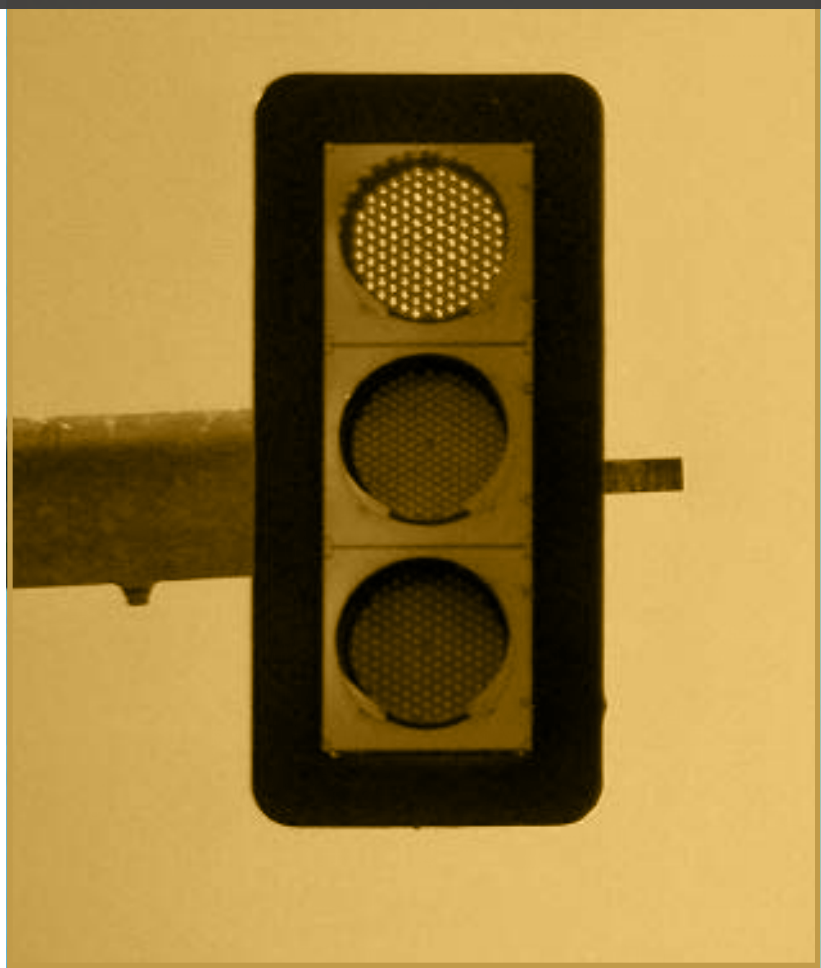
2015 Congestion Management Process

Adopted September 3, 2015



NFRMPO
NORTH FRONT RANGE METROPOLITAN PLANNING ORGANIZATION

2015 CONGESTION MANAGEMENT PROCESS

Prepared by:

NFRMPO

419 Canyon Ave, Suite 300

Fort Collins, CO 80521

Preparation of this document has been financed in part through grants from the Federal Highway Administration, the Federal Transit Administration, the Colorado Department of Transportation, and the local member communities of the North Front Range MPO.

September 2015

NFRMPO
NORTH FRONT RANGE METROPOLITAN PLANNING ORGANIZATION

RESOLUTION NO. 2015-11
OF THE NORTH FRONT RANGE TRANSPORTATION
& AIR QUALITY PLANNING COUNCIL
ADOPTING THE 2015 CONGESTION MANAGEMENT PROCESS (CMP)

WHEREAS, the North Front Range Transportation & Air Quality Planning Council (NFRMPO) is designated as the Metropolitan Planning Organization (MPO) in cooperation with local elected officials and is authorized and required to carry out the continuing, cooperative, and comprehensive transportation planning process that results in plans and programs that consider all transportation modes and supports community development, economic development, and social goals; and

WHEREAS, the North Front Range Transportation & Air Quality Planning Council (Planning Council) was designated by the Governor of the State of Colorado as the MPO agency responsible for carrying out the transportation planning process, and for developing and amending the RTP; and

WHEREAS, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: a Legacy for Users (SAFETEA-LU) requires that MPOs adopt a Congestion Management Process (CMP); and

WHEREAS, in accordance with SAFETEA-LU, the NFRMPO has submitted the updated Congestion Management Process under the applicable provisions of Federal law to the Federal Highway Adminstration; and

WHEREAS, the CMP was first incorporated into the 2030 Regional Transportation Plan (RTP) and updated in the 2035 RTP;

WHEREAS, the Planning Council approves the 2015 CMP and submits copies for informational purposes to the Governor;

NOW, THEREFORE, BE IT RESOLVED THAT the North Front Range Transportation & Air Quality Planning Council adopts the 2015 CMP to guide future transportation planning efforts to minimize congestion and congestion related impacts in the NFRMPO.

Passed and adopted at the regular meeting of the North Front Range Transportation & Air Quality Planning Council held this 3rd day of September, 2015.

Sean Conway, Chair

ATTEST:

Terri Blackmore, Executive Director

North Front Range
Metropolitan Planning Organization

2015 Congestion Management Process

Objectives-driven, performance-based
Congestion Management Process

Adopted September 3, 2015

Acknowledgements

NFRMPO Planning Council

Commissioner Sean Conway, Weld County—*Chair*
Joan Shaffer, City of Loveland—*Vice Chair*
Mayor Pro-Tem Jan Dowker, Town of Berthoud—*Past Chair*
Mayor Don Brookshire, Town of Severance
Paula Cochran, Town of LaSalle
Commissioner Tom Donnelly, Larimer County
Mayor Pro-Tem Gerry Horak, City of Fort Collins
Jordan Jemiola, Town of Milliken
Troy Mellon, Town of Johnstown
Mayor John Morris, City of Evans
Mayor Tom Norton, City of Greeley
Kevin Ross, Town of Eaton
Paul Steinway, Town of Timnath
Mayor John Vazquez, Town of Windsor
Town of Garden City
Chris Colclasure, CDPHE
Kathy Gilliland, Transportation Commission

NFRMPO Staff

Terri Blackmore—*Executive Director*
Becky Karasko, AICP—*Regional Transportation Planning Director*
Aaron Buckley—*Transportation Planner*
Alex Gordon—*Transportation Planner*
Angela Horn—*Transportation Planner*
Josh Johnson—*Transportation Planner*

Technical Advisory Committee

Eric Bracke, City of Greeley—*Chair*
Suzette Mallette, Larimer County—*Vice Chair*
Martina Wilkinson, City of Fort Collins—*Past Chair*
Dawn Anderson, City of Evans
Stephanie Brothers, Town of Berthoud
Gary Carsten, Town of Eaton
John Franklin, Town of Johnstown
Eric Fuhrman, Town of Timnath
John Holdren, Town of Severance
Seth Hyberger, Town of Milliken
Dave Klockeman, City of Loveland
Janet Lundquist, Weld County
Jessicca McKeown, Town of LaSalle
Karen Schneiders, CDOT
Dennis Wagner, Town of Windsor
Amanda Brimmer, RAQC*
Aaron Bustow, Federal Highway Administration*
Christopher Barnes, COLT*
Ingrid Hewitson, CDPHE*
Will Jones, GET*
Kurt Ravenschlag, Transfort*
Gary Thomas, SAINT*

*Indicates Non-Voting Member

Resolution

*Placeholder for resolution by NFRMPO members to accept/support the 2015 CMP

Table of Contents

List of Tables

List of Figures

Transportation Planning Acronyms

A comprehensive list of transportation planning related acronyms referenced in this report are below.

Acronym	Definition
AADT	Annual Average Daily Traffic
ASCT	Adaptive Signal Control Technologies
ATMS	Advanced Traffic Management System
ATRI	American Transportation Research Institute
APC	Automated Passenger Counter
BATS	Berthoud Area Transportation Services
BRT	Bus Rapid Transit
CCTV	Closed-Circuit Television
CDOT	Colorado Department of Transportation
CMP	Congestion Management Process
CMS	Congestion Management System
CNG	Compressed Natural Gas
COLT	City of Loveland Transit
CSU	Colorado State University
DMS	Dynamic Message Signs
ETO	Emergency Transportation Operations
FHWA	Federal Highway Administration
FLEX	Regional bus serving Loveland, Berthoud & Longmont operated by Transfort
FY	Fiscal Year
GET	Greeley-Evans Transit
GGE	Gasoline Gallon Equivalent
GOPMT	Goals, Objectives, Performance Measures, and Targets
GVWR	Gross Vehicle Weight Rating
HOT	High Occupancy Toll Lanes
HTFA	Highway and Transportation Funding Act of 2014
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITS	Intelligent Transportation Systems
MAC	Media Access Control
MAP-21	Moving Ahead for Progress in the 21st Century Act
MDSS	Maintenance Decisions Support System
NFRMPO	North Front Range Metropolitan Planning Organization

Continued on next page.

NHS	National Highway System
NPMRDS	Federal Highway Administration National Performance Measurement Research Dataset
PCMS	Portable Changeable Message Signs
RFID	Radio-Frequency Identification
RSCs	Regionally Significant Corridors
RTDM	Regional Travel Demand Model
RTP	Regional Transportation Plan
RWIS	Road and Weather Information Service
SAFETEA-LU	Safe Accountable Flexible Efficient Transportation Equity Act - A Legacy for the Users
SOV	Single-Occupant Vehicle
TAC	North Front Range Metropolitan Planning Organization's Technical Advisory Committee
TEA-21	Transportation Equity Act for the 21st Century
TDM	Travel Demand Management
TIM	Traffic Incident Management
TIP	Transportation Improvement Program
TMAs	Transportation Management Areas
TMC	Transportation Management Center
TOC	Transportation Operations Center
TOD	Transit Oriented Development
Transfort	Fort Collins regional bus transit system, also operates FLEX
TTI	Travel Time Index
UNC	University of Northern Colorado
UZAs	Urbanized Areas
V/C	Volume to Capacity Ratio
VMS	Variable Message Signs
VMT	Vehicle Miles Traveled

Executive Summary

The purpose of the 2015 Congestion Management Process (CMP) is to create an objectives-driven, performance-based process to reduce regional transportation congestion. Congestion reduction goals, objectives, performance measures, and targets included in the 2040 Regional Transportation Plan (RTP), other congestion management reports, or crafted specifically for this CMP make up this report.

Nationally, congestion released 56 Billion pounds of carbon dioxide into the atmosphere, wasted 5.5 Billion hours, and 2.9 Billion gallons of fuel costing travelers $121 Billion in 2011. The North Front Range Metropolitan Planning Organization (NFRMPO) will focus on reducing congestion on the Regionally Significant Corridors (RSCs). The NFRMPO will collect data regionally from counters by anonymously recording vehicle travel times using Bluetooth, Wi-Fi, and Global Positioning System (GPS) technology. Additional data sources include INRIX travel time and volume datasets and the Federal Highway Administration's (FHWA) national HERE travel time dataset. The NFRMPO is currently working with Fort Collins, Loveland, Greeley, and CDOT to install Bluetooth counting equipment across the region along the regionally significant corridors at signalized intersections where data is not available.

