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Regional Intelligent Transportation Systems Deployment Program

Adopted June 2014

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EXECUTIVE SUMMARY

Background

The Denver Regional Council of Governments (DRCOG) administers the federally-funded "pool" project titled *Regional Intelligent Transportation System Pool,* or ITS Pool. The purpose of pool is to implement cost-effective technology, system and process improvements that advance the goals and objectives of the *DRCOG Regional Concept of Transportation Operations* (RCTO). These goals and objectives focus on providing travelers more reliable and safe transportation operations in the region, which can be measured by reductions in travel time and harmful auto emissions.

Implementation Program

The implementation program was developed with the assistance of the Regional Transportation Operations (RTO) work group, which is comprised of jurisdictional and agency staff responsible for operations across the region, and other stakeholders. The implementation plan identifies a cost-effective mix of projects to address both the RCTO goals and objectives and addresses the needs expressed by the regional stakeholders.

The implementation program (see Table E-1) consists of two categories of activities. The main component is the set of capital projects and studies directly addressing stakeholder needs. There is a secondary component for contingency and miscellaneous equipment. The primary purpose of these funds is to ensure that capital projects can proceed to construction if actual costs exceed the conceptual estimates. Once that is certain, the remaining contingency funds will be used for miscellaneous equipment purchases – mainly smaller projects and purchases of equipment to expand existing systems.

Project Sponsor Responsibilities

In addition to providing non-federal match to the federal funds programmed in this document, each project sponsor is responsible for leading project development and implementation of the projects and systems. Once implemented, the project sponsor has the further responsibility of managing and maintaining system implemented.

Furthermore, since this document programs federal funds for ITS projects, project sponsors must base the project development and design on a systems engineering analysis as per federal rules (23 CFR 940). Systems engineering analysis is a structured process for arriving at a final system design that considers a number of alternative solutions that meet the project objectives and the total life-cycle costs.

Finally, the ITS Pool Program is funded through the federal Congestion Mitigation/Air Quality (CMAQ) Program. The CMAQ Program requires annual reporting on the benefits (reduction in harmful emissions and decrease in vehicle-hours traveled) due to projects implemented through the program. The project sponsor is responsible for determining

the benefits for its project. Resources at CDOT and DRCOG are available to guide and assist in the effort.

DRCOG Traffic Operations Program Responsibilities

Through DRCOG's Traffic Operations Program, established for DRCOG's *Traffic Signal System Improvement Program*, DRCOG staff is able to support coordination of ITS projects and activities with traffic signal timing improvement efforts. This broadly includes providing both guidance for systems engineering analysis and coordination and support for project benefits evaluation.

Table E-1
ITS Pool Capital Improvement Projects

Project Description and Location		Project Cost Estimate			
		FY14	**FY15**	**FY16**	**FY17**

Arapahoe County	Implement arterial travel time monitoring system on:
	    Easter Avenue/Broncos Parkway (Havana St to Parker Rd)
	    Arapahoe Road (Olathe St to Waco St)
	    Buckley Road (Arapahoe Rd to Orchard Rd)
	    Iliff Avenue (Syracuse Wy to Dayton St)
			X		

CDOT ITS	Implement the following regional data coordination improvements:
	    CTMS Software Revision - software revision will allow CTMS to collect travel time monitoring data feeds from outside agencies.
	
	    Regional Data Warehouse - housed at the CTMC and available to all regional partners.
	
	    Denver CAD Interface - software revision will allow CTMS to accept a feed of traffic incident information from Denver's CAD.
		X	X		

CDOT Real-Time Traffic Management Branch	Implement the following regional incident management improvements:
	    Develop a regional incident management process focused on I-25 from Castle Rock to SH-7. This effort will also identify gaps in CDOT's I-25 field infrastructure regarding incident management.
	
	    Implement I-25 field infrastructure to improve incident management.
		X	X		

CDOT Region 1	Implement the following ramp metering system upgrades:
	    Implement an upgraded ramp metering system in CDOT Region 1 that includes expanded functionality and ramp metering techniques.
	
	    Implement upgraded controllers and communications capable of expanded functionality and ramp metering techniques.
				X	X

Centennial	Implement arterial travel time monitoring system on:
	    Dry Creek Road (Clarkson St to Arapahoe Rd)
	    Arapahoe Road (Franklin St to I-25)
	    Smoky Hill Road (Telluride St to Liverpool St)
			X	X	

Denver	Expand arterial travel time monitoring system on:
	    Hampden Avenue (Colorado Blvd to Dartmouth Ave)
	    56th Avenue (Quebec St to Tower Rd)
	    Federal Boulevard (Alameda Ave to Dartmouth Rd)
				X	

Denver	Develop a concept of operations to implement center-to-center functionality between Denver's traffic signal system and a neighboring jurisdiction with a different manufacture of traffic signal system.			X	
Greenwood Village	Implement arterial travel time monitoring system on DTC Boulevard (Belleview Rd to Arapahoe Rd).		X		

Lakewood	Expand arterial travel time monitoring system on:
	    Kipling Parkway/Street (26th St to Belleview Ave)
	    Colfax Avenue (I-70 to Harlan St)
	    Alameda Parkway/Avenue (C-470 to Harlan St)
	    Simms/Union Street (Alameda Pkwy to Colfax Ave)
			X	X	X

Thornton Fiber Interconnect	Install conduit and fiber to interconnect:
	    traffic signals on Thornton Parkway (Hoffman Wy to Welby Rd)
	    RTD's fiber along north rail line
			X		

Subtotal		**$ 660,000**	**$ 1,375,781**	**$ 734,700**	**$ 311,300**
Contingency/Misc. Equipment**		$ -	$ -	$ 127,300	$ 513,700
Total		**$ 660,000**	**$ 1,376,000**	**$ 862,000**	**$ 825,000**

I. INTRODUCTION

Background

The Denver Regional Council of Governments (DRCOG) administers the federally-funded "pool" project, *Regional Intelligent Transportation System Pool*. It is identified in the Transportation Improvement Program (TIP) as Project ID # 2005-026. This project is directed by the *Regional Intelligent Transportation Systems Deployment Program* adopted August 2012 by the DRCOG Board of Directors.

The purpose of this document is to program the allocated funds to efficiently invest in intelligent transportation systems (ITS) capital projects and systems that achieve the vision of the *DRCOG Regional Concept of Transportation Operations* (RCTO).

The regional stakeholders in transportation operations have distinct roles and responsibilities as described in the RCTO. Project sponsors have the lead for project development and implementation while following a systems engineering analysis. Project development and implementation of project often requires coordination with other regional stakeholders in order to adequately implement and operate the project elements. DRCOG facilitates the planning and coordination required for these projects. In addition, project sponsors, and DRCOG partner to determine the congestion and air quality benefits of each project.

Transportation operations improvement projects are focused on the Regional Roadway System within the Transportation Management Area (TMA) (see Figure 1). The Colorado Department of Transportation (CDOT) and other stakeholders within the DRCOG region also deploy and utilize ITS equipment and systems outside of the TMA. This document accounts for the other ITS deployments in the DRCOG region, but programs only within the TMA.

Figure 1
Transportation Management Area

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LEGEND

▭ Transportation Management Area

▭ DRCOG County Boundaries

N

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Miles

Source: DRCOG
Projection: Colorado State Plane, NAD 83
PJ 06/13

\\Clinton\Develop\Transportation Operations\GIS for ITS\Diagrams and Figures\TSSIP Update 2010\TMA.mxd

Purpose

The purpose of this document is to program the funds allocated in the ITS Pool. The DRCOG Regional Transportation Operations (RTO) work group assisted in the development of this document. The RTO work group is comprised of representatives from transportation operating agencies, the Colorado Department of Transportation (CDOT), the Regional Transportation District (RTD) and the Federal Highways Administration (FHWA). The RTO work group seeks to improve its capacity and capability to manage transportation operations across the region under the guidance of the RCTO.

The RCTO highlights that about two-thirds of congestion experienced nationally is due to factors that can be addressed and managed by improved operations: traffic incidents, work zones, weather, special events and signal timing. The priorities of the RCTO are reflected in this document with a highlight on improving traffic incident management and management of the Regional Roadway System. Furthermore, since roughly two-thirds of the daily vehicle-miles-traveled (VMT) in this region is on arterial roadways, an emphasis is placed on coverage of arterials and coordination between arterials and freeways.

Program Development Process

The RTO work group met several times from the fall of 2013 to the spring of 2014 to develop this document. The update process included verifying current conditions, identifying critical needs, and developing an investment program to address those needs. It is recognized that public safety professionals are key to regional transportation operations improvements, and the current level of participation of public safety representatives on the RTO work group is low. A key priority of the RTO work group, as noted in the RCTO, is to improve traffic incident management, which will require improved communications and participation between transportation and public safety professionals.

