DENVER REGIONAL INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC PLAN

Amended October 2010

THE DENVER REGIONAL COUNCIL OF GOVERNMENTS

DRCOG
DENVER REGIONAL COUNCIL OF GOVERNMENTS

Denver Regional Intelligent Transportation Systems Strategic Plan

Adopted December 5, 2007
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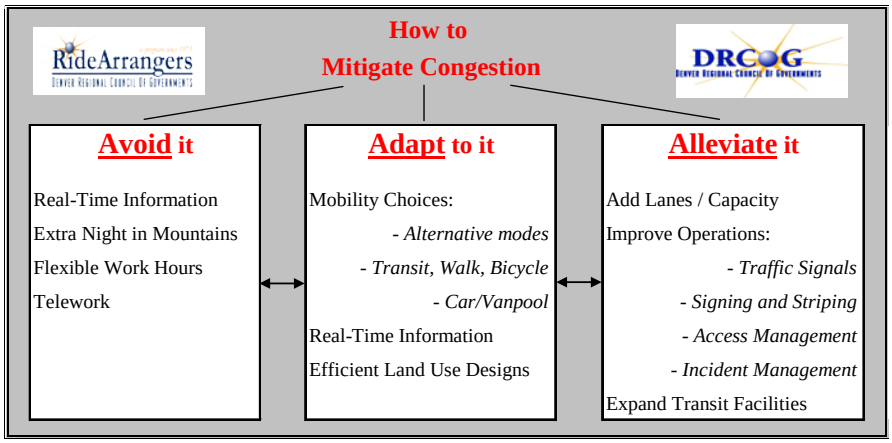
Acronyms and Abbreviations

AVL	Automated Vehicle Location
CDOR	Colorado Department of Revenue
CDOT	Colorado Department of Transportation
CMAQ	Congestion Mitigation/Air Quality
CSP	Colorado State Patrol
CTE	Colorado Tolling Enterprise
CTMC	Colorado Transportation Management Center
DMS	Dynamic Message Sign
ESS	Environmental Sensor Station
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation Systems
LRT	Light Rail Train
MDSS	Maintenance Decision Support System
MPO	Metropolitan Planning Organization
MVRTP	Metro Vision Regional Transportation Plan
PHA	Public Highway Authority
RTD	Regional Transportation District
TMC	Transportation Management Center
T-REX	Transportation Expansion Project
TSP	Transit Signal Priority
USDOT	U.S. Department of Transportation

Regional ITS Strategic Plan
Executive Summary

Transportation managers and public officials in the Denver region face a multitude of competing transportation pressures and demands. Population is growing and the demand for travel is increasing even more rapidly. Congestion on the Denver area's regional roadway system of freeways, tollways, and principal arterials has increased greatly since 1990. It is estimated that each resident of the region faces on average over 32 hours of extra congestion delay per year.

Have you faced the following situation?



You suddenly come upon stop-and-go traffic on the freeway due to a crash, wishing that you had known about the congestion before starting out. Had you known, you could have:

- taken an alternate route;
- left earlier;
- taken transit; or
- delayed the trip until another time.

In addition, if a traffic management center knew about the crash immediately after it happened, it could have:

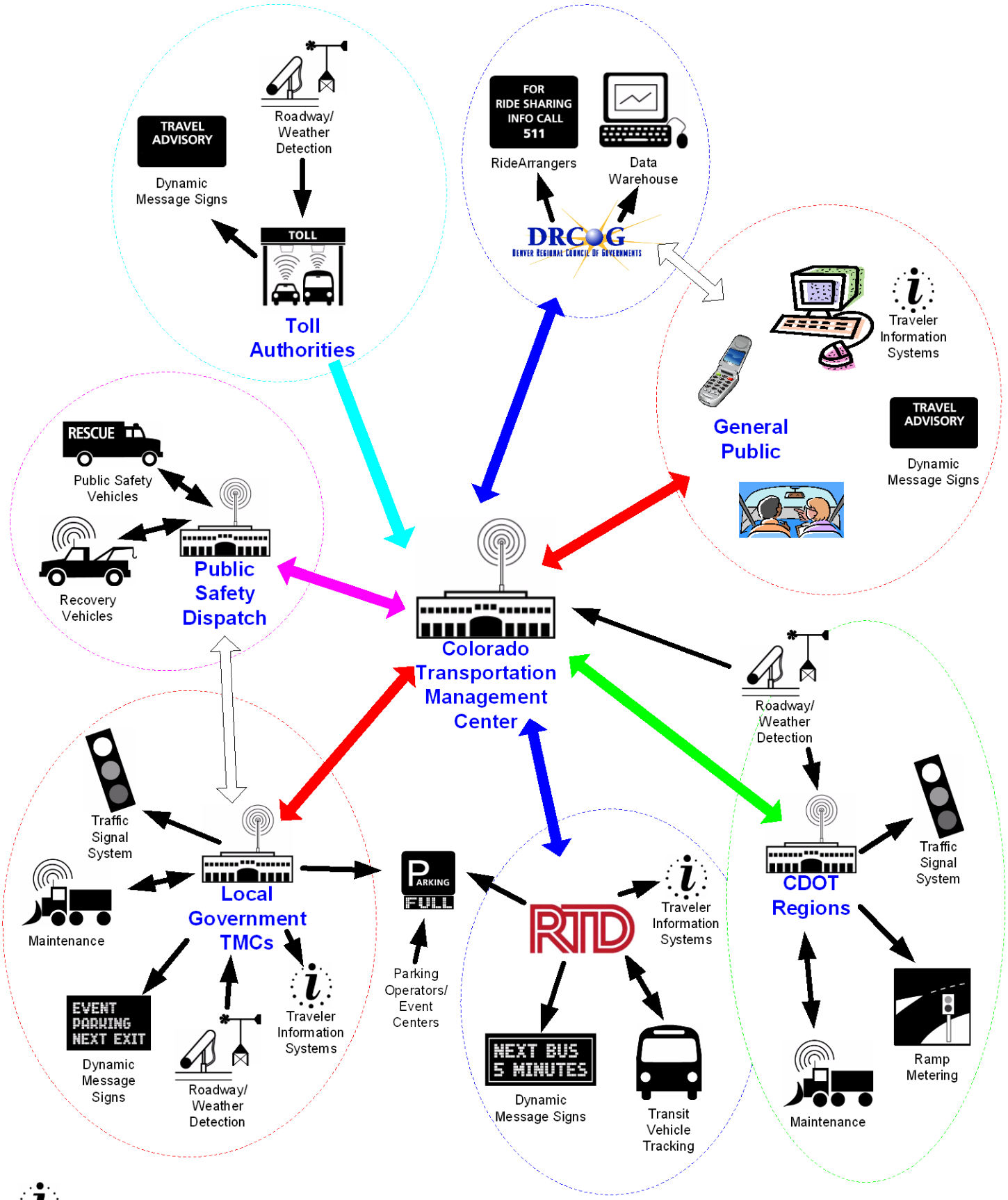
- informed the public (residents, visitors, truckers, etc.);
- alerted emergency response units;
- dispatched tow trucks; and
- alerted local jurisdictions or CDOT to implement detour routes or special traffic signal timing plans.

All of these actions (and more) are possible with **intelligent transportation systems (ITS)**, an important tool in DRCOG's congestion mitigation program. ITS is simply the application of technology to improve the operational efficiency of the regional transportation systems. Several jurisdictions in the region have been deploying and using ITS for nearly two decades.

The purpose of the *Denver Regional Intelligent Transportation Systems Strategic Plan* is to address this need for coordination in deployment. The Plan is an important element of the *2035 Metro Vision Regional Transportation Plan*. It will guide regional ITS investment to address the most critical needs, and encourage regional coordination and integration of ITS implementation across travel modes and jurisdictions. A companion technical document, the *ITS Architecture for the Denver Regional Area*, is also maintained by DRCOG. That document addresses specific federal requirements and describes procedures to carry out the Plan.

The vision for the deployment and operation of ITS within the region stresses **cooperation and coordination** between all travel modes and jurisdictions, centering on the Colorado Department of Transportation (CDOT) Traffic Management Center (CTMC) and leveraging off of existing systems deployed across the region (see diagram on following page).

Regional ITS Information Flow Schematic



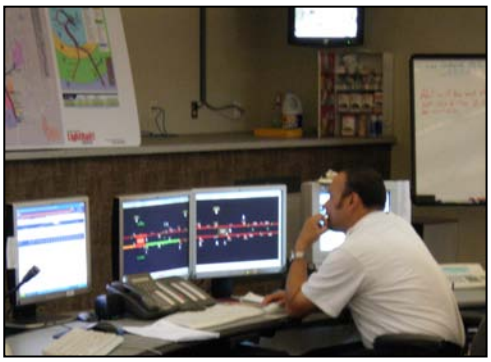
The public accesses Traveler Information Systems using websites, telephone, TV, fax, radio, mobile services, and other third party services.

DRCOG has identified the following nine transportation service areas (of which the first four are highest priority) to focus the deployment of ITS in the region:

Regional Traveler Information – Regional traveler information involves a variety of systems that collect and process transportation data then distribute the information to the public. It includes such information as: traffic conditions, travel times, incident locations, construction closures, weather condition, transit operations, and alternative travel options. The regional vision is to consolidate access to all traveler information sources through CDOT's traveler information system, consisting of the 511 phone system and the CoTrip.org website. This information will also be available for redistribution through other means such as traveler information kiosks, personalized e-mail or text messaging, mobile access, third-party traveler information, etc.

Regional Transportation Operations & Management – Regional transportation management provides coordinated transportation monitoring, response, and control functions. Regional partners will collect local data and control their local transportation systems while sharing the data through a display system that offers a regional view of traffic operations (e.g. website). This view will give transportation managers the opportunity to cooperate and respond quickly with management strategies that benefit regional travelers.

Regional Traffic Incident Management – Traffic incident management requires coordination between transportation managers as well as the cooperation of the public safety community. Currently, they have cooperated in the development and use of corridor-level incident management plans (IMPs), but one regional-level incident management plan is envisioned for the future. This plan will have the transportation managers using ITS devices to detect and verify incidents and will disseminate traveler information regarding the incident. Public safety personnel will be responsible for incident site management and incident clearance while coordinating with transportation managers.



Transit Operations & Management – Specific coordination between transit operations and other transportation managers is key to the regional traveler information and the regional transportation operations service areas above. ITS investment in transit operations is intended to improve the operational efficiency and public attractiveness of transit.

Maintenance and Construction – ITS activities will include: coordination in planning and notification for maintenance and construction activity; roadway maintenance systems that are supported by weather data collection; and, the capability to monitor ITS devices from remote locations, thus allowing quick and managed dispatch for repair.

Regional Parking Management – ITS parking management strategies include pricing mechanisms and the distribution of real-time information regarding the availability of parking. Parking facilities will be equipped to automatically track parking availability. This information may also be tied to electronic parking fee collection systems, possibly integrated with systems used on regional toll highways.

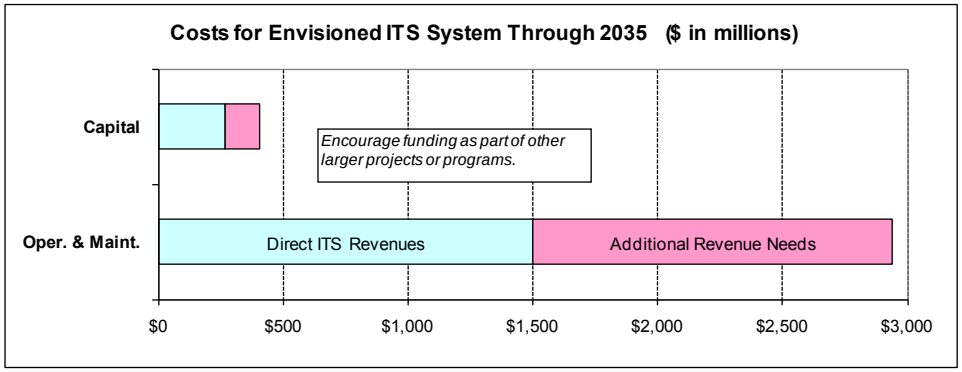
Regional Data Management – ITS inherently collects a lot of data that may be useful to operators, traffic engineers, planners, and researchers. A regional network of data collection sites will be the source of transportation data to be archived in a central web-based data warehouse hosted by DRCOG.

Regional Emergency Management – Regional Emergency management includes security and evacuation to support Department of Homeland Security initiatives including the *National Response*

Framework and the *National Infrastructure Protection Plan*. The public safety community leads these initiatives in this region; the transportation community offers support through traveler information and transportation operations.

Commercial Vehicle Operations – Activities may involve the implementation of additional ITS devices and systems to improve traveler information, operational safety, commercial vehicle monitoring and inspections and administration of commercial vehicle operations.

How much will this cost?



The Plan estimates that a capital cost of approximately $447 million (2008 dollars) for ITS capital investment would be necessary over the next two decades for full implementation. For perspective, this equates to about 2 percent of the regional roadway and the Regional Transportation District's (RTD) FasTracks total capital needs identified in the *2035 Metro Vision Regional Transportation Plan*. It is projected that there will be only about $270 million in revenues available from direct sources to address the ITS capital implementation costs (see chart). The resulting shortfall makes it critical that capital ITS elements be routinely imbedded within <u>all</u> roadway or transit construction projects to achieve greater cost savings and efficiencies. Actual federal funding commitments to ITS activities will be through the Transportation Improvement Program project selection process.

