

Congestion Mitigation and Air Quality Program
2005 Annual Report

August 16, 2006

Introduction

The purpose of the Congestion Mitigation and Air Quality Improvement (CMAQ) Program is to reduce vehicle related pollution that plays a major role in the deterioration of air quality in urban areas. The Federal Clean Air Act sets National Ambient Air Quality Standards (NAAQS) for pollutants. Transportation sources are significant for three of the NAAQS pollutants that include carbon monoxide (CO), ozone, and particulate matter – 10 microns or less (PM-10).

Congress established the CMAQ program in ISTEA, expanded it under TEA-21, and continued it under SAFETEA-LU to provide extra funding to help reduce CO, ozone, and PM-10 in areas designated as non-attainment and maintenance under the Clean Air Act. In Colorado, the non-attainment / maintenance areas are the Denver, Fort Collins, and Colorado Springs urban areas, as well as, five rural areas: Aspen / Pitkin County, Canon City, Pagosa Springs, Steamboat Springs / Routt County, and Telluride / Mountain Village. The Transportation Commission has delegated project selection to the local level.

CMAQ Projects are typically strategies that reduce pollutants emitted by motor vehicles. The funds primarily support new facilities, equipment, and services that reduce transportation related emissions. The following pollutants are the focus of the emission reduction in the CMAQ program:

- **CO / Carbon Monoxide** – caused by incomplete fuel combustion in motor vehicles and is an issue in winter
- **NOx / Nitrogen Oxides** – contributes to ozone formation in summer and brown cloud in winter
- **VOC / Volatile Organic Compounds** – caused by fuel leakage; contributes to ozone formation in summer
- **PM-10 / Particulate Matter (10 microns or more)** – road dust; contributes to visibility problems in winter (brown cloud)

Following is summary of CMAQ project categories and activities (a complete list of projects and project descriptions can be found in Appendix A):

- **Construction** – HOV Lanes, Turning Lanes, Passing Lanes and Park-n-Ride Facilities
- **ITS / Signals** – Intelligent Transportation Systems, Traffic Signal Coordination
- **TDM, Shared Ride, and Other** – Travel Demand Management, Carpools, Marketing, Equipment Replacement, Ozone Outreach (RAQC)
- **Transit** – New, Expanded, or Express Transit Service
- **PM-10** – Paving (unpaved roads), Sweeping, Deicing

In 2000, the Colorado Transportation Commission expressed concern about the effectiveness of the CMAQ program in improving air quality and adopted a resolution (TC-807) to increase accountability for the CMAQ funds. In 2002, as part of the CMAQ 2001 Annual Report, the MPOs made recommendations for improving the CMAQ benefit reporting system. In the first half of 2006, in creating this Report, there were several work groups held in order to identify issues and areas of improvement. Following is a summary of those recommendations and how the group is responding to them:

- CDOT, MPOs, and Feds establish goals for the program and work together to determine most effective way to calculate project benefits.
 - Efforts to calculate a cost effectiveness measure that will account for long-term benefits of capital improvements and construction projects are ongoing.
- CDOT and MPOs should develop standards for monitoring project effectiveness during multi-year implementation.
 - The CMAQ Reporter has been refined to account for long-term benefits over a number of years.
- Continue policy for formula distribution of CMAQ funds and clearly explain available funds.
 - Commission has continued to follow existing formula of 50 percent VMT and 50 percent population, after a \$1 million of-the-top allocation to the five CMAQ eligible rural areas.
- Continue to allow each MPO to establish its own selection criteria and selection process.

- Commission has continued to follow existing policy for MPOs with CDOT input to select projects while emphasizing the need for the most efficient use of the CMAQ funds.
- Distinguish between funds obligated in a single fiscal year (FY 2005), and total funds obligated over the life of a project (for multi-year projects).
- Distinguish between estimated benefits realized during the active fiscal year, versus total estimated benefits (active fiscal year plus variable future benefits).
 - The CMAQ Reporter has been refined to account for long-term benefits over a number of years.

The CMAQ Reporter tracks measurable emission reduction results and allows CMAQ recipients to use standardized formulas to calculate emission reductions and report obligated funds. As a result of the above recommendations the CMAQ reporter has been refined, and will continue to be developed in the future to provide a higher level of reporting consistency.

Funding

In Federal Fiscal Year 2005 (October 1, 2004 – September 30, 2005), \$25.8 million was available (obligated) for the CMAQ program statewide. According to resolution TC-807, the funds are shared between the MPOs based on a formula of 50 percent vehicle miles traveled (VMT) and 50 percent population, with an off-the-top \$1 million split among the five rural areas.

As shown in Figure 1, 64 percent or \$16.4 million was allocated to Denver Regional Council of Governments (DRCOG), 30 percent or \$7.6 million, and 3 percent or \$662,543 were allocated to Pikes Peak Area Council of Governments (PPACG) and North Front Range (NFR) MPO respectively. Rural areas, Aspen/Pitkin County, Canon City, Pagosa Springs, Steamboat Springs/Routt County, and Telluride/Mountain Village, each received a \$200,000 allocation.

