT's Transportation Commission (TC) sets HOV policy in Colorado.

Pros

- Provide improved travel time reliability
- Can be used by transit and emergency vehicles, reducing travel times

Cons

- HOV users often travel for free, which diminishes the ability for the lane to help pay for itself

Other Factors or Considerations

- HOV lane policies may be for 2+, 3+, 4+, or even 5+.
- HOV users can be difficult to monitor and the lanes challenging to enforce.
- May be coupled with an Express Lane through the use of a switchable HOV transponder.

Example

SH82 HOV Lanes: CDOT operates HOV lanes on SH82 in Pitkin and Garfield counties between 6:00 a.m. and 9:00 a.m. up valley toward Aspen, and 3:00 p.m. to 6:00 p.m. down valley toward Basalt. HOV for this corridor requires at least two people, motorcycles, or alternative fuel vehicles. The Roaring Fork Transportation Authority (RFTA) operates its VelociRFTA BRT service on SH82 using the HOV lanes.

Image credit: Google Maps

Ridesharing

Ridesharing refers to carpooling and vanpooling, in which a vehicle carries additional passengers when making a trip, with minimal additional mileage.

Pros

- Reduces single-occupant vehicle trips
- May significantly shorten travel times if High Occupancy Vehicle (HOV) lanes are available

Cons

- Still encourages vehicle travel
-

Other Factors or Considerations

- Should be implemented in conjunction with a guaranteed ride home program.
- Designated parking for carpooling or vanpooling proximate to destination may encourage users.
- Park-n-Rides may need to be made available to provide convenient starting locations.

Example

VanGo™ Vanpools: Vanpools consist of individuals with similar commutes ranging from 20 to just under 100 miles each way. A monthly fare covers gas, maintenance, repairs, insurance, and tires. Riders in each van coordinate driving and may be eligible for commuter tax benefits and use of HOV Lanes in the Denver Metro area. The VanGo™ program also offers a GRH program for riders, where riders can be reimbursed for up to two trips per year.

Image credit: NFRMPO staff

Tier 4: Improve Roadway Operations without Expansion, including ITS

Today, roadway operations are driven primarily through advancements in technology, though proper planning and physical projects may play a role as well. Intelligent Transportation System (ITS) strategies use technology to improve mobility, increase safety, and reduce delays. ITS improves the existing roadway system's operations in a cost-effective manner.

Access Management

Planning and design practices that identify existing and future land use and arterial access points to maximize traffic safety and mobility. Strategies include medians, turn lanes, side/rear access points between businesses, shared access, and local land use ordinances to control access.

Pros

- Improves safety along managed roadway
- Increases roadway capacity by enabling greater vehicle throughput
- Reduces corridor delay, thus improving travel times

Cons

- Local businesses, residents, and commuters may oppose limiting access to or from developments
- May increase vehicle delay on local streets

Other Factors or Considerations

- Proper access management may enhance the safety and comfort of bicyclists and pedestrians by limiting ingress and egress points that cross bicycle and pedestrian infrastructure.
- Drawbacks of access management may be limited by appropriate site design of adjacent development, including side or rear access and access via transit or biking and walking.

Example

WCR74 Access Control Plan: The Weld County Road 74 Access Control Plan (ACP) was created by Eaton, Severance, and Weld County and focused on the approximately 11-mile section of WCR 74/ Harmony Road between SH257 and WCR 39. The ACP was adopted in September 2020. The main purpose of the WCR 74 ACP is to maintain and enhance safety and mobility while also providing reasonable access to adjoining properties as growth and development occur over time. Roadway safety is the primary reason for managing access on the corridor.

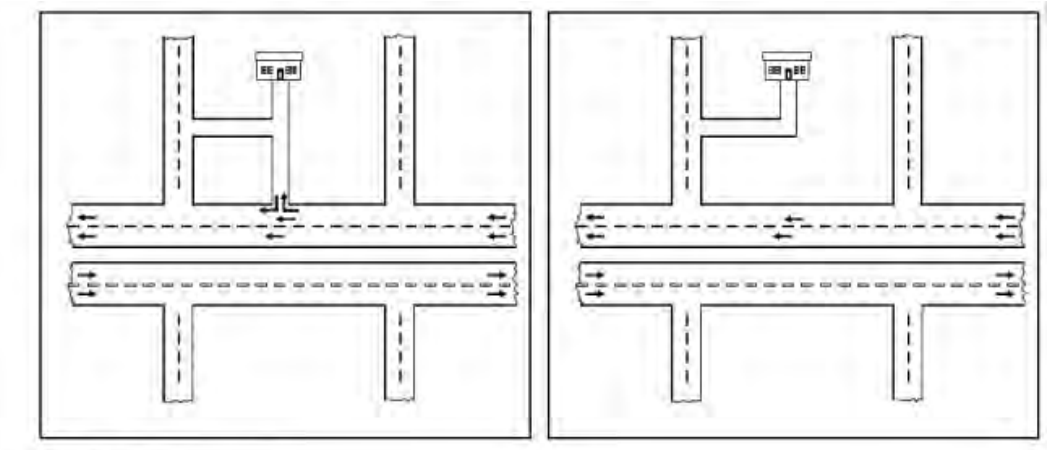


Figure 26 Access Elimination

Image credit: WCR74 ACP

Advanced Traveler Information System

The Advanced Traveler Information Systems applications provide for the collection, aggregation, and dissemination of a wide range of transportation information. The collection of information includes traffic, transit, road weather, and work zone data. Mobile devices, web portals, 511 systems, and variable message signs.

Pros

- Helps to optimize the transportation system by allowing drivers to select the best routes
- May prevent secondary crashes caused by unexpectedly stopped traffic

Cons

- Using apps while driving may result in distracted driving
- Difficult to show conditions on all segments of a planned trip passing through multiple jurisdictions

Other Factors or Considerations

- Different apps or websites may be required to display information about roads within different jurisdictions, for example COtrip only provides information for roads under CDOT's control.

Example

COtrip: CDOT updated its COtrip website, which includes zoomable and searchable map displays, trip planner tools, trucker-specific resources and tools, real-time updates on road conditions and closures, and camera images and live streaming video. CDOT also provides a smart phone App, COtrip Planner, which provides real-time travel information. Travelers can also sign up for text messages and emails which provide similar updates.

