Chapter 11

Congestion Management Process

Aerial View of Severance. Image Credit: Town of Severance

Chapter 11: Congestion Management Process

A. Introduction

New residents are moving into the North Front Range region every day. Offering travelers' safe, convenient transportation alternatives can reduce vehicular congestion on the regional roadway system. The North Front Range Metropolitan Planning Organization's (NFRMPO) Congestion Management Process (CMP) creates a performance-based plan to track regional congestion.

Now, more than ever, residents of the North Front Range region are incorporating walking, bicycling, and transit in their daily commutes. Intelligent Transportation Systems (ITS) and Travel Demand Management (TDM) principles are reducing regional congestion by increasing efficiency and highlighting new mode choices.

In the sections that follow, the steps to create a CMP are outlined. Consistent, ongoing data collection efforts will supply information for annual CMP reporting. The goal of CMP reporting is to create a performance-based CMP for the region.

B. Background

Purpose of the CMP

The purpose of a CMP is to identify the process for collecting congestion data, develop performance measures used to report congestion data to the public, and guide funding toward projects and strategies which most effectively address congestion. The 2015 CMP Report augments existing plans in the metropolitan transportation planning process, while annual CMP reports track transportation system performance.

Federal requirements state regions with a population over 200,000 in urbanized areas (UZAs), also known as Transportation Management Areas (TMAs), must develop and maintain a CMP and use it to make informed transportation planning decisions. The 2015 CMP Report identifies congested Regionally Significant Corridors (RSCs), develops strategies to mitigate the congestion, and provides a way to monitor the effectiveness of the strategies.

Requirements for a CMP

The current funding authorization bill, Moving Ahead for Progress in the 21st Century Act (MAP-21) requires consideration first be given to strategies which reduce single-occupant vehicle (SOV) travel and improve the efficiency of the existing transportation system. All reasonable strategies must be analyzed before a capacity increasing improvement is proposed as a congestion management technique.

Federal regulations (23 CFR Part 450.320)[4] specify an effective CMP should include:

- Methods to monitor and evaluate the performance of the multi-modal transportation system, identify the causes of recurring and nonrecurring congestion, identify and evaluate alternative strategies,

[4] 23 CFR 450.320 – Congestion Management Process in Transportation Management Areas. GPO U.S. Government Publishing Office. http://www.gpo.gov/fdsys/granule/CFR-2011-title23-vol1/CFR-2011-title23-vol1-sec450-320

provide information supporting the implementation of actions, and evaluate the efficiency and effectiveness of implemented actions;

- Defined objectives and performance measures to assess congestion and evaluate congestion reduction and mobility enhancement strategy effectiveness;
- Establish a data collection and system performance monitoring program that defines the extent and causes of congestion, determines the causes of congestion, and evaluates the efficiency and effectiveness of implemented actions;
- Identifies and evaluates the anticipated performance and benefits of both traditional and non-traditional congestion management strategies;
- Identifies an implementation schedule, responsibilities, and potential funding sources for each strategy; and
- Identifies a process for periodic assessment of the efficiency and effectiveness of implemented strategies.

MAP-21 legislation requires performance measures, targets, plans, and reporting. This performance and outcome-based program ensures States invest resources in projects which collectively make progress toward the achievement of national goals. The legislation outlines seven national goal performance areas, highlighted in **Table 11-1**.

Table 11-1 MAP-21 Seven National Performance Areas

Goal Area	National Goal
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 (NHS)
System Reliability	To improve the efficiency of the surface transportation system
Freight Movement and Economic Vitality	To improve the national 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

Source: *FHWA MAP-21 Performance Management*[5]

[5] FHWA. Performance Management. Fact Sheet. http://www.fhwa.dot.gov/map21/factsheets/pm.cfm

Three of the national goals directly pertain to the CMP: Congestion Reduction, System Reliability, and Freight Movement and Economic Vitality. **Section D** of this chapter discusses strategies to alleviate congestion.

History of the NFRMPO CMP

Originally, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) introduced the concept of Congestion Management Systems (CMS). The CMS was created to collect congestion data, enhance the tools for data management and modeling, expand the use of ITS, and encourage regional cooperation and coordination.

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) continued the CMS requirement. In 2005, the Safe Accountable Flexible Efficient Transportation Equity Act - A Legacy for the Users (SAFETEA-LU) was signed into law to continue this effort by requiring the use of a Congestion Management Process in TMAs. MAP-21, the current federal transportation bill, signed into law in 2012, maintains the CMP requirement, but requires enhanced monitoring, reporting of congestion, reliability, and formalized performance measures.