The NFRMPO and local communities will track regional CMP progress using three performance measures including: Travel Time Index (TTI), Vehicle Miles Traveled (VMT), and Transit Performance Measures. In addition, Transportation Demand Management strategies (TDM) and Intelligent Transportation System (ITS) technologies will be used to reduce congestion.

Chapter 1: 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) 2015 Congestion Management Process Report (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 2010, the total population of the North Front Range region was 488,513. It is expected to rise to 896,191 by 2040, a growth rate of 83.45 percent.[1] The NFRMPO covers 675 square miles and contains 15 member governments, including: Berthoud, Eaton, Evans, Fort Collins, Garden City, Greeley, Johnstown, LaSalle, Loveland, Milliken, Severance, Timnath, Windsor, Larimer County, and Weld County. Regionally, the NFRMPO transportation network contains:

- 102 miles of the National Highway System (NHS)
- Seven miles of Scenic Byway, the Cache La Poudre – North Park (SH 14 and US 287)
- 773 miles of Regionally Significant Corridors (RSCs)
    - 427 miles of roadway corridors and 346 miles of bicycle corridors
- 294 miles of on-road bicycle lanes
- 91 miles of bicycle routes
- 208 miles of shared-use trails
- 2,434 miles of sidewalks
- 271 miles of bus routes
    - Greeley Evans Transit (GET): 45 miles
    - City of Loveland Transit (COLT): 40 miles
    - Fort Collins FLEX: 26 miles
    - Fort Collins Transfort: 160 miles
- 98 miles of railroad tracks

In the chapters that follow, a comprehensive process for alleviating transportation congestion is 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.

[1] 2040 Economic and Demographic Forecast North Front Range Metropolitan Planning Organization (NFRMPO) 2012-2013. June 2013. http://www.nfrmpo.org/ResourcesDocuments.aspx

Chapter 2: Background

2.1 Purpose of the 2015 CMP

The purpose of the 2015 CMP Report 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 Federal Highway Administration (FHWA) defines a CMP as "a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meets state and local needs."[2]

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.

2.2 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)[3] 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, 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.

[2] Congestion Management Process: A Guidebook. U.S. Department of Transportation, Federal Highway Administration. April 2011. Pg. 1.

[3] 23 CFR 450.320 – Congestion Management Process in Transportation Management Areas. GPO U.S. Government Publishing Office. Accessed 7/2/2015. http://www.gpo.gov/fdsys/granule/CFR-2011-title23-vol1/CFR-2011-title23-vol1-sec450-320

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 2-1**.

Table 2-1 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
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*[4]

Three of the national goals directly pertain to the CMP: Congestion Reduction, System Reliability, and Freight Movement and Economic Vitality. **Chapter 4** of this report discusses strategies to alleviate congestion.

2.3 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.

[4] US Department of Transportation. Federal Highway Administration. MAP-21 – Moving Ahead for Progress in the 21st Century. Performance Management. Accessed 5/8/15. http://www.fhwa.dot.gov/map21/factsheets/pm.cfm

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 (TAC) 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 3-1** in **Chapter 3**.

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 (see **Chapter 3**). As the data accumulates, longitudinal studies will be possible. In the interim, the NFRMPO's Regional Travel Demand Model (RTDM) will be used to identify corridors to deploy data collection devices along with local expertise.

2.4 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

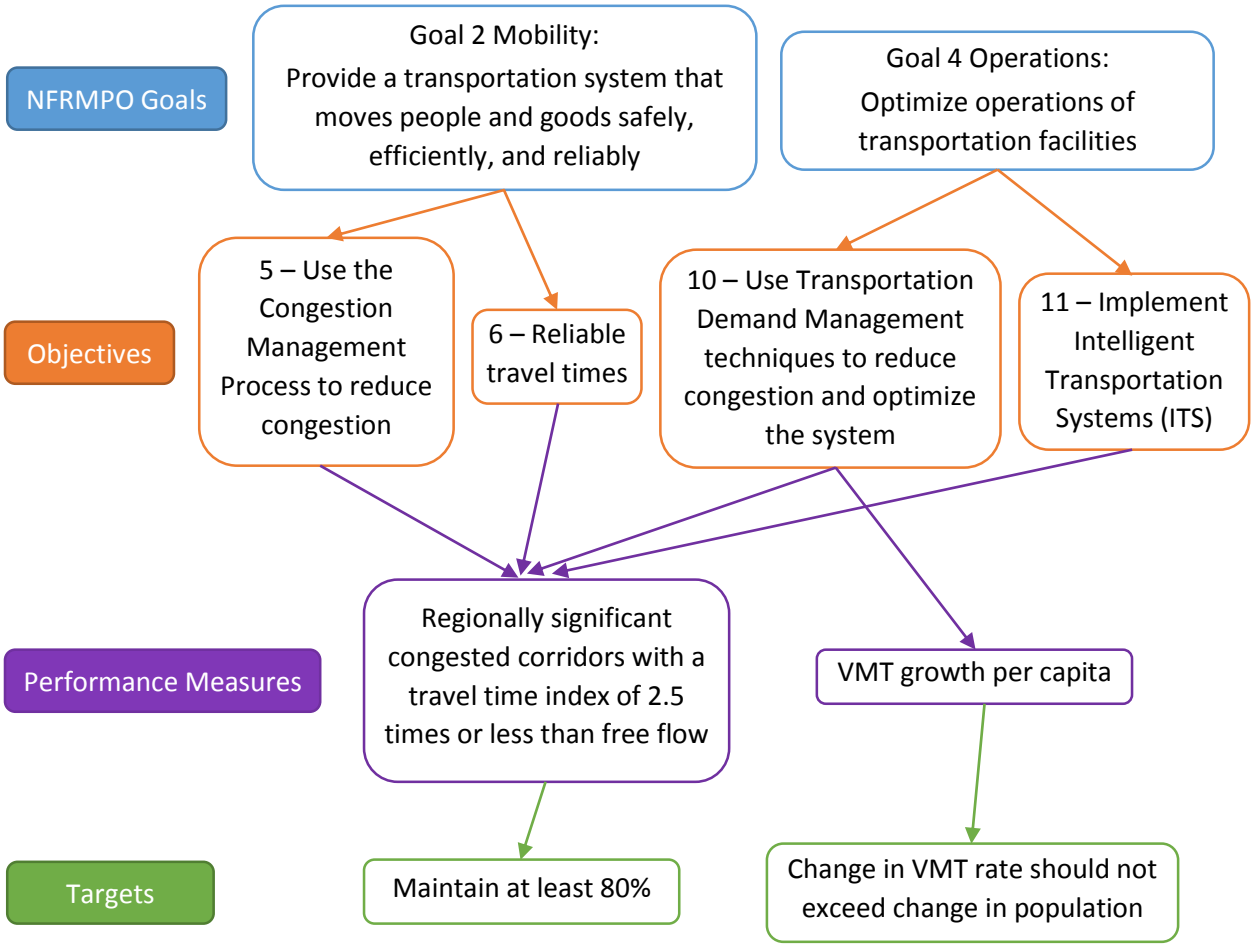
Objective: Reduce crashes for all modes, focusing especially on improving safety for pedestrians and bicyclists and on reducing the number of incident-related crashes.

Goal 4: Increase Reliability

Objective: Increase travel time reliability while reducing user exposure to traffic incidents, crashes, and work zones.[5]

From the 2040 RTP adopted Goals, Objectives, Performance Measures, and Targets (GOPMT) two performance measures are specific to the CMP, as shown in **Figure 2-1**.

Figure 2-1: 2040 RTP – CMP Specific Goals, Objectives, Performance Measures, and Targets



The performance measures in the 2040 RTP GOPMT match the CMP objectives. To complete the picture of regional congestion, transit performance measures have been selected and are detailed in **Chapter 4**.

2.5 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 (TIP).

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

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

projects with congestion information. Furthermore, corridor studies, transit efficiency, and non-motorized projects benefit from data collected through the CMP.

Chapter 3: Quantifying Congestion

3.1 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.

According to FHWA:

> *Congestion results when traffic demand approaches or exceeds the available capacity of the system. While this is a simple concept, it is not constant. Traffic demands vary significantly depending on the season of the year, the day of the week, and even the time of day. Also, the capacity, often mistaken as constant, can change because of weather, work zones, traffic incidents, or other non-recurring events.*[6]

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]

[6] Focus on Congestion Relief. U.S. FHWA. 7/30/2013. Accessed 5/20/15. http://www.fhwa.dot.gov/congestion/ index.htm

[7] Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation. FHWA Office of Operations. 12.4.2013. Accessed 3/24/15. http://www.ops.fhwa.dot.gov/congestion_report/executive_ summary.htm

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]

3.2 National Costs of Congestion

The Texas A&M Transportation Institute's 2012 Urban Mobility Report outlined the increasing costs of congestion. Nationally, in 2011, congestion wasted: 5.5 Billion hours, 2.9 Billion gallons of fuel, and released 56 Billion pounds of carbon dioxide into the atmosphere. Adjusted for 2011 dollars, the cost of congestion to the average commuter increased from $342 in 1982 to $818 in 2011 (**Figure 3-1**).

Adjusted for 2011 dollars, the cost of extra time and fuel wasted in congestion for the nation's 498 urban areas has increased nationally from $24 Billion in 1982, to $94 Billion in 2000, and to $121 Billion in 2011 (**Figure 3-2**). The average commuter wasted eight gallons of fuel and 16 hours in 1982 which increased to 19 gallons and 38 hours in 2011 (**Figure 3-3**). In total, there was a congestion cost of $121 Billion due to delay and fuel costs in 2011. Of that, $27 Billion was the impact of congestion on the trucking industry, not including the value of the goods being transported.[9]