II. REGIONAL CONCEPT OF TRANSPORTATION OPERATIONS

The DRCOG Board adopted the *Regional Concept of Transportation Operations* (RCTO) in July 2012. The RCTO describes the collaborative plan to improve regional transportation operations performance across the region over the next five years. The focus of the RCTO is to improve regional travel reliability, which involves both leveraging the success of existing systems and ongoing regional transportation operations practice and newly focusing on reducing the impact of traffic incidents.

The RCTO is a management tool that provides guidance to this document. It presents a unified direction for transportation systems management and operations based on a holistic view of the whole region based on operations objectives and performance measures that can be used in the transportation planning process. In addition, the RCTO clarifies the roles and responsibilities of the partners in the collaborative effort.

Purpose and Vision

This RCTO vision recognizes that travelers both expect reliable service for all travel modes and do not recognize jurisdictional boundaries as their trips take them across the region.

> ### RCTO Vision
> *The regional transportation systems in the Denver regional area will be coordinated across jurisdictions to support and continually improve traveler mobility and safety for all travel modes. Collectively, the regional transportation system operators and other stakeholders will provide seamless travel across jurisdictional boundaries and facilitate coordination between transportation modes, which will be supported by a regional multimodal traveler information system and regional traffic incident management processes.*

The purpose of the RCTO is to expand from the vision and describe an implementation plan to provide transportation services to meet those expectations. Necessarily, the implementation plan cannot simply be a description of capital improvements to expand the transportation operations infrastructure, but must describe improvements in collaboration and coordination between and within the jurisdictions and agencies.

The RCTO leverages the existing transportation systems and current successes, moving from that foundation to a new level, providing travelers a higher level of reliability – the travel experience will be similar from day to day.

The RCTO similarly recognizes all of the transportation systems that operate in the region behave as a single regional system. In order to manage the systems collectively as a regional system, operators and other stakeholders must adopt a shared vision and objectives that have a regional perspective. The performance of each individual item is important, but the relationships between the systems are critical.

Goals and Objectives

The DRCOG RCTO has three goals focused on providing reliable transportation operations services. The RCTO goals and objectives are listed below.

Table 1
RCTO Goals and Objectives

GOAL 1	**PROVIDE RELIABLE TRANSPORTATION OPERATIONS FOR REGIONAL TRAVELERS**
Objective 1.1	Increase trip travel time reliability on freeways and arterials for all modes
	• Establish automated real-time process to calculate the Travel Time Index (TTI) and Planning Time Index (PTI)
	• Combine real-time data with archived data and determine baseline indices
	• Expand travel time data collection on 40 miles of roadway segments
	• Transit operations will meet or exceed the RTD Board annual on-time reliability targets (2014 targets: local buses - 88%; regional/express buses – 94%; light rail – 90%)
Objective 1.2	Reduce traveler stops and delay due to signal operations
	• Establish a baseline for the Arterial Progression Index (API) for the signalized arterials
Objective 1.3	Reduce average incident duration time
	• Establish uniform data collection practices to calculate incident management performance measures based on data sources across multiple agencies
Objective 1.4	Reduce the occurrence of secondary incidents
	• Establish uniform data collection practices to calculate incident management performance measures based on data sources across multiple agencies
GOAL 2	**PROVIDE SAFE TRANSPORTATION OPERATIONS**
Objective 2.1	Reduce traffic injury rates (target: 68 per 100 MVMT)
Objective 2.2	Reduce traffic fatality rates (target: 0.66 per 100 MVMT)
Objective 2.3	Reduce public safety and construction/maintenance personnel injury/fatalities
	• Establish a baseline measures
GOAL 3	**PROVIDE TRANSPORTATION OPERATIONS SUPPORT FOR NON-AUTO TRAVEL MODES**
Objective 3.1	Reduce SOV mode share (target: 72 percent of "Drive Alone to Work" trips)
Objective 3.2	Reduce per capita VMT (target: 25.8 miles per day per person)
Objective 3.3	Reduce per capita greenhouse gas emissions (target: 8,700 pounds per day per person)

The DRCOG RCTO defines ten initiatives to address regional transportation operations goals and objectives. There are five main initiatives with five cross-cutting initiatives that support the main initiatives.

Table 2
RCTO Initiatives

1	Continue to coordinate Signal Timing System Timing Management across jurisdictional boundaries
2	Continue to coordinate and expand freeway management
3	Establish Regional Incident Management process
4	Improve work zone/special event management
5	Define criteria for operations improvement and monitoring for bicycles and pedestrians
C-1	Expand traffic monitoring capabilities and infrastructure
C-2	Establish shared monitoring between jurisdictions
C-3	Further coordinate multimodal traveler information
C-4	Expand the shared communications network
C-5	Establish a shared data warehouse and performance reporting process

III. SYSTEM INVENTORY

The ITS infrastructure, staffing and processes within the DRCOG region combine to form a system of systems used to monitor and manage the various transportation facilities across the region. These systems are summarized here to illustrate the base infrastructure upon which the RTO work group and ITS stakeholders are building the ITS Pool program. The description is broken into the following categories for ease of discussion: Roadway Monitoring, Roadway Management, Traveler Information, Public Transit Operations and Management, Weather Operations, Travel Demand Management, Traffic Incident Management, and Support Services.

Roadway Monitoring

Roadway monitoring includes the systems that provide transportation operators the ability to monitor the operating conditions of the roadway (see Figure 2). A mix of technologies are used, but the functionality is generally broken into three groups: 1) vehicle detection – collecting prevailing volume, speed and occupancy (a surrogate measure of congestion); 2) travel time monitoring – a system that collects and matches unique identifying codes emanating from some vehicles in order to determine the travel time between readers; and, 3) video cameras – video cameras installed along roadways to assist operators in confirming the conditions measured by other systems.

Note that the coverage illustrated in Figure 2 mainly represents video cameras and vehicle detection. Travel time monitoring is implemented on most freeways and on only a small number of arterial roadways.

Roadway Management

Roadway management includes the systems that provide transportation operators the ability to manage operations of the roadway (see Figure 3). The key element for monitoring and managing roadways is the staff and the systems at traffic management centers. Traffic management centers are purpose-built facilities that are staffed during at least peak hours (or during special events) to allow staff to monitor and actively manage transportation operations. The Colorado Transportation Management Center (CTMC) in Golden is staffed 24/7 by CDOT Transportation System Management & Operations (TSM&O) Division staff. The CTMC is in the process of expanding its current capabilities of distributing traveler information to include more real-time operations and management and incident management.

Transportation operations on arterial roadways are managed by traffic signal systems. Over 30 jurisdictions within the Denver TMA have traffic signals systems and monitor/manage nearly 2,400 traffic signals on the Regional Roadway System. Some of the traffic signal systems are managed by staff in traffic management centers while others operate with set signal timing plans, alerting operators when issues arise.

On the freeways, CDOT deploys three management strategies: 1) ramp metering – a system of detectors and traffic signals at freeway on-ramps that control the rate vehicles enter the freeway, postponing congestion; 2) managed lanes – essentially tolled lanes

that allow high-occupancy vehicles (HOV) to travel on the lane at a discounted rate; and, 3) Active Traffic Management – a system of detectors and dynamic signs that manages the use of lanes (and shoulders) on the roadway that provides travelers advanced warning of congestion.

Traveler Information

Traveler information is a core service of the CTMC as it gathers transportation-related data and distributes transportation-related information across the state. The roadway monitoring data above is supplemented with information from other sources including the CDOT Regions, Colorado State Patrol (CSP), weather services, and Colorado ports of entry. The CTMC distributes transportation information through several means: a website (http://www.cotrip.org), a smart phone app, dynamic message signs (DMS) on the state roadways, a subscription-based text/e-mail delivery service (GovDelivery), and a traveler information phone service (511). The data and traveler information is also shared under agreement with other stakeholders that generally repackage the data for other purposes.