The NFRMPO was designated as a TMA in 2002, following the 2000 US Census. In 2004, FHWA accepted a Congestion Management Framework in lieu of a Congestion Management System, given the short timeframe between the NFRMPO's TMA designation and the publication of the *2030 Regional Transportation Plan* (RTP). In 2007, the NFRMPO expanded the framework into a full CMP and integrated it with the 2035 RTP.

During the development of the *2010 CMP* and *2035 RTP* in 2007, the NFRMPO's Technical Advisory Committee and Planning Council identified the Tier One RSCs to be the focus of the CMP in the North Front Range. Tier One corridors included I-25, US 34, US 287, and their parallel facilities although data was only collected for the main corridor. For the *2040 RTP*, the NFRMPO has moved away from tiers to individual corridors. All congested roadway RSCs are included in the *2015 CMP* data collection and analysis. The RSCs can be found in **Table 2-1** in **Chapter 2**.

The *2010 CMP* concluded with two possible modifications to the CMP in the future, including:

- Update the identification of currently congested corridors based on actual data collected through the region-wide data collection program, rather than using travel demand model results.
- Reconsider the network for which the CMP applies; the CMP may not be as appropriate to rural portions of the Tier One corridors as the portions that are in urban areas.

Over the last year, NFRMPO members have begun collecting real-time travel data in the region (**Section C**). As the data accumulates, longitudinal studies will be possible. In the interim, the NFRMPO's RTDM will be used to identify corridors to deploy data collection devices along with local expertise.

Vision, Goals, and Objectives of the Congestion Management Process

The vision statement for the 2015 CMP Report is:

The North Front Range Metropolitan Planning Organization strives to objectively reduce congestion on regionally significant corridors using TDM strategies.

Four NFRMPO CMP specific goals and objectives were developed to support this vision, including:

Goal 1: Improve Efficiency

Objective: Reduce congestion with cost-effective, non-roadway-widening solutions that use technology to the best advantage, such as traffic management, TDM, and ITS.

Goal 2: Increase Mobility

Objective: Make non-SOV transportation modes (walking, bicycling, transit, carpooling, and vanpooling) more available, convenient, safe, and attractive for everyone.

Goal 3: Improve Safety

Objective: Reduce crashes for all modes, focusing especially on improving safety for pedestrians and bicyclists and on reducing the number of incident-related crashes.

Goal 4: Increase Reliability

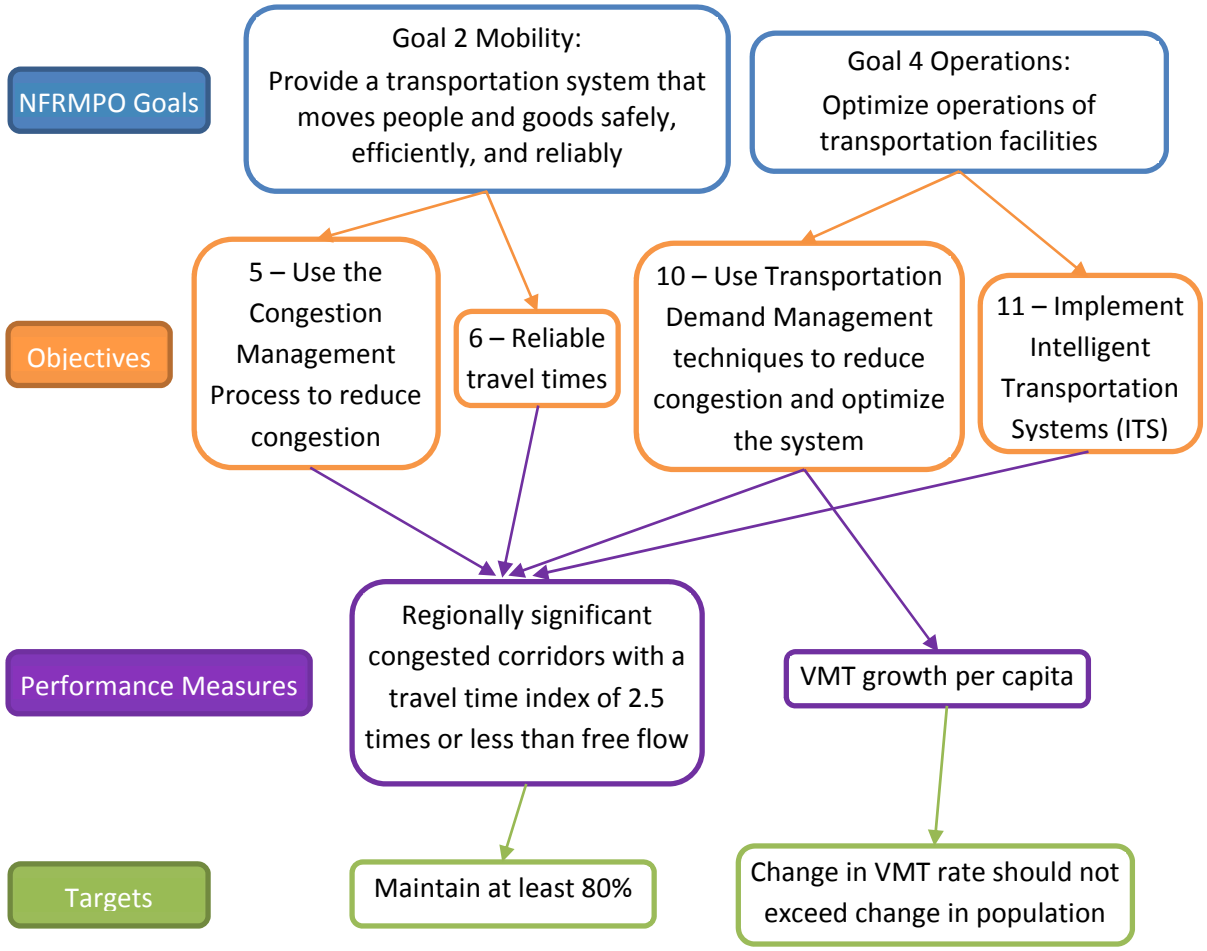
Objective: Increase travel time reliability while reducing user exposure to traffic incidents, crashes, and work zones. [6]