Figure 3-1 Commuter Cost

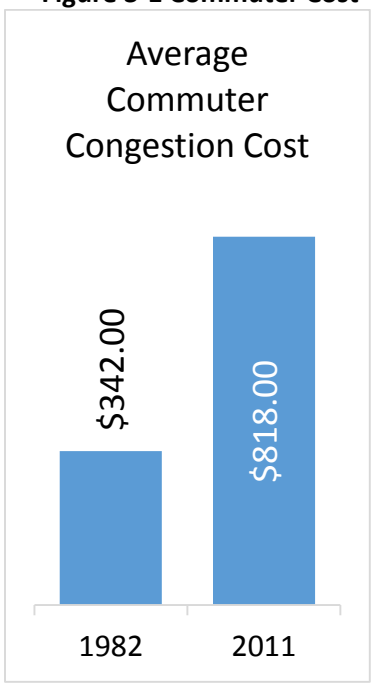


Figure 3-2 National Cost

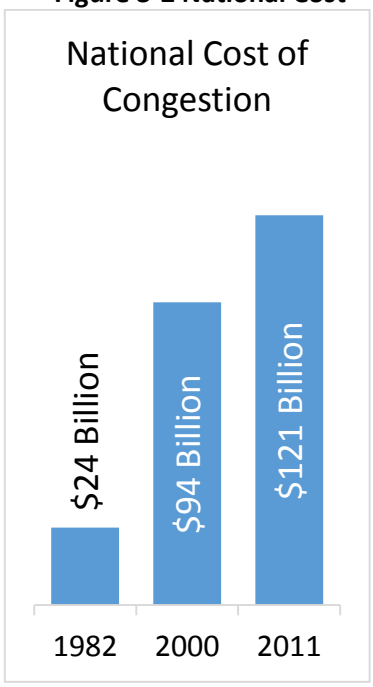
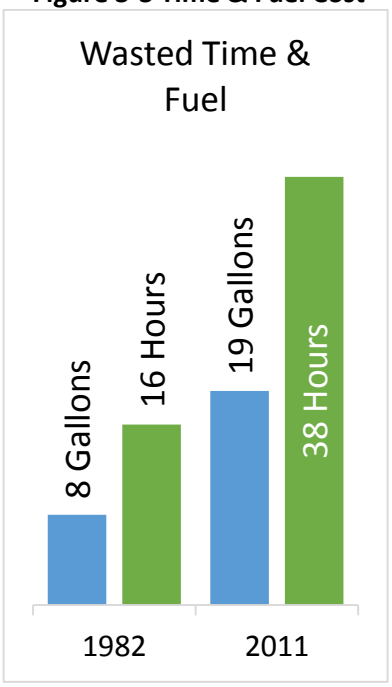


Figure 3-3 Time & Fuel Cost



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

[9] Schrank, David. Eisele, Bill, and Lomax, Tim. TTI's 2012 Urban Mobility Report Powered by INRIX Traffic Data. Texas A&M Transportation Institute. December 2012. http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/ documents/mobility-report-2012.pdf

3.3 Regional Transportation Network

3.3.1 Regionally Significant Corridors (RSCs)

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. A RSC is defined as:

> *An important link in a multi-modal, regional network comprised of existing or new transportation corridors that connect communities and/or activity centers by facilitating the timely and safe movement of people, goods, information, and services.*

Three criteria were used to identify RSCs:

- Includes all State Highways
  - The Colorado Department of Transportation (CDOT) requires a corridor vision be developed for all state highways as part of the regional transportation plan. Since this is a CDOT requirement, and most state highways are regional in nature, this was established as the first criteria.
- Functional Classification
  - Roadways must have a functional classification of minor arterial or higher.
  - The higher the functional classification, the greater the likelihood trips are longer and the roadway connects more than one community.
- Connectivity
  - The corridor must go through, or plan to go through, more than one governmental jurisdiction and connect activity centers.

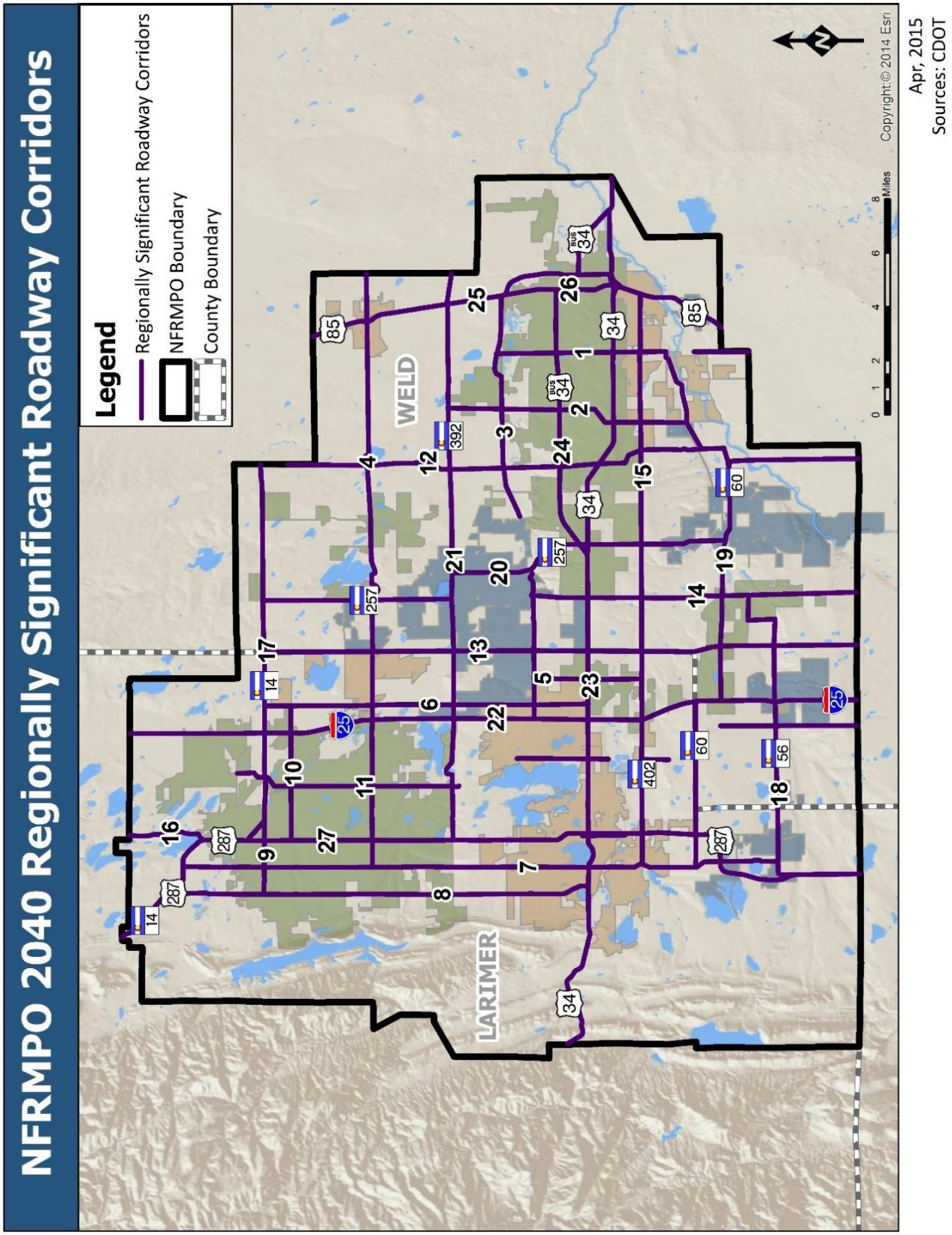
Table 3-1 lists the location of the 27 RSCs, while **Figure 3-4** shows the locations of the RSC's.

Table 3-1: Regionally Significant Corridors

Corridor	Corridor Name/Component	Description
Corridor 1	35th Avenue (Greeley)	US 85 on the south to O street on the north
Corridor 2	65th Avenue (Greeley)	59th Street on the south to SH 392 on the north
Corridor 3	Crossroads/O Street	US 85 on the east to I-25 on the west
Corridor 4	Harmony Road/WCR 74 (Fort Collins/Weld County)	LCR 17 to NFRMPO Boundary east of Eaton
Corridor 5	LCR 3	Southern NFRMPO Boundary to Crossroads Boulevard on the north
Corridor 6	LCR 5	US 34 on the south to SH 14 on the north
Corridor 7	Shields Street / Taft Avenue / LCR 17	US 287 on the north to SH 56 on the south
Corridor 8	LCR 19	US 34 on the south to US 287 on the north
Corridor 9	Mulberry Street	Riverside Avenue (SH 14) to LCR 19
Corridor 10	Prospect Road (Fort Collins)	LCR 5 on the east to US 287 on the west

Corridor 11	Timberline/LCR 9/WCR 7	Southern NFRMPO boundary to Vine Drive on the north, follows WCR 7 to LCR 9E (road approximate) to Timberline Road
Corridor 12	Two Rivers Parkway/83rd Avenue	Southern NFRMPO boundary to northern NFRMPO boundary, approximately WCR 27
Corridor 13	WCR 13	Southern NFRMPO boundary to SH 14 on the north
Corridor 14	WCR 17	Southern NFRMPO boundary to Crossroads extension on the north
Corridor 15	SH 392	US 85 on the east to LCR 17 on the west
Corridor 16	SH 1	US 287 on the south to the northern NFRMPO boundary
Corridor 17	SH 14	Eastern NFRMPO boundary to College Avenue (US 287)
Corridor 18	SH 56	WCR 17 on the east to US 287 on the west
Corridor 19	SH 60	Two Rivers Parkway on the east to LCR 17 on the west
Corridor 20	SH 257	SH 60 on the south to SH 14 on the north, includes offset in Windsor
Corridor 21	SH 392	US 85 on the east to US 287 on the west
Corridor 22	I-25	Southern NFRMPO boundary to northern NFRMPO boundary
Corridor 23	US 34	Eastern NFRMPO boundary to western NFRMPO boundary
Corridor 24	US 34 Business	Eastern NFRMPO boundary to US 34 on the west
Corridor 25	US 85	WCR 48 on the south to north of WCR 70
Corridor 26	US 85 Business	US 34 to US 85
Corridor 27	US 287	Southern NFRMPO boundary to northern NFRMPO boundary, includes Berthoud Bypass

Figure 3-4: Regionally Significant Roadway Corridors



3.4 Congestion Management Data Sources

3.4.1 Regional Travel Demand Model

The NFRMPO and member jurisdictions use the 2040 NFRMPO Regional Travel Demand Model (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 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.

3.4.2 Travel Time Data Sources

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 Department of Transportation (DOT) and NFRMPO use. The regional NPMRDS coverage is highlighted in **Figure 3-5**.

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.[10]

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. Over half a billion travel time records are created each month.

The October 2011 to June 2013 archived dataset includes:

- The NHS with approximately 100,000 bidirectional miles,

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*

[10] Vehicle Weight Classes & Categories. U.S. Department of Energy. Alternative Fuels Data Center. http://www.afdc.energy.gov/data/ Accessed 6/26/15.

- All 50 states, Washington D.C., and Puerto Rico, and
- Border crossings with Canada and Mexico.

The monthly dataset for the entire NHS from July 2013 to present includes:

- NHS with over 500,000 bidirectional miles,
- All 50 states, Washington D.C., and Puerto Rico, and
- Border crossings with Canada and Mexico.