The Regional Transportation District (RTD) operates a website (http://www.rtd-denver.com) that provides transit traveler information and also provides a multi-modal trip planner service. RTD also provides e-mail/text Rider Alerts (GovDelivery) and MyStop (available both through phone service and website) that provides the times for the next three arrivals at a specific bus stop.
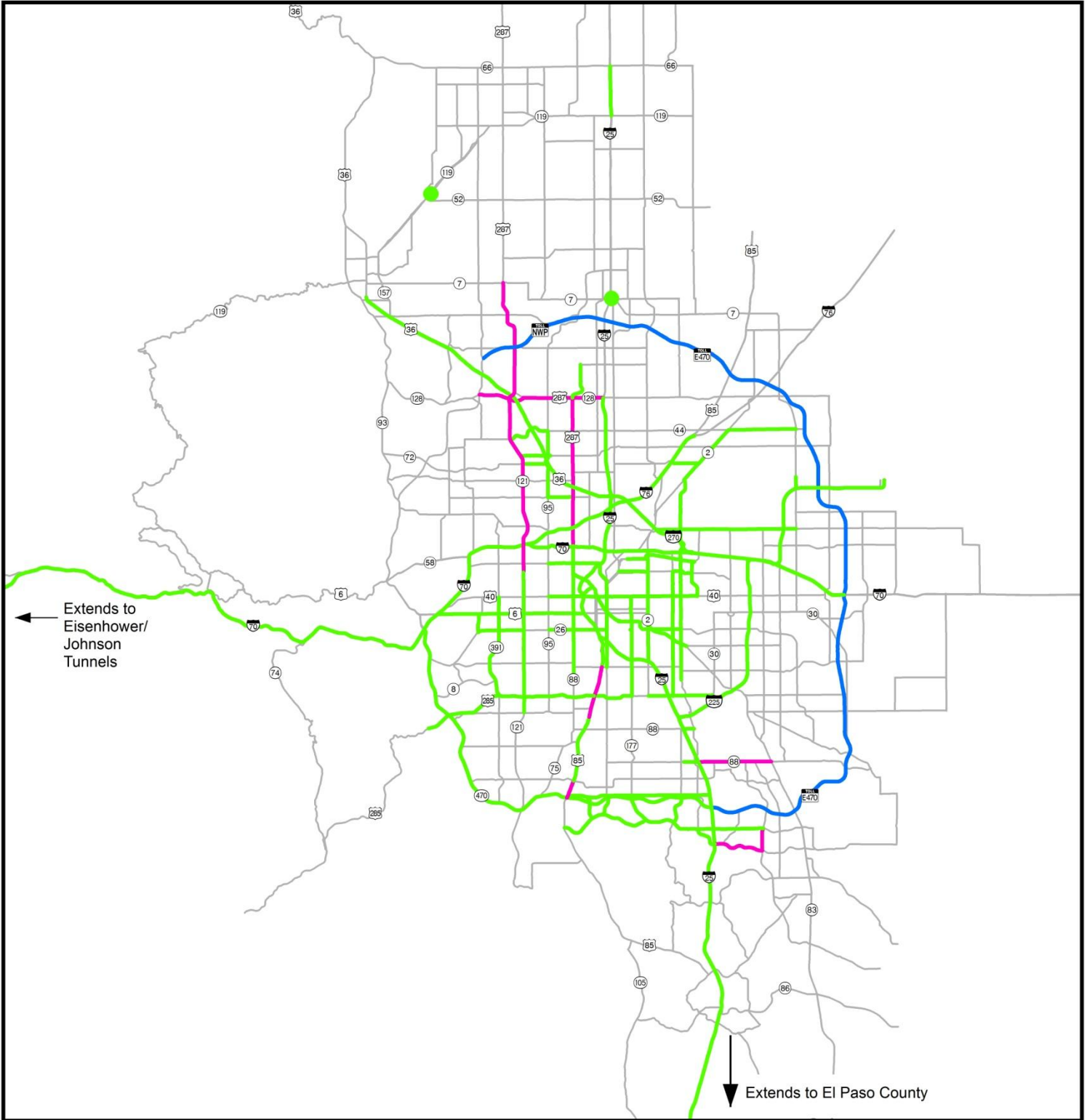
Way to Go also provides a multi-modal trip planner service (http://www.WaytoGo.org) that is integrated with a ride-matching service for carpools and vanpools. Way to Go is a regional partnership between DRCOG and a dedicated group of Transportation Management Associations that promotes and facilitates travel options other than single-occupant vehicles.

The internet (and, in a few cases, local television [Channel 8]) is a source of a tremendous variety of traveler information in the region. Several local jurisdictions distribute traveler information on their own websites. The content varies, including: local camera images, roadway conditions information from local sources (i.e. COTrip.org), and roadway conditions information from third party sources. Local jurisdiction websites also share work zone and construction information. DRCOG has inventoried nearly 30 jurisdictional websites that provide work zone and construction information in a variety of formats and that are updated with a variety of frequencies.

Overall, traveler information coordination between jurisdictions in the region is currently limited. The DRCOG RCTO places CDOT's traveler information system at the core of the region's traveler information efforts and seeks greater coordination and integration between the various information sources. The intent is to provide consistent and reliable traveler information to the public regardless of where it is sought.
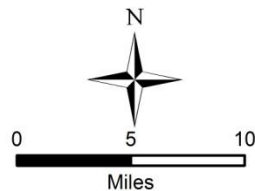
Figure 4 illustrates the coverage of traveler information on roadways across the region. This coverage described is mainly dynamic message sign deployment.

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Figure 2
Roadway Monitoring

Extends to
Eisenhower/
Johnson
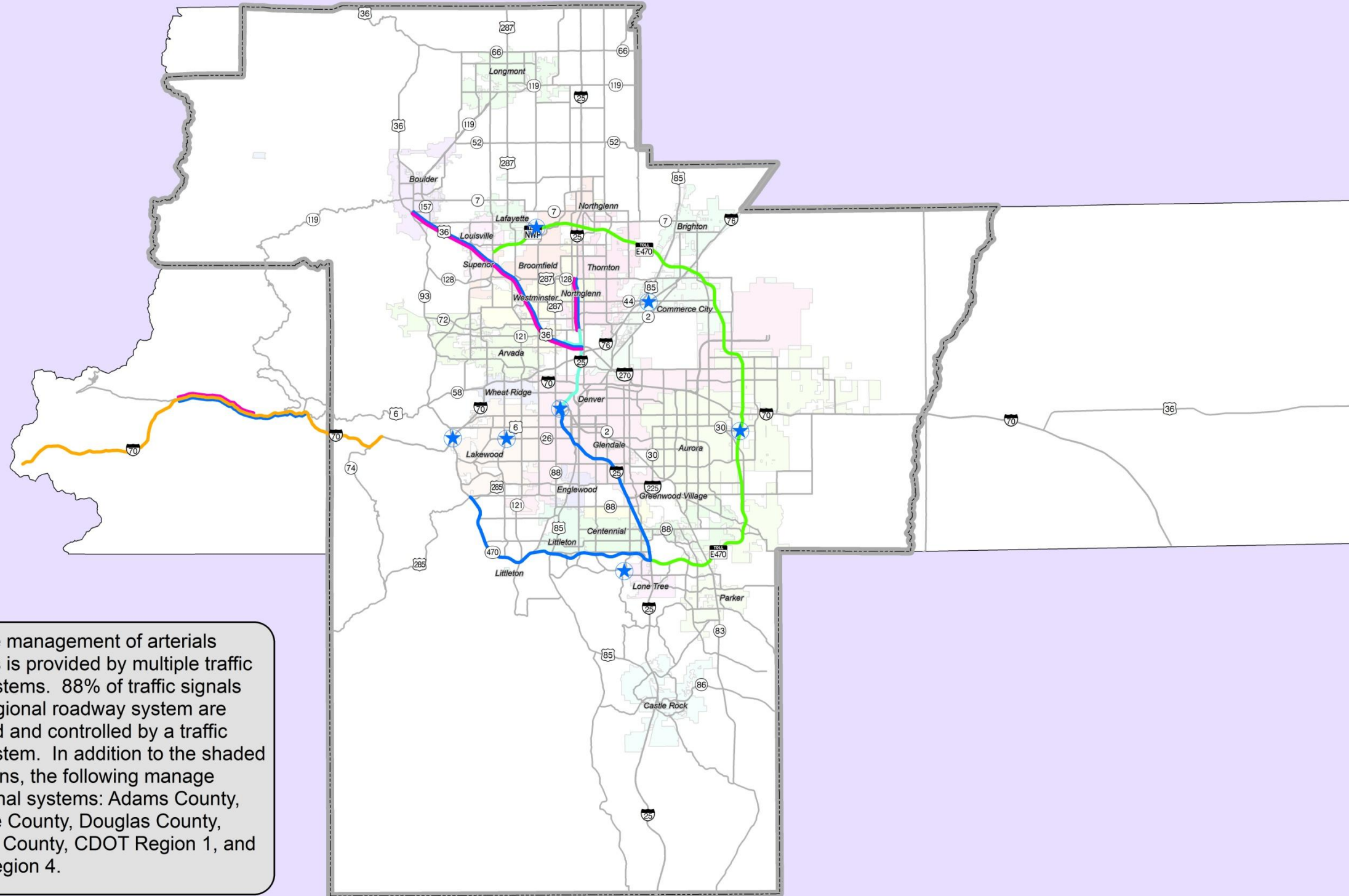Tunnels

Extends to El Paso County

LEGEND

— Existing Roadway Monitoring
(Vehicle detection, travel time monitoring, PTZ cameras)

— Roadway Monitoring [near implementation]
(travel time monitoring, PTZ cameras)

— Public Highway Authority Monitoring
(PTZ cameras)

N

0   5   10
Miles

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Figure 3
Roadway Managements

Real-time management of arterials roadways is provided by multiple traffic signal systems. 88% of traffic signals on the regional roadway system are monitored and controlled by a traffic signal system. In addition to the shaded jurisdictions, the following manage traffic signal systems: Adams County, Arapahoe County, Douglas County, Jefferson County, CDOT Region 1, and CDOT Region 4.