Capital investments must be made in infrastructure and systems that allow transportation managers to use existing ITS equipment and infrastructure (monitoring and detection devices, signs, communications, management centers, traffic signal systems, etc.) more efficiently. Thus, emphasis will be on the first four transportation service areas: Regional Traveler Information, Regional Transportation Operations & Management, Regional Traffic Incident Management and Transit Operations & Management.

In order to maximize benefits for the traveling public, there must be adequate **staffing and resources to operate and maintain** the ITS infrastructure and replace equipment when it exceeds its useful life. The cost for these tasks is estimated at an average of $104 million per year for the entire system as fully envisioned, which also includes existing infrastructure, or about $2.9 billion total through 2035. However, only about $1.5 billion in revenues is expected to be available for operations and maintenance.

The implementation and use of ITS applications represent an evolution of transportation agency's business practices and services they provide. A portion of the operations and maintenance funding requirements for ITS systems should become part of the annual budgets established by the transportation agencies. Of course, it is recognized that this may require additional investment in staffing and skills training beyond current funding.

1. Introduction

Background

Transportation managers and public officials in the Denver region face a multitude of competing transportation pressures and demands. Population is growing and the demand for travel is increasing even more rapidly. Roads, highways, and public transportation systems are increasingly prone to inefficiency typified by congestion, less reliability, crashes, and travel delays. Congestion on the Denver area's regional roadway system of freeways, tollways, and principal arterials has increased greatly since 1990. The following results from the DRCOG *2006 Annual Report on Traffic Congestion in the Denver Region* give an indication of the severity of congestion:

- About 1/5 of the regional roadways have severe congestion over 3 hours per day;
- On average, travel during rush hours takes 27% longer than in the off-peak;
- Each resident faces about 32 extra hours congestion delay per year; and
- Delays cost residents and businesses over $1.7 billion per year

These statistics do not include the full impact of incidents such as crashes or extreme weather events. The prospects for the future do not get better. By 2035, the region's population is expected to increase by 1.5 million people resulting in more severe and longer lasting congestion extending to other roadways. Due to extreme funding shortfalls, very few new lanes will be added to the regional roadway system to respond to growth, which will result in increased congestion (Figure 1). While most transportation managers and many public officials agree that more financial resources must be brought to transportation, the likelihood is there will never be sufficient funding to fully address all the problems in the transportation system.

What is evident is that the Denver region must operate the infrastructure it already has as safely, effectively, and efficiently as it can. In fact, a key policy in the *2035 Metro Vision Regional Transportation Plan* focuses on system management and operations: "Make the best use of existing transportation facilities by implementing measures that actively manage and

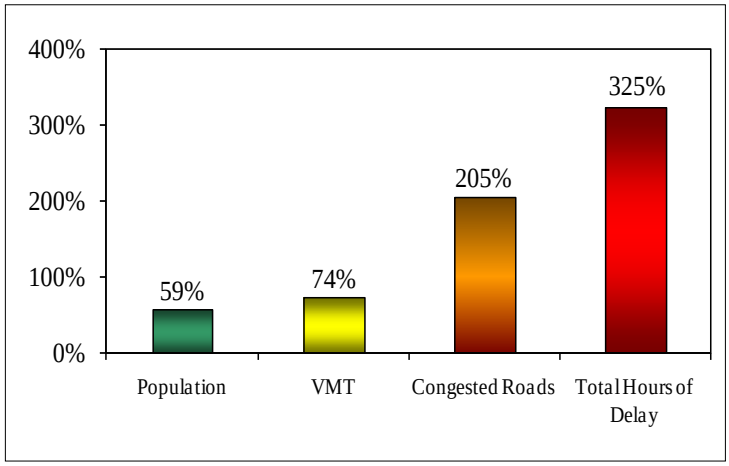


Figure 1: Estimated Impacts of Anticipated Regional Growth Through 2035[1]

[1] *2035 Metro Vision Regional Transportation Plan*, DRCOG, 2009

integrate systems, improve traffic operations and safety, provide accurate real-time information, and reduce the demand for single-occupant motor vehicle travel." In other words, make the existing infrastructure and systems work better. To improve the day-to-day performance of the transportation system, traffic engineers, transportation professionals and transit officials have increasingly enlisted the aid of advanced technology: so-called Intelligent Transportation Systems, or ITS.

What Are Intelligent Transportation Systems (ITS)?

ITS is the integrated application of technology to surface transportation systems to improve transportation mobility and safety.

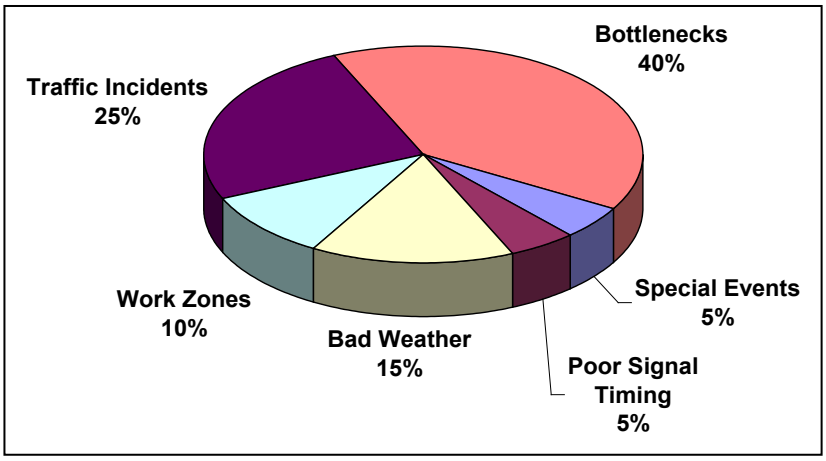


Figure 2: Sources of Congestion[2]

As congestion on our regional roadway network builds and funding for transportation capital investment becomes increasingly scarce, it is clear that we have to do more with the infrastructure currently available – make the transportation network more efficient through active management. The concept of active management of the transportation system to optimize performance is feasible only with targeted implementation of advanced technology and strategies to address several sources of congestion (see Figure 2). ITS is already being applied in the Denver region, across the United States, and throughout the developed nations of the world. In addition, the automobile industry continues to improve vehicle safety through the application of technology in the vehicles, and information service providers sell traveler information that builds from and supplements that provided by public transportation agencies.

To put ITS into a more familiar context, Exhibit 1 presents several examples (not an exhaustive list) of technology applications implemented in Denver and elsewhere that are ITS applications.

Note that ITS is not a panacea; it will not make the congestion problem completely disappear. But failure to implement ITS will make conditions intolerable and erode public confidence in the region's ability to wisely manage its resources. ITS can help bring about a safer, more effective, and more efficient transportation system. It is another valuable tool in the congestion mitigation toolbox.

[2] *Traffic Congestion and Reliability: Linking Solutions to Problems*, Federal Highways Administration, 2004

Exhibit 1: Examples of ITS

Ramp Metering: Ramp meters help to manage the flow of traffic onto the freeway. In Denver, the original pilot project implemented in 1981 (northbound I-25) showed ramp metering increased peak period freeway travel speeds and reduced overall delay more than 25 percent, and reduced peak period crashes by 50 percent. In 2000, a nationally-significant examination in Minneapolis- St. Paul, Minnesota, turned off existing ramp meters for a period of time to study their effects. The results showed that when the meters were turned off freeway throughput declined by 14 percent, travel time increased by 22 percent, travel time reliability decreased by 91 percent, crashes increased by 26 percent, and air pollutant emissions increased in excess of 3 tons per day.

Incident Management: Freeway incidents are reported nationally to account for more than half of the delay experienced on the freeway system. The less time an incident is allowed to impede traffic, the lower the delay to the system. Integrated incident management programs, including such elements as freeway service courtesy patrols, video observation, and consolidated/cooperative dispatch have been widely implemented across the U.S. In every instance, these programs have demonstrated noticeable reductions in the time taken to clear incident scenes, and the number of secondary incidents was reduced as well.

Electronic Toll Collection: Electronic toll collection, as currently deployed on E-470, Northwest Parkway and the I-25 Express Lanes, eliminates the need for the traveler to stop, which decreases delay and improves reliability.

Coordinated Traffic Signals: Signalized intersections are the controlling points of the arterial network. As demonstrated in the Denver region and across the country and world, coordinated traffic signal systems reduce stops and delay, typically improving arterial travel times 10 to 15 percent and decreasing emissions and fuel consumption. Signal systems also improve operational reliability through automatic resynchronization and malfunction reporting.

Transit Vehicle Tracking: The ability to monitor the real-time location of transit vehicles is the building block for active management of the transit system. The Regional Transportation District (RTD) uses such data in developing schedules, tracking schedule adherence, and posting real-time arrival/departure information for waiting passengers.

Traveler Information: Easily accessible traveler information (e.g., web site, phone, dynamic message signs), identifying real-time conditions of the roadway and transit network, is in growing demand by consumers. As an example, real-time observed travel times along corridors can be provided directly to users allowing travel decisions to be made based on an understandable piece of information – travel time reliability.

Courtesy Patrol: Courtesy Patrol vehicles assist stranded motorists with the secondary purpose of reducing the congestion caused by many of the stranded conditions. Central dispatch and GPS equipment in the vehicles will further enhance the incident management capabilities. The initial pilot demonstrated a return of $10 -17 for every dollar invested in the program.

2. Strategic Plan

Purpose of Regional ITS Strategic Plan

The purpose of the *Denver Regional Intelligent Transportation Systems Strategic Plan* ["the Plan"] is to provide a regional policy framework for the application of Intelligent Transportation Systems (ITS) in the Denver region to meet critical, recognized regional transportation problems. The Plan presents an unconstrained regional vision for investment in ITS applications over the next two decades and provides strategic guidance for deployment over the coming years, within the context of Metro Vision and the Regional Transportation Plan. The Plan demonstrates a unified approach for deploying ITS among the primary components of the regional transportation system and at several levels of implementation.

In order to promote efficient ITS investment across our nation, federal regulations were established that require regions to provide focused planning for the deployment of ITS in order to be eligible to receive federal funding. The USDOT has prepared the National ITS Architecture as a guide for this planning. The National ITS Architecture describes a high-level framework for developing regionally integrated transportation systems including the systems to be deployed, the stakeholders involved, their roles and responsibilities, and the relationships and information exchange requirements that support integrated operations.

DRCOG responded to the federal regulations by adopting the *Denver Regional Intelligent Transportation Systems Strategic Plan (March 2002)* and the *Denver Regional Intelligent Transportation Systems Architecture (December 2001)* ["the Architecture"]. The Architecture is a companion technical document to the Plan that specifically addresses federal regulations and describes the ultimate relationships between regional entities required to achieve the strategic plan.

Since the Plan was adopted, there has been significant deployment of ITS infrastructure in the region, including:

- Transportation Expansion project (T-REX) installed roughly 250 ITS devices (dynamic message signs [DMS], video cameras, ramp meters, etc.) along I-25 as well as other video-based traffic monitoring equipment on select arterials;
- CDOT ITS Branch and many of the local jurisdictions expanded their deployment of ITS systems and devices (i.e. traffic detectors, CCTV cameras, weather detectors, and DMS) and the associated ITS infrastructure (i.e. fiber optic communications and wireless communications) to interconnect several management centers and connect to ITS devices;

- Colorado Tolling Enterprise (now operating as the High Performance Transportation Enterprise) began operation of the I-25 Express Lanes, collecting tolls from single-occupant vehicles;
- Colorado Transportation Management Center was moved to Golden and upgraded, maintaining 24/7 operations monitoring and managing the regional freeway operations. This center has also been interconnected to traffic operations at several local jurisdictions and CDOT Regions 1 and 6 by fiber optic communications;
- CDOT ITS Branch implemented 511 as the statewide traveler information telephone number;
- The Regional Transportation District (RTD) implemented an improved traveler information phone service called MyStop;
- RTD implemented a system to both collect fees for parking at select RTD facilities and monitor for violations;
- RTD deployed automated passenger counting equipment on their fixed-route bus fleet;
- CDOT ITS Branch began monitoring real-time travel times on select freeway links and posting this information to freeway DMS and the CoTrip website; and,
- CDOT ITS Branch has deployed an initial phase of the City and County Transportation Management Desktop, a regional transportation operations display, accessed through a secure website.

In addition, the National ITS Architecture, the national framework for deploying integrated ITS services, has been updated and now includes a number of new ITS tools and services that had not previously been considered to address regional transportation issues.

Local, state, and regional agencies have been implementing and operating ITS applications for nearly two decades. The Plan provides a mechanism through which these numerous stakeholders will work together toward cooperative, coordinated, system-wide deployment and operations to provide maximum public benefit. **The Plan also reflects a formal endorsement by elected officials and transportation managers that ITS is one of the tools that will be used to address the region's transportation problems.**

Plan Coverage Area

The Plan covers the nine-plus county area that comprises the planning area for DRCOG. The transportation networks encompassed include the freeway system, the major regional and principal arterials, and the public transit system as defined in the *2035 Metro Vision Regional Transportation Plan* (2035 MVRTP).

The following three figures depict the current inventory of ITS facilities and services across the region, which form the core of the ITS elements that this Plan intends to integrate and expand. Figure 3 illustrates the traffic management inventory, which includes the equipment that allows traffic managers to both monitor traffic

conditions on freeways and arterials and manage operations by responding to issues observed on the network. Also illustrated on this figure is the extensive network of DMS, which are used to provide traveler information to driver on the road. Figure 4 illustrates the existing transit facilities and systems where ITS plays a role. At select light-rail transit (LRT) stations, select park-n-Ride lots, and at automated traveler information kiosks across the region, RTD distributes transit traveler information to their customers through DMS. In addition, demand responsive transit routes rely on several technologies in order to operate those routes effectively. Figure 5 illustrates the location of other ITS equipment and services that support safe and efficient operations in the region: weather stations dedicated to monitoring weather conditions and impacts on the roadway; weigh stations in the pavement to facility commercial vehicle operations; and, courtesy patrol.