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:

- **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 3-5: 2015 Travel Time Data Sources

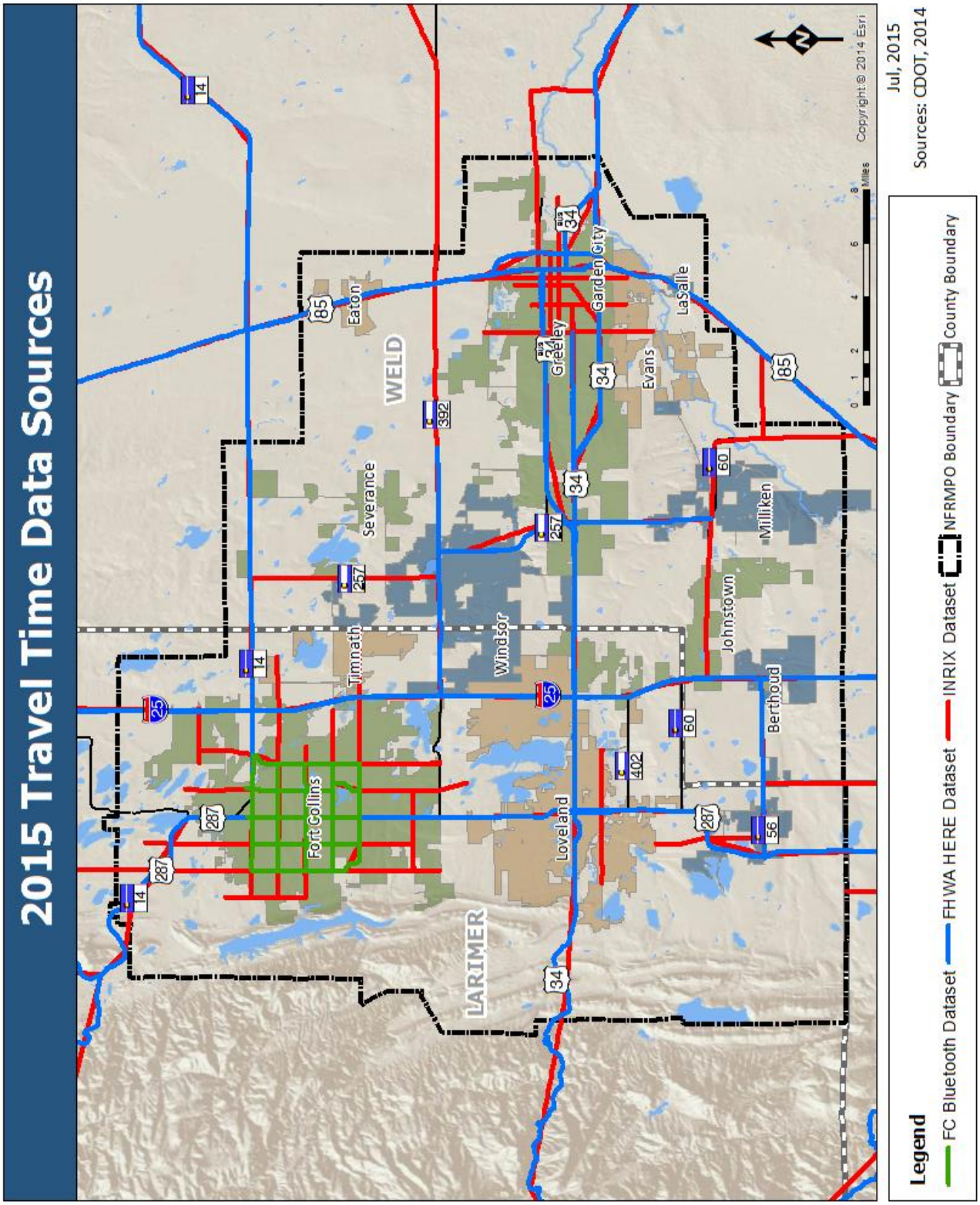
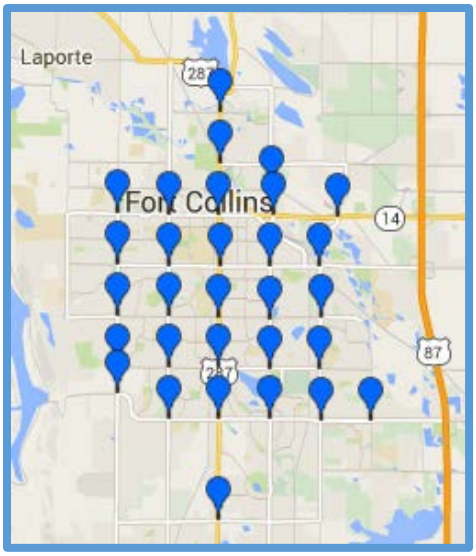


Figure 3-6: Fort Collins Bluetooth Counter Locations



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 3-6**). The Fort Collins Bluetooth counters are also highlighted in **Figure 3-5** 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.

By counting Bluetooth-enabled devices as they pass by, speed and travel time data can be gathered. This allows for in-depth origin-destination studies, trip length analysis, TDM modeling, and signal timing optimization.

During special events, traffic incidents, or weather incidents the Bluetooth data can be used as a source of information to aid in signal timing adjustments. Over time, the data can be used to compare trends for roadway segments and intersections. Planning processes will rely on this travel time data to justify future projects.

City of Loveland, City of Greeley, and CDOT Bluetooth Counters

Currently, the City of Loveland, the City of Greeley, and 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.

3.4.3 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 primarily 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 B**.

Chapter 4: Strategies to Alleviate Congestion

4.1 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 4-1 Identifies CMP performance measures the NFRMPO will report in the Annual CMP Reports.

Table 4-1: 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.

4.1.1 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.[11] 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.*[12]

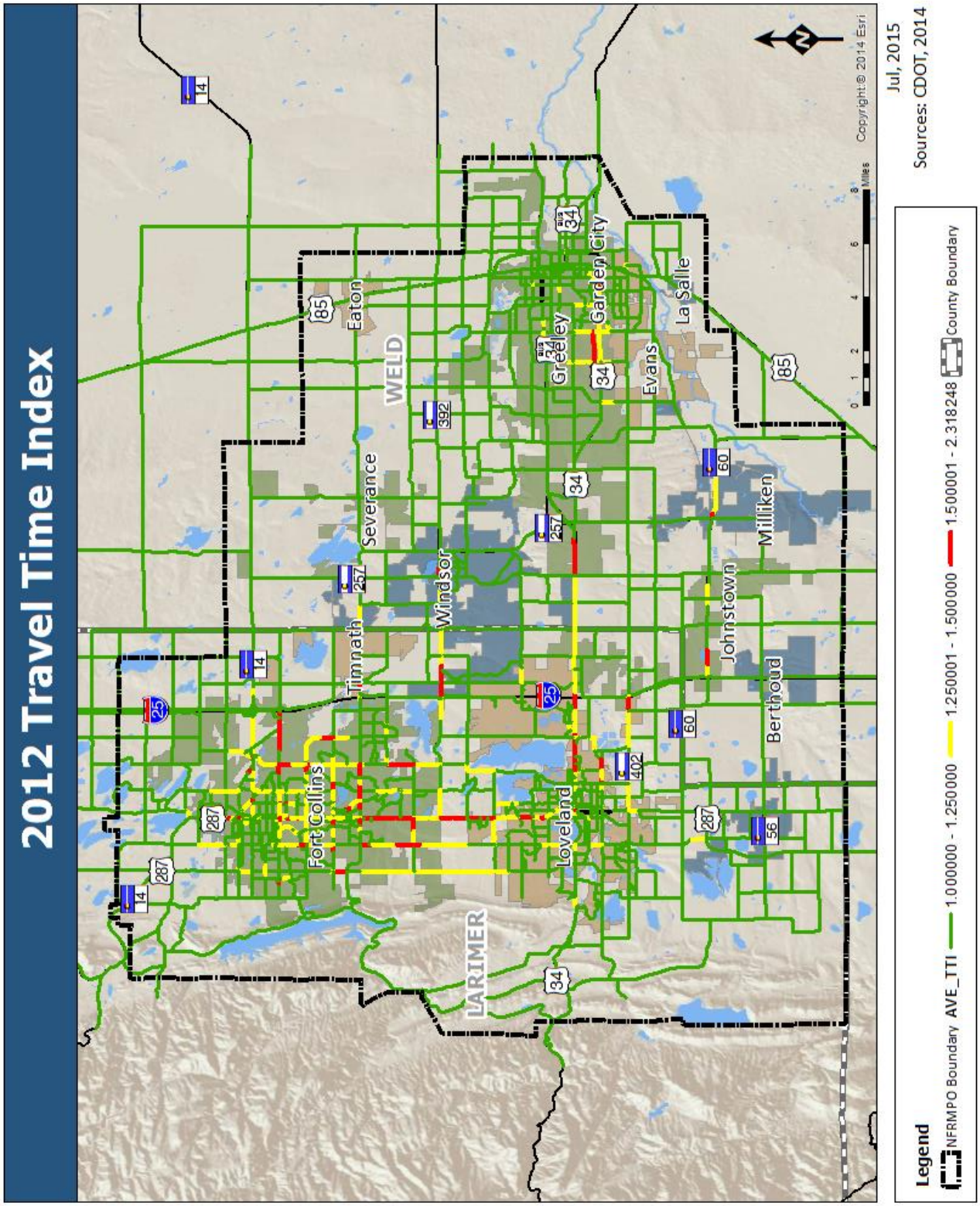
Figure 4-1 highlights the regional TTI for 2012 and **Figure 4-2** the projected regional TTI for 2040. In 2012, the TTI indicates much of the network experienced free-flow or near free-flow conditions. Conversely, the 2040 TTI shows much of the network congesting or congested. Additionally, the 2040 network includes all funded planned transportation improvements.

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

[12] Glossary of Mobility-Related Terms. Texas A&M Transportation Institute. Urban Mobility Information. Accessed 5/21/15. http://mobility.tamu.edu/ums/media-information/glossary/