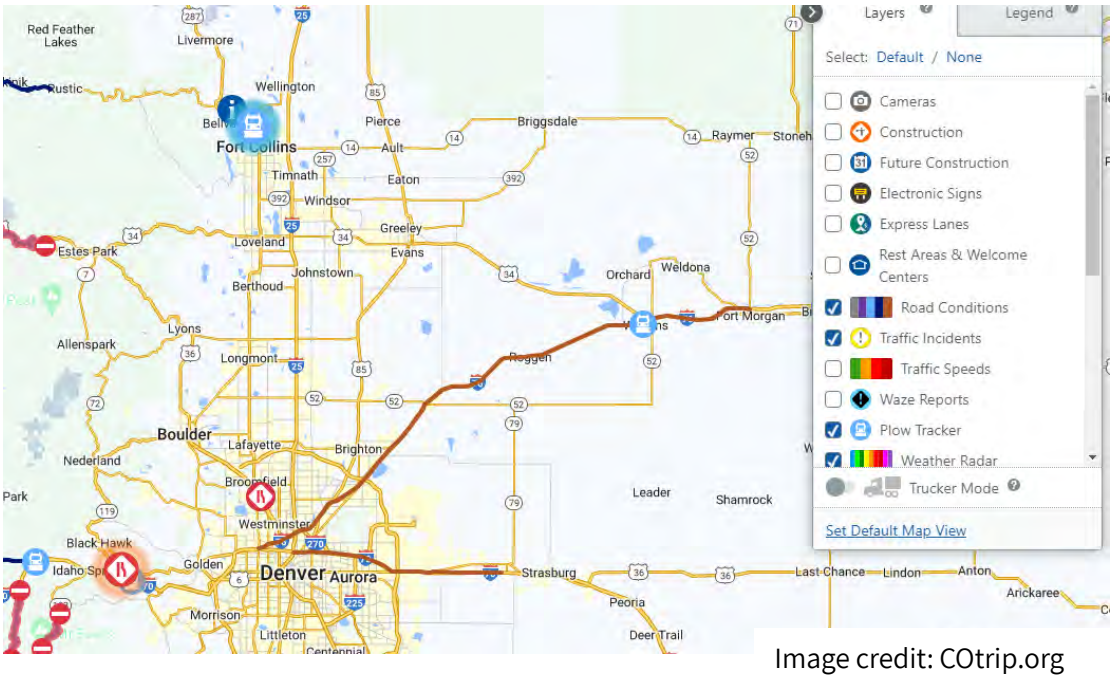


Image credit: COtrip.org

Automatic Road Enforcement

A mounted camera used to record and ticket travelers who disobey a speed limit or other legal road requirement and subsequently mail a ticket to their address of record.

Pros

- Encourages safe driving practices
- May reduce severe or fatal intersection crashes

Cons

- Could have political limitations
- Residents and commuters may distrust data collection by camera
- May lead to more property damage crashes

Other Factors or Considerations

- Based on current State law, points are not assessed to a person's driver license unless they were moving in excess of 25 miles over the speed limit.

Example

Fort Collins Red Light Cameras: Fort Collins Police Services is authorized to use red-light cameras within the City to detect violations at signalized intersections. Red light cameras are located four signalized intersections and programmed to automatically produce photographs depicting any vehicle whose driver has run a red light at the intersection. The four locations are Shields Street and Mulberry Street, Shields Street and Prospect Road, College Avenue and Drake Road, and Harmony Road and Drake Road.

Image credit: Google Maps

Dynamic Parking Management

Parking management notifies travelers of available parking spots, preventing travelers from circulating for extended periods of time looking for parking. Parking management strategies include phone apps and variable sign technology.

Pros

- Efficient parking management could prevent congestion in high-traffic areas such as campuses, hospitals, and downtowns

Cons

- In high demand situations, parking spots may be taken by the time travelers arrive at the parking space
- If parking spaces are readily reserved or easy to find, may counteract effects of parking restrictions and pricing

Other Factors or Considerations

- Some parking apps allow travelers to reserve parking spots ahead of time for a nominal fee, further reducing the need to circulate in search of parking.
- Parking management should occur in conjunction with parking restrictions and pricing to prevent an over-reliance on available parking spaces.

Example

Downtown Fort Collins Parking Garages: Parking garages in Downtown Fort Collins notify drivers of the number of parking spaces remaining via digital signs on the facades of the garages.

Image credit: Google Maps

Electronic Toll Collection

Uses a camera to record vehicle license plate numbers and subsequently mail a bill or an in-vehicle radio-frequency identification (RFID) sensor to charge a toll.

Pros

- Prevents queuing around toll locations
- Significant cost-savings compared to staffed toll booths

Cons

- Initial investment in electronic toll collection is expensive

Other Factors or Considerations

- Limited ability for application.
- Should be considered in conjunction with all toll-lane projects.
- Toll passes may be more cost effective.

Example

ExpressToll: Toll collectors in Colorado use the ExpressToll platform, including E-470, Express Lanes, and the Northwest Parkway. Customers pay tolls using a transponder, which automatically deducts the toll from a pre-paid toll account. In addition, customers with an ExpressToll account pay the reduced toll rate.