Figure 1 – FY 2005 Obligated Funds by Maintenance Area (in thousands)

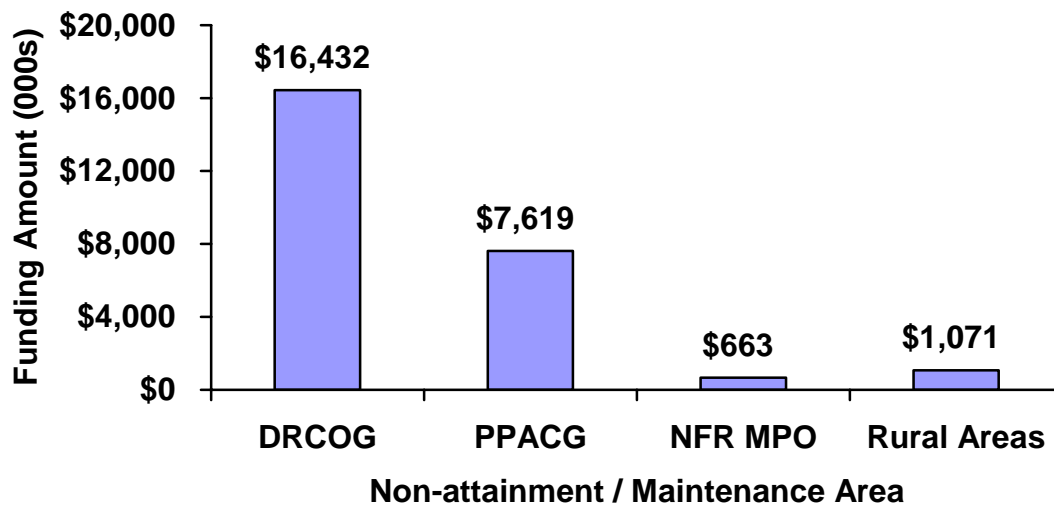


Table 1 on the following page provides detailed information about all Fiscal Year 2005 CMAQ projects and includes funds budgeted, obligated, and expended during Federal Fiscal Year 2005 (October 1, 2004 through September 31, 2005) as well as all funds budgeted, obligated and spent over the life of the project (FY 2003 – FY 2005). Differences in funds budgeted, obligated, and expended are due to unspent funds from one fiscal year being “rolled” forward into the next fiscal year.

TABLE 1: Fiscal Year 2005 and CMAQ Project Total Funds Budgeted, Obligated, and Spent