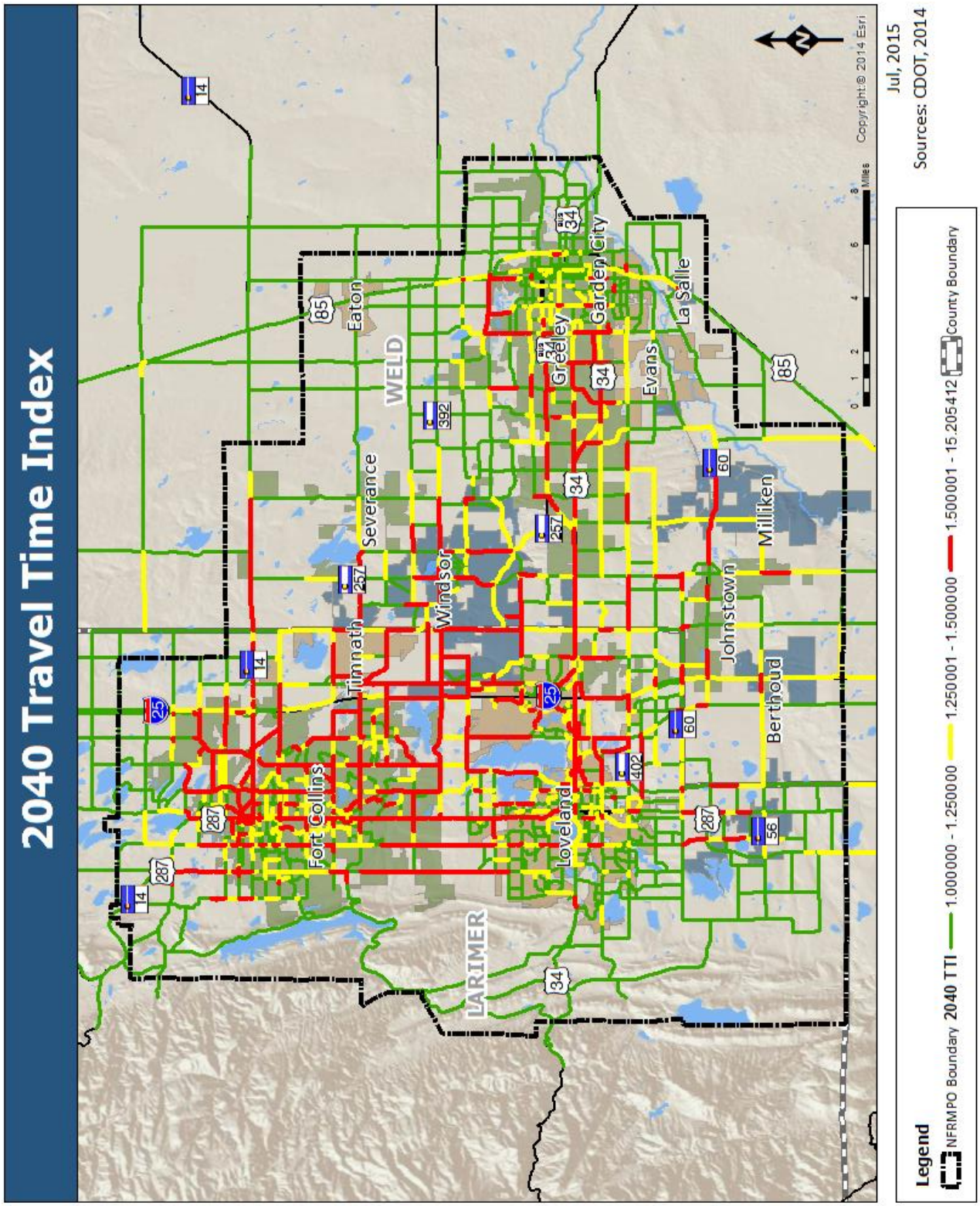
Over the next two years, the NFRMPO will transition to the collection and use of TTI information from the FHWA HERE dataset, INRIX dataset, and Bluetooth counters discussed in **Chapter 3**. In the future, posted speed limits will be used as the baseline for free-flow travel time.

Figure 4-1: Travel Time Index for 2012



*2012 TTI values range from 1.00 to 2.32.

Figure 4-2: Travel Time Index for 2040



*2040 TTI values range from 1.00 to 15.21.

4.1.2 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.

4.1.3 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.

4.2 Transportation Demand Management (TDM)

Transportation Demand Management (TDM) strategies are actions which improve transportation system efficiency by altering transportation system demand rather than through roadway capital expansion. TDM strategies include the following:

- Reducing trip length or time;
- Encouraging off-peak travel; and
- Reducing single occupancy vehicles (SOV) on roadways.

In 1996, the NFRMPO began implementation of the SmartTrips™ program for Northern Colorado with designated staff from the NFRMPO and the communities of Fort Collins, Greeley, and Loveland. The program was part of a package of strategies developed to reach the goals established by the NFRMPO which include reducing the number of trips made by SOVs by 10 percent by the year 2015.

The NFRMPO currently provides several TDM programs, including the VanGo™ vanpooling program, ride matching through the Go Portal (www.smarttrips.org), and business outreach services and events.

4.2.1 NFRMPO Household Survey of 2010 and Implications for TDM

The NFRMPO conducted a household survey in 2009 for the NFRMPO sub-regions. Staff collected data throughout the region and documented it in the NFRMPO Household Survey of 2010. The survey was conducted in the same manner across all sub-regions, providing a snapshot of current travel behavior throughout the North Front Range. The data has been used to target TDM service improvements for existing programs as well as exploring the potential for new services and programs in the region.

Key differences between the cities, towns, and rural areas in the region are reflected in household travel behavior. Some characteristics include:

- **Fort Collins** – Fort Collins households report smaller-than-average household sizes and fewer vehicles. These households report the highest levels of non-motorized travel in a typical week and the highest levels of transit pass ownership. Household members have higher-than-average education levels and more students per household than the other areas. Fort Collins respondents have a higher average number of bicycles per household and report riding a bicycle or walking to work or school more frequently than other parts of the region.
- **Greeley/Evans** – Households in the Greeley/Evans area are the most unique of the four areas. Consisting of more retirees and minorities than other areas, these households tend to be smaller, with fewer vehicles, fewer students, fewer workers, lower incomes, and the highest disability rates. The Greeley/Evans area has higher renter rates, and respondents are more likely to hold a transit pass than other areas of the region, with the exception of Fort Collins. Households in the Greeley/Evans area use transit more frequently than other parts of the region. Thirteen percent of Greeley/Evans drivers do not have a driver's license, which may contribute to higher levels of walking or transit use.
- **Loveland** – Loveland households tend towards average regional characteristics. They report somewhat smaller household sizes and number of workers per household, but higher-than-average renters. Loveland households have above-average transit usage for the region.
- **Larimer County** – Household size in unincorporated Larimer County is smaller than average, but respondents report the highest number of vehicles per household. They have the highest licensure rate, lowest levels of disability, above-average number of workers per household, and have the highest reported income levels in the region.
- **Weld County** – Respondents in unincorporated Weld County are similar to those in Larimer County, with the exception that they have lower education rates and more Hispanic households than the regional average. They are younger, have more students, and report the largest household size. Transit use is lowest in unincorporated areas of Weld County.

4.2.2 I-25 Carpool Park and Ride Study

In the summer of 2010, the NFRMPO conducted a survey to determine how Park-n-Rides (PNRs) were being used along the I-25 corridor in the region. The six regional PNRs were surveyed during the morning (a.m.) and evening (p.m.) peak periods on weekdays, during July and August 2010. The regional PNRs include:

- Harmony Road (Fort Collins) –Exit #265
- SH 392 (Windsor) – Exit #262
- US 34 (Loveland) – Exit #257

- SH 402 (Loveland) – Exit #255
- SH 60 (Johnstown) – Exits #252 and #254
- SH 56 (Berthoud) – Exit #250

The results of the surveys show a significant change in PNR use compared to previous surveys. Highlights from the 2010 survey include:

- SH 402 and SH 60 approached or exceeded 100 percent capacity on the days surveyed. At the SH 402 PNR, which currently has 88 paved spaces, users were also parking in a makeshift unpaved extension of the lot.
- SH 392 had the largest drop in use (from 36 vehicles in previous surveys to 11-12 vehicles).
- License plate data collected from 532 license plates and matched with home addresses in Northern Colorado revealed 38 percent of the cars at the six PNRs were from the Fort Collins area, while 25 percent were from the Loveland area. Berthoud, Greeley, Johnstown, and Denver Metro area each yielded between 9 and 10 percent.
- Carpools represent more than 70 percent of the overall usage at PNRs in the NFRMPO region. Vanpools accounted for 24 percent of the vehicles leaving in the morning and 20 percent of the vehicles arriving in the afternoon. The Harmony Road PNR had the largest number of morning and afternoon carpools (39 and 48 vehicles, respectively).
- 54 percent of carpools in both the morning and afternoon contained two passengers while the three passenger vehicles accounted for 11 and 18 percent, respectively.

4.2.3 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.

Methods for achieving a more efficient transportation system include:

- Shrink Trip Time or Length (less time congesting roadway)
  - Intelligent Transportation Systems (ITS)
  - Commuter-Oriented Development
- Encourage Off-Peak Travel (travel during less congested periods)
  - Alternative Work Schedules
  - Congestion Pricing
  - High-Occupancy Toll (HOT) Lanes
- Reducing Single Occupancy Vehicles (less vehicles during congestion)
  - Ridesharing Transit

- Telecommuting[13]

4.2.4 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.[14]

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.

[13] Long Range Transportation Demand Management Plan. North Front Range Metropolitan Planning Organization. December 2010.

[14] Reference Sourcebook for Reducing Greenhouse Gas Emissions from Transportation Sources. Chapter 5 Transportation Demand Management Strategies. U.S. Department of Transportation, Federal Highway Administration. Updated 3/24/15. http://www.fhwa.dot.gov/environment/climate_change/mitigation/publications_and_tools/reference_sourcebook/page05.cfm#s1

- **Employer Transportation Assessment Program:** NFRMPO staff assist local businesses in the creation of a TDM policy for employees.
- **ITS Improvements:** Covered in **Chapter 4** of this report.

4.2.5 Regional Transportation Demand Management Efforts

NFRMPO serves as the regional coordinator for TDM programs in the North Front Range. This includes the VanGo™ Vanpool Services program and business outreach.

VanGo™ - The VanGo™ program, managed by the NFRMPO, provides vanpool services to meet the origin and destination needs of commuters in the region and between the North Front Range and the Denver Metro area. The program, which began in 1994, has grown over the last 20 years to more than 400 riders and 74 routes in 2014.

SmartTrips™ - The NFRMPO has focused on regional modes of transportation, including carpooling and vanpooling along with the ridesharing website www.smarttrips.org.

The Go Portal - The NFRMPO has developed a free online tool The Go Portal, which allows commuters to find carpool matches, calculate commute savings, and get information on commute options.

CarGo™ - Carpool matching is provided by CarGo™, a ridesharing system available through the SmartTrips™ website. The CarGo™ program enables users to receive personalized carpool matches. The tool matches carpool participants who live near each other and are traveling in the same direction, during the same time period, to share the ride to school or work.

Bicycle Programs - The NFRMPO works with CDOT and local governments to promote Bike Month and Bike to Work Day every June. Additionally, there are more than 290 miles of bicycle facilities (bike routes, paths, lanes, and off-street trails) within ¼-mile of the RSCs in the region (I-25, US 34, and US 287 and parallel facilities, as defined in *Section 2A*). The SmartTrips™ website allows users to track miles of bicycle travel. Tracking these miles serves as an important performance measure for the program. Personal and employer incentives will need to be employed to increase reporting participation.

4.2.6 Local Government Transportation Demand Management Efforts

Local governments in the region are also involved in TDM efforts. Transit and bicycle programs are the most common focus of TDM efforts in the NFRMPO region. Some local governments have also developed ITS which provide information to travelers about traffic, weather, construction, and other travel factors.

City of Fort Collins

The City of Fort Collins is the largest city in the NFRMPO region, with a population of 143,986 (2010 Census). It is an economic and academic hub within the region and is home to Colorado State University (CSU). Fort Collins was designated a Platinum Level Bicycle Friendly Community[SM] by the League of American Bicyclists in 2013.