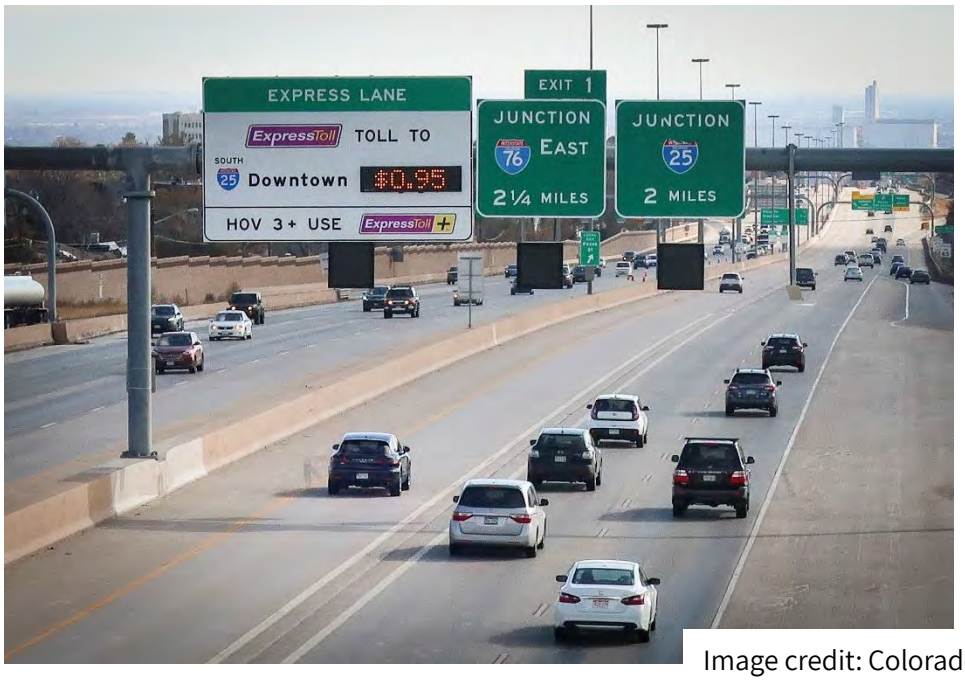


Image credit: Colorado Public Radio

Fiber-Optic Communications

Use pulses of light through an optical fiber to carry information for still and live feed cameras, transfer data to and from Traffic Operations Centers and between traffic signals where adaptive technologies have been installed and connect to the permanent Variable Message Signs (VMS). In the future, fiber will enable Vehicle-to-Everything (V2X) connected vehicle technology, allowing communication between connected vehicles and surrounding environment. V2X encompasses V2V (Vehicle-to-Vehicle), V2I (Vehicle-to-Infrastructure), V2N (Vehicle-to-Network), V2D (Vehicle-to-Device) and V2G (Vehicle-to-Grid).

Pros

- Fiber is more resilient than other communication technologies and is not as susceptible to interference or failure as its wireless counterparts

Cons

- Can be expensive to install
- With rapidly changing technology, investments may become outdated

Other Factors or Considerations

- Roadway and utility projects that require digging up existing infrastructure should consider implementing fiber at time of construction to lower the cost of implementing fiber.

Example

CDOT Fiber Network: CDOT currently operates a fiber network along I-25 from the Wyoming state line to the New Mexico state line. Specifically in the NFRMPO, CDOT currently operates a fiber network along US34 from I-25 to US85, and on US85 from US34 south to the Denver Metro area. CDOT has proposed fiber along US34 between US85 and I-76.

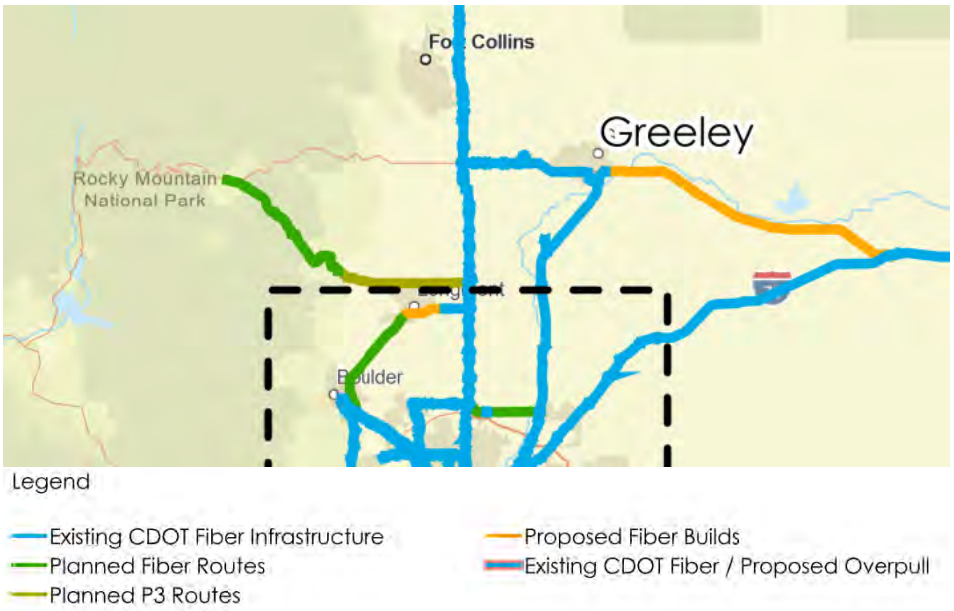


Image credit: CDOT

Maintenance Decisions and Support System (MDSS)

A computer-based tool employed by road operating agencies to provide recommendations on road maintenance courses of action based on corridor-specific historical, current, and forecasted road and weather data. Recommendations can include treatment type and amount of material, optimal application times, short-term incident management strategies for quick response, and closures or advisories. MDSS also provide training opportunities for maintenance personnel using historical event playbacks.

Pros

- Reduces cost of labor, materials, and equipment
- Improves safety
- Reduces response time
- Provides training opportunity for new and experienced maintenance staff
- Improves collaboration within and between agencies

Cons

- Can be costly to implement the system and maintain data, operating, and hosting agreements
- System implementation may require shifts in organizational and management structures
- System may rely on data not currently collected by an agency

Other Factors or Considerations

- One system may be able to serve multiple agencies and/or MDSS outputs may help inform strategies for agencies not actively using the system.
- Analyzing effectiveness of MDSS recommendations and learning system biases and tendencies are key to calibrating the system.

Example

CDOT Winter Maintenance: CDOT's Maintenance Decision Support System (MDSS) combines advanced weather prediction, advanced road condition prediction and rules of practice for anti-icing and de-icing to generate road treatment recommendations on a route-by-route basis. CDOT crews compare real-time conditions, including road and ambient temperature, type of snow removal products being used and the application rate to weather reports. The system provides suggested treatments based on the information and models.

Image credit: CDOT

Ramp Metering

Traffic signals installed on freeway on-ramps to manage the rate of vehicles entering the freeway. Vehicles wait at a designated stop line for a green light that releases individual vehicles into mainline traffic. The signal releases vehicles based on the freeway traffic volume and current speed to minimize stoppages and slowdowns cause by merging and weaving. Volume and speed information are collected by detectors in the mainline freeway pavement.