LEGEND

— Ramp Metering
— Variable Speed Limit Signs
— Reversible Tolled Lane
— Active Traffic Management/Managed Lanes
— Public Highway Authority Toll Roads

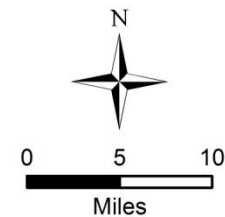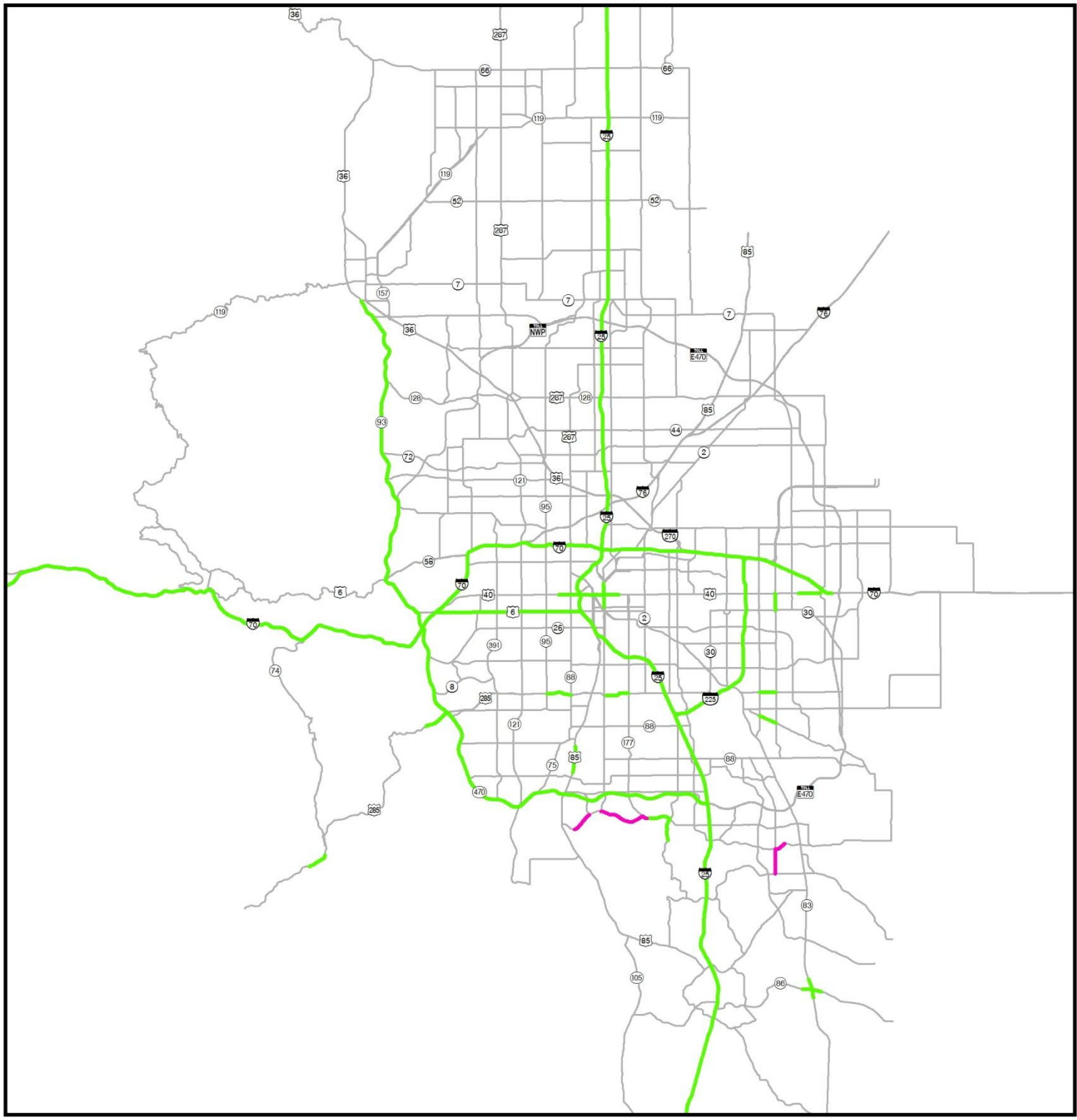★ Traffic Management Center

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Miles

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Source: DRCOG
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PJ 5/20/2014

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Figure 4
Traveler Information

LEGEND

— Existing Cooridors With DMS

— Corridors With Pending DMS Implementation
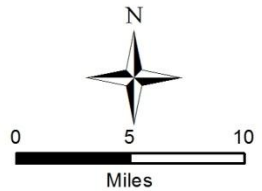
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Source: DRCOG
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PJ 5/12/2014

FILESRV2\Traffic_Operations\Regional Transportation Operations\GIS for ITS\ITS Pool Program\Fig4\Figure_4_Traveler_Information.mxd

Travel Demand Management

Travel Demand Management (TDM) is critical to reduce congestion in the region as it reduces the demand on the roadway network, which, in turn, improves operations. There are a number of significant ongoing travel demand systems and efforts in this region that are described in previous categories, including:

- CDOT's managed lanes systems (encouraging carpooling/vanpooling) [under roadway management];
- Way to Go's promotion of alternate modes (carpool/vanpool, transit, bicycle, pedestrian) [under traveler information];
- Way to Go's ride matching service [under traveler information]; and,
- Way to Go's promotion of telework as an option [under traveler information].

In addition, Way to Go is expects to expand its multi-modal trip planning service, providing connection to more travel options based on the current location of the travelers.

Public Transit Operations and Management

The primary provider of public transit within the region is the Regional Transportation District (RTD). The complete transit provider inventory is found in the *Transit Element of the 2035 Metro Vision Regional Transportation Plan*.

RTD provides a comprehensive network of light rail, fixed-route bus service, and demand-responsive services for much of the DRCOG region. RTD utilizes several technology systems (i.e. smart card fare collection system, computer-aided dispatch and automatic vehicle location system, traveler information web page and phone service systems, network of traveler information kiosks, and several other internal systems) to assist in the efficient operations and management of the transit service provided. For the most part, the systems are specific to transit and do not interface with other systems in the region.

The exception is RTD's partnership in transit signal priority (TSP) implementations across the region. Core to TSP operation is the interface between traffic signal systems and transit operations. Transit vehicles are detected by traffic signal systems and, depending on the agreed-upon policies, the traffic signal will safely revise the signal indications to allow the transit vehicles to pass through the intersection more quickly.

Figure 5 illustrates the locations of TSP implementations in the region. RTD is leading implementations along US 36 and Colfax Avenue in collaboration with the jurisdictions responsible for traffic signal operations. The planning and design effort for these projects has led to a preferred concept of operations that will be the regional standard. The three other TSP implementations do not yet follow the standard as they were implemented prior to the standard being established.

Figure 5
Transit Coordination

RTD is also exploring arterial Bus Rapid Transit (BRT) and shoulder running applications that will also require expansion of the use of TSP.

Weather Operations

The mobility and safety impacts of weather are sometimes be significant. As such, CDOT has made significant investment in a Maintenance Decision Support System (MDSS), which combines information from environmental sensor stations deployed along the roadway and in maintenance vehicles with weather forecasting services. The result is real-time roadway surface treatment recommendations for CDOT vehicle operators.

Figure 6 illustrates the existing environmental sensors stations across the region. Most of the stations are operated and maintained by CDOT. The others are operated and maintained by various jurisdictions that use the information in a similar way. The weather data from each jurisdiction is currently not shared between the jurisdictions that operate and maintain stations.

Traffic Incident Management

Traffic incident management is a high priority in the RCTO. CDOT has also identified improvement in traffic incident management as a high priority.

There are many existing elements of traffic incident management across the region. First, CDOT maintains several incident management plans, which describe the roles and responsibilities of stakeholder with CDOT assuming the prime responsibility for traveler information and establishing necessary traffic diversion routes. The most successful traffic incident management plan is on the I-70 corridor. This is due mainly to frequent meetings of the plan stakeholders to review and exercise plan application.

Second, CDOT also dispatches several courtesy patrols from the CTMC. Courtesy patrol is a fleet of tow vehicles that are authorized and equipped to assist motorist breakdowns and minor traffic incidents.

Finally, the two operating Public Highway Authorities in the region have both incident management plans and courtesy patrol functions on their facilities.

Figure 7 illustrates the coverage of both the existing traffic incident management plans and the courtesy patrol routes.