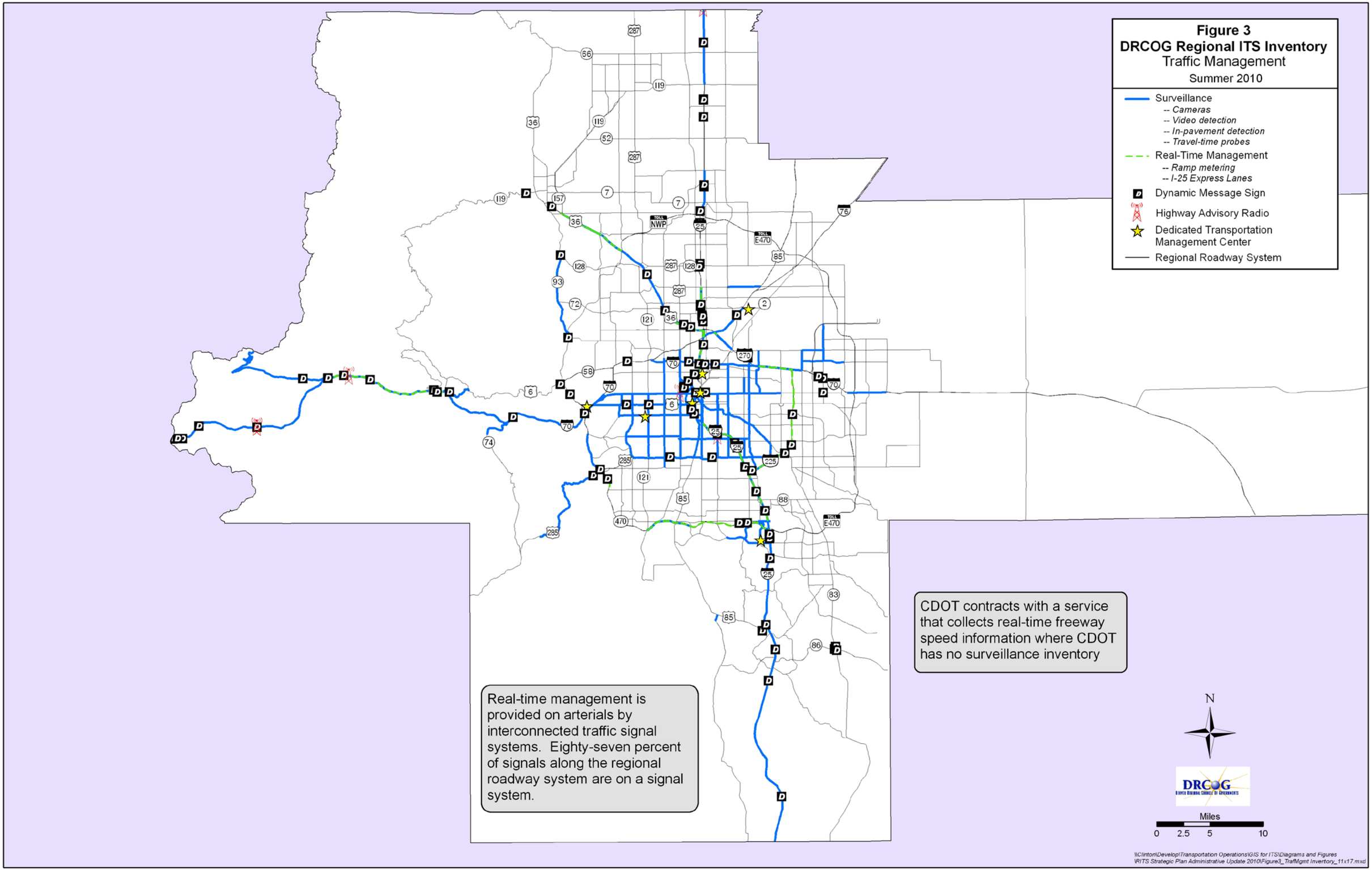


Figure 3
DRCOG Regional ITS Inventory
Traffic Management
Summer 2010
Surveillance
-- Cameras
-- Video detection
-- In-pavement detection
-- Travel-time probes
Real-Time Management
-- Ramp metering
-- I-25 Express Lanes
Dynamic Message Sign
Highway Advisory Radio
Dedicated Transportation Management Center
Regional Roadway System
CDOT contracts with a service that collects real-time freeway speed information where CDOT has no surveillance inventory
Real-time management is provided on arterials by interconnected traffic signal systems. Eighty-seven percent of signals along the regional roadway system are on a signal system.
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\RITS Strategic Plan Administrative Update 2010\Figure3_TrafMgmt Invertory_11x17.mxd

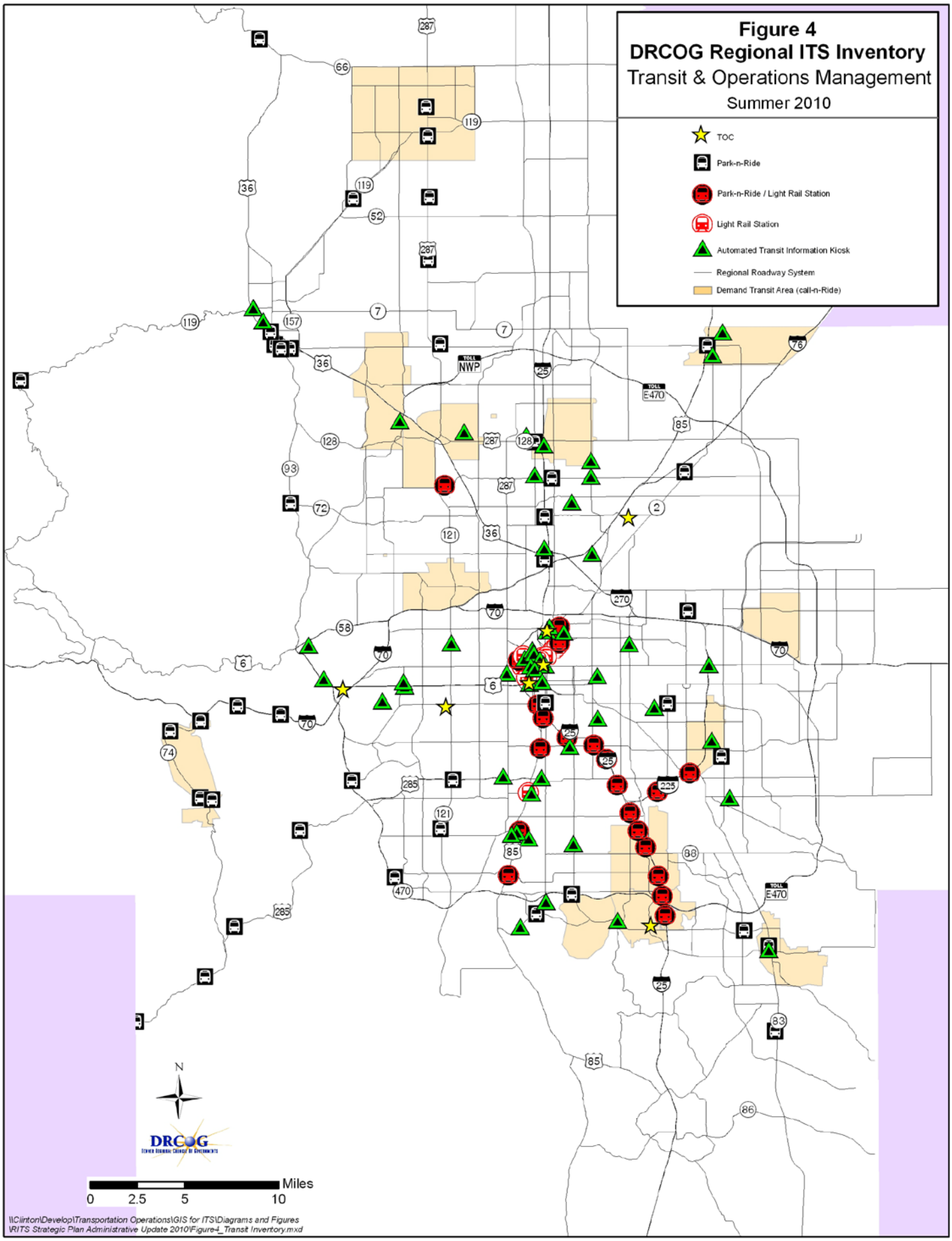
Figure 4
DRCOG Regional ITS Inventory
Transit & Operations Management
Summer 2010
TOC
Park-n-Ride
Park-n-Ride / Light Rail Station
Light Rail Station
Automated Transit Information Kiosk
Regional Roadway System
Demand Transit Area (call-n-Ride)
TOLL NWP
TOLL E-470
TOLL E-470
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\\Clinton\Develop\Transportation Operations\GIS for ITS\Diagrams and Figures
\RITS Strategic Plan Administrative Update 2010\Figure-4_Transit Inventory.mxd

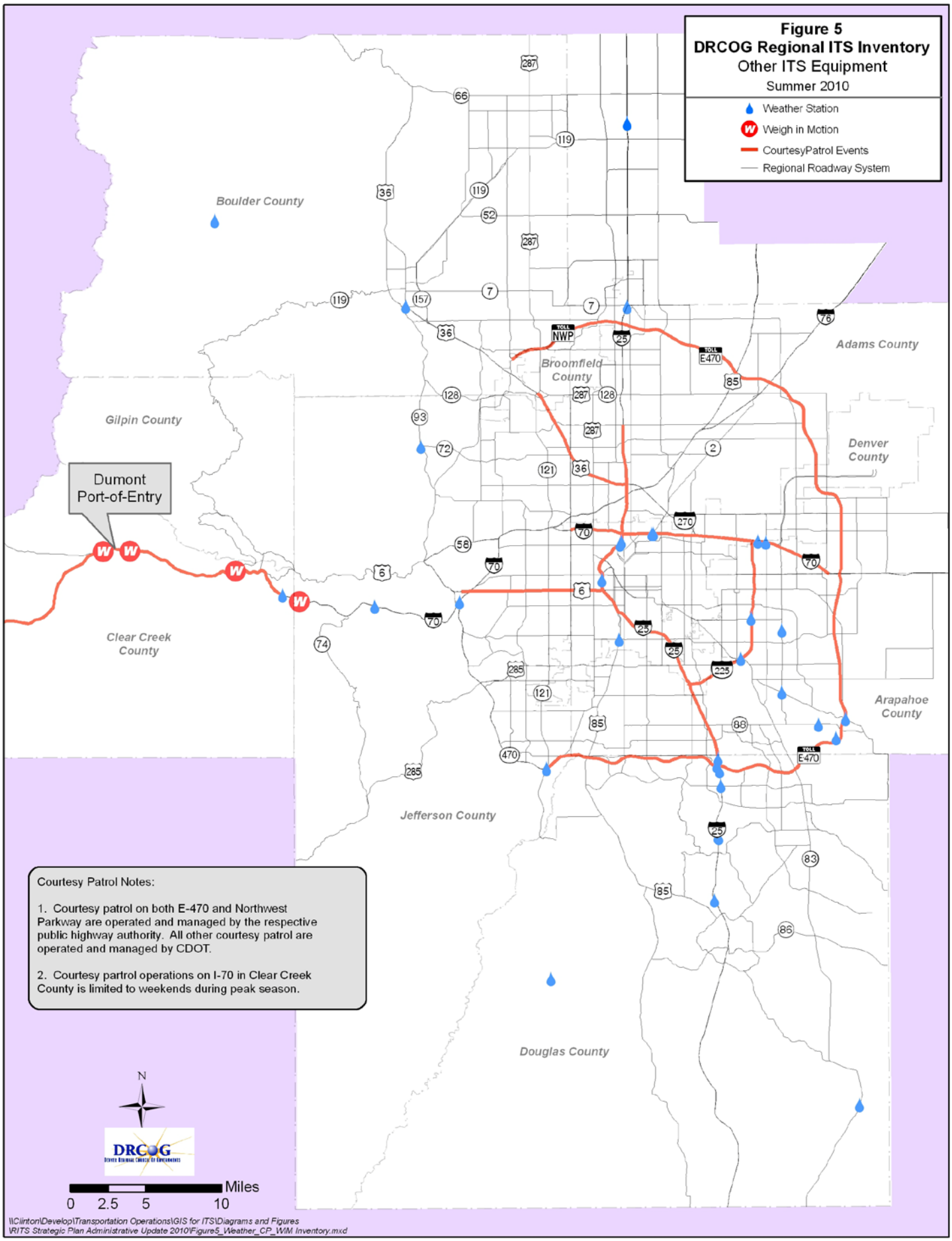
Figure 5
DRCOG Regional ITS Inventory
Other ITS Equipment
Summer 2010
Weather Station
Weigh in Motion
CourtesyPatrol Events
Regional Roadway System
Boulder County
Gilpin County
Clear Creek County
Broomfield County
Adams County
Denver County
Arapahoe County
Jefferson County
Douglas County
Dumont Port-of-Entry
NWP
E470
Courtesy Patrol Notes:
1. Courtesy patrol on both E-470 and Northwest Parkway are operated and managed by the respective public highway authority. All other courtesy patrol are operated and managed by CDOT.
2. Courtesy partrol operations on I-70 in Clear Creek County is limited to weekends during peak season.
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\\Clinton\Develop\Transportation Operations\GIS for ITS\Diagrams and Figures
\RITS Strategic Plan Administrative Update 2010\Figure5_Weather_CP_WIM Inventory.mxd

Plan Update Process

The ITS working group, stakeholders assembled for the development of the *Denver Regional Intelligent Transportation Systems Strategic Plan (March 2002)*, was reconvened as a technical resource to assist in the update of the strategic plan.