Pros

- Increased mainline speeds and decreased travel times
- Decreased rear-end and side crashes
- Emission reductions

Cons

- Installation can be expensive
- Relies on drivers following rules and regulations

Other Factors or Considerations

- A ramp meter feasibility study by CDOT found all ramps on I-25 from Johnstown to Fort Collins could use ramp meters.

Example

Local installation: CDOT has installed ramp meters along I-25 on the southbound Harmony Road on-ramp and the northbound and southbound SH392/Carpenter Road on-ramps at a cost of $400,000.

Image credit: Google Maps

Signage Improvements

Additional signage, signage upgrades, or removal of non-essential signs can facilitate the route-finding and decision-making ability of roadway users.

Pros

- Signage installation is relatively low-cost
- Signage allows users to make more informed decisions with ample time to react and provides reminders of ways to keep traffic moving safely and efficiently

Cons

- Too much or poorly placed additional signage can create a chaotic environment and/or go unnoticed
- Signage may not fix infrastructural issues

Other Factors or Considerations

- Refer to the Manual on Uniform Traffic Control Devices (MUTCD) for minimum standards and guidance on uniformity of messages, locations, sizes, shape, colors, and more.

Example

Signs around the region alert drivers of major intersections, traffic signals, bicycle and pedestrian crossings, and other important areas that need additional or intentional driver attention.

Image credit: Google Maps

Traffic Operations Center

A central command center which allows traffic engineers to monitor traffic signals, closed-circuit television (CCTV), and remote data sensors to analyze and manage traffic in real-time.

Pros

- Traffic engineers can monitor the transportation system, update driver information via variable message signs (VMS), modify signal timings, and troubleshoot many signal malfunctions remotely in real time
- Changes to signal timing can reduce delays, travel times, and emissions

Cons

- TOCs are costly to implement and maintain

Other Factors or Considerations

- Remote traffic signal control requires installation of communication infrastructure across the system.

Example

Municipal Traffic Operations: The cities of Fort Collins, Greeley, and Loveland each have a TOC. The City of Fort Collins Traffic Operations department oversees all aspects of traffic related responsibilities within the City, including signal systems, signs and pavement markings, traffic engineering such as speed limits, other studies, work area traffic control, safety, pedestrian and bike innovations, neighborhood traffic mitigation, etc.

Image credit: Fort Collins Traffic Operations

Traffic Signal Timing Adjustments

Adjustments to signal timing patterns are necessary over time as conditions and traffic patterns change. Inadequate timing may result in unnecessary idling, delays, and cues, especially at peak times when patterns shift dramatically at certain locations.

Pros

- Reduces idling, delays, cues, crashes, travel times, and emissions
- Can enhance the pedestrian and bicyclist experience if clearance intervals are extended at dedicated signals

Cons

- Signal timing adjustments can be costly and require new equipment that may be incompatible with existing infrastructure

Other Factors or Considerations

- Determining need for signal timing adjustments may require a traffic study.
- Reasons to retime signals include land use changes, population growth, traffic growth changes in vehicle classification profiles, incident management, special events, construction work zone or temporary traffic signal, traffic signal equipment change, scheduled or periodic traffic signal retiming, and high crash rates.

Example

Adaptive Signals: Several agencies have installed Adaptive Signal Control Technologies (ASCT) along congested corridors. ASCT changes signal timing based in real time as demand changes. Greeley has received funding from the NFRMPO to expand its ASCT to 35th Avenue, which would integrate with existing signaling on US34 Bypass and 10th Street. CDOT has also installed Commercial Vehicle Signal Priority (CVSP) detection devices along US85 to detect by extending the green phase of a signal for approaching commercial vehicles to reduce delay caused by the slow acceleration and deceleration of stopping at red lights and improve safety.

Image credit: Greeley Transportation Services

Transit Signal Priority

Transit Signal Priority (TSP) tools modify traffic signal timing or phasing when transit vehicles are present either conditionally for late runs or unconditionally for all arriving transit.[14] Queue jump lanes allow transit priority at red traffic signals, meaning the bus will receive a green light prior to general traffic.

Pros

- Allows transit services to remain on schedule or to make up time
- Fewer stops can make a more comfortable ride for transit riders
- Can be installed at major intersections, does not need to be installed at each intersection to be useful

Cons

- Requires additional technology for buses and traffic signals
- Can be abused by non-transit vehicles
- Does not help if bus is stuck behind a line of non-transit vehicles
- Could impact traffic on side or cross streets

Other Factors or Considerations

- TSP is predominantly used for BRT but can benefit local buses fitted with the proper technology.
- Need for TSP depends on traffic and transit volumes.
- TSP requires the coordination of traffic engineers, transit staff, and possibly CDOT.

Example

MAX: Fort Collins uses TSP along the MAX corridor. Traffic signals operated by Fort Collins, Loveland, Greeley, and CDOT may be able to allow installation of TSP software in the future.

Image credit: Google Maps

[14] Transit Street Design Guide, National Association of City Transportation Officials, https://nacto.org/publication/transit-street-design-guide/intersections/signals-operations/active-transit-signal-priority/, accessed 3/22/19.

Variable Speed Limits

Typically used on interstate highways or high-speed arterials, VSLs leverage data on volume, operating speeds, weather information, sight distance, and roadway surface conditions to digitally post appropriate speed limits.

Pros

- Eliminate or delay bottlenecks
- Reduce crashes associated with slowed traffic on high-speed roadways
- Increase road capacity by decreasing vehicle spacing distances
- Reduced emissions due to less stop-and-go driving

Cons

- Increased maintenance costs
- Driver compliance varies
- Developing VSL algorithms is complicated
- If poorly managed, VSLs can increase variance in speeds

Other Factors or Considerations

- Variable message signs (VMS) are often used to achieve similar objectives by displaying messages such as "Slow Traffic Ahead".

Example

I-25 South Gap: CDOT used an on-site project operations center staffed seven days per week to manage safety on the project. One of the tools used by the operations center was portable/variable speed limit signs. In total, 22 portable variable speed limit trailers were used on the project.[15]

Image credit: CDOT

[15] Managed work zone on Colorado's I-25 shows tech's life-saving value, 2020. Accessed 3/29/2023.