Two performance measures outlined in **Chapter 4** from the 2040 RTP adopted Goals, Objectives, Performance Measures, and Targets (GOPMT) are specific to the CMP, **Figure 11-1.**

The performance measures in the 2040 RTP GOPMTs match CMP objectives. To help complete the picture of regional congestion transit performance measures have been selected and are detailed in **Section D** of this chapter.

[6] Boston Region MPO Congestion Management Process. 2013. Chapter 1. http://www.ctps.org/Drupal/cmp

Figure 11-1: 2040 RTP-CMP Specific Goals, Objectives, Performance Measures, and Targets



Integration in the Planning Process

The CMP has the potential to create an efficient transportation system, increase mobility, and maximize the utility of limited resources. It enables the NFRMPO to measure system performance in a systematic manner. The CMP is tied to the federally required RTP and helps to inform the NFRMPO Transportation Improvement Program.

While the RTP provides a vision for transportation planning in the North Front Range region, the TIP programs funding for regional transportation projects. The CMP helps inform these documents and projects with congestion information. Furthermore, corridor studies, transit efficiency, and non-motorized projects benefit from data collected through the CMP.

C. Quantifying Congestion

Often, sources of congestion occur together. Weather events can easily create unsafe driving situations resulting in crashes. Special events can cause drivers to avoid certain areas resulting in congestion along a less traveled corridor. A lack of parallel facilities and a lack of transportation options for pedestrians, bicyclists, and transit users can result in high levels of unrestrained SOV demand.

Congestion

There are two types of congestion: recurring and non-recurring.

Recurring congestion includes:

- Unrestrained demand
  - Lack of Other Modes
  - Land Use
- Insufficient capacity
  - Lack of Parallel Facilities
  - Roadway Capacity
- Ineffective management of capacity
  - Operations – Inefficient signal timing and progression and/or lack of auxiliary lanes.
  - A lack of TDM techniques such as carpool/vanpool programs or congestion pricing.

Seven root causes of congestion:

1. *Physical bottlenecks*
2. *Traffic incidents*
3. *Work zones*
4. *Weather*
5. *Traffic control devices*
6. *Special events*
7. *Fluctuations in normal traffic*

Source: *Focus on Congestion Relief, FHWA*

Non-recurring congestion:

- Temporary events
  - Traffic Incidents - Crashes, traffic stops, at-grade railroad crossings, and/or breakdowns
  - Weather Events
  - Special Events
  - Work Zones
  - Emergencies[7]

Congestion management is the "application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods."[8]

Regionally Significant Corridors

Previously, the CMP only focused on the Tier 1 RSCs, but the scope has expanded to include all congested RSCs. The RSC designation allows the NFRMPO to maximize the use of limited transportation funding. Information about RSC location can be found in **Chapter 2**. Information about congested RSCs can be found in **Chapter 9**.

Congestion Management Data Sources

Regional Travel Demand Model

The NFRMPO and member jurisdictions use the 2040 NFRMPO RTDM as a tool to forecast traffic and travel demand in communities within the model area. The primary purpose of the travel model is to support the RTP and air quality conformity analysis, but the information can be helpful for the CMP as well. The model can help

[7] Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation. FHWA Office of Operations. 12.4.2013.
http://www.ops.fhwa.dot.gov/congestion_report/executive_summary.htm

[8] Congestion Management Process: A Guidebook. U.S. Department of Transportation, FHWA. April 2011. Pg. 1.

to evaluate proposed roadway projects, potential impacts of proposed development projects, and various transportation studies of the region, subareas, and corridors.