Participants in the working group included representatives from the Colorado Department of Transportation's (CDOT) ITS Branch and from the three CDOT regions serving the DRCOG area, from the Regional Transportation District (RTD)—the region's public transit agency, and several local governments that have deployed and are operating ITS equipment. Local government membership was self-selecting; invitations to technical staff were issued at several opportunities, and all interested persons were placed on the working group notification list. Federal Highway Administration (FHWA) staff also participated as a member of the working group.

The working group provided updated ITS inventory information, and assisted in all steps of the update process, including participation a series of workshops to define operational concepts.

The update process began by addressing several major topics:

- A review of the existing ITS inventory;
- A review of existing problems on the transportation network that may benefit by implementing ITS;
- A review of ITS applications that may be applied to problems on the network;
- A definition of an ITS deployment vision and strategies; and
- Development of an operational concept for specific transportation service areas:
    - Regional Traveler Information
    - Regional Transportation Operations & Management
    - Regional Traffic Incident Management
    - Transit Operations & Management
    - Maintenance and Construction
    - Regional Parking Management
    - Regional Data Management
    - Regional Emergency Management
    - Commercial Vehicle Operations

The operational concepts define the roles and responsibilities of the various stakeholders as they work together to provide specific ITS services.

This *Denver Regional Intelligent Transportation Systems Strategic Plan* was reviewed by the Transportation Advisory Committee and the Regional Transportation Committee pursuant to adoption of this Strategic Plan by the DRCOG Board of Directors on December 5, 2007. Subsequent updates to this Plan will be conducted in a similar manner on roughly a five-year basis in order to support the *Metro Vision Regional Transportation Plan* updates. This administrative update of the Plan was completed in 2010 to incorporate the new area and roadways contained in the expanded DRCOG boundary that now includes a portion of Weld County.

The companion technical document, the *Denver ITS Architecture for the Denver Regional Area*, in parallel with the Plan, was updated with key assistance from CDOT. The Architecture will be maintained by DRCOG in the current version of Turbo Architecture, a tool provided by the FHWA to assist with the creation and maintenance of regional ITS architectures, to reflect regional ITS deployment and technical changes in the deployment of ITS elements.

Regional Transportation Problems

The basic premise of the Plan is that in the Denver Region, ITS will be implemented to address evident transportation problems. To assure that the Plan was properly directed, stakeholders were asked to confirm significant transportation problems that could be positively addressed by ITS applications. The working group confirmed that the following problems are critical and should have the highest priority:

- **"Normal" Freeway or Arterial Congestion** – Recurring congestion occurs when the capacity of a transportation facility is insufficient to serve the demand for certain time periods. Generally, this is a predictable daily or weekly occurrence. This congestion results in reduced travel speed, increased travel time, and vehicle delays.
- **Unfocused Traveler Information –** The collection and distribution of traveler information can help travelers avoid or adapt to congested conditions. Currently, traveler information is collected and distributed from various sources within the region. There is only a moderate level of coordination both among public agencies and between public agencies and commercial entities that provide traveler information. The distributed array of information may not be used efficiently by travelers. Also, inconsistencies between traveler information sources may confuse travelers.
- **Incidents and Safety –** Incidents are non-predictable events that can affect traffic flow and reduce capacity, causing congestion, and result in economic and potentially human loss. Depending on the severity of the incident and the time of day in which it has occurred, the impact of incidents on the traffic network can be amplified beyond the duration and location of the incident itself, and the potential for secondary incidents can be increased.

- **Multimodal Integration –** Travelers make travel mode decisions based upon the competitive features of each mode. The region is strongly committed to expanding and improving the transit system. There are several challenges facing the transit system that impact its viability as an alternative travel mode: longer trip travel times compared to other modes, travel time reliability, transfers, provision of timely traveler information, ease of use when compared to other modes, and apparent and perceived security issues.
- **Maintenance and Construction Projects –** Construction activity and accompanying capacity reductions can substantially increase congestion and delay and can result in an increased number of crashes and other incidents. Of special importance is safety in construction areas, for both travelers and workers. Currently, closures for maintenance and construction are neither fully coordinated with relevant traffic management organizations nor are they well coordinated with nearby projects.
- **Weather –** Weather is a special event that impacts traveler mobility and safety. Without good knowledge and communication of pending weather events, transportation agencies may not optimally respond to the conditions with appropriate operations strategies and maintenance activities. Without timely and accurate information, travelers cannot make informed travel decisions.

- **Venues and Activity Centers –** These locations can generate demand that exceeds the capacity of the surrounding network depending on the time of day, magnitude, and recurrence. This too yields congestion, and may also entail parking and neighborhood traffic concerns. Examples of venues/activity centers are large commercial complexes, large employment centers, and sporting or entertainment centers.
- **Access to Transportation Data –** Traffic operations, operations planning, and transportation planning rely on accurate and timely data. The data are used in evaluating system performance, determining priorities, calibrating models, developing and evaluating scenarios, timing signals, and managing events and incidents. Where data are old or nonexistent, the results of these activities may be compromised.
- **Transportation Network Security –** This nation, through the Department of Homeland Security, has refocused its view of the importance of transportation infrastructure. The transportation infrastructure is critical to operations for both for day-to-day conditions and critical events that may require major evacuations of the population. The North Central All-Hazards

Region, a component of the State's Division of Emergency Management, is developing a regional evacuation plan, which includes significant transportation participation. In addition, CDOT and other state agencies have completed an evaluation of the critical transportation infrastructure in the region. Coordination is required between transportation planning and security planning.

- **Commercial Vehicle Regulations –** Individual jurisdictions throughout the region regulate and permit the movement of certain commercial vehicles on their roadways (or roadway networks), with limited coordination with other jurisdictions or state regulatory agencies.

ITS Vision and Operational Concepts

The following expresses the vision which will guide the implementation of the *Denver Regional ITS Strategic Plan*:

> *Regional ITS partner agencies will deploy efficient management processes and systems to promote and facilitate cooperative, regional and multimodal operations.*

Such deployment will occur in the following transportation service areas through specific operational concepts. Exhibit 2 illustrates the transportation service areas that are applicable to the regional transportation problems that have been identified. The transportation service areas are:

- **Regional Traveler Information –** Regional traveler information involves a wide range of data including: traffic conditions, travel times, incidents, construction, weather, transit operations, and alternative travel options. This data is then repackaged and disseminated to the public. The regional partners will work towards a traveler information system that is centered on CDOT's traveler information system, which will act as a unified point of access for regional traveler information for all modes in the region. CDOT's traveler information system consists of the 511 phone system and the CoTrip.org website. Regional partners will collect and process their own data and either update the CDOT traveler information system or maintain access to their traveler information through the CDOT's system. Other services to distribute this information (i.e. personalized e-mail or text messaging, mobile access, third party traveler information) will grow from this consolidated traveler information. The priority is to consolidate existing data sources prior to expanding the coverage of data collection points.
- **Regional Transportation Operations & Management –** Regional transportation management provides transportation monitoring and control functions coordinated across modes and regional jurisdictions. Regional partners will collect local data and employ local transportation control strategies while sharing the data with other regional partners through the City and County Transportation Management Desktop, a regional transportation operations

Regional Transportation Problems	Regional Traveler Information	Regional Transportation Operations	Regional Traffic Incident Management	Transit Operations and Management	Maintenance & Construction	Regional Parking Management	Regional Data Management	Emergency Management	Commercial Vehicle Operations
	Transportation Service Areas								
"Normal" Freeway or Arterial Congestion	✓	✓	✓	✓	✓	✓			
Unfocused Traveler Information	✓	✓	✓	✓		✓		✓	
Incidents and Safety	✓	✓	✓					✓	
Multimodal Integration	✓	✓		✓		✓			
Maintenance and Construction Projects	✓				✓				
Weather	✓	✓	✓	✓	✓				
Venues and Activity Centers	✓	✓		✓		✓			
Access to Transportation Data							✓		
Transportation Network Security								✓	
Commercial Vehicle Regulations									✓

Exhibit 2: Transportation Problems Addressed by Transportation Service Areas

display (e.g. secure website) maintained by CDOT. Regional partners will develop and utilize regional transportation management strategies that will be supported by center-to-center interfaces allowing information sharing between jurisdictions and modes.

- **Regional Traffic Incident Management –** The regional partners involved are divided into two general groups: transportation operations and public safety. Using ITS devices, transportation operations will employ incident detection and verification and will disseminate traveler information regarding the incident. Public safety has primary responsibility for incident site management and incident clearance and will coordinate with transportation operations to support their activities and to promote safer operations.
- **Transit Operations & Management –** Specific coordination between transit operations and other regional partners is part of regional transportation operations and regional traveler information. Other ITS investment in transit operations are intended to improve operational efficiency, which will be reflected in the coordination with regional transportation operations and regional traveler information and will ultimately increase the attractiveness of transit.
- **Maintenance and Construction –** There are three main areas in which ITS is related to maintenance and construction. First, maintenance and construction activity for the region will be made available through traveler information; the same database will be used by regional partners to coordinate closures and restrictions that impact neighboring jurisdictions. Second, roadway

maintenance will be coordinated with weather data collection to support such activities as snow clearing operations and roadway striping. Third, maintenance recommendations for the network of ITS devices will be derived from the system monitoring service and agency management systems.

- **Regional Parking Management –** The parking management concept supports the implementation of parking management strategies (i.e. pricing strategies) within the region and involves coordination between multiple parking facilities and multiple owners/operators. The parking facility operators (including RTD) will equip their facilities to track the available facility capacity and to collect parking fees electronically. This concept expects to build on technologies and system infrastructure already deployed within the region, including possibly the toll collection system used on regional toll facilities.
- **Regional Data Management –** Regional Data Management involves the organization of transportation system performance data spanning across modal and jurisdictional boundaries. The data will be used by operators (for operational analysis and event planning), planners (for long-term planning) and researchers. The concept is to define a specific network of data collection sites (many that already exist) where data will be collected in a central data warehouse. Regional partners will record their own data and submit it for storage in the central data warehouse system. Users of the warehouse will have access to all the data stored by the regional partners through a web-based interface.
- **Regional Emergency Management –** Security and evacuation are key services in Regional Emergency Management that support Department of Homeland Security initiatives including the National Response Framework and the National Infrastructure Protection Plan. The public safety community leads these initiatives in this region; the transportation community provides support through traveler information and transportation operations. ITS devices and systems may be used to support the protection of critical transportation infrastructure within the region. Note that ITS devices and systems are also critical transportation infrastructure that must remain available to support the public safety community in the event of a disaster.
- **Commercial Vehicle Operations –** ITS devices and systems may be deployed in this region to support both the Colorado State Patrol (CSP) and the Colorado Department of Revenue (CDOR) interactions with commercial vehicle operations. CSP is responsible for the safety of commercial vehicle operations, which involves driver credential review, truck inspections, and HAZMAT routing and tracking. CDOR is responsible for commercial vehicle tax administration, assuring compliance with the State's commercial vehicle size and weight laws, and performing safety inspections on vehicles and their drivers. CDOT is responsible for issuing Extra-Legal and

Longer Combination Vehicle permits and administering those programs. Coordination is on-going among the primary agencies to improve and integrate the commercial vehicle operations.

ITS Deployment

The previous section described the functional deployment priorities for ITS in the region. This section describes the priorities of specific applications and the associated locations for deployment. For ease of understanding, the description is separated into four areas:

- Regional Coordination;
- Freeway Management;
- Arterial Management; and
- Transit Operations & Management.

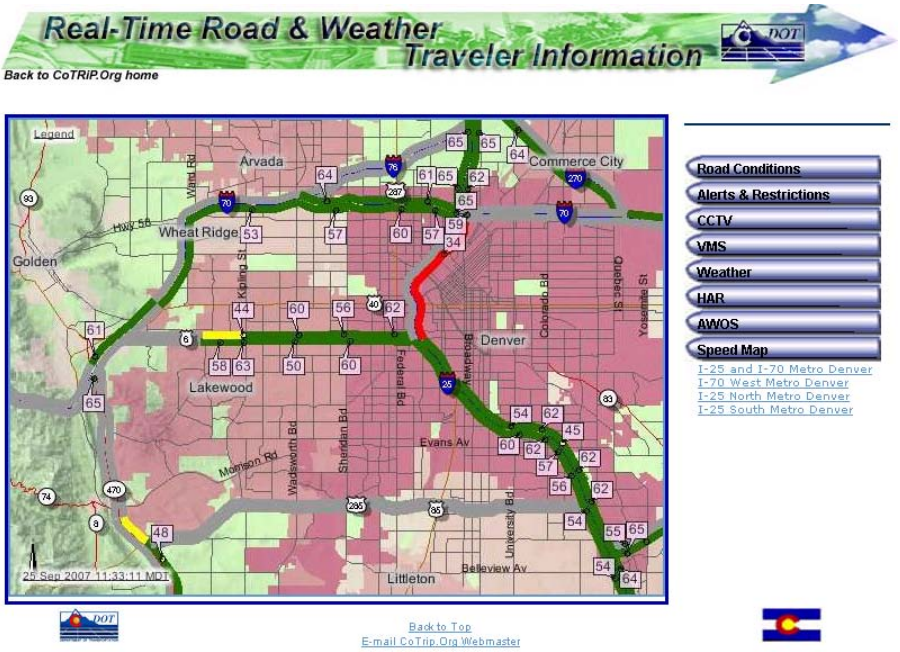
While the Plan was crafted to represent a vision, fiscal prudence indicates that it is unreasonable to expect deployment of all desired ITS applications across the region by 2035. The fiscal constraints were considered in relation to the time frame for implementation:

- short term—desired within 5 years
- medium term—desired in 5 to 10 years
- long term—desired after 10 years

It is a recognized that simply deploying devices does not by itself improve the effectiveness or efficiency of the transportation system. Adequate transportation agency staffing must be provided to operate and maintain the system in order to most effectively take advantage of the transportation management tools.