Tier 5: Traffic Incident Management (TIM)

A traffic incident is any occurrence that impedes the normal flow of traffic on a highway, including crashes, vehicle breakdowns, and spilled loads. According to FHWA:

> *Traffic Incident Management (TIM) consists of a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. Effective TIM reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims and emergency responders.*[16]

TIM activities are typically categorized into five overlapping functional areas:

1. **Detection and Verification**: the determination that an incident of some type has occurred, and the determination of the precise location and nature of the incident.
2. **Traveler Information**: The communication of incident related information to motorists who are at the scene of the incident, approaching the scene of the incident, or not yet departed from work, home, or other location.
3. **Response**: The activation of a "planned" strategy for the safe and rapid deployment of the most appropriate personnel and resources to the incident scene.
4. **Scene Management and Traffic Control**: the coordination and management of resources and activities at or near the incident scene, including personnel, equipment, and communication links and the process of managing vehicular traffic around the scene of the incident.
5. **Quick Clearance and Recovery**[17]: the safe and timely removal of a vehicle, wreckage, debris, or spilled material from the roadway and the restoration of the roadway to its full capacity.

These functional areas incorporate a number of operational agencies to assist in traffic incident recovery. Typically, the agencies responsible for incident recovery include: CDOT, State and local law enforcement, Fire/EMS, local jurisdictions, coroners, courtesy patrols, and towing/recovery agencies.

IN-VEHICLE TECHNOLOGY

Much of the progress in Traffic Incident Management is being made through in-vehicle technology. Onboard systems are increasingly providing improved travel information, including route options and alerts for hazards. Some vehicles are even equipped with emergency response systems, alerting the proper authorities when the vehicle and driver have been in an accident. As in-vehicle safety systems continue to improve, traditional Traffic Incident Management protocol may change.

[16] Traffic Incident Management. U.S. Department of Transportation. Federal Highway Administration. Emergency Transportation Operations. http://ops.fhwa.dot.gov/eto_tim_pse/about/tim.htm Accessed 3/5/19.
[17] Best Practices in Traffic Incident Management. U.S. Department of Transportation. Federal Highway Administration. Emergency Transportation Operations. September 2010. https://ops.fhwa.dot.gov/publications/fhwahop10050/fhwahop10050.pdf Accessed 3/5/19.

Courtesy Patrol

Service provided to stranded freeway (or tollway) travelers to assist with vehicle breakdowns, stalls and crashes.

Pros

- May help reduce secondary crashes
- Reduce the time vehicles are disabled within the right-of-way

Cons

- May be costly to implement

Other Factors or Considerations

- Courtesy patrol programs do not replace emergency responders, but can serve as a stop gap.
- May only be applicable for high-travel corridors with high incident rates.

Example

Safety Patrol: CDOT partners with GEICO to provide limited roadside assistance at no charge to drivers in need. The Safety Patrol Program can provide fuel, change flat tires, jumpstart vehicles, provide lockout assistance, move disabled vehicles to the shoulder, assist stranded motorists, provide back up to Colorado State Patrol at incident scenes, and clear debris from the highway to improve traffic flow and prevent future incidents.

Image credit: CDOT

TIM Plans

TIMPs are plans and programs developed to improve the procedural and coordination components of unplanned events on the roadways that impact traffic flow. These events can include stalled vehicles, crashes, hazardous materials incidents, and more. TIMP allows first responders, maintenance and operations crews, and other partners to better communicate and coordinate before, during, and after an incident by standardizing roles and expectations.

Pros

- Increased safety at incident sites for motorists and responders
- Reduced traffic flow recovery time after incidents
- Development of a TIMP provides training, networking, and best practice-sharing opportunities for agency staff

Cons

- Requires intensive involvement from many agencies along the corridor

Other Factors or Considerations

- Decisions made during the TIMP development process must consider existing protocols and agreements.

Example

Colorado TIM Program: The Statewide TIM program states its goal as "removing incidents from Colorado's highways and restores normal travel operations as safely and quickly as possible." TIM teams have been developed around the State. Larimer and Weld counties are part of the Northeast TIM region. Teams within the NFRMPO region include I-25 and US85. TIM teams are made up of CDOT and Colorado State Patrol (CSP) staff and captains who coordinate on incidents along major corridors. [18]

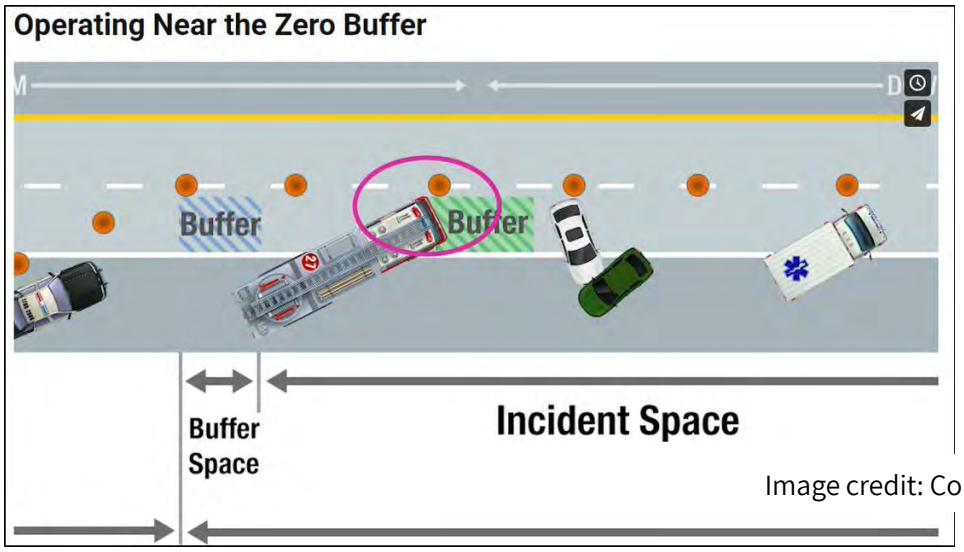


Image credit: Colorado TIM Program

[18] Colorado TIM Program. Accessed 3/29/2023.

