

The Denver Region Traffic Signal System Improvement Program

Planning for Management and Operations

The Denver Regional Council of Governments (DRCOG) works with over 30 local jurisdictions on the Traffic Signal System Improvement Program (TSSIP), a combination of management and operations strategies designed to time and coordinate traffic signals in the Denver region. The program is updated regularly through a collaborative planning process involving representatives from the region's operating agencies. Each agency identifies critical needs yet understands that the focus of the program is improving signals at regionally significant arterials. The traffic signal program is identified as one of six action strategies in DRCOG's 2035 Metro Vision Regional Transportation Plan to support the region's policy of effective management and operations. It serves as a key component of DRCOG's congestion mitigation program and funding is programmed for TSSIP through the transportation improvement program (TIP). The program has already improved operations at more than a thousand traffic signals in the region — reducing travel times, fuel consumption, and vehicle emissions. Future plans include transit signal priority, expanded signal timing, and development of regional performance measures.

Background

The Denver Regional Council of Governments (DRCOG) serves as the metropolitan planning organization for the Denver region, home to approximately 2.7 million residents in ten counties in north-central Colorado. There are now more than 3,500 traffic signals maintained and operated by 32 different jurisdictions within the Transportation Management Area (TMA).

In 1989, the traffic signal operating agencies in the Denver area concluded that there was a need for interjurisdictional timing and coordination of traffic signals. These agencies selected DRCOG to develop a regional program because DRCOG was viewed as an agency that was regional in nature and had the capabilities to facilitate cooperation between multiple jurisdictions. DRCOG and the traffic signal operating agencies worked together to begin a small signal timing and coordination program funded by an energy grant. The program provided for one traffic engineer to assist in signal timing and coordination in the region and no capital improvements.

Although the benefits were modest, the first few years of the program proved its worth to the region and impressed the DRCOG Board of Directors. When the Denver region began to receive Congestion Mitigation/Air Quality (CMAQ) funds due to the adoption of the Intermodal Surface Transportation Efficiency Act (ISTEA), more funding became available for traffic signal improvements. In 1994, the Traffic Signal System Improvement Program (TSSIP) was officially adopted and an annual budget of \$1 million was provided in the TIP.

How TSSIP Functions

The purpose of TSSIP is to implement cost-effective traffic signal timing and coordination improvements that reduce travel time and harmful auto emissions within the DRCOG TMA.



Currently, there are 32 jurisdictions participating in the TSSIP including Adams County, Arapahoe County, Boulder County, Douglas County, Jefferson County, Arvada, Aurora, Boulder, Broomfield, Brighton, Castle Rock, Commerce City, Denver, Englewood, Federal Heights, Golden, Greenwood Village, Lafayette, Lakewood, Littleton, Longmont, Louisville, Northglenn, Parker, Sheridan, Superior, Thornton, Westminster, Wheat Ridge, as well as the Colorado Department of Transportation’s (DOT) Region 1, Region 4, and Region 6.

DRCOG approaches this program as a partnership among DRCOG and the traffic signal operating agencies. Regular program updates are made through a collaborative dialogue led by DRCOG, and operating agencies work with each

other to implement the projects defined in the program. In addition to coordinating TSSIP, DRCOG is responsible for conducting timing and coordination tasks on a project-by-project basis for the projects identified in the TSSIP and as requested by individual operating agencies. Through these tasks, DRCOG identifies corridors to retime, develops and fine-tunes timing plans, and documents improvements and benefits. In turn, the operating agencies are responsible for maintaining and operating their signals, maintaining the timing, and reviewing and approving plans. In addition to the capital projects that are listed in the TSSIP, the program maintains a minor capital improvement contingency fund. Annually, operating agencies can apply to compete for these funds for the purchase of signal system equipment. The operating agencies are responsible for installing any new equipment they receive.

The TSSIP is updated every 3 to 4 years through a collaborative planning process involving representatives from the region’s operating agencies and was most recently updated in 2007. Currently, the budget for the program is approximately \$3.7 million per year for the period 2008-2013; DRCOG serves as the facilitator for the program and its Board of Directors approves each new proposed program update. TSSIP is a set of management and operations strategies that are a significant component to DRCOG’s congestion mitigation program that also include travel demand management and intelligent transportation systems (ITS). The traffic signal program is identified as one of six action strategies in DRCOG’s *2035 Metro Vision Regional Transportation Plan* to support the region’s policy of management and operations: “Make the best use of existing transportation facilities by implementing measures that actively manage and integrate systems, improve traffic operations and safety, provide accurate real-time information, and reduce the demand for single-occupant motor vehicle travel.” Additionally, DRCOG’s regional transportation plan commits funding to TSSIP over the long term. CMAQ funding is programmed for the combined traffic signal and ITS program in the TIP.