FCTrip

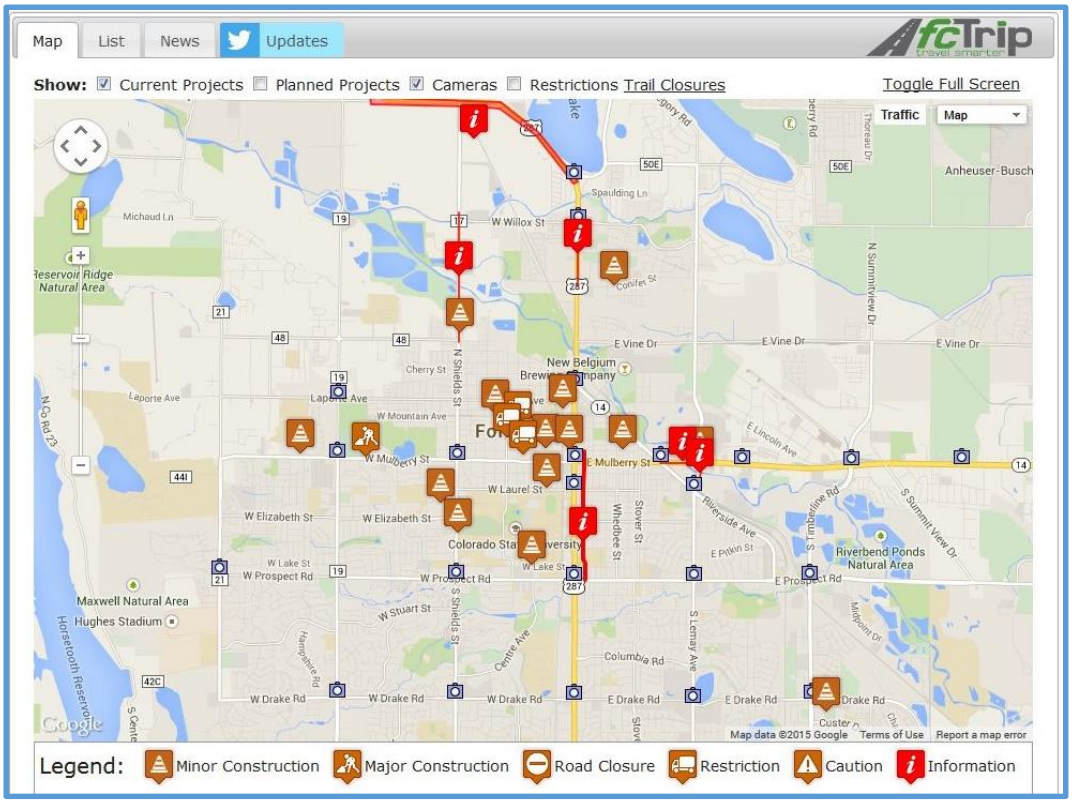
FCTrip is a web-based application that provides information to travelers in the City of Fort Collins, including:

- Timely and accurate information regarding traffic conditions;
- Information on weather conditions;

- Information on work area traffic, road construction, and road/lane closures; and
- Up to-the-minute photographs of major intersections.

FCTrips provides this information through a network of closed-circuit television cameras, video detectors, and pavement sensors. Users are able to view real-time maps that provide information on traffic conditions, construction, and road closures. An example FCTrip map is shown in **Figure 4-3**.

Figure 4-3: FCTrip Map



Fort Collins Bike Library

The Fort Collins Bike Library was established in conjunction with FC Bikes – City of Fort Collins, New Belgium Brewery, the Downtown Development Authority, and Bike Fort Collins – a non-profit group established in 2005 for bicycle advocacy. The Bike Library provides bicycle and equipment rental service for residents, students, and visitors to Fort Collins for a minimal cost (first day free, $10 each additional day). Members can borrow a bike for as short as one hour or for as long as seven days. The bike library provides a fleet of commuter bikes, cruiser bikes, children's bikes, striders, tandem bicycles, and bicycle trailers to attract a broad user base. As of May 2015, just over 24,000 registered patrons have checked out over 24,000 bikes, logged over 275,000 miles, 109,000 rider days, and prevented nearly 125 metric tons of CO_2 from being released into the atmosphere.[15]

FC Bikes

FC Bikes is the bicycle program established for the City of Fort Collins. In 2014, Fort Collins completed an updated Bicycle Master Plan that covers a cost-effective approach to bicycle infrastructure, connectivity,

[15] According to FC Bikes and Bike Fort Collins

policies, and programs. The plan aims to implement bicycle infrastructure improvements which will move the City toward achieving League of American Bicyclists Diamond Status for Bicycle Friendliness by the year 2020. The goals, principles, and policies that pertain to bicycling established in the City's Plan and the Transportation Master Plan have laid the foundation for the current policies, projects, and programs as well as the focus for the numerous recommendations provided. In addition, FC Bikes promotes bicycling in the City by sponsoring events such as Bike to Work Day, Winter Bike to Work Day (in December), and BikeWinter, encouraging cyclists to ride throughout the winter. Winter Bike to Work Day in December is the cornerstone event, with increased numbers of participants each year since its inception in 2007. The City of Fort Collins Transportation Board incorporated a bicycle sub-committee in 2009.

Colorado State University – TDM Programs

With a 2015 Spring Semester[16] enrollment of 26,775 students CSU has a significant transportation impact on the City of Fort Collins. The presence of students and faculty impacts the City's demographics and transportation system. For example, Fort Collins has a higher level of bicycle commuting than the national average and other parts of the region. This can be partially attributed to the student population. In addition, more than 35 percent of Fort Collins households reported that someone walks or bikes to work or school at least once a week.[17] CSU has implemented TDM programs to alleviate parking issues and congestion on campus.

All CSU students, faculty, and staff are eligible to ride the Transfort bus system at no cost, using their university identification card. In 2006, the transit center at Lory Student Center opened and includes a Transfort customer counter with monitors displaying departure times, news stories, and an indoor passenger waiting area to increase comfort and convenience. The transit center is certified LEED Gold.

The Lory Student Center also has a Fort Collins Bike Library station providing students, faculty, and staff access to bicycles. CSU has hundreds of user-friendly bike racks to accommodate an estimated 14,200 bicycle parking spaces on the main campus and 1,100 spaces at the satellite campuses.[18] CSU offers free parking for VanGo™ vans faculty and staff use for vanpooling.

City of Loveland

In 2012, the City of Loveland completed their Bicycle and Pedestrian Plan which covers strategies and activities to increase the use and convenience of bicycle and pedestrian facilities throughout the City. The plan aims to provide goals and objectives to provide a safe and effective bicycle and pedestrian system, fill in missing segments in the system, design and develop a Complete Streets system, and develop a continued source of funding for bicycle and pedestrian infrastructure.

Loveland also sponsors an annual Bike to Work Day event, including a business challenge to encourage employers to promote cycling as a transportation option to their employees. Additionally, the City of Loveland's Engineering Department has partnered with the Thompson School District to promote Safe Routes to School Program. This program benefits children and the community by reducing traffic

[16] Colorado State University Census Enrollment, spring 2015. Department of Institutional Research, Colorado State University

[17] NFRMPO Household Survey of 2010

[18] Colorado State University Bicycle Master Plan, 2014

congestion in school zones, improving air quality, increasing physical activity for children and adults, and promoting safe neighborhoods.

City of Greeley

The City of Greeley is home to approximately 115 miles of bike lanes, trails, and paths and the League of American Bicyclists designated them a Bronze Level Bicycle Friendly Community[SM] in May 2013. Greeley's Bicycle Master Plan was adopted in May 2015 and aims to increase investment in the bicycle and pedestrian system through a dedicated budget and implementation of a Complete Streets program.

The City also hosts a number of cycling events throughout the year, including bike to work day and pop-up demonstrations of enhanced bicycle facilities. Greeley has also used the Safe Routes to School Program to provide funding for school zone enhancements to the bicycle and pedestrian system.

4.2.7 Transit Services

Transit services in the NFRMPO region assist with TDM efforts. The following list outlines transit services offered by member communities.

City of Fort Collins - Transfort offers bus transit service Monday through Saturday. Youth ages 17 and younger ride free with school identification. City of Fort Collins employees are offered an annual Transfort bus pass free of charge. Transfort offers Passfort, an employer-based bus pass program which allows the bulk purchase of bus passes at a 68% savings if a minimum of 50 passes are purchased. All buses are equipped with bicycle racks to increase multimodal transportation opportunities.

- FLEX is a regional bus service operated by Transfort and offers service to Loveland, Berthoud, and Longmont (this service will be extended to Boulder in 2016).
- MAX is a Bus Rapid Transit (BRT) service operated by Transfort offering north/south service along the Mason Street corridor, which parallels College Avenue/US 287.

City of Loveland - City of Loveland Transit (COLT) provides fixed-route bus transit Monday through Saturday, with connections to the FLEX service.

City of Greeley - The City of Greeley operates the Greeley-Evans Transit (GET) service which provides local transit service in Greeley, Garden City, and Evans. Students at the University of Northern Colorado (UNC) ride GET free of charge with student ID cards. Greeley elementary and secondary students also ride free with a pass. UNC operates the Boomerang Shuttle (Bear Bus) free of charge for students, faculty, and staff to move around campus.

Town of Berthoud - The Town of Berthoud operates the Berthoud Area Transportation System (BATS) demand-response transit service. The system operates five vehicles and offers service within Berthoud, to Loveland, and to Longmont.

CDOT - CDOT sponsors Bustang, an interregional express bus service for long distance commutes to Denver along the I-25 and I-70 corridors. Bustang will initiate service on July 13, 2015. The service will connect commuters to the north in Fort Collins and Loveland and to the south in Monument, Woodmen, Colorado Springs, and Tejon using I-25. To the east it will connect commuters in Glenwood, Eagle, Vail, Frisco, and the Denver Federal Center using I-70.

4.2.8 Employer-Based Transportation Demand Management Programs

Employer-promoted TDM programs are an effective, locally-based mechanism to increase employee use of alternative modes for their work commutes.

A notable employer-based TDM effort in the region is the New Belgium Brewery. New Belgium actively promotes and supports bicycle commuting within their company and nation-wide. New Belgium employees receive a custom cruiser bicycle after one year of employment with the company. Team Wonderbike is New Belgium's bicycle commuter advocacy program with more than 10,000 members who have pledged to offset more than eight million car miles per year by riding their bikes. New Belgium also offers local grants, sponsorships, and product donations to applicants whose objectives align with New Belgium's.

CDOT offers TDM programs to its employees located throughout Colorado. Employees who work in the NFRMPO region are provided with a monthly commuter check worth $35 to subsidize vanpool costs. Employees who travel to the Denver metro area for meetings are provided with a RTD Eco Pass allowing them to ride transit. Full-time employees who commute to the Denver region from the NFRMPO region are also provided with Eco Passes. CDOT sponsors Bike to Work Day events in June at all of its statewide offices and provides incentives for employees to ride their bikes to work through the month of July.

Several regional employers promote transportation alternatives in conjunction with other events at the workplace, most commonly health fairs, including:

- Advanced Energy, Inc.
- AMD
- Avago Technologies
- Gallegos Sanitation
- Hach
- Hewlett-Packard
- Intel
- LSI Corporation
- McKee Medical Center
- Platte River Power Authority - Rawhide Power Plant
- Rickards Long & Rulon, LLP
- Poudre River Public Library District
- State Farm Insurance – Great Western Region
- Weld County
- Woodward Governor

4.3 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 manner. [19]

4.3.1 ITS Technologies and Applications

ITS can apply to all forms of transportation and has the capacity to improve safety, reduce vehicle wear, shrink delay, and lessen fuel consumption. ITS technology includes both intelligent transportation technologies and intelligent transportation applications which are outlined below.