Tier 6: Roadway Capacity

Though increasing roadway capacity can produce significant reductions in congestion in the short term, these projects are typically extremely costly, can cause congestion during construction, and tend to have a shorter lifetime of proposed benefits.

Auxiliary Lanes

Auxiliary Lanes include turning lanes and deceleration and acceleration lanes. Turn lanes are additional lanes that separate left or right turning vehicles from through-traffic. Deceleration lanes are extensions placed just prior to a freeway exit or intersection turn lane to allow vehicles to reduce speed outside the through-lanes. Acceleration lanes are extensions provided following entrance to the freeway or turn lane onto an arterial street for vehicles to increase speed and merge more smoothly into the through lane.

Pros

- Allows vehicles safe merging onto high-speed highways or slower speed arterials

Cons

- May require property acquisition
- Auxiliary lanes are costly
- Widens intersections, creating a longer distance for pedestrians to cross

Other Factors or Considerations

- Acceleration and deceleration lanes should be made long enough to allow drivers to cover the speed differential from the on or off-ramp.

Example

I-25 Auxiliary Lane: CDOT Installed an auxiliary lane along northbound I-25 to connect the 136th Avenue on-ramp to the 144th Avenue off-ramp, which helps drivers merge more comfortably between the two interchanges.

Image credit: Google Maps

Climbing Lanes

Additional lanes provided for a short distance, where grade is steep, to allow slower-moving vehicles (e.g. trucks and recreational vehicles) to move to the right, allowing faster-moving vehicles to pass.

Pros

- Relieves congestion caused by slow moving vehicles
- Reduces crashes

Cons

- Merging as the climbing lane ends can cause bottlenecks during peak periods
- Lane additions are costly

Other Factors or Considerations

- Chapter 3 of CDOT's 2005 Roadway Design Guide provides guidance on justification criteria when considering climbing lanes.

Example

Berthoud Climbing Lane: In 2016, CDOT constructed a southbound climbing lane on I-25 from south of SH56 to south of Weld County Road 38. The third lane allows large and/or slow moving vehicles to move all the way right during the fairly steep ascent.

Image credit: Google Maps

Grade-Separated Crossings/Intersections

A grade-separated intersection is a crossing at which converging facilities are separated vertically, removing the need for a signalized crossing and allowing each facility to flow without interrution. Grade separation for congestion management purposes is commonly used to remove conflicts between automobiles, automobiles and trains, automobiles and bicyclists, automobiles and pedestrians, or some other combination. Grade separation can bring both congestion relief and safety benefits to travelers.

Pros

- Reduces congestion caused by the presence of signalized intersections
- Reduces crashes by eliminating conflicts between vehicles or vehicles and other travel modes

Cons

- Grade-separated intersections are extremely costly

Other Factors or Considerations

- Where space allows, grade separation for a specific mode of travel may present opportunity to include other modes. For instance, including bicycle lanes and a shared-use path where a road passes under a highway removes a barrier for all users by building just one grade-separated intersection.

Example

Lemay Avenue and Vine Drive: Fort Collins opened the grade-separated crossing of Lemay Avenue over Vine Drive in December 2021. The existing at-grade intersection was located just north of the BNSF Railway and could become congested during peak hours and when the train passed through. The new Lemay Avenue bridge provides additional capacity and multiuse paths for bicycles and pedestrians.

Image credit: Fort Collins Flickr

New Lanes/Roads

Additional travel lanes on existing roadways or new roadways along separate corridors.

Pros

- Adds significant short-term capacity
- Can connect new areas to activity centers
- Accommodates new growth outside of urban core

Cons

- Extremely costly to implement
- Induces demand on the treated corridor
- Growth of population and jobs in the region, leading to an increase in VMT, will further reduce the benefit of project
- Long construction times may cause delays
- Imposes environmental impacts and requires mitigation

Other Factors or Considerations

- Requires consideration and proof of insufficiency of TDM and/or operational efficiency improvements prior to being incorporated in TIP.

Example

Suniga Road: Fort Collins designed and built East Suniga Road from its existing terminus at Redwood Street to the new Lemay Avenue overpass. This new extension provides relief for Vine Drive , new connections to Lemay Avenue, and additional opportunities for development in the fast growing north Fort Collins area.

Image credit: Google Maps

Roundabouts

Roundabouts are yield-controlled intersections, usually circular-, oval-, peanut-, or dogbone-shaped. Traffic enters the roundabout when the coast is clear and travels counterclockwise at slow speeds around a center island. Traffic only stops prior to entering if there is oncoming traffic. When designed properly, roundabouts can safely and efficiently accommodate all travel modes.

Pros

- Reduces conflict points and crashes at intersections (traditional intersections have 32 conflict points; roundabouts have eight conflict points)
- Reduces delay and improves traffic flow
- Higher capacity than traditional intersections
- Less expensive than traditional signalized intersections
- Potentially less space is required at the approaches of a roundabout due to removal of turn lanes

Cons

- The roundabout itself may require more space than a traditional intersection
- Requires educational outreach on benefits and proper use
- Costly to construct

Other Factors or Considerations

- Local agencies often develop informational materials for the public when implementing roundabouts. The City of Fort Collins has published a Roundabout User Guide as well as an informational video.
- If the roundabout is on a route frequented by truck traffic, it is important to incorporate elements such as a truck apron along the center island.

Example

WCR54 & WCR17 Roundabout: Weld County designed and built a new roundabout at Weld County Road (WCR) 54 and WCR 17, which opened in August 2020. The roundabout is designed for the heavy agricultural and oil and gas trucks that travel this corridor, which is expected to increase. Additionally, this roundabout will provide additional capacity compared to the stop signs as the SH402/Freedom Parkway develops.

Image credit: Weld County

Toll/Express Lanes

New lane or conversion of an existing lane to serve toll paying vehicles; typically, congestion-based or time-based pricing.