CDOT is embarking on improvements for the incident management capabilities across the state. First, CDOT is preparing a guidelines document that will summarize the best incident management practices to encourage standard practices statewide. CDOT expects to specifically leverage the results of this effort for application of specific incident management planning in the DRCOG region. Second, CDOT plans to implement and utilize data fusion techniques/software to better capture dangerous conditions and detect incidents. This situational awareness software is intended to
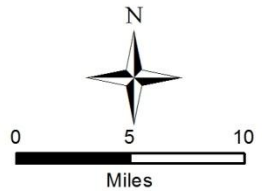
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Figure 6
Weather/Maintenance
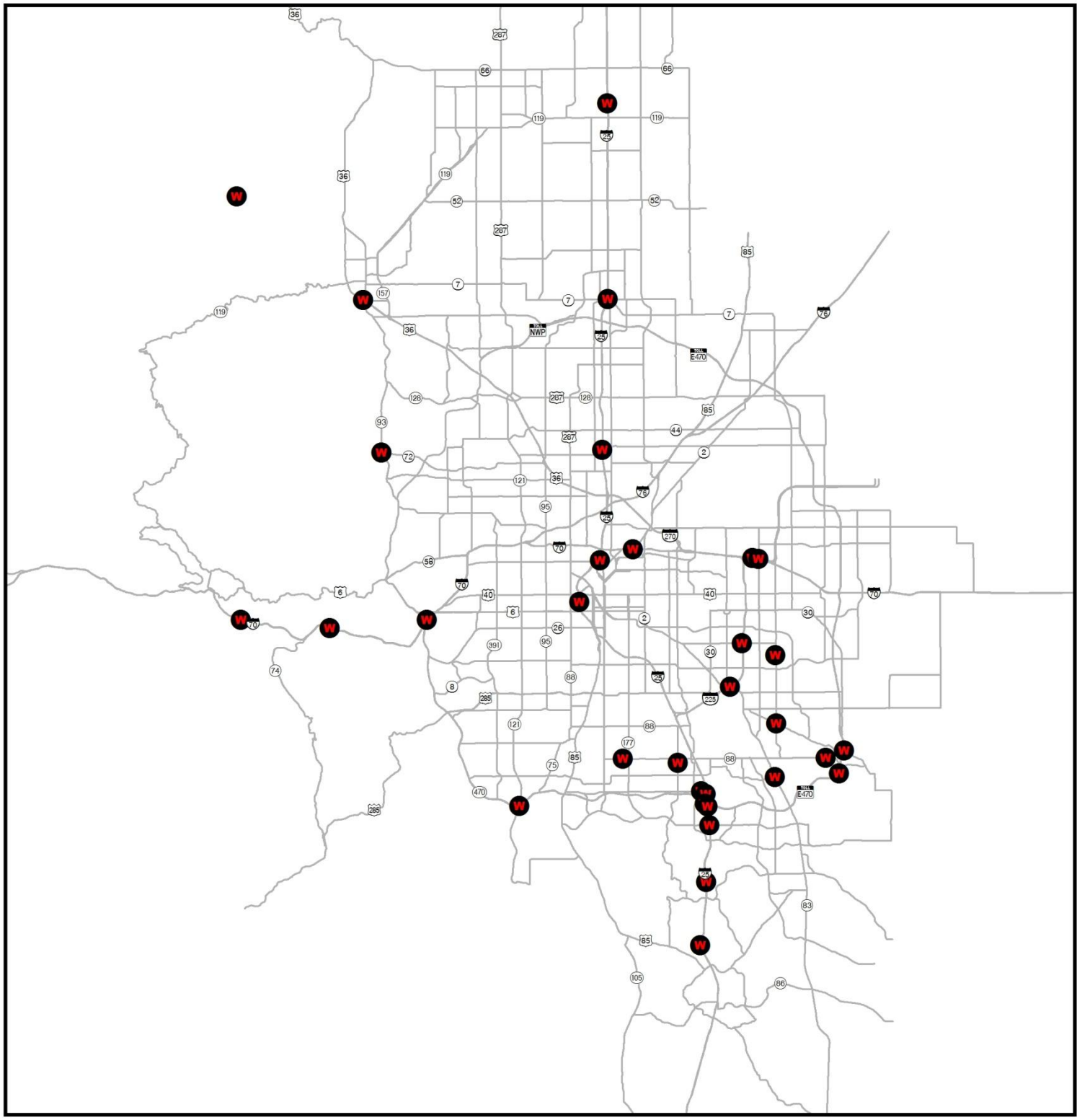
LEGEND

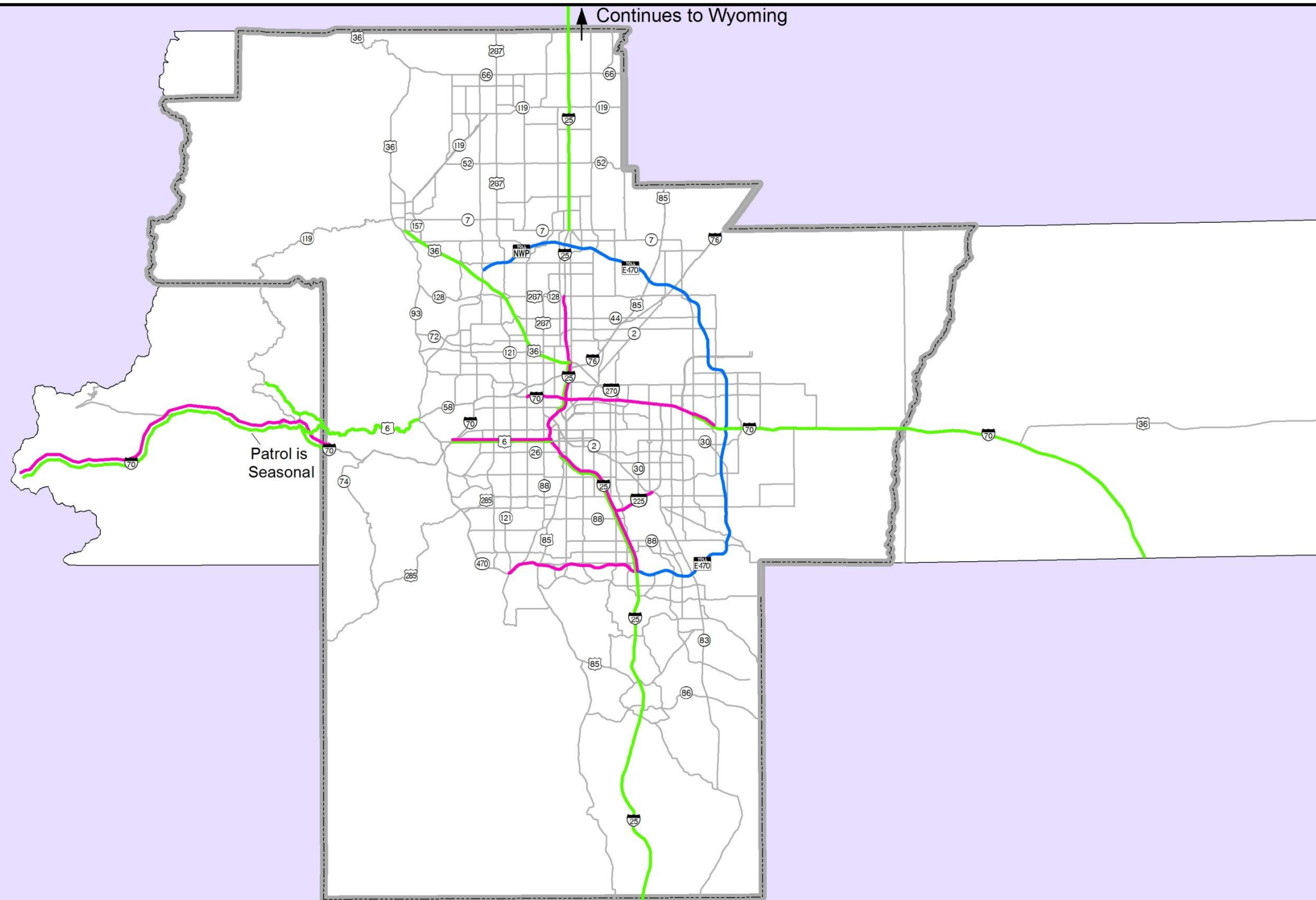W Weather/Maintenance

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Miles

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Figure 7
IncidentManagement

LEGEND

CDOT Courtesy Patrol

CDOT Incident Management Plans

Public Highway Authority
(Courtesy Patrol and Incident Management Plans)

improve CDOT's capability to both detect incidents and to provide standard and effective incident response.

Support Services

There are three key infrastructure elements that are critical to achieving the RCTO goals and objectives: interjurisdictional communications; data sharing/storage facilities and processes; and performance reporting facilities and processes.

Interjurisdictional communications

Communications systems carrying data between the field devices and the control point are key to the operations of all systems. A variety of communications systems are in service across the region, operated and managed separately by the jurisdictional owners. Interjurisdictional communications is the next advance in communications with the purpose of sharing data to improve operators' awareness and decision-making.

CDOT operates and manages multiple communications networks in the region that interconnect several jurisdictions. Currently, the main purpose of these networks is to allow sharing of video cameras between various jurisdictions and departments. CDOT is currently upgrading and integrating the networks into one Ethernet network that provides greater capacity and is easier to manage. DRCOG and its partners are coordinating with CDOT to develop a partnership and management process to support this shared resource.

Data Sharing/Storage

The bulk of the data currently shared over the interjurisdictional networks is video monitoring and control between jurisdictions. Some arterial roadway data from Denver, Douglas County, and Englewood is being shared with CDOT for display on COTrip.org.