Additionally, system equipment maintenance and replacement are critical factors in the long-term serviceability of the ITS devices and infrastructure. Maintenance and replacement are well-recognized requirements of all transportation investments; however, the life cycle of ITS devices is moderately short, not dissimilar to the life of a bus or blacktop rather than long-term investments such as a bridge or a light rail power system. Implicit in this Plan is an assurance by the stakeholders of sufficient staff and resources for management, operations, maintenance, and replacement of deployed ITS devices and infrastructure to make it an effective investment.

Regional Coordination ITS Elements



Regional travelers of all types (e.g. commuters, truck drivers, tourists, etc.) may understand the difference between travel modes, but most are not necessarily aware of the jurisdictional boundaries as they travel across the region. To better serve these travelers, transportation managers and operators must adopt a more regional view of transportation operations. The sharing of transportation operations data is key to assuring that the regional transportation system is operated efficiently and effectively.

Efficiency is gained at two levels. First, multimodal transportation managers are provided a broader awareness of regional transportation conditions, which allows them to make better informed, coordinated, and quicker operational decisions. For example, multimodal operations are improved as transit managers are able to anticipate or react to traffic conditions. Regional incident management is improved through quicker incident detection and response allowing the emergency service providers to respond more rapidly and effectively to traffic incidents. Arterial operations are improved as they can better serve traffic diverting from a major freeway crash or from maintenance or construction activity in a neighboring jurisdiction. Additionally, the public safety dispatch centers can be connected to the transportation management centers, which can assist in routing emergency vehicles to avoid transportation network delay.

At the second level, sharing or consolidating transportation operations data to become a common and comprehensive source of traveler information will help improve the information distribution to the traveling public and encourage “smarter” decisions regarding their regional trips. This includes both pre-trip planning and decision-making while en route. CDOT ITS Branch has established www.cotrip.org and the 511 traveler information telephone service, which will serve as the primary access points for all regional traveler information, including: roadway conditions and travel times; weather conditions; incident information; parking availability and information regarding special events; and access to

automated and dynamic ridesharing. The traveler information collected by the regional jurisdictions will be consolidated at the Colorado Transportation Management Center (CTMC) for access to the public, the regional transportation managers, third-party traveler information service providers and the regional data warehouse.

Currently, there are several transportation management centers (with varying functionality) in the region. Of particular note are the dedicated transportation management center facilities (CTMC, RTD, Denver, Lakewood, Commerce City, and Douglas County) and facilities with advanced ITS functionality (Englewood, Littleton, CDOT Region 1 and CDOT Region 6). These centers house multiple ITS functions including network surveillance, data collection, roadway network control, and traveler information. In addition, these centers are connected to each other with dedicated, high-speed communications that currently allows the centers to share information. These centers, with the CTMC as the central point, will form the primary group that will share transportation data for both operations and traveler information. Similar center-to-center communications exist between the group above and Greenwood Village, Aurora, and Arapahoe County with extensions planned to Thornton, Northglenn, and Boulder. It is anticipated that expansion of the data sharing and traveler information functions will be expanded to this group shortly after implementation with the primary group. As new transportation management centers with advanced ITS functionality are established, they will be connected to the regional network of centers with dedicated, high-speed communications.

In addition to supporting integrated transportation operations, interconnected transportation management centers can allow regional control support. Specifically, the CTMC, which is staffed 24/7, can monitor for system disruptions in other jurisdictions during their off hours and can potentially assist in the implementation of appropriate responses. Assistance from regional stakeholders will likely be necessary to support regional coordination activities and the additional role that would be required of the CTMC.

In addition to its use for traveler information, weather data collection will also play an important role in transportation operations. Currently, CDOT and Denver employ a maintenance decision support system (MDSS), which utilizes data collected from environmental sensor stations (ESS) across the region and

real-time maintenance vehicle location data to assist in making decisions regarding roadway maintenance activities, mainly during the winter. The network of ESS will be expanded to properly cover the region and will also support the expansion of Clarus, a federal initiative to integrate weather data collection at a national level.

ITS devices and applications will be used as tools to support both the public safety community and statewide commercial vehicle operations. ITS devices and applications such as cameras and traveler information will be used to support the public safety community in their functions of transportation infrastructure protection and disaster/event response and recovery. The deployment of ITS tools can support more efficient commercial vehicle operations both from the trucking industry standpoint and from the view of the state agencies responsible for administering commercial vehicle operations. Initiatives to support commercial vehicle operations will be led by the Colorado Department of Revenue; CDOT ITS Branch is already supporting improved traveler information dissemination at ports-of-entry (of which there is one in the DRCOG region).

The envisioned regional ITS applications of the Strategic Plan, unconstrained by available resources, are listed in Exhibit 3.

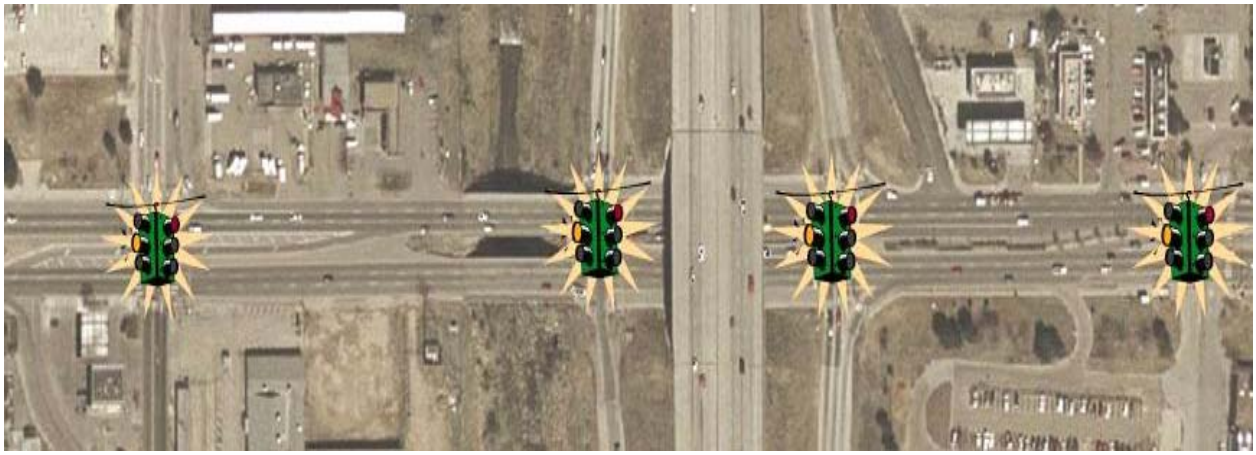


Exhibit 3: Regional Coordination ITS Elements

Short Term (0 to 5 years)

Regional Traveler Information

- provides information on road conditions, weather conditions, incident alerts, construction alerts, and alternative transportation services (e.g. RTD and RideArrangers)
- disseminates near real-time transportation condition information by means of existing infrastructures (i.e. fax, TV, radio, kiosks, internet, telephone)
- allows system managers to provide information to the traveling public and to private information service providers

Regional Traffic Control, Transportation Operations Data Sharing, and Event Management

- provides for the sharing of traffic information and possibly system control among transportation management centers to support a regional (multi-agency) operations strategy
- allows system managers to coordinate operations across jurisdictions and modes for unplanned operational changes (i.e. coordinate arterial signal systems with ramp meters or implement an incident diversion route signal timing plan)
- allows system managers to plan and manage transportation operations around special events (i.e. sports events).

Multimodal Coordination

- establishes two-way coordination between transit and traffic management centers
- allows system managers to utilize data collected from other modes for their own operations (e.g. transit travel time information can be used by traffic system managers to represent roadway system conditions; transit system managers can use incident information to reroute select buses).

Incident Management System

- provides communications links and protocols to exchange information between emergency management centers and transportation management centers at the regional level
- allows freeway and arterial system managers to employ incident detection using network surveillance
- allows transportation managers a greater capability to summon the appropriate resources to deal with incidents
- allows emergency service managers to more rapidly respond with appropriate equipment and personnel.

Road Weather Data Collection, Processing and Distribution Systems

- collects and distributes information on weather conditions and road surface conditions; field devices capture data such as temperature, precipitation, wind to determine icing or snow pack
- allows system managers to anticipate changing weather conditions and more rapidly implement appropriate responses for both traffic operations and maintenance (i.e. Maintenance Decision Support Systems [MDSS]).

Exhibit 3 (cont.): Regional Coordination ITS Elements

Emissions Monitoring and Management

- collects information on air quality pollutants at sites across the region
- allows system managers to post air quality advisories through traveler information services.

Speed Monitoring

- collects speed data at independent spot locations and automatically informs drivers of unsafe speeds.

Data Mart

- collects and stores data gathered from field devices for future analysis by system managers and transportation planners.

Medium Term (5 to 10 years)

Maintenance and Construction Activity Coordination

- assembles and provides real-time information regarding road or lane closures and detours across the region
- allows system managers to respond to the anticipated and actual changes in traffic patterns and also share this information with the traveling public.

Dynamic Ridesharing Service

- is a web-based service that dynamically and automatically matches travelers looking for car pools.

Data Warehouse

- serves as a regional transportation data repository for multiple agencies (and their individual data marts), spanning across modal and jurisdictional boundaries
- provides transportation planners and system performance evaluators the "biggest picture" regional transportation performance.

Parking Facility Management and Regional Parking Management

- monitor utilization at parking facilities using field devices to compute lot occupancy
- allow system managers to disseminate the parking availability information using traveler information services
- enable sub-area parking management strategies, for example among numerous parking lots supporting event venues or at a series of park-n-Rides serving a light rail line (traveler information for park-n-Rides may be combined with system to collect parking fees).

Disaster Response, Recovery and Evacuation

- can be supported by all available ITS devices; the public safety community will direct the transportation management community during disaster or emergency response.

Exhibit 3 (cont.): Regional Coordination ITS Elements

Long Term (after 10 years)

Transportation Infrastructure Protection

- provides equipment (i.e. cameras) to monitor critical transportation infrastructure
- allows emergency managers to detect and respond to threats against critical infrastructure.

Emergency Dispatch/Emergency Routing

- provides two-way communications between transportation agencies and emergency service providers; transportation agencies may share regional traffic information with emergency service provider dispatch to support dynamic routing of emergency vehicles to avoid potential delay; emergency service providers may share computer-aided dispatch systems information with transportation agencies so that they are aware of emergency conditions.

Commercial Vehicle Applications

- encompass several information systems and communications networks that support commercial vehicle operations
- provide for automated electronic clearance at weigh stations (the only weigh station within the DRCOG region is on I-70 at Dumont)
- provide other applications such as electronic administrative processes (commercial vehicle and driver credentialing and tax filing), safety monitoring and reporting, and oversize/overweight vehicle permitting/tracking.

Freeway Management

Freeways typically serve very high volumes of traffic and carry a significant portion of the region's longer trips. Freeways are greatly affected by congestion, incidents, special events, maintenance and construction, and weather. Deployment of ITS applications on the freeway system will provide system managers with timely information on current conditions, better tools for controlling flow, and improved capability to distribute traveler information to the public.

The direct benefits anticipated from actively managing the freeway system are reduced delay, increased person and vehicle throughput, smoother flow, fewer crashes, and quicker incident detection and response time (i.e. public safety and emergency service providers arrive quicker to the scene). Secondary benefits expected are more reliable travel times and reduced air pollutant emissions and a reduction in secondary incidents. ITS applications identified as appropriate for all or portions of the freeway system are described in Exhibit 4.

Freeway operations in the region will be coordinated between and among the CDOT ITS Branch, three CDOT regions, and the public highway authorities. The CDOT ITS Branch at the Colorado Transportation Management Center (CTMC) will have primary responsibility for monitoring freeways and state highways and providing pre-trip and en route traveler information dissemination. CDOT Regions 1, 4, and 6, at their respective regional offices (or centers), will have primary responsibility for freeway control (i.e. ramp metering) and HOV/HOT and reversible lane operations.

The CTMC currently maintains center-to-center communications with CDOT Regions 1 and 6 (as well as other local jurisdictional centers) for the exchange of information and possibly the shared control of roadside equipment. Outside of the DRCOG region, the CTMC also maintains center-to-center communications with the City of Colorado Springs Transportation Management Center and with Hanging Lake Tunnel Transportation Management Center for the same purpose. Expansion to CDOT Region 4 (in Greeley) is anticipated in the short term. The interconnection of regional TMCs with the CTMC will allow the CTMC to serve as the focal point for regional traveler information and regional transportation operations.

The E-470, Northwest, and the recently established Jefferson Parkway Public Highway Authorities (PHA) are responsible for operations along their respective facilities including electronic toll collection, freeway control, traffic information dissemination, and weather information processing systems. A link for sharing information will be established between the PHA operations centers and the CTMC.