The model identifies which roadway links are currently congested and those with the potential to be congested by calculating free flow speed, travel time, and capacity. This information is then used to see if congestion management performance measures are being met. Project sponsors and stakeholders use this and other information to select projects to relieve congestion in the region. The model is regularly updated by the NFRMPO to reflect current conditions using the most recent and available data. Until regional Bluetooth counters are operational, the RTDM will be used to generate maps to highlight congested areas in the region.

FHWA National Performance Measurement Research Data Set

The National Performance Measurement Research Data Set (NPMRDS) is a historical archive of average travel times by calendar day, in 5-minute increments, covering the NHS. FHWA has purchased HERE North America, LLC (formerly Nokia/NAVTEQ) travel time data for DOT and MPO use. The regional NPMRDS coverage is highlighted in **Figure 11-2**.

Three categories of travel time data are collected: passenger vehicles, freight vehicles, and a category with both groups combined. No modeling or historical data is applied if probe data does not exist for a particular epoch and no record is provided. Some outliers are included in the dataset, but clearly invalid probe data are discarded. Invalid probe data includes zero-speed vehicles, off-road vehicles, and vehicle headings that do not correspond with existing corridors.

The data for personal vehicles is gathered from multiple sources including: mobile phones, vehicles, and personal navigation devices. Data for freight vehicles is gathered by the American Transportation Research Institute (ATRI) and is sourced from Class 7 and 8 trucks.[9]

Class 7 trucks have a gross vehicle weight rating (GVWR) between 26,001 – 33,000 lbs.

Class 8 trucks 33,001 lbs. or above. Both Classes require a Class B license to operate in the US.

Source: *U.S. Department of Energy*

Archived datasets include only Interstates for the period of October 2011 to June 2013. Monthly datasets began in July 2013, in 5-minute increments for the entire NHS. The datasets are broken down by Transportation Management Center (TMC), an industry standard referencing system streets, segments, and roads typically from intersection to intersection.

INRIX Travel Time and Volume Data Set

INRIX provides nationwide real-time traffic information, historical traffic information, traffic forecasts, travel times, travel time polygons, and traffic counts to businesses and individuals. Travel time data is collected through Global Positioning System (GPS) enabled devices including cell phones and connected cars. The collected travel information is housed on the Ritis website where users can analyze the data in a number of ways, including:

[9] Vehicle Weight Classes & Categories. U.S. Department of Energy. Alternative Fuels Data Center. http://www.afdc.energy.gov/data/

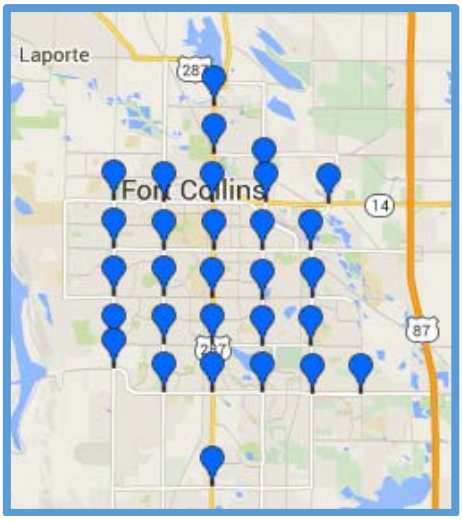
- **Region Explorer** – Explores the relationships between bottlenecks and traffic events in real-time and in the past.
- **Congestion Scan** – Describes the rise and fall of congested conditions on a stretch of road.
- **Performance Charts** – Highlights performance metric information over time.
- **Bottleneck Ranking** – Explains which roadway bottlenecks have the greatest impact.
- **Trend Map** – Creates an animated map of roadway conditions.
- **Performance Summaries** – Reports on Buffer Time Index, Planning Time Index, and other performance metrics.
- **User Delay Cost Analysis** – Assigns a dollar value on how much a road's performance impacts its users.

Highlighting a segment of INRIX probe data allows the user to see segment length, current speed, average speed, reference speed (free-flow), confidence score, and travel time (minutes) across a full day. Additionally, depending on location a number of additional layers can be incorporated in the regional analysis, including:

- **Incidents and Events**
- **Dynamic Message Signs (DMS)**
- **Traffic Detectors**
- **Road Weather**
- **Radio Scanners**
- **Evacuation Support**
- **Public Transit**
- **Weather Alerts**

Figure 11-2: 2015 Travel Time Data Sources

Figure 11-3: Fort Collins Bluetooth Counter Locations



Source: *Fort Collins, Division of Traffic Operations*

Fort Collins Bluetooth Dataset

In June 2014, the City of Fort Collins, Division of Traffic Operations began installing a series of 30 Bluetooth traffic counters at major intersections across the City (**Figure 11-3**). The Fort Collins Bluetooth counters are also highlighted in **Figure 11-2** with the FHWA NPMRDS HERE travel time dataset.