There are multiple databases across the region where transportation operations data is available for sharing. In particular, CDOT manages two databases: an operational database that includes data generated by CDOT field devices within the last four hours, and an archive database where data older than four hours is stored. These databases also include the data sent to CDOT (i.e. arterial roadway data currently being reported on COTrip.org).

To ensure consistent traveler information is provided to the public, CDOT has developed the *Regional Integrated Traveler Information Display Guidelines*. These guidelines document the minimum requirements data must meet before it can be posted on COTrip.org. CDOT has also prepared a communications standard detailing how travel time monitoring information will be collected by CDOT. Local jurisdictions and their vendors must conform to the standard in order to share travel time monitoring data with CDOT.

Performance Reporting

Since the bulk of the state's transportation data is being collected at the CTMC, CDOT acquired software to assist in performance monitoring and other information reporting. The software, depending upon licensing and network access, is capable of using CDOT data and other outside data sources to create performance monitoring reports.

CDOT is currently confirming performance measures to be tracked by the CTMC. The DRCOG RCTO also identifies several regional performance measures. Considering all the performance monitoring needs, CDOT is securing support to configure the necessary reports within the performance monitoring software.

IV. NEEDS ASSESSMENT

Overview

The specific ITS needs were expressed through a two-phase call for projects. Prior to the initial phase, DRCOG staff and the RTO work group confirmed the regional priorities based on the DRCOG RCTO. Sponsors were then invited to submit conceptual project applications that were reviewed by the RTO work group both to identify opportunities for interagency collaboration and to offer beneficial input. For the second phase, sponsors were invited to submit complete applications including the initial documents related to the systems engineering analysis[1].

Call for Projects

Nine jurisdictions/agencies (Arapahoe County, CDOT ITS Branch, CDOT Real-Time Traffic Management Branch, CDOT Region 1, City of Centennial, City and County Denver, City of Greenwood Village, City of Lakewood, and City of Thornton) submitted 11 applications for ITS-related projects. The total estimated cost of the projects is approximately $4.5 million representing a request of about $3.6 million in federal funds. A summary of the project requests follows below, listed in alphabetical order by sponsor.

Arapahoe County................................ *implement arterial travel time monitoring system*

Arapahoe County requested funds to implement an arterial travel time monitoring system along four corridors within its jurisdiction: Easter/Broncos Parkway (Havana Street to Parker Road); Arapahoe Road (Olathe Street to Waco Street); Buckley Road (Arapahoe Road to Orchard Road); and, Iliff Avenue (Syracuse Way to Dayton Street).

The justification for this project is to collect the data necessary to determine performance measures that will allow Arapahoe County to more effectively monitor and manage the roadways in its jurisdiction (RCTO Initiative C-1). Arapahoe County also anticipates expanding this system in the future to distribute real-time traveler information to travelers on Arapahoe Road and parallel routes.

Arapahoe County has committed to coordinating the implementation of this project with another project submitted by the City of Centennial (see below). Arapahoe County and Centennial have committed to sharing operational data collected from the two projects. Arapahoe County has also committed to coordinating with CDOT to provide the travel time data collected for the purpose of regional traveler information and performance measures.

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[1] Systems engineering analysis is a structured process for designing complex systems that is a FHWA requirement for ITS projects.

CDOT ITS Branch ....*implement and improve regional data coordination*

The CDOT ITS Branch requested funds to implement and improve regional data coordination. The project has three elements:

Upgrade Colorado Transportation Management System (CTMS) Software – CDOT ITS requested funds to implement software revisions to CDOT's CTMS software necessary to collect travel time data collected by outside agencies. The travel time information derived from this data will be posted to COTrip.org according to CDOT's *Regional Integrated Traveler Information Display Guidelines*. The justification for this project is to fulfill CDOT's central role in the region for traveler information and data management (RCTO Initiative C-3). To achieve this CDOT must modify its CTMS management software. CDOT ITS has committed to posting roadway conditions data collected by local jurisdictions.

Establish Regional Data Warehouse – CDOT ITS requested funds to implement a regional data warehouse for transportation-related data collected by and transmitted to CDOT. The justification for this project is to fulfill CDOT's central role in the region for data management (RCTO Initiative C-5). To achieve this CDOT must modify the current archive database to optimize it for use as a data warehouse. CDOT ITS has committed to maintaining a regional data warehouse that will benefit both CDOT and its partners.

Establish Interface with Denver Computer-Aided Dispatch (CAD) – CDOT ITS requested funds to modify CDOT's CTMS management software to accept a traffic incident information feed from Denver's CAD. The justification for this project is to improve CDOT's awareness of traffic incidents (RCTO Initiative 3). CDOT ITS currently receives a feed from the Colorado State Patrol (CSP) and has found it beneficial, prompting an expansion to other jurisdictions.

CDOT Real-Time   *implement regional*
Traffic Management Branch .... *incident management process*

The CDOT Real-Time Traffic Management Branch requested funds for a two-phase project to develop and implement a regional incident management process centered on I-25 from Castle Rock to SH-7. The main purpose of the first phase is the development of the regional incident management process in collaboration with regional transportation and public safety partners. The first phase will also: identify specific scenarios and situations that will be integrated into CDOT's situational awareness software; and, identify gaps in the field infrastructure. The second phase of the project will implement field devices to fill in the priority gaps.

The justification for this project is the need to improve traffic incident management across the region (RCTO Initiative 3). CDOT Real-Time

Management has committed to working with traffic operations and public safety staff from across the region.

CDOT Region 1 ....*implement upgraded ramp metering system*

CDOT Region 1 requested funds for a two-phase project to upgrade its ramp metering system. The first phase involves the upgrade of the control system and the second phase involves the upgrade of the ramp meter controllers and communications system.

The justification for the project is to upgrade the functionality and reliability of the ramp metering system to dynamically manage freeway operations (RCTO Initiative 2). The additional functionality that will be included is: non-simultaneous lane release (increases potential ramp release volumes); lane-dependent rates (allows different metering rates for HOV lanes); traffic-responsive operation (expansion of existing operations to allow the system to start and stop metering based on measured conditions); and, coordinating with neighboring traffic signals.

Centennial ....*implement arterial travel time monitoring system*

Centennial requested funds to implement an arterial travel time monitoring system along four corridors within its jurisdiction: Dry Creek Road (Clarkson Street to Arapahoe Road); Arapahoe Road (Franklin Street to I-25); Arapahoe Road (I-25 to Parker Road); and, Smoky Hill Road (Telluride Street to Liverpool Street). Note that Arapahoe Road east of I-25 is not Centennial's jurisdiction and no agreement exists between Centennial and CDOT for such work.

The justification for this project is to collect the data necessary to determine performance measures that will allow Centennial to more effectively monitor and manage the roadways in its jurisdiction (RCTO Initiative C-1).

Centennial has committed to coordinating the implementation of this project with another project submitted by Arapahoe County (see below). Arapahoe County and Centennial have committed to sharing operational data collected from the two projects. Centennial has also committed to coordinating with CDOT to provide the travel time data collected for the purpose of regional traveler information and performance measures.

Denver ....*expand arterial travel time monitoring system*

Denver requested funds to expand its existing arterial travel time monitoring system (which includes approach-delay monitoring) along three corridors within its jurisdiction: Hampden Avenue (Colorado Boulevard to Dartmouth Avenue); 56th Avenue (Quebec Street to Tower Road); and, Federal Boulevard (Alameda Avenue to Dartmouth Road).

The justification for this project is to collect the data necessary to determine performance measures that will allow Denver to more effectively monitor and manage the roadways in its jurisdiction (RCTO Initiative C-1).

Denver has committed to coordinating with CDOT to provide the travel time data collected for the purpose of regional traveler information and performance measures.

Denver .... *conduct center-to-center feasibility study*

Denver requested funds to develop a concept of operations for implementing center-to-center functionality between Denver's traffic signal system and neighboring jurisdictions that use alternate traffic signal systems.

The justification for this project is to coordinate signal timing system management across jurisdictional boundaries (RCTO Initiative 1) and to provide a connection to share monitoring (RCTO Initiative C-2). Since there are a number of different traffic signal systems across the region, a concept of operations describing how two different systems will work together has multiple potential applications. This study will be the foundation for future implementation.

Denver .... *implement driver feedback sign system*

Denver requested funds to install a number of driver speed feedback signs along five corridors: Logan Street (Speer Boulevard to Colfax Avenue); Downing Street (Speer Boulevard to Colfax Avenue); Speer Boulevard (Broadway to Downing Street); Evans Avenue (I-25 to Quebec Street); and, 17th Avenue (University Boulevard to Colorado Boulevard). Driver speed feedback signs measure the speed of approaching traffic and display its speed to the drivers in real time. Denver intends to use the signs to encourage drivers to maintain the speed that allows them to remain within the coordinated timing.

The justification for this project is improved travel time reliability along the corridors as the signal coordination will be more effective (RCTO Initiative 1). However, Denver did not illustrate that vehicle speed was a specific transportation operations reliability problem.