The High Performance Transportation Enterprise (HPTE) is responsible for administration of the High Occupancy Toll (HOT) lanes within the region. The I-25 Express Lanes operating along portions of I-25 and US 36 are currently the only HOT lanes in operation. Expansion of HOT lanes along US 36 toward Boulder is an element of the preferred alternative identified in the US 36 Record of Decision in 2009. Subsequently, this HOT lane expansion was included in the Fiscally Constrained 2035 Regional Transportation Plan. Other regional corridors are being considered by HPTE for the implementation of HOT or managed lanes.

Exhibit 4 lists the ITS applications appropriate for freeways. The ITS applications along the regional freeway network are prioritized for implementation on the basis of the locations, types, and severity of the identified regional problems, as well as a reasonable and logical sequence for deployment. Table 1 describes the relevant ITS applications and the desired implementation priority on the freeway and state highway network. Figure 6 depicts the geographic deployment of the four key freeway ITS applications called “cornerstone applications” for ease of description. The “cornerstone applications” are network & probe surveillance, freeway control, traffic information dissemination, and incident management system.

Exhibit 4: Freeway Management Elements

Network surveillance & Probe Surveillance

- collect information on travel conditions through field devices deployed on or along the freeway (i.e. roadway detectors and video cameras) and collects travel times through devices installed on "probe" vehicles (i.e. over a half million toll tags in Colorado vehicles)
- allow system managers to monitor traffic flow conditions, identify and verify incidents, detect faults in system operations, and collect data which can be used for traffic strategy development and long range planning.

Freeway Control

- provides meters on ramps to cause vehicles to enter the freeway at a steadier rate and merge with less disruption (congestion often results during peak operations when freeway drivers slow to let ramp traffic enter).

Traffic Information Dissemination

- allows system managers, using DMS and HAR, to 1) notify travelers of construction, incidents, or other events; 2) potentially provide alternative travel suggestions; 3) provide travel time information; 4) provide parking availability information; 5) provide Amber Alert information; and, 6) provide air quality alert information.

Incident Management System

- allows transportation managers to employ incident detection using network surveillance and provides a greater capability to summon the appropriate resources to deal with incidents.

Roadway Service Patrols (or Courtesy Patrol)

- deploys service vehicles equipped and trained to respond to travelers in distress and to augment incident detection capabilities.

Roadway Maintenance Support Functions

- integrate MDSS with collection of weather data and maintenance vehicle location monitoring
- integrate weather data collection with the operation of automated de-icing equipment installed at key locations along the roadway.

HOV/HOT Lane and Reversible Lane Management

- monitors and controls the unique requirements of these freeway lanes, such as the time of day requirements of HOV lanes (and, perhaps in the future, variable occupancy requirements) and directionality of reversible lanes.

Electronic Toll Collection

- allows users of toll facilities to pay without stopping (as with the EXpress Toll service currently offered on E-470, Northwest Parkway and the I-25 Express Lanes)
- provides an enabling technology if the region implements additional roadway pricing schemes in the future.

Table 1: ITS Equipment Deployment Priorities

Name*	Segment		Network Surveillance			Probe Surveillance	Incident Management System	Freeway Control	Traffic Information Dissemination	HOV/ Reversible Lane Management	Service Patrol	Electronic Toll Collection	Roadway Maintenance Support Functions	
	Begin	End	LEVEL 1	LEVEL 2	LEVEL 3								MDSS Corridor	Deicing System
I-25	WCR 38	SH-7	Short	Short	Short	Short	Short		Short				Existing	
	SH-7	120th Avenue	Short	Medium	Medium	Short	Short	Short	Medium		Short			
	120th Avenue	US-36	Existing/ Planned	Short/ Planned	Short	Planned	Planned	Existing	Existing/ Short		Existing	Existing to 70th Ave. on I-25 Express Lanes	Planned**	
	US-36	I-70	Existing	Existing	Short	Planned	Planned	Short	Existing	Existing	Existing	Existing on I-25 Express Lanes	Planned**	
I-25	I-70	Santa Fe Drive	Existing/ Planned/ Short	Existing/ Planned/ Short	Short	Planned	Planned		Existing	Existing	Existing	Existing to 20th Street on I-25 Express Lanes	Planned**	Short on I-25/Bronco Bridge
I-25	Santa Fe Drive	C-470	Existing	Existing	Existing	Planned	Planned	Existing	Existing		Existing		Planned**	Planned on I-25/I-225 Flyover
I-25	C-470	Founders/ Meadows Parkways	Existing	Existing/ Short	Short	Short/ Planned	Short/ Planned	Short	Existing				Existing from Lincoln	
	Founders/ Meadows Parkways	El Paso/Douglas County Line	Existing/ Short	Existing/ Medium	Short	Short/ Planned	Short/ Planned	Short	Existing/ Short				Existing	
I-70	C-470	SH-58	Existing	Short/ Planned	Short/ Planned	Existing/ Planned	Short/ Planned	Long	Existing		Existing		Existing	
	SH-58	Wadsworth Boulevard	Short/ Planned	Short/ Planned	Short/ Planned	Existing/ Planned	Short/ Planned	Medium	Existing		Existing		Existing	
	Wadsworth Boulevard	I-25	Existing/ Planned	Existing/ Planned	Short/ Planned	Existing/ Planned	Short/ Planned	Short	Existing		Existing		Existing to I-76	
I-70	I-25	Peña Boulevard	Existing/ Planned	Existing/ Planned	Short/ Planned	Existing/ Planned	Short/ Planned	Existing/ Short	Existing		Existing		Planned**	
	Peña Boulevard	E-470	Existing	Long	Long	Existing	Short	Short	Existing				Planned** to Tower	
I-76	I-70	I-270	Short	Short	Medium	Medium	Medium	Medium	Short				Planned**	
	I-270	US-85 North	Medium	Existing/ Medium	Medium	Medium	Medium	Medium	Medium				Planned**	
	US-85 North	WCR 10	Long	Long					Long				Existing	
US-6	I-70	I-25	Existing	Existing	Short/ Planned	Existing/ Planned	Short/ Planned	Existing @ Federal/ Short	Existing		Existing		Planned**	
US-36	Baseline	Wadsworth Boulevard	Existing	Existing	Short	Planned	Planned	Existing	Existing/ Planned	Long***	Short	Long***	Existing	
	Wadsworth Boulevard	Pecos Street	Existing	Existing	Short	Planned	Planned	Short	Planned	Medium***	Existing	Short***	Planned**	
	Pecos Street	I-25	Existing	Existing	Short	Planned	Planned	Short	Planned	Existing	Existing	Existing		

Table 1 (cont): ITS Equipment Deployment Priorities

Name*	Segment		Network Surveillance			Probe Surveillance	Incident Management System	Freeway Control	Traffic Information Dissemination	HOV/ Reversible Lane Management	Service Patrol	Electronic Toll Collection	Roadway Maintenance Support Functions	
	Begin	End	LEVEL 1	LEVEL 2	LEVEL 3								MDSS Corridor	Deicing System
SH-58	US-6	I-70	Medium	Medium		Medium	Medium	Medium					Existing	
I-225	I-25	Parker Road	Existing	Existing	Planned		Short	Existing	Existing		Existing		Planned**	Planned on I-225/Tunnel Short on I-225/Parker Road
	Parker Road	I-70	Short	Existing	Short		Short	Existing	Existing		Existing		Planned**	Short on I-225/I-70 WB
I-270	I-25	I-70	Existing/ Short	Existing/ Short	Short	Medium	Medium	Existing/ Medium	Existing/ Short				Planned**	
US-285	SH-8	Lowell Boulevard	Existing @ Sheridan/ Long	Long	Long	Medium	Medium	Medium	Existing				Planned**	Planned on US 285/ Wadsworth
C-470	US-6	Wadsworth Boulevard	Short	Existing/ Planned	Short	Planned	Planned	Existing/ Short	Short/ Planned		Short		Existing	
	Wadsworth Boulevard	I-25	Existing @ Wadsworth/ Short	Existing/ Planned	Short	Planned	Short	Existing	Existing		Existing		Existing	
Peña Blvd.	I-70	DIA Terminal	Short	Short/ Planned	Medium	Existing/ Planned	Short/ Planned	Long	Existing/ Short					
I-70	Eisenhower Tunnel	C-470	Existing	Existing	Existing	Existing	Existing/ Planned	Existing @ Spots/ Short	Existing		Existing seasonal		Existing	
I-70	E-470	Bennett	Long	Long	Long	Short	Short	Short	Medium					
	Bennett	Arapahoe/Elbert Co Line		Existing @ US 36 E										
E-470	I-25/C-470	I-25/NW Pkwy	Existing	Existing		Short	Short		Existing			Existing		
NW Pkwy	I-25	US-36	Existing	Existing		Short	Short		Existing			Existing		
Jefferson Pkwy	SH-128	SH-93	Medium						Medium		Medium	Medium		
US-6	C-470	SH-119	Short	Short	Short	Short	Short	Short	Short				Existing to SH 58/93	
SH-119	US-6	Black Hawk	Short	Short	Short	Short	Short	Short	Short					
US-85	I-76	SH-7	Medium	Short	Medium	Medium	Medium	Medium	Short				Existing	
	SH-7	WCR 10							Short				Existing	
SH-7	US-85	I-25	Medium	Medium	Medium	Medium	Medium	Medium	Medium					
SH-7	I-25	Boulder	Medium	Medium	Medium	Medium	Medium	Medium	Medium					
SH-157/ SH-119	US-36	Weld Co. Line				Medium	Medium	Medium					Existing from SH 157	
	Weld Co. Line	I-25											Existing	

Table 1 (cont): ITS Equipment Deployment Priorities

Name*	Segment		Network Surveillance			Probe Surveillance	Incident Management System	Freeway Control	Traffic Information Dissemination	HOV/ Reversible Lane Management	Service Patrol	Electronic Toll Collection	Roadway Maintenance Support Functions	
	Begin	End	LEVEL 1	LEVEL 2	LEVEL 3								MDSS Corridor	Deicing System
US-287	US-36	Larimer Co. Line				Medium	Medium	Medium					Existing from SH 7	
	SH-128	US-40				Medium	Medium	Medium						
SH-52	SH-119	I-25											Existing	
	I-25	WCR 19	Medium						Medium				Existing	
SH-66	US-36	I-25											Existing	
	I-25	WCR 19	Long						Long				Existing	
SH-30	6th Ave.	US-83				Medium	Medium	Medium						
US-85	I-25	I-25	Medium	Medium		Medium	Medium	Medium	Medium					
SH-177	US-285	C-470				Medium	Medium	Medium						
US-83	SH-30	Bayou Gulch	Medium	Medium		Medium	Medium	Medium	Medium					Planned on US 83/SH 88
US-285	Lowell	SH-30				Medium	Medium	Medium						
SH-121	US-36	C-470				Long	Long	Long				Short		
SH-2	I-76	US-285				Long	Long	Long						
SH-88	US-40	US-285				Medium	Medium	Medium						
	I-25	Peoria				Long	Long	Long						
SH-79	I-70	Bennett							Medium					
SH-103	I-70	SH-73							Medium					
US-40	I-70	Empire							Medium					

* The order of the corridors in the table does not denote any form of priority.

** Maintenance vehicles will be equipped with MDSS equipment in the Medium term.

*** CDOT has received partial funding to implement an HOV/HOT lane along US 36,

planned = near term with funding programmed
short term = within 5 years
medium term = between 5 and 10- years
long term = after 10 years
blank = no requirement for deployment

Network Surveillance

LEVEL 1 – CCTV camera surveillance at key locations
LEVEL 2 – Limited coverage of vehicle detectors
LEVEL 3 – Increased density of CCTV camera surveillance and vehicle detector coverage

Probe Surveillance – system to anonymously collect toll tag information along freeways to determine real-time travel times

Incident Management System – CTMC detects and confirm freeway incidents, coordinates response with other jurisdictions, and distributes traveler information

Freeway Control – ramp metering system

Traffic Information Dissemination – dynamic message signs and highway advisory radio

HOV/Reversible Lane Management – safe operations of reversible lanes

Service Patrol – Courtesy Patrol zones

Electronic Toll Collection – toll collection and enforcement on toll roadways and lanes

MDSS – roadway segments included in maintenance decisions support system (combining weather data and maintenance vehicle location monitoring)