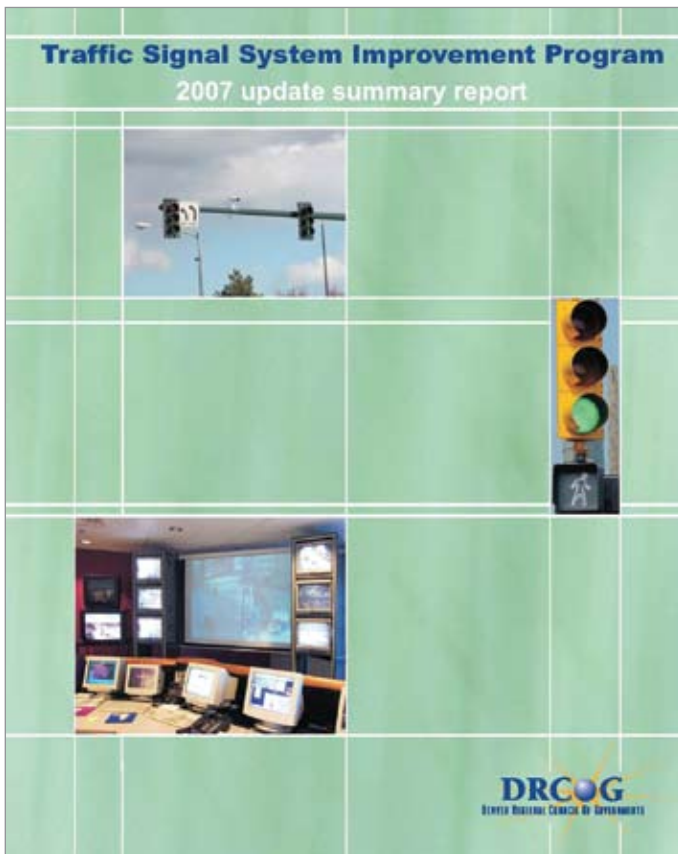


Figure 1. The TSSIP is updated every few years. It contains a thorough signal system inventory, a description of needs, an implementation schedule, and tracks progress. Source: DRCOG.



The TSSIP update process determines which signal needs in the region will be addressed through the programmed funds. At the onset of the update process, DRCOG invites all 32 signal operating agencies to be part of a work group and participate in the program. The participant level ranges from transportation director to traffic engineer, depending on the size of the participant's agency.

The process begins with an update of the regional inventory of the existing signal system. Information on the type of signal control system, number of signals, and hardware for each operating agency is recorded into a GIS database maintained by DRCOG. After assessing current conditions, the working group does a needs assessment. Each agency identifies its critical needs with an understanding that the focus of the TSSIP is on regionally significant signals on main arterials. At the working group meetings, the participants develop a list of evaluation criteria for prioritizing signal improvement needs. The participants evaluate the collective needs based generally on:

- Criticality of need.
- Importance of the corridor.
- Strategic need for the communication link.
- Local priorities and synergies.
- Cost-effectiveness.

The TSSIP 2007 update is compiled in a written document that contains a thorough signal system inventory, a description of needs, and an implementation schedule of the specific projects to be performed. In addition, the document records the progress that has been made in the region since the last TSSIP update and it gives data on the specific benefits gained from the program.

Outcomes

Determining and documenting the benefits and effectiveness of currently ongoing and programmed projects is critical to the TSSIP program. Because the TSSIP is funded with Federal CMAQ funds, the benefits of every project must be measured and reported.



Figure 2. Map of TSSIP projects completed from June 2003 until the 2007 update.
Source: DRCOG.



There are now more than 3,500 traffic signals maintained and operated by 32 different jurisdictions within the Denver TMA. Nearly 2,600 of these signals are considered key signals (signals on principal arterials and major regional arterials). In addition, more than 1,940 key signals are currently connected to a traffic signal control system. All agencies that have key signals and more than 20 signals to operate have a signal control system.

Since the 2003 TSSIP update, the program has assisted 16 operating agencies in these upgrade efforts and has completed capital improvement projects for 55 arterial roadway sections. The program also completed 19 timing and coordination projects and 4 traffic responsive control projects during the 2003-2008 period. These projects improved operations for more than 1,100 traffic signals throughout the region and reduced delay by nearly 36,000 vehicle hours per day, reduced fuel consumption by more than 15,000 gallon per day, and reduced air pollution emissions (mainly carbon monoxide) by more than 45,000 pounds per day. Performance results are summarized and distributed to the DRCOG Board of Directors so that it can use those findings when it makes decisions on how to distribute funds across programs. Thus far, the continued success of the TSSIP has warranted maintaining its level of funding.

Future Directions

During the 2008-2013 period, a number of critical needs that have been identified by DRCOG will receive attention. These include:

Capital Improvements to Signal Systems

- Upgrade and replace insufficient/unreliable communications for more than 25 corridors (330 signals).
- Expand the system control to “key signals” not on a system for more than 12 corridors/areas or projects (160 signals).
- Improve the efficiency of signal system control in four jurisdictions.

System Engineering and Design

The TSSIP will fund system studies and design activities required for the capital projects identified, as well as coordination for regional transportation management and ITS planning efforts.

Special Projects

The TSSIP will implement three special projects: transit signal priority (continued from efforts begun during the previous plan period), Denver Central Business District signal timing (more than 200 traffic signals), and the initial development of a regional performance measures program for traffic signal system operations.



Timing and Coordination

This fundamental part of the program anticipates continued development of new time-of-day (TOD) schedule-based timing plans on a recurring basis in a three- to five-year cycle or as needed for major corridors and for all capital projects implemented (including miscellaneous signal equipment purchases). Some additional funds will be targeted for selectively developing TOD plans that address weekend traffic patterns. Development and evaluation of timing plans for traffic responsive control achieved successful results in the past few years through trial projects and will now be included as they arise.

References

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