Greenwood Village .... *implement arterial travel time monitoring system*

Greenwood Village requested funds to implement an arterial travel time monitoring system along DTC Boulevard/Yosemite Street (Belleview Road to Arapahoe Road).

The justification for this project is to collect the data necessary to determine performance measures that will allow Greenwood Village to more effectively monitor and manage the roadways in its jurisdiction (RCTO Initiative C-1).

Specifically, Greenwood Village intends to use the system to measure the impact of implementing traffic-adaptive signal control along the corridor.

Greenwood Village has committed to coordinating with CDOT to provide the travel time data collected for the purpose of regional traveler information and performance measures.

Lakewood .... *expand arterial travel time monitoring system*

Lakewood requested funds to expand its existing arterial travel time monitoring system along four corridors within its jurisdiction: Kipling Parkway (26th Street to Belleview Avenue); Colfax Avenue (I-70 to Harlan Street); Alameda Parkway (C-470 to Harlan Street); and, Simms/Union Street (Alameda Parkway to Colfax Avenue).

The justification for this project is to collect the data necessary to determine performance measures that will allow Lakewood to more effectively monitor and manage the roadways in its jurisdiction (RCTO Initiative C-1).

Lakewood has committed to coordinating with CDOT to provide the travel time data collected for the purpose of regional traveler information and performance measures.

Thornton .... *implement fiber interconnect*

Thornton requested funds to install conduit and fiber optic cable to extend from existing fiber optic cable along Thornton Parkway (Hoffman Way to Welby Road). The fiber optic cable will link Thornton's traffic management system to both the traffic signals along its route and RTD's fiber along the North Metro Line.

The justification for this project is twofold. First, it will provide the foundation for sharing data and camera feeds between Thornton and RTD (RCTO Initiatives C-2 and C-4). Second, Thornton will be able to monitor and manage traffic signals along the Regional Roadway System more effectively (RCTO Initiative 1).

Thornton has committed to coordinate with RTD to connect its communications networks and share data and information.

Summary of Critical Needs

Table 3 summarizes needs identified by the workgroup within the context of the DRCOG RCTO initiatives. The estimated cost required to fully implement those needs is also listed.

Table 3
Summary of Needs

Initiative 1	**CONTINUE TO COORDINATE INTERJURISDICTIONAL SIGNAL TIMING**
	1. Develop a concept of operations to connect neighboring traffic signal systems of different manufacture.
	2. Implement a series of dynamic speed limit signs to encourage traffic to drive the speed for which signal timing plans were designed.
	3. Interconnect five traffic signals on one corridor with the local traffic signal system.
Initiative 2	**CONTINUE TO COORDINATE AND EXPAND FREEWAY MANAGEMENT**
	Implement an upgraded ramp metering system and controllers and associated communications to provide more reliability and advanced ramp metering.
Initiative 3	**ESTABLISH REGIONAL INCIDENT MANAGEMENT PROCESS**
	1. Implement CTMS software revisions to accept a data feed from Denver's CAD containing traffic incident data.
	2. Develop and implement a regional incident management process.
	3. Identify equipment gaps in freeway infrastructure and install missing equipment to improve traffic incident management capabilities.
Initiative C-1	**EXPAND TRAFFIC MONITORING**
	Implement travel time monitoring on 16 corridors covering about 57 miles of arterial roadway.
Initiative C-2	**ESTABLISH SHARED MONITORING BETWEEN JURISDICTIONS**
	1. Develop a concept of operations to connect neighboring traffic signal systems of different manufacture.
	2. Implement shared communications between Thornton and RTD.
Initiative C-3	**FURTHER COORDINATE MULTIMODAL TRAVELER INFORMATION**
	Implement CTMS software revisions to collect and display arterial roadway conditions traveler information based on travel time monitoring data.
Initiative C-4	**EXPAND THE SHARED COMMUNICATIONS NETWORK**
	Implement shared communications between Thornton and RTD.
Initiative C-5	**ESTABLISH SHARED DATA WAREHOUSE AND PERFORMANCE REPORTING PROCESS**
	Implement an optimized data warehouse at CDOT while providing access to regional partners.

Estimated Costs for Needs:
Funding requested: $3.6 million
Local match: $0.9 million
Total project cost: $4.5 million
Total funds available: $3.7 million

V. IMPLEMENTATION

Overview

This section presents an implementation program/schedule that identifies the best mix of projects to address the RCTO goals and objectives and provides the most benefits to the region within available resources. Sufficient funding is not available to fully address all the needs identified by the operating agencies.

Funds Available

The implementation plan was developed based on a level of funding consistent with current program allocations and, as shown in Table 4, is extended to fiscal year 2017. Fiscal years 2014 and 2015 have an approved allocation of $825,000 each in the *2012-2017 Transportation Improvement Program* (TIP) *Policy*. Available program savings of about $423,000 have been added to fiscal year 2015. Fiscal years 2016 and 2017 are projected at the same annual level as previous fiscal years, assuming that the DRCOG Board continues to support this program at that level of funding.

Table 4
Federal Funding for Implementation Program ($1,000)

	Fiscal Year[1]				
	2014	2015	2016	2017	Total
Regional Traffic Signal System Improvement Program*	$825	$1,248	$825[2]	$825[2]	$3,686

[1] In "year-of-expenditure" dollars.
[2] Funding level assumptions. Funding levels to be set in upcoming TIP Policy definition.

Prioritization and Implementation Rationale

Priorities for project selection are based in the goals and objectives of the RCTO. The RTO work group developed the following selection priorities through consensus. A detailed listing of the priorities distributed with the call for projects is included in Appendix A:

1. Prepare and implement regional traffic incident management system improvements

2. Extend and expand traffic monitoring infrastructure and capability

3. Prepare and implement projects that facilitate coordinated operations across multiple agencies, including improvements in: communications networks, data sharing, regional data warehouse, performance measures reporting, shared monitoring, and traveler information integration.

4. Prepare and implement projects that improve work zone/special event management

5. Prepare and implement projects that expand operational capabilities for: support of bicycle and pedestrian operations; advanced traffic signal system management across jurisdictional boundaries; and, expansion of freeway management and operations.

In order to consider projects at the same priority level, other factors were considered in the evaluation process. These factors are:

1. The Congestion Mobility Grade along roadways in the project area as determined by DRCOG's Congestion Mitigation Program. A higher congestion score has a higher priority.
2. For construction projects and equipment procurement projects, the cost effectiveness is determined as estimated benefits divided by the project cost. Projects with larger ratios have higher preference.

Implementation Program

The implementation program (see Table 5) consists of two categories of activities:

- *Capital improvements and studies* – The capital program invests in projects and studies that most efficiently advance the RCTO goals and objectives.

- *Contingency and miscellaneous equipment purchases* – A contingency and miscellaneous equipment category is included in the program. The primary purpose of these funds is to ensure that projects can proceed to construction if actual costs exceed the conceptual estimates.

  However, once it is certain that construction projects can be completed without contingency funds the remaining contingency funds are used for miscellaneous equipment purchases. It is anticipated that miscellaneous equipment purchases will involve procuring devices that allow jurisdictions to expand an existing system.

  The miscellaneous equipment selection process will be conducted in conjunction with the annual miscellaneous equipment selection conducted for the DRCOG's *Traffic Signal System Improvement Program*.

Table 5
ITS Pool Capital Improvement Projects

Project Description and Location		Project Cost Estimate			
		FY14	FY15	FY16	FY17

Arapahoe County	Implement arterial travel time monitoring system on:
	  Easter Avenue/Broncos Parkway (Havana St to Parker Rd)
	  Arapahoe Road (Olathe St to Waco St)
	  Buckley Road (Arapahoe Rd to Orchard Rd)
	  Iliff Avenue (Syracuse Wy to Dayton St)
			X		

CDOT ITS	Implement the following regional data coordination improvements:
	  CTMS Software Revision - software revision will allow CTMS to collect travel time monitoring data feeds from outside agencies.
	
	  Regional Data Warehouse - housed at the CTMC and available to all regional partners.
	
	  Denver CAD Interface - software revision will allow CTMS to accept a feed of traffic incident information from Denver's CAD.
		X	X		

CDOT Real-Time Traffic Management Branch	Implement the following regional incident management improvements:
	  Develop a regional incident management process focused on I-25 from Castle Rock to SH-7. This effort will also identify gaps in CDOT's I-25 field infrastructure regarding incident management.
	
	  Implement I-25 field infrastructure to improve incident management.
		X	X		

CDOT Region 1	Implement the following ramp metering system upgrades:
	  Implement an upgraded ramp metering system in CDOT Region 1 that includes expanded functionality and ramp metering techniques.
	