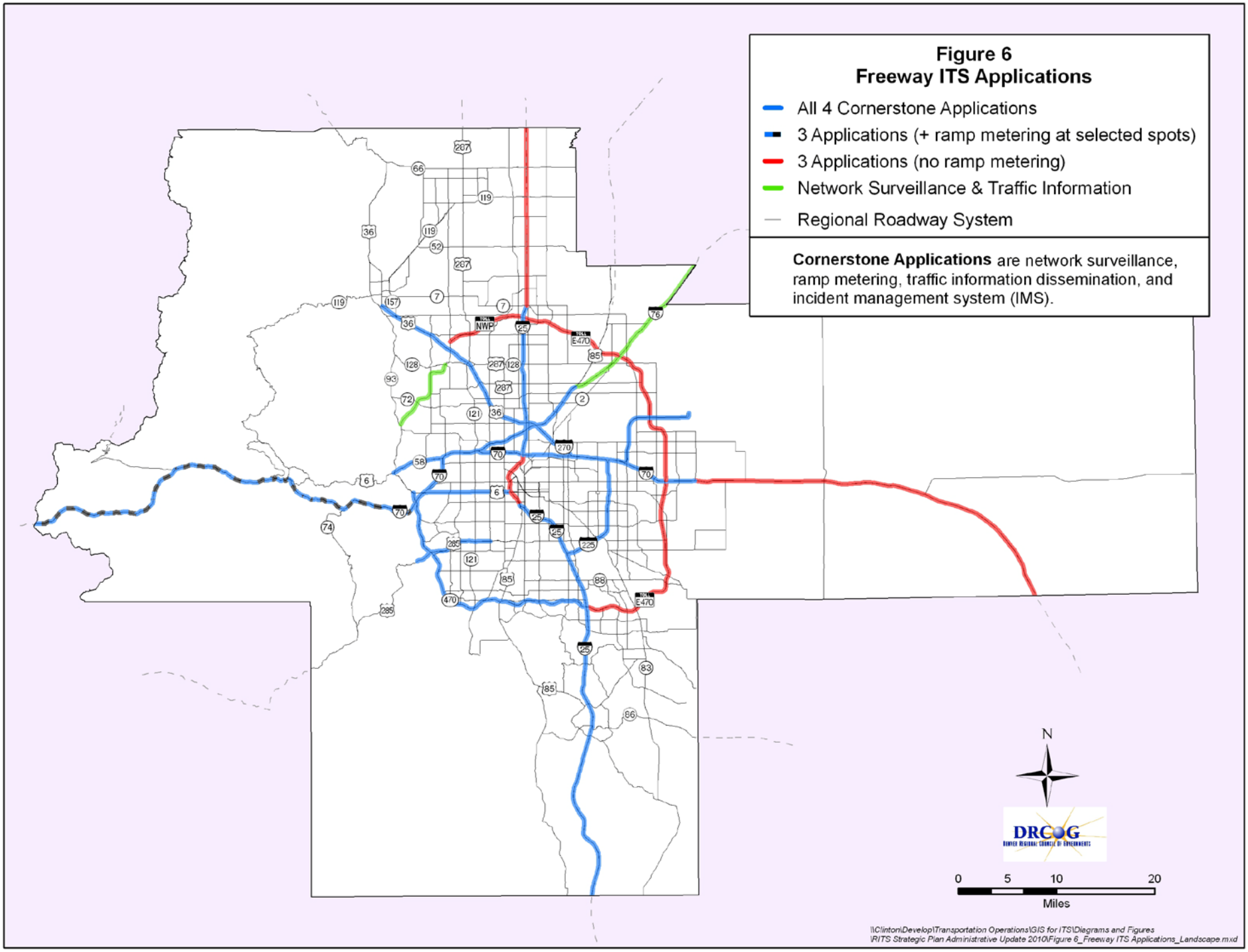


Figure 6
Freeway ITS Applications
All 4 Cornerstone Applications
3 Applications (+ ramp metering at selected spots)
3 Applications (no ramp metering)
Network Surveillance & Traffic Information
Regional Roadway System
Cornerstone Applications are network surveillance, ramp metering, traffic information dissemination, and incident management system (IMS).
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\RITS Strategic Plan Administrative Update 2010\Figure 6_Freeway ITS Applications_Landscape.mxd

Arterial Management

Exhibit 5 identifies the ITS applications appropriate to the arterial system. For arterials, a slightly different approach for listing deployment priorities of the ITS applications on the arterial system was used. Five hierarchical levels of arterial ITS investment are identified (see Table 2) rather than short-, medium- and long-term investment priorities. In addition, many of the regional ITS applications from Exhibit 2 that are applicable to arterials are also included to provide a complete context for the deployment on arterials.

ITS applications on the arterial system will, for the most part, provide smoother flow on the arterial network. Any arterial condition information will be assembled for dissemination to the traveling public and shared with transportation and transit managers. Direct benefits anticipated include reduced travel time, stops and delay, and fewer incidents. Secondary benefits expected are reduced pollutant emissions, decreased energy consumption, and less cut-through traffic on neighborhood streets.

For purposes of arterial traffic management, all agencies that operate traffic signals are assumed to have a traffic management "center." In the surface street control context, this simply means the location of the traffic signal central control computer or, for systems with field master controllers, the central monitoring computer. The physical attributes or complexity of these centers is not of concern at this time. They may be dedicated centers as in Denver or Lakewood, or they may be simply a desktop where the traffic engineer's computer resides. As with freeway management, what is important is that these centers be interconnected with communications for the exchange of information and possibly control. Individually, these centers, like their freeway counterparts, are responsible for coordinating the management of the facilities under their specific control, and for the data mart application. These centers also serve as the focus for facilitating the regional applications.

As noted in Table 2 and Exhibit 5, “basic” surface street control is at the highest level of the arterial ITS hierarchy and is currently deployed across the entirety of the principal arterial network where traffic signals exist or are anticipated. For the network surveillance, traffic information dissemination, and traffic responsive surface street control arterial ITS applications, the arterial network is stratified, with these deployments proposed in the second and third levels on key arterials (“emphasis corridors for operational improvements” as identified in the *2035 Metro Vision Regional Transportation Plan*) or key locations on those corridors. Figure 7 depicts these emphasis corridors.

Exhibit 5: Arterial Management Elements

Surface Street Control

- interconnects and manages the traffic signals in a jurisdiction; several different levels for surface street control are identified in Table 2:
  - "basic" surface street control is the most relevant and effective ITS application on the arterial network and must be operating before higher levels of surface street control or additional ITS applications can be implemented.
  - traffic "responsive" control implements specific timing plans based on detected traffic conditions instead of following a time-of-day schedule.
  - traffic "adaptive" control uses the signal system to automatically develop and implement timing plans in real time based on detected field conditions.

Network Surveillance and Probe Surveillance

- collects travel information through field devices deployed on or along the roadway, as described under freeway management (i.e. roadway detectors and video cameras) and collects travel times through devices installed on "probe" vehicles
- allows arterial system managers to monitor traffic and roadway conditions
- is necessary for levels of surface street control beyond basic.

Transit Signal Priority

- implements equipment at signalized intersections that enables transit signal priority, which gives some level of preference to transit vehicles at signalized intersections (for example an early or extended green), which helps improve transit travel time reliability and may reduce scheduled run time.

Traffic Information Dissemination

- provides highway advisory radio and dynamic message signs on arterials to provide travelers information to be used for making trip decisions en-route.

Roadway Maintenance Support Functions

- integrate MDSS with collection of weather data and maintenance vehicle location monitoring
- integrate weather data collection with the operation of automated de-icing equipment installed at key locations along the roadway.

HOV Lane Management

- monitors and controls the unique requirements of arterial HOV lanes, such as the time of day requirements of HOV lanes (and, perhaps in the future, variable occupancy requirements).

Standard Railroad/Grade Crossing

- addresses ITS applications at arterial/railroad at-grade crossings, including advanced train detection and railroad crossing/traffic signal system interfaces.

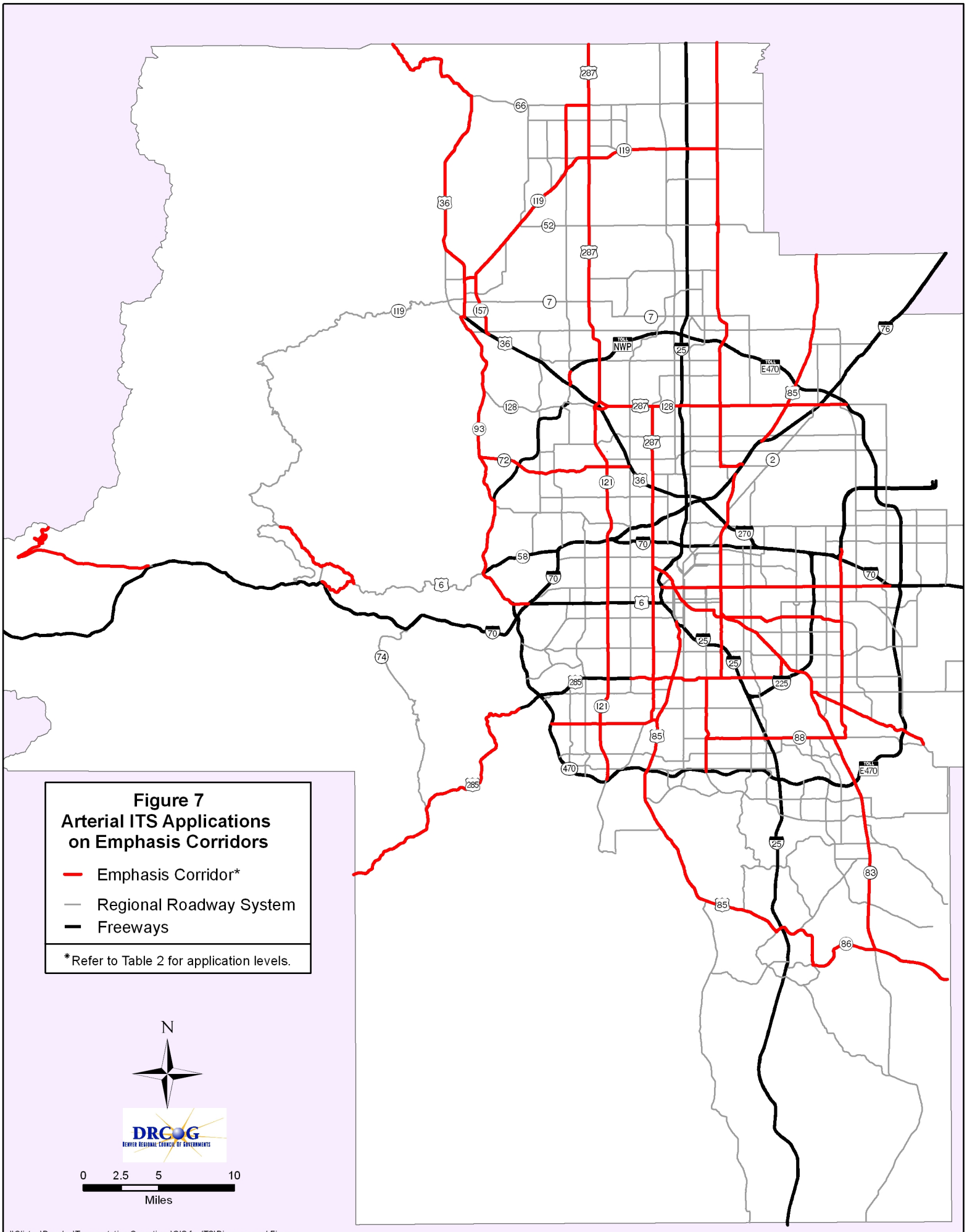
Railroad Operations Coordination

- provides communications between transportation management and railroad operations centers
- allows transportation operators to better anticipate and respond to railroad operations.

Table 2: ITS Investment Hierarchy for Arterial Network

ITS APPLICATIONS	FOCUS	DEPLOYMENT	COVERAGE/TASK
First Level Priority (highest)			
Surface street control	RS	Basic Control	Entire signalized principal arterial network.
Second Level Priority			
Traveler information	RM	Initial Deployment	Consolidate traveler information; connect advanced TMCs
Incident management	RM	Initial links to EMCs	Needs based; priority for IMP corridors
Network Surveillance	RS	Initial deployment	Needs based; priority for emphasis corridors
Regional traffic control	RS	Initial deployment	Priority for emphasis corridors; connect advanced TMCs
Multi-modal coordination	RM	Initial Deployment	Build link to transit as regional traffic control comes on-line
Third Level Priority			
Incident management	RM	Expanded links to EMCs	Needs based; priority for emphasis corridors
Surface street control	RS	Traffic responsive	Needs based; priority for emphasis corridors
Traffic information dissemination	RS	Initial deployment	Needs based; priority for emphasis corridors
HOV Lane management	RS	Initial deployment	At HOV lane locations
Roadway Maintenance Support Functions	RS/CF	Initial deployment	Needs based; priority for emphasis corridors
Transit signal priority	RS	Trial deployment	Pilot deployment on selected arterials
Probe surveillance	RS	Trial deployment	Attempt to adapt freeway probe surveillance
Fourth Level Priority			
Traveler information	RM	Expanded	To rest of region as appropriate
Network Surveillance	RS	Expanded	To remainder of network as appropriate
Regional traffic control	RM	Expanded	Deploy to remainder of TMCs
Roadway Maintenance Support Functions	RS/CF	Expanded	Expand as needed; coordinate with freeway maintenance
Transit signal priority	RS	Expanded	Pilot deployment on selected arterials
Standard railroad grade crossing	RS	Initial deployment	Arterial grade crossings; needs based
Fifth Level Priority			
Probe surveillance	RS	Expanded	Expand deployment if proven to be successful in trial
Railroad operations coordination	CF	Initial deployment	As appropriate, link traffic centers to RR operations centers
Surface street control	RS	Traffic adaptive	Needs based; priority for emphasis corridors
Traffic information dissemination	RS	Expanded	To rest of network as appropriate.

RS = roadside focus
RM = regional management
CF = center function
EMC = Emergency Management Center
TOC = traffic operations center
IMP = incident management plan



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Transit Operations & Management

A key objective of using advanced technologies within the transit system is to make transit a more competitive, predictable and convenient choice for travelers, leading to increased ridership. An increased transit market share yields numerous benefits, including reduced air pollutant emissions, decreased energy consumption, and less congestion in some locations.

ITS applications within the transit system provide transit managers with timely information on current conditions. This information can be used to support operations (dispatch and control of vehicles) and traveler information (distribution of real-time information to transit users). Other ITS applications are also deployed to improve traveler safety, enhance traveler security, make paying fares easier and to allow better tracking of ridership. ITS applications identified as desired for the transit system are listed in Exhibit 6.