Operational since October 2014, these counters wirelessly connect to cell phones, headsets, music players, and navigation systems using Media Access Control (MAC) protocols. Unique identifiers from these devices are not associated with any specific user or account, eliminating any ability to gather private information.

City of Loveland, City of Greeley, and Colorado Department of Transportation Bluetooth Counters

Currently, the City of Loveland, the City of Greeley, and the Colorado Department of Transportation (CDOT) are in the process of researching Bluetooth counters for intersections in their communities or region. To create a robust regional dataset the NFRMPO will be assisting with the purchase of counters for CDOT and the cities of Fort Collins, Loveland, and Greeley. Counter purchasing will begin in summer 2015, with counters coming online by late 2015. A substantial portion of the regional transportation network is expected to be covered by 2017.

NFRMPO Congestion Survey

In 2014, the NFRMPO conducted a regional congestion survey. The purpose of the survey was to better understand the region's perspective on transportation congestion. The 12 question survey had approximately 200 respondents from the 15 NFRMPO member communities. The majority of respondents lived in Fort Collins (42 percent) and an even larger group worked in Fort Collins (71 percent). The two largest respondent groups were in the 30-44 and 55-64 age ranges. Approximately, 42 percent of respondents had a household income above $100,000 a year. Additionally, they were highly educated with 38 percent holding a college degree and 43 percent with a post graduate degree.

Almost 86 percent of respondents drove alone as their primary commute method; however, nearly nine percent chose a bicycle for transportation. Heavy traffic and congestion was primarly attributed to, 'too many people on the road' and 'unorganized or ineffective traffic lights.' Split between three answers, survey participants believed heavy traffic or congestion means '6-10 miles per hour less than the posted speed', '11-15 miles per hour less than the posted speed', and 'at a complete stop at a location other than a traffic light or stop sign.'

Heavy traffic and congestion was reported to occur 'every day' (43 percent) or 'a few times a week' (48 percent). The three most important factors in considering travel included 'minimize time spent in heavy traffic', 'minimize travel time', and 'reliability of travel time.' On a multiple answer question the main methods used to avoid heavy traffic included taking a different route (56 percent) or changing driving time (30 percent); however, 37 percent said they were unable to avoid traffic. An overwhelming margin (95 percent) stated congestion had gotten worse compared to congestion five years ago.

The complete list of survey questions can be found in **Appendix A**.

D. Strategies to Alleviate Congestion

Congestion Performance Measures

The focus of the 2015 CMP is the effective movement of people and goods. Throughout a normal day, congestion can occur for all users and all modes in the region.

Table 11-2 identifies CMP performance measures the NFRMPO will report in the Annual CMP Reports.

Table 11-2: Implemented Congestion Performance Measures	
CMP Performance Measure	**Description**
Travel Time Index (TTI)*	Ratio of average peak travel time to an off-peak (free-flow) standard. A value of 1.25 indicates that the average peak travel time is 25% longer than off peak travel times.
Vehicle Miles Traveled (VMT)*	Measurement of miles traveled by vehicles in a specified region over a specified time period. Calculated per person for all trips or for specific destinations including home, work, commercial, etc.
Transit Performance Measures	On Time Performance – Percentage of time a bus remains on published schedule. Passengers per Hour per Direction indicates travel patterns and system capacity. Passengers per Mile per Gallon is a measure of transit system use and fuel efficiency.

**These performance measures are from the NFRMPO 2040 RTP GOPMT. The transit performance measures are specific to the 2015 CMP Report.*

The Travel Time Index and Transit Performance Measures are explained in greater detail in the following sections.

Travel Time Index (TTI)

Currently, the NFRMPO is transitioning from volume over capacity (V/C) congestion measurements (2010 CMP) to Travel Time Index (TTI) as a primary measure of regional congestion. V/C measurements can appear acceptable in near-gridlock situations because the roadway's carrying capacity has been 'maximized.' In reality, a roadway with a lower V/C ratio can move more vehicles over the same given time period, but the corridor can appear under-utilized. TTI offers a more consistent view of vehicle congestion. The NFRMPO has estimated TTI information using the NFRMPO's RTDM.[10] TTI 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. A value of 1.3, for example, indicates a 20-minute free-flow trip requires 26 minutes during the peak period.*[11]

[10] North Front Range 2012 Base Year Regional Travel Model Technical Documentation. 2015. http://nfrmpo.org/ResourcesDocuments/2040RTP.aspx

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

Maps of the 2012 regional TTI and 2040 regional TTI can be found in **Chapter 7**.