Organization	Program Name	Fiscal Year 2005 Funds (Single Year)			Total Project Funds (Multi Year Projects)*		
		Program Budget	Obligated Funds**	Total Spent	Program Budget	Obligated Funds*	Total Spent
Aspen/Pitkin County							
Aspen	Aspen PM-10 Area (Flush Truck)	\$200,000	\$194,175	\$194,175	\$200,000	\$194,175	\$194,175
Central Front Range							
Canon City	Rural PM-10 Area (Paving)	\$237,670	\$237,670	\$237,670	\$655,027	\$455,027	\$455,027
Denver Regional Council of Governments							
DRCOG	Arvada Call-n-Ride	\$247,000	\$247,000	\$247,000	\$247,000	\$247,000	\$247,000
DRCOG	RideArrangers (TDM Carpool)	\$1,731,000	\$1,731,000	\$1,298,382	\$3,394,000	\$3,394,000	\$2,831,382
DRCOG	Traffic Signal Improvements (2005)	\$2,207,327	\$2,207,327	\$1,706,003	\$5,107,560	\$5,107,560	\$3,550,902
DRCOG	Acquisition of Denver Union Station***	\$11,853,000	\$4,353,000	\$4,353,000	\$21,090,000	\$13,590,000	\$13,590,000
DRCOG	Bus Route 153 (Transit Expansion)	\$1,068,000	\$1,068,000	\$1,068,000	\$1,068,000	\$1,068,000	\$1,068,000
DRCOG	TDM Program Monitorship	\$824,066	\$824,066	\$253,805	\$4,429,681	\$4,429,681	\$1,898,020
DRCOG	Conformity Finding Mitigation (RAQC)	\$2,032,000	\$2,032,000	\$971,538	\$2,032,000	\$2,032,000	\$971,538
DRCOG	Englewood Shuttle Service	\$276,000	\$276,000	\$276,000	\$606,000	\$606,000	\$606,000
DRCOG	Region 1 Sweepers	\$162,500	\$162,500	\$301,760	\$301,760	\$301,760	\$301,760
DRCOG	C Line Operating Assistance (RTD)	\$505,000	\$404,000	\$404,000	\$5,641,000	\$5,540,000	\$5,540,000
DRCOG	(DR6429 Duplicate) Smart Sign	\$90,591	\$90,591	\$90,591	\$90,591	\$90,591	\$90,591
DRCOG	Clean Yellow Fleets for Blue Skies	\$1,804,500	\$1,804,500	\$1,804,500	\$1,804,500	\$1,804,500	\$1,804,500
DRCOG	Castle Rock Street Sweeping Expansion	\$150,000	\$150,000	\$117,556	\$150,000	\$150,000	\$117,556
DRCOG	ITS Pool	\$1,082,703	\$1,082,703	\$406,009	\$1,082,703	\$1,082,703	\$406,009
DRCOG	DRCOG TOTAL	\$24,033,687	\$16,432,687	\$13,298,144	\$47,044,795	\$39,443,795	\$33,023,258
North Front Range							
NFR MPO	Fort Collins TDM Outreach	\$272,991	\$272,991	\$272,991	\$272,991	\$272,991	\$272,991
NFR MPO	Fort Collins Carpool & Vanpool	\$342,552	\$342,552	\$275,730	\$342,552	\$342,552	\$275,730
NFR MPO	Lemay at Mulberry (Lane Improvement)	\$25,000	\$47,000	\$56	\$25,000	\$47,000	\$56
NFR MPO	NFR MPO TOTAL	\$640,543	\$662,543	\$548,777	\$640,543	\$662,543	\$548,777
Pikes Peak Area Council of Governments							
PPACG	Citywide Congestion Mgmt.	\$5,821,000	\$5,821,000	\$4,172,347	\$6,671,000	\$6,671,000	\$4,365,771
PPACG	Downtown C Springs Circulator	\$524,000	\$445,000	\$445,000	\$1,342,000	\$1,263,000	\$1,263,000
PPACG	Intercity Commuter Bus (FREX)	\$1,309,000	\$1,079,000	\$1,079,000	\$2,325,000	\$2,095,000	\$2,095,000
PPACG	Ridefinders (TDM Carpool)	\$274,000	\$274,000	\$263,484	\$274,000	\$274,000	\$263,484
PPACG	PPACG TOTAL	\$7,928,000	\$7,619,000	\$5,959,831	\$10,612,000	\$10,303,000	\$7,987,255
Southwest Region							
Pagosa Spg.	Pagosa Springs (Paving Great West Ave.)	\$165,000	\$165,000	\$0	\$165,000	\$165,000	\$165,000
Pagosa Spg.	Pagosa Springs (Magnesium Chloride)	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Pagosa Spg.	SOUTHWEST TOTAL	\$190,000	\$190,000	\$25,000	\$190,000	\$190,000	\$190,000
Northwest Region							
Steamboat Spg.	Steamboat Springs Paving Project	\$276,261	\$259,553	\$0	\$276,261	\$276,261	\$0
Gunnison Valley							
Telluride	Mountain Village Combo Unit	\$150,000	\$145,000	\$139,532	\$150,000	\$145,000	\$139,532
Telluride	Telluride / Mountain Village Transit Van	\$50,000	\$45,000	\$45,000	\$50,000	\$45,000	\$45,000
TOTAL COLORADO CMAQ FUNDS****		\$33,656,161	\$25,785,628	\$20,403,129	\$59,768,626	\$51,669,801	\$42,538,024

*Total Project Funds may or may not differ from FY05 information depending on if the project is active over multiple years (FY 2003 - FY 2005).

**For the purposes of this report, funds are budgeted in State Fiscal Year 2005 (July 1, 2004 - June 30, 2005) and obligated according to the Federal Fiscal Year 2005 (October 1, 2004 - September 31, 2005).

***Denver Union Station project was budgeted for \$11.9 million in FY05, only obligated for \$4.4 million, leaving over \$7 million not yet obligated.

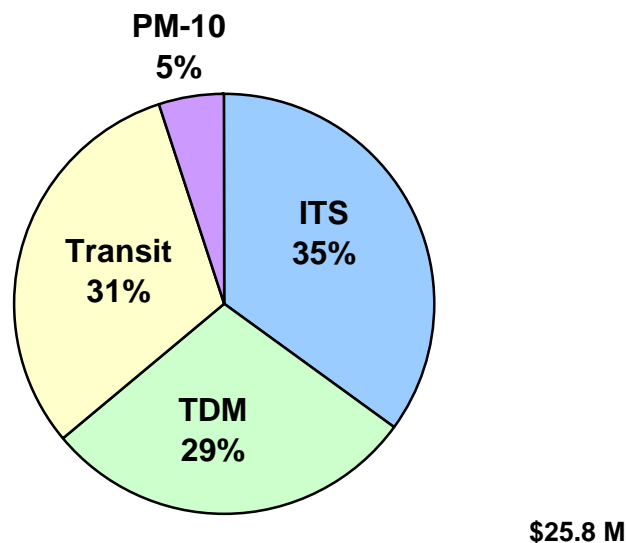
****Total 2005 CMAQ Funds Exceed \$25 Million in Annual Funds because unused funds from previous years are budgeted in 2005 and unobligated and unused funds from 2005 will likely show up in 2006, creating a 2006 Program Budget in Excess of \$25 Million.