RTD has implemented, or is planning to implement in the short term, many of these ITS applications. Improvements in transit vehicle tracking; deployment of automated passenger counting equipment; deployment of advanced transit systems for both fixed-route and demand-responsive operations; and, expansion of transit traveler information dissemination are at the core of RTD's operations, which will be continually advanced to meet the needs of the agency. MyStop, a phone-based transit traveler information dissemination system has been completed and implementation of DMS at key park-n-Ride lots that serve as major transit transfer points is nearly complete. Geographic expansion of these ITS elements will grow with the investment in FasTracks.

RTD's traveler information capabilities will be integrated and coordinated with the regional traveler information consolidation to be led by CDOT. In addition, RTD will coordinate with regional transportation operations data sharing activities by providing transit operations computer-aided dispatch data to become part of the City and County Transportation Management Desktop secure website, which will also be available to RTD dispatch to support their activities.

RTD's transit security goal is to deploy video surveillance in the transit vehicles, the transit centers and the rail stations, and at parking garage facilities (video surveillance at park-n-Ride lots will be deployed on an as-needed basis).

RTD is replacing/upgrading its fare box system in the short term while also exploring the deployment of smart cards for transit fare management. A pilot deployment is planned for Boulder for the short term for evaluation prior to a system-wide deployment in the medium term. The advanced transit maintenance application is desired to be fully implemented in the long term. Parking facility management/regional parking management was deployed as part of T-REX at stations on the southeast line; these implementations are being evaluated as a pilot. In addition, as part of parking facility management, RTD has deployed a system to collect fees for parking at select RTD parking facilities while monitoring for violations.

ITS Deployment Summary

Exhibit 7 summarizes the priorities for deployment of the ITS applications grouped into the transportation service areas within the region. Items nearer to the top left corner of the exhibit have higher emphasis for implementation than items nearer to the bottom right corner.

Note that other applications may be considered at such time that they are proposed for evaluation through the DRCOG MPO planning process (e.g. new or expanded HOV and reversible facilities, new or expanded toll or HOT lane facilities, new or expanded emissions monitoring and management, etc.).

Exhibit 6: Transit Elements

Short Term (0 to 5 years)

Transit Vehicle Tracking

- identifies the location of transit vehicles. RTD's fleet has been provided with an automated vehicle location (AVL) system for several years, which is set for replacement in 2013
- allows transit managers to track vehicles' real time schedule adherence and supports demand-responsive transit systems, transit traveler information and transit security; AVL may also facilitate transit signal priority functions.

Advanced Transit Operations

- supports demand-responsive operations
- allows transit managers to use the information collected by the AVL system to dictate schedule adjustments or allocate fleet resources in response to real time traffic, demand, and availability conditions.

Automated Passenger Counting

- automatically registers passenger boardings (and possibly passenger exits)
- allows transit managers to both to make operational decisions and to adjust route schedules
- provides opportunity to support conditional transit signal priority (i.e. priority is only granted in the case where the bus occupancy exceeds a threshold).

Transit Traveler Information Dissemination

- employs field devices to provide information to transit users (i.e. transit stop enunciators and 'next stop' displays on buses; real-time websites, kiosks and bus arrival signs at bus stops); this same information can be distributed to personal digital assistants and cell phones through regional traveler information system.

Transit Fare Management

- uses electronic equipment on transit vehicles to collect fare payments (i.e. smart fare card)
- speeds the process of fare payment, minimizing delays, and provides a wealth of utilization data useful for route and service planning.

Exhibit 6 (cont): Transit Elements

Medium Term (5 to 10 years)

Transit Signal Priority

- provides equipment on buses to enabling communications with the signalized intersection and transit signal priority. Transit signal priority gives some level of preference to transit vehicles at signalized intersections (for example an early or extended green), which helps improve transit travel time reliability and may reduce scheduled run time.

Parking Facility Management and Regional Parking Management

- allow transit managers to apprise potential transit riders of park-n-Ride lot occupancy status and parking alternatives
- provide opportunity for integration with RTD park-n-Ride fee collection.

Long Term (after 10 years)

Transit Security

- performs surveillance at critical locations of the transit system, and operator communications for security (i.e. video cameras deployed at station platforms, parking areas, in tunnels and walkways, and driver mayday buttons); enhanced security promotes transit use.

Advanced Transit Maintenance

- monitors the status transit vehicles' critical components by means of on-board condition sensors and communication devices
- allows transit managers to better maintain equipment, yielding increased safety and reliability.

Multi-modal Coordination

- integrates and coordinates with CDOT's traveler information system

Exhibit 7: Key ITS Applications Summary

	Regional Traveler Information	Regional Transportation Operations & Management	Regional Traffic Incident Management	Transit Operations & Management	Maintenance and Construction	Regional Parking Management	Regional Data Management	Regional Emergency Management	Commercial Vehicle Operations
Short Term 0-5 Years	• consolidate access to regional traveler information (include freeways, arterials, transit and transportation alternatives) • expand probe surveillance on freeways • implement pilot probe surveillance on arterials	• develop regional transportation operations display mechanism • connect TMCs and public safety operations • develop regional operational strategies • coordinate signal operations on emphasis arterials • pilot Transit Signal Priority (TSP) projects • implement ramp meters as warranted • deploy speed monitoring as needed	• develop a unified, regional incident management plan • expand incident detection and response on freeways • cities and counties explore incident detection for arterials • initiate improvements in communications and protocols with public safety community	• replace and/or upgrade automatic vehicle location (AVL) system • expand traveler information dissemination on buses and at bus stops • expand automated passenger counting deployment • expand transit security on buses and at transit facilities • expand advanced transit operations functions • pilot TSP projects	• CDOT and Denver to expand use of MDSS • CDOT and Denver to explore methods to coordinate separate systems • plan and deploy regional environmental sensor stations (weather stations, de-icing stations and other weather detection related equipment)		• define data warehouse network and protocols • establish data mart at TMCs consistent with data warehouse network and protocols	• coordinate with public safety community to identify critical infrastructure • support public safety community planning efforts for disaster operations, evacuation and recovery	• CDOR to coordinate with CDOT to improve traveler information functions at port-of-entry
Medium Term 5-10 Years	• implement dynamic ridesharing website • expand participation in consolidated traveler information • expand network surveillance coverage on freeways • expand network surveillance on emphasis arterials • expand probe surveillance on arterials • deploy additional DMS of freeways and emphasis arterials	• expand participation in regional operations display and coordination (as new TMCs are deployed) • implement ramp meters as warranted • expand TSP deployment as desired • deploy speed monitoring as needed	• develop database tool to support regional IMP • improve communications links and protocols with public safety community • expand freeway service patrols (both on freeway and to cover interchange area on arterials) • expand incident detection and response on freeways and emphasis arterials	• expand traveler information dissemination on buses and at bus stops • expand automated passenger counting • expand transit security on buses and at transit facilities • expand TSP deployment as desired	• deploy database to coordinate and track, in real-time, maintenance and construction activity across the region • deploy environmental sensor stations according to plan • coordinate with federal initiative to share weather data nationally, Clarus	• implement parking information systems for RTD p-n-R (as part of fee collection system) • implement parking information systems for Denver CBD event centers	• fulfill regional network for data collection • establish data warehouse	• continue to support public safety community planning efforts for disaster operations, evacuation and recovery	• CDOT to deploy roadside commercial vehicle safety detection systems
Long Term more than 10 years	• expand participation in consolidated traveler information • expand network surveillance coverage on freeways • expand network surveillance beyond emphasis arterials • expand deployment of DMS on freeways and arterials	• expand regional operations display and coordination to new TMCs • implement ramp meters as warranted • expand TSP deployment if desired • implement coordinated systems with railroad operations • deploy speed monitoring as needed	• expand incident detection and response on freeways and arterials	• implement systems on buses to assist with transit vehicle maintenance • deploy smart card fare collection • expand traveler information dissemination on buses and bus stops	• expand use of database to coordinate and track, in real-time, maintenance and construction activity across the region • deploy environmental sensor stations according to plan • coordinate with federal initiative to share weather data nationally, Clarus	• expand parking information systems to Southeast Corridor • expand parking information systems for RTD p-n-R (as part of fee collection system)		• link to transportation operations display to public safety dispatch • continue to support public safety community planning efforts for disaster operations, evacuation and recovery • ITS deployment to support critical infrastructure protection functions	• Work with PrePass to improve functionality of PrePass system • link PrePass system to CDOT Permitting • link CDOT Permitting to PrePass • improve driver credentialing and tracking

3. Capital and Operations/Maintenance Costs

Table 3 illustrates that it would cost approximately $447 million (2008 dollars) to implement the desired ITS elements of the Plan. For perspective, this equates to about 2 percent of the regional roadway and RTD FasTracks total capital needs identified in the 2035 Metro Vision Regional Transportation Plan.

> All road construction and transit projects should incorporate recommended ITS applications as an integral part of the project.

It is estimated that there will be only about $270 million in revenues available from direct sources to potentially address the ITS implementation costs. Such sources include:

- DRCOG Regional Intelligent Transportation System Pool and DRCOG Traffic Signal System Improvement Program Pool: roughly $95 million in federal Congestion Mitigation and Air Quality (CMAQ) funds;
- Local Funds: roughly $25 million as both non-federal match for the CMAQ funds and local projects; and,
- CDOT Funds: roughly $75 million from the Mobility (Congestion Relief) and Safety (Traffic Signal) programs; and,
- RTD Funds: roughly $75 million identified for equipment improvements and transit traveler system improvements.

The resulting shortfall makes it critical that capital ITS elements be routinely embedded and required within all roadway or transit construction projects. This will achieve greater cost savings and efficiencies. The shortfall also dictates that the best projects are carefully considered and evaluated when funding decisions are made.

Table 3: Capital Costs for Recommended ITS Applications

	Capital Cost (million)	Design Cost (million)	Total Implementation Cost (million)
Freeways	$97.0	$9.7	$106.7
Arterials	$96.2	$9.6	$105.8
Transit	$170.0	$17.0	$187.0
Regional	$43.1	$4.3	$47.5
Total	**$406.4**	**$40.6**	**$447.0**

It is extremely important that maximum benefits for the traveling public are derived from the ITS system. There must be adequate staffing and resources to operate and maintain the ITS elements (monitoring and detection devices, signs, communications, management centers, traffic signal systems, etc.), as well as replace the infrastructure as it exceeds its useful life. The cost for these tasks is estimated at an average of $104 million per year to optimally operate and maintain the entire system as fully envisioned (including existing operations) or about $2.9 billion total through 2035. About $1.5 billion in revenues is expected to be available from ongoing sources such as local agency operational budgets and the traffic operations maintenance programs of the CDOT ITS Branch and CDOT Regions 1, 4 and 6.

The use of advanced technologies and specialized systems represent an evolution of business practices at transportation agencies and their provision of services – most items are introduced to improve the efficiency of the services currently offered. Therefore, a portion of the operations and maintenance funding requirements for these systems will become part of the annual budgets established by the transportation agencies. However, it has been specifically recognized by many agencies across the region that active transportation management, involving full-time observation and system management, requires additional investment in additional staffing and skills training beyond current funding. This represents the bulk of the significant shortfall in operations and maintenance funding that will prohibit drivers, businesses, commercial vehicles, and transit riders from reaping the most potential benefits from the ITS system.

APPENDIX

Adopting Resolution

DENVER REGIONAL COUNCIL OF GOVERNMENTS

STATE OF COLORADO

BOARD OF DIRECTORS RESOLUTION NO. 19, 2010

A RESOLUTION TO ADOPT THE ADMINISTRATIVE UPDATES TO BOTH THE DENVER REGIONAL INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC PLAN AND THE DENVER REGIONAL TRANSPORTATION OPERATIONS STRATEGY.

WHEREAS, the Denver Regional Council of Governments, as the Metropolitan Planning Organization, is responsible for the operation and maintenance of the continuing 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, the Denver Regional Intelligent Transportation Systems (ITS) Strategic Plan is needed to provide a regional vision regarding use of specific ITS applications to address regional transportation problems and provide a policy basis for development of the federally required Regional Intelligent Transportation Systems Architecture; and

WHEREAS, the Denver Regional Transportation Operations Strategy is needed to guide improvements in coordination and cooperation between regional jurisdictions and agencies for the purpose of improving regional transportation operations; and

WHEREAS, the Denver Regional Council of Governments Metropolitan Planning Area boundary changed in February, 2008, to include southwest Weld County; and

WHEREAS, both documents, being completed in December 2007, required administrative updates to account for the Metropolitan Planning Area boundary change; and

WHEREAS, the Regional Transportation Committee has recommended approval of the administrative updates for both the Denver Regional Intelligent Transportation Systems Strategic Plan and the Denver Regional Transportation Operations Strategy.

A RESOLUTION TO ADOPT THE ADMINISTRATIVE UPDATES TO BOTH THE DENVER REGIONAL INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC PLAN AND THE DENVER REGIONAL TRANSPORTATION OPERATIONS STRATEGY.

NOW, THEREFORE, BE IT RESOLVED that the Denver Regional Council of Governments hereby adopts the administrative updates to both the Denver Regional Intelligent Transportation Systems Strategic Plan, dated October 2010, and the Denver Regional Transportation Operations Strategy, dated October 2010.

RESOLVED, PASSED AND ADOPTED this 20th day of October, 2010 at Denver, Colorado.

Rod Bockenfeld, Chair
Board of Directors
Denver Regional Council of Governments

ATTEST:

Jennifer Schaufele, Executive Director

DENVER REGIONAL COUNCIL OF GOVERNMENTS

DENVER REGIONAL INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC PLAN

1290 BROADWAY • SUITE 700 • DENVER COLORADO 80203 - 5606
TEL 303-455-1000 • FAX 303-480-6790 • EMAIL: DRCOG@DRCOG.ORG • WEBSITE: WWW.DRCOG.ORG