- Intelligent transportation technologies

[19] About ITS. US Department of Transportation, Office of the Assistant Secretary for Research and Technology Intelligent Transportation Systems Joint Program Office. Accessed 5/7/15. http://www.its.dot.gov/faqs.htm

- Automated Passenger Counter (APC) – Use infrared beams located near transit vehicle entrances to record passenger boarding and alighting.
- Automatic traffic recording – Consists of devices that automatically record vehicles passing by a specific point along a corridor.
- Computational technologies – Vehicles are trending towards using fewer, but more powerful computer processors to assist with transportation.
- Fiber-optic communications – Use pulses of light through an optical fiber to carry information for telephone signals, internet communication, and television signals.
- Floating car data/floating cellular data – A low cost method of collecting travel time and speed data which references mobile phones or GPS systems in a two-way method of use.
- Sensing technologies – Allows for the communication of computers embedded in vehicles-to-vehicles and vehicles-to-infrastructure includes pneumatic road tubes, inductive loops, over-roadway sensors, in vehicle speed sensors, impact sensors, vehicle-to-vehicle scanning sensors, etc.[20]
- Video vehicle detection – Uses a computer system with video cameras to observe the changing characteristics of recorded imagery to indicate if a lane is occupied (i.e. a car waiting at a traffic signal).
- Weather condition collection – Sensors placed in the environment record and transmit weather condition information to assist in planning efforts.
- Wireless communications – A number of short and long range radio communications are used to transmit and receive data about the transportation system condition.

❖ Intelligent transportation applications

- Adaptive Signal Systems – This technology adjusts the timing of red, yellow and green lights to accommodate changing traffic patterns and ease traffic congestion.[21]
- Automatic road enforcement – A mounted camera used to record license plate numbers for travelers who disobey a speed limit or other legal road requirement and subsequently mail a ticket.
- Bluetooth detection – Uses transmitted MAC addresses that are generated by devices such as cell phones, laptops, and GPS units to detect and record travel times, travel direction, and origin/destination.
- Cordon zones with congestion pricing – Specific areas where drivers are charged a fee for the use of a transportation corridor during a specific time period.

[20] A Summary of Vehicle Detection and Surveillance Technologies use in Intelligent Transportation Systems. Chapter 3 – Overview of Vehicle Detection and Surveillance Technologies. Policy Information, Highway Finance Data & Information. FHWA. Accessed 5/15/2015.
http://www.fhwa.dot.gov/policyinformation/pubs/vdstits2007/03.cfm

[21] Adaptive Signal Control. FHWA. Accessed 7/1/2015.
http://www.fhwa.dot.gov/everydaycounts/technology/adsc/

- Collision avoidance systems – Either in-vehicle systems to automatically stop the vehicle when a potential collision is detected or infrastructure to announce slowed traffic to motorists with Dynamic Message Signs (DMS).
- Dynamic Traffic Light Sequence – A system using RFID sensors embedded in a traveler's electronics to signal vehicle queuing to adjust traffic signal timing.
- Dynamic Messaging Signage (DMS) – Electronic traffic sign used to inform travelers about special events, traffic conditions, or roadway construction.
- 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.
- Emergency vehicle notification systems – An in-vehicle system drivers can activate to contact emergency personnel while automatically sending incident time, location, and direction with vehicle identification.
- Inductive loop detection – Placed in a roadbed, charged loops detect vehicles as they pass through the generated magnetic field.
- Maintenance Decisions Support System (MDSS) – Is a decision support tool that integrates relevant road weather forecasts, coded maintenance rules of practice, and maintenance resource data to provide winter maintenance managers with recommended road treatment strategies.[22]
- Pavement condition detection – Pavement condition is objectively quantified using photography, 3D laser, or manual assessment methods to classify roadway reconstruction priority.
- Ramp Metering – Uses a traffic signal to control the rate at which vehicles enter the freeway.[23]
- Traffic operations center – A central command center which allows traffic engineers to monitor traffic signals, CCTV, and remote data sensors to analyze and mange traffic in real-time.
- Traffic Signal Timing adjustments offer travelers decreased travel delay and increased fuel savings while providing increased pedestrian clearance intervals.
- Variable speed limits – Typically used to reduce traffic speed limits in poor conditions portable changeable message signs (PCMS) can potentially smooth traffic flow, saving traveler's time while reducing accidents.[24]

[22] FHWA Road Weather Management Program Projects and Activities. FHWA. Accessed 7/1/2015. http://ops.fhwa.dot.gov/weather/mitigating_impacts/programs.htm

[23] Jacobson, L., J. Stribiak, L. Nelson, and D. Sallman. Ramp Management and Control Handbook. Report No. FHWA-HOP-06-001, produced for FHWA by PB Farradyne, Washington, DC, January 2006.

[24] ITS ePrimer Module 3. Office of the Assistant Secretary for Research and Technology, United States Department of Transportation. Intelligent Transportation Systems Joint Program Office. Accessed 5/12/2015. http://www.pcb.its.dot.gov/ePrimer.aspx

4.3.2 Intelligent Transportation Systems in Northern Colorado

Within the region, the cities of Fort Collins, Greeley, and Loveland use ITS to monitor traffic and control traffic signals.

- From the City's Traffic Operations Center (TOC), Fort Collins uses an Advanced Traffic Management System (ATMS), which consists of wireless communication and fiber-optic technology used to connect 175 traffic signals; 42 closed-circuit television (CCTV) cameras; and remote data sensors to the TOC. With this system, Fort Collins can monitor the transportation system, modify signal timing, and troubleshoot signal malfunctions from a centralized location. In 2014, the City introduced a system which measures travel time using Bluetooth readers throughout the City. Using the Bluetooth signal from passing devices, the TOC can monitor travel times along major corridors. The sensors can be read in real-time, allowing TOC staff to adjust traffic signals as needed. City staff can study traffic patterns and make adjustments in the traffic signal timing. During special events traffic engineers can monitor roadway congestion and adjust signal timing as necessary.
- From Loveland's TOC, the City can interface with CCTV, variable message signs (VMS), weather-monitoring stations, and their fiber-optic network. Traffic engineers in the TOC can use these technologies to measure roadway congestion and adjust traffic signals accordingly to improve the flow of traffic. Loveland has completed projects adding fiber optic cables to enhance communication to local traffic controllers. In the future, a system of Bluetooth vehicle counters will be installed in Loveland to measure travel times.
- Between 2009 and 2014, the City of Greeley made a concentrated effort to bring their traffic signal operation into the 21st century. The City has installed a Traffic Management Center (TMC), upgraded all signals with Advanced Traffic Controllers, connected 117 traffic signals through 30 miles of fiber-optic cable, installed 20 CCTV cameras, added two weather stations, and installed six permanent count locations. In addition, Greeley was the first in Colorado to install Adaptive Signal Control Technologies (ASCT) for the 15 traffic signals along the 10th Street Corridor. This adaptive signal operation has improved travel times and reduced accidents along the corridor. In 2015, the City will work with CDOT to add an additional 12 traffic signals, along the US 85 and US 34 Bypass corridors, to the ASCT system. The City of Greeley is currently exploring Bluetooth technology to monitor travel times throughout the City.

CDOT is currently installing fiber optics on I-25, which will act as the backbone for larger ITS projects on state highways. The project includes fiber wiring and cameras as well as connecting the permanent VMS. CDOT Region 4 is installing fiber-optics, cameras, and VMS on US 34 from I-25 to west Greeley and will be installing ramp meters between SH 392 and Harmony Road.

In the NFRMPO region a number of ITS strategies are currently in place to help travelers, including:

- Adaptive Signal Systems
- Automatic Traffic Recording Devices - Tube Counters, Inductive Loop Detection, Bluetooth, Wi-Fi, Video Vehicle Detection
- Backup Traffic Signal Control Cabinets
- Closed Circuit TV (CCTV)
- Dynamic Message Signage (DMS)

- Fiber Optic Communications (I-25, US 34, and throughout Greeley)
- In-Pavement Traffic Sensor - Inductive Loop Detection
- Lane Control Signage
- Maintenance Decisions Support Systems (MDSS) – Winter weather roadway maintenance
- Pavement Condition Detection
- Traffic Operations Centers (TOC)
- Road and Weather Information Service (RWIS) – monitors weather conditions and traffic signals programmed to adapt their timing in response to traffic congestion
- Weather Stations – Provide precipitation detection, visibility measurements, wind speed, surface condition, etc.

In 2011, CDOT, the NFRMPO, and local jurisdictions developed the CDOT Region 4 Intelligent Transportation Systems Strategic Implementation Plan.[25] 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. **Figure 4-4** shows the funded ITS projects in the FY2012-2017 TIP. Many of the projects were city-wide, including improvements to traffic control centers and traffic signal upgrades. In these cases, the point shows the location of the traffic control center rather than a specific project location. **Table 4-2** shows the location and funding sources for each of the ITS projects.

Table 4-2: NFRMPO ITS Projects from FY2012-2017 TIP

ITS Project	Funding Source	Location
Northern Fort Collins Rail Crossing Signals	CMAQ	Fort Collins
Greeley Fiber Optic Communication	CMAQ	Greeley
Loveland Traffic Signals Controllers	CMAQ	Loveland
Loveland I-25/US 34/Crossroads VMS	CMAQ	Loveland
Loveland Traffic Operations Center	STP-Metro	Loveland
Greeley Fiber Optic Communication	STP-Metro	Greeley
Implementation of Network Management System	FASTER	Fort Collins
Adaptive Signal Control US 85 (Greeley)	RAMP	Greeley
US 34 Bypass (Greeley) Adaptive Signals	RAMP	Greeley
US 34 from I-25 to West Yard Fiber Installation	RAMP	Greeley