Source: The Colorado Department of Transportation & Regional Planning Partners

Projects

Figure 2 shows the statewide funds obligated by project type. Overall, 35 percent of the available funds were obligated for Intelligent Transportation System (ITS) and traffic signal projects. Transit Improvements (new or expanded transit services) were obligated at 31 percent and Transportation Demand Management (TDM) was obligated at 29 percent. The PM-10 projects (paving, sweeping, de-icing) received 5 percent of all obligated funds. As in years past, slightly more funds were obligated in 2005 because of additional (unspent) funds available from previous years.

Figure 2 – FY 2005 Statewide Obligated Funds by Improvement Type

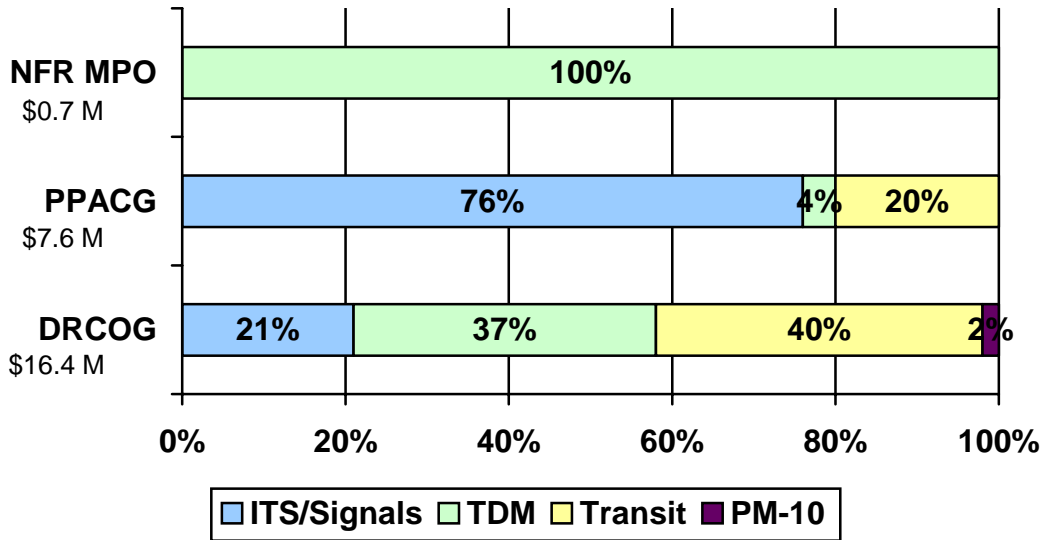


The following sections detail how each area (MPO & TPR) distributed the available CMAQ funds according to obligations during fiscal year 2005. Figure 3 illustrates how the Metropolitan Planning Organizations (MPOs) obligated their 2005 CMAQ funds.

Metropolitan Area Projects

In 2005, DRCOG obligated 40 percent of the available CMAQ funds on transit, 37 percent on Transportation Demand Management (including shared ride projects), and 21 percent on Intelligent Transportation System and signal projects. The remaining funds were used on PM-10 projects such as paving and purchasing street sweepers.

Figure 3 – FY 2005 MPO Funds Obligated by Project Type



In FY 2005, PPACG distributed 76 percent of the available CMAQ funds for Intelligent Transportation System and signal projects, 20 percent toward transit, and the small remainder on Transportation Demand Management projects.

In FY 2005, the North Front Range MPO used all of its obligated funds toward Transportation Demand Management; two capital improvement (construction) projects were scheduled to utilize FY05 finds, both projects are in progress, however benefits of these projects will not be reported until FY 2006.

Non-Urban Area Projects

CMAQ eligible non-urban areas can spend money on various PM-10 reduction projects. These include deicing (purchase of a truck, tank, and liquid), sweeping, and paving. In 2005, rural areas used CMAQ funds to pave soft surface roads, purchase deicer, and purchase a flush truck to wash away sand from paved streets. Sweeping efforts with equipment purchased in previous years are ongoing and are accumulating addition emission reductions. Telluride / Mountain Village introduced a new transit service into the region during fiscal year 2005 with the purchase of two vans, benefiting the region with fewer automobiles on the road.

Accomplishments

No violations of the Ozone, CO or PM-10 standards occurred in 2005, although there were five days that exceeded the 8-hour standard for Ozone Levels. The tables in Appendix B beginning on page 17 list emission levels as compared with Federal standards for the eight air quality maintenance areas across the state.