Pros

- Helps alleviate congestion during peak periods and other periods of high demand
- Could help alleviate recurring and non-recurring congestion
- Tolls may help provide necessary funding to operate

Cons

- Extremely costly to implement
- Induces demand on the treated corridor
- Growth of population and jobs in the region, leading to an increase in VMT, will further reduce the benefit of project
- Long construction times may cause delays

Other Factors or Considerations

- Consider operating in conjunction with Electronic Toll Collection to avoid congestion near tolling location.
- Egress and ingress to and from the express or toll lane should be managed to mitigate the potential for collisions.
- May encourage carpooling by allowing use of a Switchable HOV Transponder for free.

Example

CDOT is constructing the *North I-25: Express Lanes* project between Fort Collins and Mead, which will build an express lane in each direction in addition to other infrastructure upgrades. The Express Lanes will allow for HOV3+ vehicles to use the lanes for no cost at all times, while others may pay dynamic tolls to use the lanes.

Image credit: Google Maps

North Front Range
Metropolitan
Planning
Organization

5

Implementing the CMP

2050 RTP
REGIONAL TRANSPORTATION PLAN

5.1 Implementation

The CMP and its related strategies will influence and be integrated with various NFRMPO plans and programs. These include the NFRMPO Call for Projects and associated funding sources, Transportation Improvement Program (TIP), Regional Transportation Plan (RTP), and the growing TDM program.

Calls for Projects

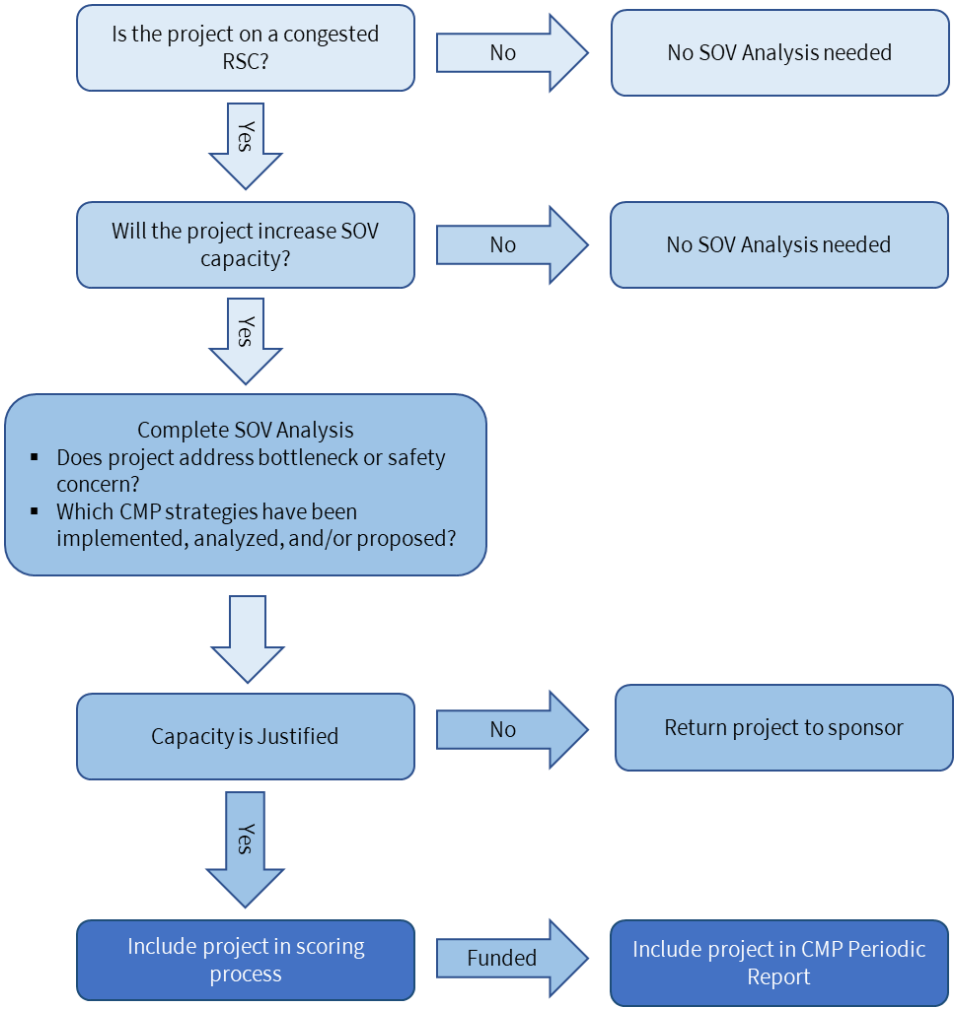
The NFRMPO will consider CMP strategies in the selection of projects for the five major funding sources awarded by the NFRMPO: Congestion Mitigation & Air Quality (CMAQ); Surface Transportation Block Grant (STBG); Transportation Alternatives (TA); Carbon Reduction Program; and Multimodal Transportation and Mitigation Options Funds (MMOF). Incorporation of CMP strategies into the Call for Projects may include:

- Specific application questions related to justifying need for expanded capacity
- Worksheet explaining implementation of CMP strategies prior to project selection
- Scoring criteria related to CMP strategy implementation

The NFRMPO should implement a capacity screening process in the Call for Projects, as demonstrated in **Figure 12**.

Each of the funding sources are described in the following section. **Table 8** identifies the CMP strategies that are eligible for each funding type; however, additional strategies may be deemed eligible on a case-by-case basis. Local communities and the NFRMPO should consider how each funding source can support and fund CMP strategies. In many cases, multiple funding sources may be combined to address multiple causes of congestion.

Figure 12: Recommended Call for Projects Capacity Screening Process



Congestion Mitigation & Air Quality (CMAQ)

The CMAQ program provides "a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas)."[19]

[19] Congestion Mitigation and Air Quality Improvement Program Fact Sheet, FHWA, https://www.fhwa.dot.gov/fastact/factsheets/cmaqfs.cfm, accessed 4/18/19.