Over the next two years, the NFRMPO will transition to the collection and use of TTI information from the FHWA HERE dataset, INRIX dataset, and Bluetooth counters discussed in **Section C**. In the future, posted speed limits will be used as the baseline for free-flow travel time.

Vehicle Miles Traveled (VMT)

VMT is the number of miles traveled by vehicles within a specified region, during a specified time period. Modeling VMT requires estimates of trip generation (origin) and trip length. As the region's population continues to grow, an increase in VMT is expected. A reduction in VMT rates can be used to show 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.

Transit Performance Measures

Future CMP reporting will use three performance measures for transit including:

- On Time Performance: The percentage of time a bus remains on its published schedule. This performance metric indicates the ability for the traveling public to rely on posted times.
- Passengers per Mile per Gallon: Requires the calculation of a Passengers per Mile metric and a vehicle mile per gallon figure. Subsequently, the number of Passengers per Mile is multiplied by the vehicle's mile per gallon figure resulting in a figure that can be compared to other vehicles. For vehicles using compressed natural gas (CNG) a gasoline gallon equivalent (GGE) comparison will be calculated.
- Passengers per Hour per Direction: Requires the number of Passengers per Hour multiplied by a directional coefficient, unless it is collected immediately with the passenger boarding/exiting. The resulting figure is useful when examining travel patterns.

Currently, not all regional transit providers can supply passenger direction information. As additional passenger tracking technology comes online, this information will be collected. Furthermore, not all regional transit providers collect on time performance measurements in the same manner. Transit providers will transition to comparable on time performance collection methods as older buses are retired.

Transportation Demand Management (TDM)

The NFRMPO completed the Long Range Transportation Demand Management Plan in December 2010. TDM strategies are actions which improve transportation system efficiency by altering transportation system demand rather than through roadway capital expansion. TDM is about increasing transportation system carrying capacity through operational efficiencies or reducing demand. **Chapter 2** covers existing TDM practices in the NFRMPO region.

Intent and Methods of Transportation Demand Management

Federal regulations specify all reasonable congestion management strategies must be evaluated and deemed ineffective or infeasible prior to the consideration of a roadway capacity increase as a congestion management approach. A common misconception of TDM is it is focused strictly on "getting people out of their cars." Rather there are many ways to improve the efficiency of the existing transportation network.

Transportation Demand Management Strategies

TDM strategies can use voluntary or mandatory mechanisms to reduce demand. Eight common TDM strategies include:

- **Road Pricing:** Programs which charge drivers based on their usage of the roadway. Congestion pricing includes price variations based on time of day and level of congestion.
- **Parking Management and Parking Pricing:** Parking Management includes time of day restrictions such as before 10:00 a.m. or allows the price for parking to fluctuate to ensure a certain percentage of parking spaces are vacant. Parking Pricing is the price associated with the use of a parking space.
- **Car Sharing:** Participants pay to rent vehicles on a per-trip basis allowing the costs of operating a vehicle to be spread among many users.
- **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.
- **Ridesharing and HOV Lanes:** Ridesharing is two or more people traveling in a vehicle to their destination. HOV lanes incentivize ridesharing by offering travelers who rideshare a less congested travel lane, preferred parking, etc.
- **Transit Incentives:** Businesses or other organizations can offer reduced or free fares to incentivize the use of transit by employees.
- **Transit Improvements:** Improving the availability, efficiency, reliability, convenience, and comfort of transit incentivizes traveler's use of the network.
- **Telework:** Working from home reduces the frequency of employees needing to commute to an employment location.[12]

Additional TDM measures were recommended by the NFRMPO in the Long Range Transportation Demand Management Plan, including:

- **TDM Workshops:** Targeted to employees, a workshop would highlight TDM practices an employer could use to encourage healthy, safe, effective transportation practices.
- **Guaranteed Ride Home:** Used to supplement an employee's mode choice, the Guaranteed Ride Home service provides a free or inexpensive taxi for emergencies for those employees who rideshare.
- **Employer Transportation Assessment Program:** NFRMPO staff assist local businesses in the creation of a TDM policy for employees.
- **ITS Improvements:** Covered in the ITS section of this chapter.

Intelligent Transportation Systems (ITS)

ITS improves transportation safety and mobility and enhances productivity through the integration of advanced communications technologies into transportation infrastructure and vehicles. Encompassing a broad range of wireless and wire-line communications ITS enriches existing roadway system operations in a cost effective

[12] Reference Sourcebook for Reducing Greenhouse Gas Emissions from Transportation Sources. Chapter 5 Transportation Demand Management Strategies. U.S. Department of Transportation, Federal Highway Administration. http://www.fhwa.dot.gov/environment/climate_change/mitigation/publications_and_tools/reference_sourcebook/page05.cfm#s1

manner. [13] ITS can apply to all forms of transportation and has the capacity to improve safety, reduce vehicle wear, shrink delay, and lessen fuel consumption.