Benefits

The following charts provide estimated benefit information by MPO and TPR for 2003, 2004, and 2005 CMAQ projects. These are single-year benefits, measuring only the benefits estimated during the year in which the funds were obligated.

2003 Project Results (Emission Reductions Realized in 2003)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	3
Canon City	-	-	-	10
Colorado Springs (PPACG)	3,633	-	-	-
Denver (DRCOG)	3,544	34	170	736
Fort Collins (NFR MPO)	178	-	-	-
Pagosa Springs	-	-	-	86
Steamboat Springs / Routt County	-	-	-	284
Telluride / Mountain Village	-	-	-	1
2003 TOTAL	7,355	34	170	1,120

Source: 2003 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year

2004 Project Results (Emission Reductions Realized in 2004)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	results pending
Canon City	-	-	-	26
Colorado Springs (PPACG)	581	-	-	-
Denver (DRCOG)	1,590	47	44	1
Fort Collins (NFR MPO)	1,116	-	-	-
Pagosa Springs	-	-	-	65
Steamboat Springs / Routt County	-	-	-	0
Telluride / Mountain Village	-	-	-	639
2004 TOTAL	3,287	47	44	730

Source: 2004 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year

2005 Project Results (Emission Reductions Realized in 2005)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	2
Canon City	-	-	-	16
Colorado Springs (PPACG)	1,311	-	-	-
Denver (DRCOG)	3,982	145	232	26
Fort Collins (NFR MPO)	111	-	-	-
Pagosa Springs	-	-	-	12
Steamboat Springs / Routt County	-	-	-	14
Telluride / Mountain Village	-	-	-	48
2005 TOTAL	5,405	145	232	117

Source: 2005 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year

Estimated emission reductions increased in CO, NOx and VOC between Fiscal Years 2004 and 2005. PM-10 emissions have seen a steady decline in benefits from Fiscal Years 2003 to 2005, largely due to changing project priorities and fewer PM-10 specific efforts in the Denver Region.

The following tables provide more detailed information regarding funds obligated to and benefits estimated from the various air quality improvement efforts of the 2005 CMAQ projects. Table 2 provides details of project costs and benefits of DRCOG efforts. Table 3 details the costs and benefits associated with PPACG projects. Table 4 looks at efforts made within the North Front Range MPO, and Table 5 looks at funds obligated and benefits estimated for those projects within the Non-Urban (PM-10) TPRs.

TABLE 2: Cost Benefit Analysis of 2005 DRCOG CMAQ Projects (Funds Obligated and Benefits Realized in FY05)

Project Description	AVMTR (mi)	CO (KG)	VOC (KG)	NOx (KG)	PM-10 (KG)	Funds Obligated
Intelligent Traffic Signals (ITS) Programs						
Traffic Signal Improvements (2005)	0	454,157	0	0	0	\$2,207,327
ITS Pool	54,167	19,931	NA	NA	NA	\$1,082,703
TOTAL ITS BENEFITS	54,167	474,088	0	0	0	\$3,290,030
TDM, Shared Ride, & Other Projects						
RideArrangers (TDM Carpool)	21,980,514	468,035	34,800	37,517	1,007	\$1,731,000
Conformity Finding Mitigation (RAQC)	0	14,168	2,565	66	0	\$2,032,000
DRCOG TDM Pool	6,322,139	133,890	9,951	10,905	294	\$824,066
(DR6429 Duplicate) Smart Sign	0	1,769,010	64,909	71,169	0	\$90,591
Clean Yellow Fleets for Blue Skies	0	981,805	108,837	13,981	3,854	\$1,804,500
TOTAL TDM Benefits	28,302,653	3,366,908	221,062	133,638	5,155	\$6,482,157
Transit Projects						
Acquisition of Denver Union Station*	1,752,000	37,104	2,758	3,022	81	\$4,353,000
Arvada Call-n-Ride	0	0	0	0	0	\$247,000
Bus Line 153 (Montbello Transit Expansion)	3,496,406	74,047	5,503	6,031	163	\$1,068,000
Englewood Shuttle Service	215,722	4,569	340	372	10	\$276,000
C Line Operating Assistance (RTD)	1,213,318	25,696	1,910	2,093	56	\$404,000
TOTAL TRANSIT BENEFITS	6,677,446	141,416	10,511	11,518	310	\$6,348,000
PM-10 Reduction Projects						
Castle Rock Street Sweeper Expansion	NA	NA	NA	NA	1,061	\$150,000
Region 1 Sweepers	NA	NA	NA	NA	19,187	\$162,500
TOTAL PM-10 BENEFITS	NA	NA	NA	NA	20,248	\$312,500
TOTAL DRCOG BENEFITS	35,034,266	3,982,412	231,573	145,156	25,713	\$16,432,687

Source: Colorado Department of Transportation & Denver Regional Council of Governments

TABLE 3: FY05 PPACG CMAQ Projects (Funds Obligated and Benefits Realized in FY05)