Surface Transportation Block Grant (STBG)

According to FHWA, the Surface Transportation Block Grant program (STBG) provides "flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals."[20]

Transportation Alternatives (TA) Program

TA funds are a "set-aside of the Surface Transportation Block Grant (STBG) program funding. These set-aside funds include all projects and activities that were previously eligible under TAP, encompassing a variety of smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, and safe routes to school projects."[21]

Carbon Reduction Program (CRP)

CRP funds are intended for "projects designed to reduce transportation emissions, defined as carbon dioxide (CO2) emissions from on-road highway sources."[22]

Multimodal Transportation & Mitigation Options Funds (MMOF)

According to CDOT, the MMOF program promotes a "complete and integrated multimodal system that benefits seniors by making aging in place more feasible; benefits residents of rural and Disproportionately Impacted (DI) Communities by providing them with more accessible and flexible public transportation services; provides enhanced mobility for persons with disabilities; provides safe routes to school for children; and reduces emissions of air pollutants and Greenhouse Gases (GHG) that contribute to adverse environmental effects, including but not limited to Climate Change and adverse Human Health Effects."[23]

Table 8: CMP Strategy Eligibilities by Funding Program[24]

CMP Strategy	CMAQ	STBG	TA	CRP	MMOF
Tier 1: Shorten Trips and Reduce Need for Trips					
Efficient Land Use and Development Practices					
Telecommuting	✓			✓	
Tier 2: Encourage Shift to Transit and Active Modes					
Bicycle Infrastructure	✓	✓	✓	✓	✓

[20] Surface Transportation Block Grant Program (STBG), FHWA, https://www.fhwa.dot.gov/specialfunding/stp/, accessed 4/18/19.
[21] Transportation Alternatives Fact Sheet, FHWA, https://www.fhwa.dot.gov/fastact/factsheets/transportationalternativesfs.cfm, accessed 4/18/19.
[22] Carbon Reduction Program (CRP), FHWA, https://www.fhwa.dot.gov/bipartisan-infrastructure-law/crp_fact_sheet.cfm, accessed 3/30/23.
[23] Multimodal Transportation and Mitigation Options Fund (MMOF) Local MMOF Program Guidelines, CDOT, https://www.codot.gov/programs/planning/assets/grants/mmof/mmof-local-fund-overview-final-14oct2019.pdf, accessed 3/30/23.
[24] This table is intended to provide a general sense of project eligibilities by funding source, not a definitive list. Additional eligibilities may be identified on a case-by-case basis.

CMP Strategy	CMAQ	STBG	TA	CRP	MMOF
Bicycle and Scooter Share Service	✓				
Bus Rapid Transit (BRT)	✓			✓	✓
Car Sharing	✓				
Complete Streets Policies					
Mobility Hubs	✓	✓		✓	✓
Parking Pricing or Parking Restrictions	✓			✓	
Pay-as-You-Drive Insurance					
Pedestrian Infrastructure	✓	✓	✓	✓	✓
Transit Incentives	✓				✓
Transit Service Quality Factors	✓	✓		✓	✓
Transit Service Quantity Factors	✓	✓		✓	✓
Tier 3: Increase Vehicle Occupancy and Shift Travel to Non-Peak Periods					
Alternative/Flexible Work Schedules					
Congestion Pricing	✓			✓	
Guaranteed Ride Home	✓				
HOV Lanes	✓			✓	
Ridesharing	✓			✓	✓
Tier 4: Improve Roadway Operations without Expansion, including ITS					
Access Management	✓	✓		✓	
Advanced Traveler Information System	✓			✓	
Automatic Road Enforcement					
Dynamic Parking Management				✓	
Electronic Toll Collection	✓			✓	
Fiber-Optic Communications	✓				
Maintenance Decisions and Support System (MDSS)					
Ramp Metering	✓				
Signage Improvements					
Traffic Operations Center					
Traffic Signal Timing Adjustments	✓			✓	
Transit Signal Priority	✓			✓	✓
Variable Speed Limits	✓				
Tier 5: Traffic Incident Management (TIM)					
Courtesy patrol					
Traffic Incident Management Plans (TIMP)					
Tier 6: Roadway Capacity					
Auxiliary Lanes	✓	✓			
Climbing Lanes		✓			
Grade-separated railroad crossings/intersections		✓			
New lanes/roads		✓			
Roundabouts	✓	✓			
Toll/Express Lanes		✓			

Transportation Demand Management (TDM) Program

The NFRMPO is in the process of developing a TDM program for Northern Colorado, expanding the purview of its RideNoCo Mobility program. The TDM program will be responsible for supporting local governments, businesses, employees, visitors, and other stakeholders with identifying transportation options other than single-occupancy vehicle trips. As of spring 2023, the NFRMPO operates or is developing the following tools to assist in implementation of TDM strategies:

- RideNoCo Call Center and Trip Discovery tool
- Development of US34 Transportation Management Organization (TMO)
- Expansion of VanGo™ Vanpools to Estes Park

Evaluation

Periodic Report

The NFRMPO will develop a periodic report evaluating the Regionally Significant Corridors (RSCs) for congestion, which strategies have been implemented or are in planning, and which strategies may need to be further implemented. The Periodic Report will consider what is laid out in the Evaluation section.

Story Map

NFRMPO staff has developed a GIS Story Map evaluating the impacts of CMP strategies on the congested RSC network. This Story Map will be used to evaluate potential strategies in focused areas around the region and make recommendations for improvements. This Story Map should be periodically updated based on new data, strategies, and potential implementation.

Planning and Programs

In the development of new NFRMPO plans and programs, local communities and NFRMPO staff should evaluate the impact of these strategies on identified congested RSCs. Examples of evaluation by plan is shown in **Table 9**.

Table 9: CMP Strategy Evaluation Method

NFRMPO Plan	Evaluation
Active Transportation Plan	Building out the Regional Active Transportation Corridors (RATCs) implements the Bicycle and Pedestrian Infrastructure strategies laid out in the 2023 CMP, making active transportation more attractive as an option. Additionally, improvement to trail crossings, improved sidewalk and trail quality, and expansion of micromobility options can impact congested RSCs as well.
Freight Northern Colorado	The NFRMPO's Freight Plan considers how congestion may impact the movement of freight in the region. Truck Travel Time Reliability (TTRI) is both impacted by and impacts congestion in the region.
Coordinated Public Transit/Human Services Transportation Plan	The Coordinated Public Transit/Human Services Transportation Plan focuses on mobility of older adults and individuals with disabilities; however, improvements like better access to transit, a better link between land use and transportation, and all-weather safety considerations may have spillover effects onto congestion in the region.