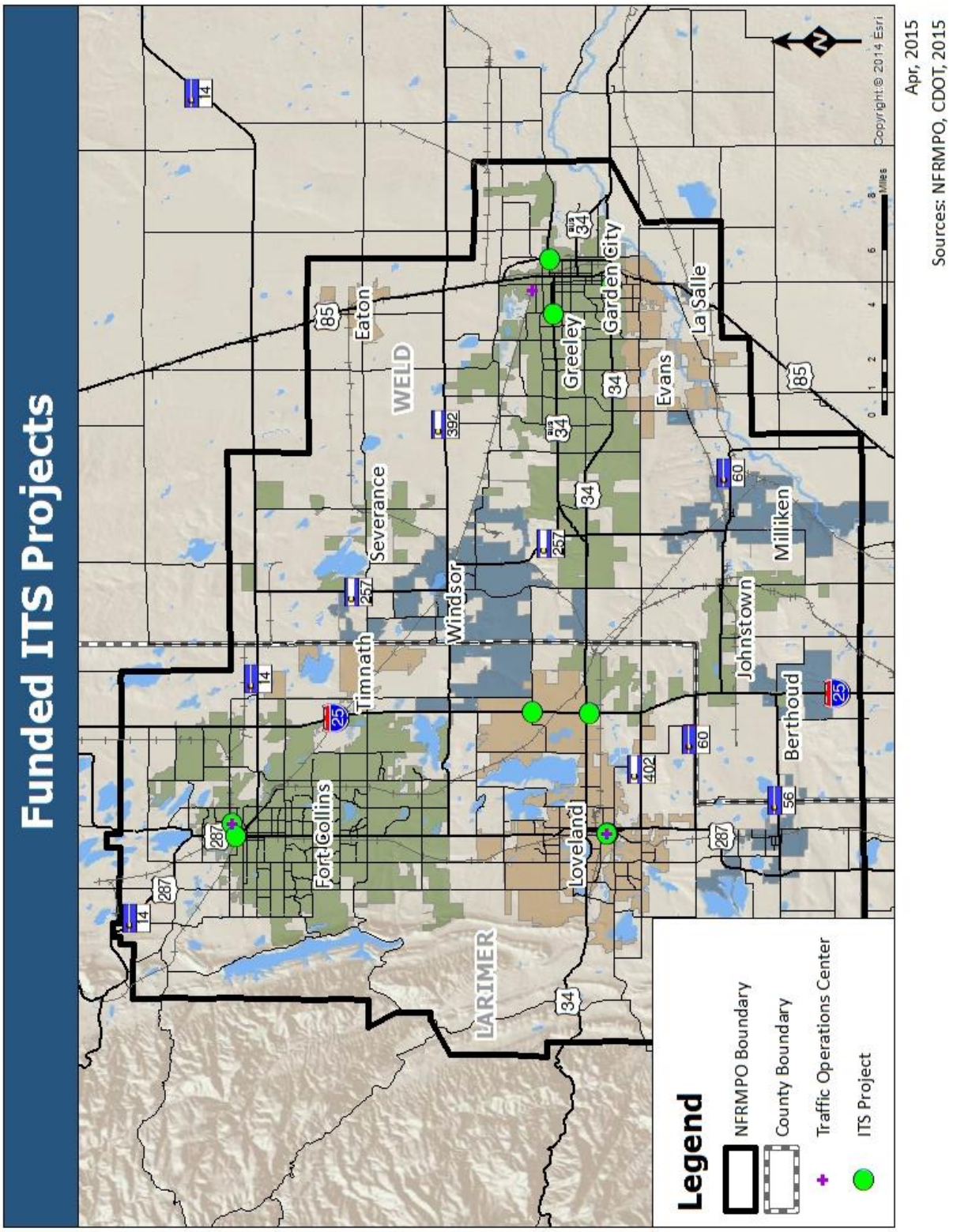
Source: NFRMPO FY2012-2017 TIP

In addition to projects sponsored by local communities, CDOT operates its COTRIP website (www.cotrip.org) offering travel alerts, road conditions, speeds, and road work advisories for the entire State. Using this website, residents can use the State's available ITS information to choose the best routes, best mode, or view any detours. The program takes advantage of previously completed ITS projects to offer commuters an idea of conditions before they begin their travel. Traffic cameras around the region provide live updates on traffic. The cameras are located in municipalities as well as key spots along the I-

[25] 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

25 corridor. CDOT also provides an App, CDOT Mobile, which provides real-time travel information. Travelers can also sign up for text messages and emails which provide similar updates.

Figure 4-4: 2012-2017 TIP Funded ITS Projects



4.4 Transit Congestion Management Strategies

The Texas Transportation Institute's 2010 Urban Mobility Report outlines public transportation's national congestion reduction benefit.

> "If public transportation service had been discontinued and the riders traveled in private vehicles in 2009, the 439 urban areas would have suffered an additional 785 million hours of delay and consumed 640 million more gallons of fuel. The value of the additional travel delay and fuel that would have been consumed if there were no public transportation service would be an additional $18.8 billion, a 16% increase over current congestion costs in the 439 urban areas."[26]

Transit plays an important role in creating a holistic transportation system. A number of transit related congestion reduction benefits are outlined in the sections that follow.

4.4.1 Congestion Pricing

According to Transit and Congestion Pricing, A Primer, congestion pricing uses the power of the market to reduce waste associated with traffic congestion. Travelers who choose to use the transportation system during peak periods are charged an additional usage fee. Depending on size of the fee, drivers have an incentive to shift their travel time, mode, or route. Effective transit service is essential for the successful implementation of congestion pricing. The mode shift encouraged by congestion pricing requires a robust transit system to absorb the additional ridership. With a reduction in vehicles, the system is able to flow more smoothly. Public concerns about instituting an additional fee is offset by an increase in reliable travel times for all users.[27]

There are five main types of pricing strategies:

1. Variably priced lanes: Variable tolls on separated lanes within a highway, such as express-toll 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.

Revenue generated by congestion pricing can be used to enhance the transportation network for other modes, install new infrastructure, and implement TDM and ITS improvements. While the benefits of congestion pricing are numerous, some include: transit travel times are improved with the reduction in

[26] Lomax, Tim. et al. Real-Timing the 2010 Urban Mobility Report. Final Report. Texas Transportation Institute. February 2011. http://utcm.tamu.edu/publications/final_reports/Lomax_10-65-55.pdf

[27] Transit and Congestion Pricing, A Primer. U.S. Department of Transportation. Federal Highway Administration. June 2009. Accessed 5/13/15. http://ops.fhwa.dot.gov/publications/fhwahop09015/fhwahop09015.pdf

traffic; reducing the breakdown of traffic flow maximizes the public investment in transportation facilities; and emergency personnel response time is improved, and increased travel time reliability is provided for users.

4.4.2 Bus Rapid Transit (BRT)

BRT is "an integrated system of facilities, equipment, services, and amenities that improves the speed, reliability, and identity of bus transit."[28] 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.

4.4.3 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
  - 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

[28] 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

- Cleanliness[29]

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.

4.5 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 as possible. Effective TIM reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims and emergency responders.*[30]

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

[29] 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

[30] 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 6/2/15.

- 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[31]

- 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.

4.5.1 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 demand. Between 2006 and 2010, there were 545 crashes resulting in injuries or fatalities (an average of 103 per year).[32]

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."[33]

The I-25 TIMP offers a number of recommendations to improve incident response, including:

[31] 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 Accessed 6/2/15.
[32] 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 6/2/15.
[33] I-25 Traffic Incident Management Plan, SH 7 to Wyoming State Line. Colorado Department of Transportation. June 2012.

- 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 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.

Chapter 5: Next Steps

5.1 Future Congestion Data Collection

5.1.1 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.

5.1.2 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.

5.2 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 **Chapter 4**, the region's demographic data, congestion trends 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 **Chapter 4**:

- 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

Appendix

A. FHWA CMP Ruling

Title 23 Sec. 450.320 Congestion management process in transportation management areas.

Statewide Transportation Planning; Metropolitan Transportation Planning;

Final Rule, February 14, 2007.

(a) The transportation planning process in a TMA shall address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53 through the use of travel demand reduction and operational management strategies.

(b) The development of a congestion management process should result in multimodal system performance measures and strategies that can be reflected in the metropolitan transportation plan and the TIP. The level of system performance deemed acceptable by State and local transportation officials may vary by type of transportation facility, geographic location (metropolitan area or subarea), and/or time of day. In addition, consideration should be given to strategies that manage demand, reduce single occupant vehicle (SOV) travel, and improve transportation system management and operations. Where the addition of general purpose lanes is determined to be an appropriate congestion management strategy, explicit consideration is to be given to the incorporation of appropriate features into the SOV project to facilitate future demand management strategies and operational improvements that will maintain the functional integrity and safety of those lanes.

(c) The congestion management process shall be developed, established, and implemented as part of the metropolitan transportation planning process that includes coordination with transportation system management and operations activities. The congestion management process shall include:

(1) Methods to monitor and evaluate the performance of the multimodal transportation system, identify the 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;

(2) Definition of congestion management 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. Since levels of acceptable system performance may vary among local communities, performance measures should be tailored to the specific needs of the area and established cooperatively by the State(s), affected MPO(s), and local officials in consultation with the operators of major modes of transportation in the coverage area;

(3) Establishment of a coordinated program for data collection and system performance monitoring 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. To the extent possible, this data collection program should be coordinated with existing data sources (including archived operational/ITS data) and coordinated with operations managers in the metropolitan area;

(4) Identification and 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. The following categories of strategies, or combinations of strategies, are some examples of what should be appropriately considered for each area:

(i) Demand management measures, including growth management and congestion pricing;

(ii) Traffic operational improvements;

(iii) Public transportation improvements;

(iv) ITS technologies as related to the regional ITS architecture; and

(v) Where necessary, additional system capacity;

(5) Identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation; and

(6) Implementation of a process for periodic 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.

(d) In a TMA designated as nonattainment area for ozone or carbon monoxide pursuant to the Clean Air Act, Federal funds may not be programmed for any project that will result in a significant increase in the carrying capacity for SOVs (i.e., a new general purpose highway on a new location or adding general purpose lanes, with the exception of safety improvements or the elimination of bottlenecks), unless the project is addressed through a congestion management process meeting the requirements of this section.

(e) In TMAs designated as nonattainment for ozone or carbon monoxide, the congestion management process shall provide an appropriate analysis of reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in which a project that will result in a significant increase in capacity for SOVs (as described in paragraph (d) of this section) is proposed to be advanced with Federal funds. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor and additional SOV capacity is warranted, then the congestion management process shall identify all reasonable strategies to manage the SOV facility safely and effectively (or to facilitate its management in the future). Other travel demand reduction and operational management strategies appropriate for the corridor, but not appropriate for incorporation into the SOV facility itself, shall also be identified through the congestion management process. All identified reasonable travel demand reduction and operational management strategies shall be incorporated into the SOV project or committed to by the State and MPO for implementation.

(f) State laws, rules, or regulations pertaining to congestion management systems or programs may constitute the congestion management process, if the FHWA and the FTA find that the State laws, rules, or regulations are consistent with, and fulfill the intent of, the purposes of 23 U.S.C. 134 and 49 U.S.C. 5303.

B. North Front Range MPO 2014 Congestion Survey

In 2014, the NFRMPO completed the 2014 Congestion Survey. In total 226 participants answered at least one question and 93 answered all 12 questions. The included survey questions are below:

1. Where do you live?
2. Where do you work/volunteer?
3. What is your primary commute method?
4. What do you think causes heavy traffic and congestion?
5. Heavy traffic/congestion means I am:
6. How often do you experience heavy traffic/congestion?
7. Please select up to 3 factors you consider important when making travel decisions (route choice, travel method, departure time) for your commute trip.
8. How do you avoid heavy traffic?
9. Compared to five years ago, would you say traffice congestion has:
10. Which category below includes your age?
11. What is your household income category?
12. What is the highest level of education you have completed?