Intelligent Transportation Systems in Northern Colorado

In 2011, CDOT, the NFRMPO, and local jurisdictions developed the CDOT Region 4 Intelligent Transportation Systems Strategic Implementation Plan.[14] The plan serves as the guiding document for ITS projects to 2021, and identifies the funding needs, recommended deployment time frames, and potential funding sources. **Chapter 2** covers ITS information, funded ITS projects, and ITS on BRT.

Transit Congestion Management Strategies

Bus Rapid Transit

BRT is "an integrated system of facilities, equipment, services, and amenities that improves the speed, reliability, and identity of bus transit."[15] BRT can be thought of as an above ground subway or a rubber-tired light rail system with the added benefit of having greater operating flexibility and lower costs. This high-frequency service offers not only congestion mitigation benefits, but also community development benefits. The constant availability of a bus is attractive to travelers, residents, and business owners.

A number of facilities augment the capacity and usefulness of BRT. To eliminate conflicts with slower vehicles, BRT can use dedicated right-of-way lanes in the median. Station platforms level with the bus floor accelerate passenger boarding time and allow wheelchairs and strollers to easily roll on or off the bus. Off-board fare collection systems allow passengers to pre-pay before using the BRT. To decrease intersection wait times BRT is sometimes prioritized in the signal queue. Emergency vehicles also benefit from BRT by having an additional travel lane.

Operational Transit Congestion Management Measures

A number factors can be incorporated in transit service strategies which can be implemented to further enhance the effectiveness of transit. The factors include:

- Pricing Factors
  - Reduction or elimination of fares
- Service Quantity Factors
  - Increasing service hours including Sunday service
  - Reducing the time between transit vehicles
  - Reducing transfer time
  - Prioritizing transit vehicles at traffic signals

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[13] About ITS. US Department of Transportation, Office of the Assistant Secretary for Research and Technology Intelligent Transportation Systems Joint Program Office. http://www.its.dot.gov/faqs.htm

[14] CDOT Region 4 Intelligent Transportation Systems Strategic Implementation Plan. Colorado Department of Transportation. June 2011. http://www.cotrip.org/content/itsplans/CDOTRegion%204%20ITS%20Strategic%20Implementation%20Plan_06-30-11.pdf

[15] TCRP Report 118. Bus Rapid Transit Practitioner's Guide. Transportation Research Board. 2007. Washington, D.C. http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_118.pdf

- Focusing routes on high density corridors or locations

- Service Quality Factors
  - Transit stop amenities
  - Off-board fare collection
  - Bus scheduling information
  - Station and in-route safety
  - Customer service
  - Cleanliness[16]

Reducing or eliminating fares can play a large role in increasing transit ridership. Currently, free transit passes for CSU, UNC, and some K-12 students incentivize use of the transit network. During the 2014-2015 school year GET ridership numbers increased 313 percent among elementary, middle, and high school students with identification for the Ride Free with ID program, approximately 47,000 rides.

Adjacent land use practices compound the usefulness of transit. For college students transit connects residential facilities with campus. Businesses along transit routes are encouraged by the accessibility transit offers and employers are incentivized to locate near transit to offer transportation options for employees.

In Fort Collins, a Transit-Oriented Development (TOD) Overlay Zone was developed to focus growth around the MAX BRT system along the Mason Street corridor. Running north-south through Fort Collins the Mason Street corridor connects residents to a mix of housing, office, and retail opportunities. The MAX BRT system along Mason Street increases economic opportunity, active lifestyle choices, and access to employment options while reducing vehicular congestion. This concentration of accessible development reduces resident's transportation costs while increasing property values near the BRT system.

In 2009, Transfort adopted their Transit Strategic Operating Plan which focuses on creating a productive transit system rather than a system with complete citywide coverage. Similarly, GET is reconfiguring transit routes in 2016 to increase productivity by reducing coverage. A bus service offering frequent service ensures maximum ridership by encouraging potential riders to make a mode shift. Offering service Saturday and Sunday further increases the utility of transit. Service quality is an important factor in continued ridership and permanent mode shift. Riders are willing to continue using transit when safe, clean, and convenient travel is offered.