	AVMTR (mi)	Benefits CO (KG)	Funds Obligated
Intelligent Traffic Signals (ITS) Programs			
Citywide Congestion Management*	0	950,251	\$5,821,000
TDM and Shared Ride Projects			
Ridefinders	4,555,731	111,752	\$274,000
Transit Projects			
Downtown Colorado Springs Circulator	144,717	3,550	\$445,000
Intercity Commuter Bus (FREX)	10,011,096	245,572	\$1,079,000
TOTAL TRANSIT BENEFITS	10,155,813	249,122	\$1,524,000
TOTAL PPACG BENEFITS	14,711,544	1,311,125	\$7,619,000

Source: Colorado Department of Transportation & Pikes Peak Area Council of Governments

TABLE 4: North Front Range MPO FY 2005 CMAQ Projects (Funds Obligated and Benefits Estimated in FY05)

PROJECT NAME	AVMTR (mi)	CO (KG) Emissions Red.	Funds Obligated
TDM and Shared Ride Projects			
SmartTrips - Carpool Match Marketing	99,966	2,527	\$342,552
TDM Outreach (special events & marketing)*	4,308,428	108,896	\$272,991
TOTAL TDM Benefits	4,408,394	111,423	\$615,543

Source: Colorado Department of Transportation & North Front Range MPO

TABLE 5: CMAQ Projects in PM-10 Non-Attainment/Maintenance Areas (Funds Obligated and Benefits Realized in FY05)

Rural PM-10 Programs	Project Description	PM-10 Kilograms	Funds Obligated
Aspen/Pitkin County			
Aspen	Aspen PM-10 Area (Flush Truck)	1,602	\$194,175
Central Front Range			
Canon City	Rural PM-10 Area (Paving)	16,319	\$237,670
Southwest Region			
Pagosa Springs	Pagosa Springs (Paving)	11,010	\$165,000
Pagosa Springs	Pagosa Springs (Magnesium Chloride)	639	\$25,000
Northwest Region			
Steamboat Springs	Steamboat Springs Paving Ridge Road	14,329	\$259,553
Gunnison Valley			
Telluride	Telluride / Mountain Village De-Icer	305	\$145,000
Telluride	Mountain Village Vanpool	47,532	\$45,000
	TOTAL PM-10 AREA PROJECTS	91,736	\$1,071,398

Source: Colorado Department of Transportation & Transportation Planning Region Offices

2005 Results with Future Benefits

As mentioned in the previous annual report, CMAQ efforts that involve capital projects have benefits that extend well past the first year of operation. These long term benefits must be captured to develop a cost benefit calculation that gives equal credit to both short and long term projects. A typical lifespan for these long term projects is as follows:

- Signal Timing / ITS Improvements – 5 year average
- Paving Soft Surface Roads – 10 year average
- Transit Stations – 20 year average
- Transit Rolling Stock – 12 year average
- Some TDM efforts (marketing and outreach) realize only single-year benefits, while others (equipment replacement) will see benefits over a period of 3 to 5 years.

The following table shows the projects from 2005 with the associated long term benefits. Benefits are reported when the funds are obligated. For example, in the Pikes Peak Area, El Paso County installed video detection to reduce the amount time cars spend waiting at signals. This project was obligated in 2005. Above, only benefits that occurred during 2005 are shown, however, it is assumed that this one year effort will reduce emissions over a period of five years. The table below accounts for the benefits for all five years (2005 – 2009).

2005 Project Results (Emission Reductions in FY 2005 & Future)				
Non-attainment / Maintenance Area	CO	NOx	VOC	PM
Aspen / Pitkin County	-	-	-	16
Canon City	-	-	-	163
Colorado Springs (PPACG)	3,378	-	-	-
Denver (DRCOG)	17,723	654	1,235	239
Fort Collins (NFR MPO)*	111	-	-	-
Pagosa Springs	-	-	-	111
Steamboat Springs / Routt County	-	-	-	143
Telluride / Mountain Village	-	-	-	143
2005 TOTAL	21,212	654	1,235	382

Source: 2005 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year
 *NFR MPO had two projects that started in FY 2005 but benefits will be reflected in FY 2006 Report.

Conclusion

In Federal Fiscal Year 2005 there were twenty-seven active projects under the Congestion Mitigation and Air Quality Improvement Program. Some of the projects were and will continue to be more effective than others in improving Colorado's air quality, but overall the MPOs and Non-Urban TPRs selected projects that significantly reduced emissions of concern for their area.

As with any comprehensive and efficient transportation system, multiple strategies are necessary. The aim of the CMAQ program is to address Colorado's air quality issues and reduce pollution. In order to effectively achieve results, it is helpful to target multiple strategies and project types that fit specific circumstances and needs of an area. Although some efforts provide greater benefit than others, a balance of project types may be necessary to create the CMAQ program for a specific area.