	  Implement upgraded controllers and communications capable of expanded functionality and ramp metering techniques.
				X	X

Centennial	Implement arterial travel time monitoring system on:
	  Dry Creek Road (Clarkson St to Arapahoe Rd)
	  Arapahoe Road (Franklin St to I-25)
	  Smoky Hill Road (Telluride St to Liverpool St)
			X	X	

Denver	Expand arterial travel time monitoring system on:
	  Hampden Avenue (Colorado Blvd to Dartmouth Ave)
	  56th Avenue (Quebec St to Tower Rd)
	  Federal Boulevard (Alameda Ave to Dartmouth Rd)
				X	

Denver	Develop a concept of operations to implement center-to-center functionality between Denver's traffic signal system and a neighboring jurisdiction with a different manufacture of traffic signal system.			X	
Greenwood Village	Implement arterial travel time monitoring system on DTC Boulevard (Belleview Rd to Arapahoe Rd).		X		

Lakewood	Expand arterial travel time monitoring system on:
	  Kipling Parkway/Street (26th St to Belleview Ave)
	  Colfax Avenue (I-70 to Harlan St)
	  Alameda Parkway/Avenue (C-470 to Harlan St)
	  Simms/Union Street (Alameda Pkwy to Colfax Ave)
			X	X	X

Thornton Fiber Interconnect	Install conduit and fiber to interconnect:
	  traffic signals on Thornton Parkway (Hoffman Wy to Welby Rd)
	  RTD's fiber along north rail line
			X		

Subtotal		**$ 660,000**	**$ 1,375,781**	**$ 734,700**	**$ 311,300**
Contingency/Misc. Equipment**		$ -	$ -	127,300	513,700
Total		**$ 660,000**	**$ 1,376,000**	**$ 862,000**	**$ 825,000**

Project Sponsor Responsibilities

In this section, only the federal funds requested for the projects are listed. It is the responsibility of the project sponsor to provide a non-federal match (17.21% of project cost).

Federal rules (23 CFR 940) require that all ITS projects funded in whole or in part with the highway trust fund must be based on a systems engineering analysis. Systems engineering analysis is a structured process for arriving at a final system design that considers a number of alternative solutions that meet the project objectives and the total life-cycle costs. CDOT has prepared the *Colorado ITS Systems Engineering Analysis Guidelines* to describe the necessary process and documentation needs. CDOT's own project development process embraces these guidelines for all operations projects. The project sponsors must follow these guidelines to receive the funding allocated in this program.

The ITS Pool Program is funded through the federal Congestion Mitigation/Air Quality (CMAQ) Program. The CMAQ Program requires annual reporting on the benefits (reduction in harmful emissions and decrease in vehicle-hours traveled) due to projects implemented through the program. The project sponsor is responsible for determining the benefits for its project. Resources at CDOT and DRCOG are available to guide and assist in the effort.

DRCOG Traffic Operations Program Responsibilities

Through DRCOG's Traffic Operations Program, established for DRCOG's *Traffic Signal System Improvement Program*, DRCOG staff is able to support coordination of ITS projects and activities with traffic signal timing improvement efforts. This broadly includes providing both guidance for systems engineering analysis and coordination and support for project benefits evaluation.

APPENDIX A

Priority Level	Priority Justifications

1	Prepare and implement regional traffic incident management system improvements, in descending priority:
	
	    a. Planning and project development efforts establishing a Regional Incident Management Process. Efforts may include developing standards and processes for communications, data sharing and management to support coordinated incident management operations.
	    b. Inter-agency improvements that advance Regional Incident Management Process. Efforts may include establishing/enhancing databases, websites, software integration, and communications integration.
	
	The operating agency must demonstrate significant commitment from all stakeholders.

2	Extend and expand traffic monitoring infrastructure and capability, in descending priority:
	
	    a. Arterials
	    b. Freeways
	
	The operating agency will follow CDOT's *Regional Integrated Traveler Information Display Guidelines* and will commit to efforts (following/establishing regional standards and implementing CTMS software modifications, as necessary) to share data produced by the project with CDOT's CTMS.
	
	The operating agency must identify personnel and equipment (or partnership with another agency) to provide active monitoring and management of the system at least during weekday peak periods. The operating agency must have a plan of operation (i.e. response strategies) to utilize the real-time information collected.

3	Prepare and implement projects that facilitate coordinated operations across multiple agencies, in descending priority:
	
	    a. Improvements in or expansion of the shared (inter-agency) communications network.
	    b. Establishment in or improvements of inter-agency data sharing.
	    c. Establishment in or improvements of the regional data warehouse.
	    d. Establishment in or improvements of performance measures reporting.
	    e. Establishment and utilization of shared monitoring between jurisdictions.
	    f. Improvements in coordination and integration of multi-modal traveler information.
	
	The operating agency must demonstrate significant commitment from all stakeholders.

4	Prepare and implement projects that improve work zone/special event management, in descending priority:
	
	    a. Improvements in Regional Traveler Information related to work zone/special event
	    b. Field implementation projects (i.e. work zone management)

5	Prepare and implement projects that expand operational capabilities, in descending priority:
	
	    a. Advancement of traffic signal system management to support bicycle and pedestrian operations.
	    b. Advancement of traffic signal system management across jurisdictional boundaries.
	    c. Expansion of freeway management and operations.

Notes:	System improvements for the above priorities may include design and installation of system equipment, support structures, and communications cable and conduit. It may also include software driver development and limited software modification. Custom software development will be limited to software modifications to support integration of new elements to existing elements.
	
	The operating agency commits to assisting with completion of the necessary analysis to determine the project benefits.
	
	Other factors will be considered in the evaluation process, including:
	
	    1. Congestion Mobility Grade along roadways in the project area as determined by DRCOG's Congestion Mitigation Program. Higher congestion scores have a higher priority.
	    2. Cost effectiveness. For construction projects and equipment procurement projects, the cost effectiveness is determined as estimated benefits divided by the project cost. Projects with larger ratios have higher preference.
	    3. Projects will be examined to determine feasibility of splitting into more than one project.
	    4. Relevant applicants will be contacted, if necessary, to further ascertain their priorities and perspectives.

Last Update: 10/31/13

BOARD RESOLUTION

DENVER REGIONAL COUNCIL OF GOVERNMENTS

STATE OF COLORADO

BOARD OF DIRECTORS   RESOLUTION NO. __6__, 2014

A RESOLUTION APPROVING THE *REGIONAL INTELLIGENT TRANSPORTATION SYSTEMS (ITS) DEPLOYMENT PROGRAM.*

WHEREAS, the Denver Regional Council of Governments, as the Metropolitan Planning Organization, is responsible for the operation and maintenance of the continuing comprehensive transportation planning process designed to prepare and adopt regional transportation plans and programs; and

WHEREAS, the urban transportation planning process in the Denver region is carried out through cooperative agreement between the Denver Regional Council of Governments, the Regional Transportation District, and the Colorado Department of Transportation; and

WHEREAS, a Transportation Improvement Program containing transportation improvements expected to be carried out in the period 2012-2017 was adopted by the Board of Directors on March 16, 2011; and

WHEREAS, said Transportation Improvement Program included a pool called the Regional Intelligent Transportation System Pool (TIP #2005-026) to fund intelligent transportation system projects that implement the adopted Denver Regional Intelligent Transportation Systems Strategic Plan; and

WHEREAS, the *DRCOG Regional Concept of Transportation Operations*, a management tool used to define and develop strategic implementation planning to guide collaborative efforts to improve regional transportation operations, was adopted by the Board of Directors on August 15, 2012; and

WHEREAS, the Denver Regional Council of Governments, in cooperation with the Regional Transportation Operations work group consisting of operations professionals from local governments, the Colorado Department of Transportation and the Regional Transportation District, has established the *Regional Intelligent Transportation Systems (ITS) Deployment Program* that describes the region's needed operational improvements and identified an implementation program for fiscal years 2014-2017 to pursue these improvements; and

WHEREAS, the Regional Transportation Committee of the Denver Regional Council of Governments has recommended approval of the *Regional Intelligent Transportation Systems (ITS) Deployment Program.*

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Denver Regional Council of Governments hereby approves the *Regional Intelligent*
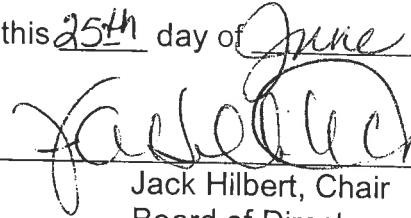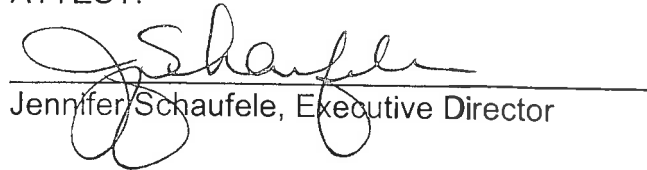
Transportation Systems (ITS) Deployment Program to provide guidance for the implementation of transportation operations improvements that advances the *DRCOG Regional Concept of Transportation Operations*.

RESOLVED, PASSED AND ADOPTED this 25th day of June, 2014 at Denver, Colorado.

_____
Jack Hilbert, Chair
Board of Directors
Denver Regional Council of Governments

ATTEST:

_____
Jennifer Schaufele, Executive Director

Regional Intelligent TransportationSystems Deployment Program

Denver Regional Council of Governments
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