Traffic Incident Management

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*

[16] Taylor, Brian D. & Fink, Camille N.Y. The Factors Influencing Transit Ridership: A Review and Analysis of the Ridership Literature. UCLA Department of Urban Planning Working Paper. 9/4/2013. Los Angeles, CA. http://www.uctc.net/papers/681.pdf

as possible. Effective TIM reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims and emergency responders.[17]

The TIM program is part of the FHWA's Emergency Transportation Operations (ETO) and plays a critical role in ensuring consistent traffic flow in the NFRMPO region. TIM activities are typically categorized into five overlapping functional areas:

- Detection and Verification
  - Detection: the determination that an incident of some type has occurred.
  - Verification: the determination of the precise location and nature of the incident.
- 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.
- Response
  - The activation of a "planned" strategy for the safe and rapid deployment of the most appropriate personnel and resources to the incident scene.
- Scene Management and Traffic Control
  - Scene Management: the coordination and management of resources and activities at or near the incident scene, including personnel, equipment, and communication links.
  - Traffic Control: the process of managing vehicular traffic around the scene of the incident.
- Quick Clearance and Recovery[18]
  - Clearance: the safe and timely removal of a vehicle, wreckage, debris, or spilled material from the roadway.
  - Recovery: 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.

Traffic Incident Management in Northern Colorado

Between 2001 and 2011, the I-25 corridor between SH 7 and the Wyoming border experienced a 2.4 percent annual growth rate in Annual Average Daily Traffic (AADT) and a 27 percent increase in traffic

[17] 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

[18] Best Practices in Traffic Incident Management. U.S. Department of Transportation. Federal Highway Administration. Emergency Transportation Operations. September 2010. http://ops.fhwa.dot.gov/publications /fhwahop10050/ch2.htm

demand. Between 2006 and 2010, there were 545 crashes resulting in injuries or fatalities (an average of 103 per year).[19]

In June 2012, CDOT released the I-25 Traffic Incident Management Plan or TIMP. The plan covers the entire length of I-25 in the NFRMPO region. The purpose of the TIMP is to, "provide a planned, coordinated, and cooperative approach to detecting and removing incidents and restoring traffic capacity as quickly and safely as possible."[20]

The I-25 TIMP offers a number of recommendations to improve incident response, including: consistent, compatible communication technology between responding agencies for an informed emergency response; creation of specific detour plans and procedures in advance to accelerate opening travel corridors; increasing the visual coverage of transportation corridors with cameras and other ITS solutions to accelerate knowledge of the scene; installing additional variable message signs (VMS) to help motorists make informed decisions about entering or leaving a corridor; unifying the command system dispatch agencies use to communicate; and establishing a standing project management team to evaluate the performance of incident plans.

E. Next Steps

Future Congestion Data Collection

Travel Time Datasets

In addition to the NPMRDS, INRIX, and the City of Fort Collins Bluetooth Dataset, the NFRMPO will be assisting the cities of Fort Collins, Greeley, Loveland, and CDOT purchase and install Bluetooth counters. These counters will be placed at signalized intersections along congested RSCs near each of the communities. Using overlapping locations the community datasets will be used to validate each other. In the future, these datasets will be used to inform the Annual CMP Reports. The datasets will increase in value as a collection of longitudinal information is created. Staff will use the collected information to compile reports and recommend strategies to alleviate regional congestion.

NFRMPO Regional Travel Demand Model Update

The NFRMPO RTDM is updated prior to the RTP, approximately every four years. This is done to accurately reflect the transportation infrastructure network and refine the criteria the model uses to forecast future conditions. As the travel time datasets become more robust they will supply the model with accurate information to ensure validity. In the interim years, the NFRMPO staff will be updating the model to add the speed limit data to all of the links in the model to allow the TTI to be calculated using the speed limit.

Annual CMP Performance Measure Reports

The NFRMPO releases an annual CMP Performance Measure Report each spring. Using data collected throughout the year based on the criteria listed in **Section D**, the region's demographic data, congestion trends

[19] 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

[20] I-25 Traffic Incident Management Plan, SH 7 to Wyoming State Line. Colorado Department of Transportation. June 2012.

and transportation system performance is quantified for analysis. This analysis is used to inform regional priorities in the RTP and project selection for the TIP.

The NFRMPO *2015 CMP* will use the performance measures listed in **Section D**:

- Travel Time Index (TTI)
- Vehicle Miles Traveled (VMT)
- Transit Performance Measures

Additionally, the NFRMPO will include information on:

- Historical Transportation Trends
- Crashes (Passenger Vehicles, Trucks, Bicycle, Pedestrian)
- Transit Ridership
- VanGo™ Ridership
- Transportation Demand Management (TDM) Practices
- Programmed and Implemented Projects
    - The CMP's Role in Project Selection
    - Selected Projects
    - Implemented Projects
- External Influences on the Transportation Network
    - Gas Prices
    - Population and Unemployment Statistics
    - Transportation Funding and Gas Tax