Appendix A – 2005 CMAQ Project Descriptions

DRCOG Projects

Acquisition of Denver Union Station - Redevelopment/reconfiguration of Union Station to serve as a regional transportation hub is a multi-year project.

Bus Route 153 - New transit service from Parker Road to the Montbello Park-n-Ride.

RideArrangers - Carpool service coordination effort and includes efforts such as: 2005 Bike to work Day, Carpool Matching, the Ridesmart Thursdays Program, SchoolPool Matching (school carpools), and Vanpools.

Clean Yellow Fleets for Blue Skies - School bus equipment replacement to reduce diesel emissions.

(RAQC) Conformity Finding Mitigation Program - Ozone reduction program through gas cap replacement, gas can replacement, and various media outreach and public education efforts.

Englewood Shuttle Bus Service - Shuttle service between Englewood City Center and South Corona Street.

Arvada Call-n-Ride - Call-n-Ride service to fill gaps in other Arvada transit services.

DRCOG ITS Pool - Multi-year project focus primarily along I-25 from Broadway to 120th Avenue. Nearby and intersecting arterial streets are also included in this project scope to assist special event management near downtown.

DRCOG TDM Pool - This is a pool of projects providing information and technical assistance to businesses interested in creating Telework programs for their employees. Funds also provided for Vanpools, Eco-passes, and outreach and incentives.

Regional Traffic Signal Improvements – Project pool of various multi-year DRCOG ITS efforts.

Region 1 Sweepers - Street sweepers purchased to reduce PM-10 pollution.

C-Line (Light Rail) Operating Assistance - Supplemental funds to assist in operating costs of an expanded transit service.

Smart Sign - emission readings of cars to notify drivers if their vehicle is “fair” or “poor” in regards to tailpipe emissions.

Castle Rock Street Sweeping Expansion - Street sweepers purchased to reduce PM-10 pollution in the Castle Rock area.

PPACG Projects

Citywide Congestion Management - This ITS program includes ITS and signal improvements for Academy, I-25 and Highway 24 in the Colorado Springs Area. Coordinated efforts are also made to improve traffic flow on I-25 through faster response to accidents.

Ridefinders - Encourages the use of alternative transportation through carpool matching, school pool, commuter vanpools, Bike to work Week, outreach, bike and ped resources, bus pass sales, and transit referrals.

Front Range Express (FREX) Intercity Bus Service - Transit between Fountain (south of Colorado Springs and Denver).

Downtown Colorado Springs Circulator - downtown circulator transit.

NFRMPO Projects

Fort Collins TDM Outreach - This pool of TDM projects include all efforts to encourage the use of alternative modes of transportation. Marketing efforts such as bike to work day, bike to work month, and advertising all NFR MPO transit services are covered under this "TDM outreach" project.

Fort Collins Carpool and Vanpool - Carpool and Vanpool coordination efforts in order to reduce single-occupant vehicle (SOV) travel; fewer vehicles on the roads.

PM-10 Area Projects

Aspen (Pitken County) Flush Truck – a new flush truck was purchased to clean sand and Mag. Chloride from the roads after a storm. Flush trucks are more efficient than traditional sweepers and emit less debris into the air.

Canon City Paving - Canon City Paving Projects include 3rd Street, Allison Avenue, Dewey Road, Madison Avenue, Highland Avenue, 10th Street, and Yale Place totaling 2,011 feet.

Pagosa Springs Paving – Paved 0.40 miles of Great West Avenue in Pagosa Springs. Great West Avenue sees average daily traffic of 200 vehicles.

Pagosa Springs Mag. Chloride - Magnesium Chloride purchased to use on roads before storms instead of sand.

Steamboat Springs Paving Project – Phase II paving 2,600 feet of Ridge Road within a new residential subdivision. Relatively low traffic volumes, averaging 65.98 vehicle miles traveled (VMT) daily.

Mountain Village Combo Unit - Telluride / Mountain Village purchased a new combo unit to aid in road sweeping and spreading mag chloride to aid in reducing PM-10 emissions.

Telluride / Mountain Village Transit Vans – purchased two new transit vans in order to reduce single-occupant vehicle (SOV) travel in the region.

Appendix B – Emission Levels

CO Emissions in Non-attainment / Maintenance Areas

In Colorado, there are three CMAQ eligible non-attainment / maintenance areas for CO. They are Denver, Colorado Springs, and Fort Collins. All three areas have met both 1-hour and 8-hour Federal standards for CO emissions during the past five years.

	2000		2001		2002		2003		2004		2005	
	1hr	8hr	1hr	8hr	1hr	8hr	1hr	8hr	1hr	8hr	1hr	8hr
Standard	35	9	35	9	35	9	35	9	35	9	35	9
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Colorado Springs	9.5	4.2	9.3	4.4	9.8	5.2	6.7	3.8	6.5	3.1	5.9	3.7
Denver	12.8	5.4	9.3	4.1	7.4	3.7	14.9	4.5	8.7	4.1	5.6	2.9
Fort Collins	7.5	3.8	6.8	3	5.5	2.9	8.1	2.3	5.3	3.1	8.1	3.2

PM-10 Concentration in Non-attainment / Maintenance Areas

The six PM-10 non-attainment / maintenance areas in Colorado have met both the 99th percentile and annual mean standards during the past five years. In the rural areas, paving has been the primary method of PM-10 reduction. Other projects have included purchasing sweepers and deicing trucks and equipment. In the Denver non-attainment / maintenance area, sweepers have been the primary method to reduce PM-10.

	2000		2001		2002		2003		2004		2005	
	99th	M	99th	M	99th	M	99th	M	99th	M	99th	M
Standard	150	50	150	50	150	50	150	50	150	50	150	50
	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³	ug ₃ / m ³
Aspen Pitkin County	66	22	66	23	90	34	50	21	44	18	127	21
Canon City	133	17	40	15	42	17	30	16	23	14	33	18
Denver	85	37	97	40	88	38	111	37	92	35	105	39
Pagosa Springs	73	28	121	34	61	24	70	27	52	23	82	24
Steamboat Spgs Routt County	89	25	74	23	79	25	89	26	73	23	86	22
Telluride Mountain Village	59	22	52	18	58	22	74	25	59	18	70	21

Ozone Levels in Non-attainment / Maintenance Areas

In 2006, Denver was an Ozone maintenance area in Colorado. The federal standards were met 1999 through 2002. However, one exceedance of the 8-hour standard occurred in 2003, and five days were in excess of the ozone standard in 2005. Multiple exceedances of the standard over a number of years are allowed before the standard is violated. The non-attainment area has experienced periodic exceedances of the standard, but has not violated the standard since 2003.

DRCOG is pursuing projects, such as the purchase of Denver Union Station which will provide a central hub for transit lines, which will reduce Ozone levels, and the Regional Air Quality Council (RAQC) has a number of projects targeting ozone emissions.

	2000		2001		2002		2003		2004		2005	
	1hr	8hr	1hr	8hr	1hr	8hr	1hr	8hr	1hr	8hr	1hr	8hr
Standard	.12	.08	.12	.08	.12	.08	.12	.08	.12	.08	.12	.08
	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³	ug / m ³
Denver	.086	.071	.091	.072	.092	.073	.096	.085	.087	.078	.108	.091

Note: In areas where there are multiple air quality monitors, the maximum value is shown. These values were extracted from the EPA website (<http://www.epa.gov/air/data/>) July 2006.

Appendix C - Current Emission Budgets

The following table illustrates which areas across the state are in air quality non-attainment / maintenance for specific pollutants. The values in the table represent the transportation emission budget in tons per day. An emission budget is set so that transportation related emission will not cause an exceedance of Federal air quality standards. The Denver area has been designated non-attainment / maintenance for CO, Ozone, and PM-10. In the five rural areas PM-10 is the pollutant of primary concern. The Fort Collins and Colorado Springs areas have been designated non-attainment / maintenance for CO.

Non-attainment / Maintenance Area	CO	NOx > PM-10	NOx > Ozone	VOC	PM-10
Season	Winter	Winter	Summer	Summer	Winter
Units	Tons/day	Tons/day	Tons/day	Tons/day	Tons/day
Aspen/Pitkin County	-n/a-	-n/a-	-n/a-	-n/a-	8
Canon City	-n/a-	-n/a-	-n/a-	-n/a-	4
Colorado Springs (PPACG)	531	-n/a-	-n/a-	-n/a-	-n/a-
Denver (DRCOG)	800	101	134	119	51
Fort Collins (NFR)	99	-n/a-	-n/a-	-n/a-	-n/a-
Pagosa Springs	-n/a-	-n/a-	-n/a-	-n/a-	4
Steamboat Springs / Routt County	-n/a-	-n/a-	-n/a-	-n/a-	11
Telluride / Mountain Village	-n/a-	-n/a-	-n/a-	-n/a-	5

Appendix D - Federal Code

23 USC 149 – CMAQ Program

Sec. 149. - Congestion mitigation and air quality improvement program

(a) Establishment. -

The Secretary shall establish and implement a congestion mitigation and air quality improvement program in accordance with this section.

(b) Eligible Projects. -

Except as provided in subsection (c), a State may obligate funds apportioned to it under section 104(b)(2) for the congestion mitigation and air quality improvement program only for a transportation project or program if the project or program is for an area in the State that is or was designated as a nonattainment area for ozone, carbon monoxide, or particulate matter under section 107(d) of the Clean Air Act (42 U.S.C. 7407(d)) and classified pursuant to section 181(a), 186(a), 188(a), or 188(b) of the Clean Air Act (42 U.S.C. 7511(a), 7512(a), 7513(a), or 7513(b)) or is or was designated as a nonattainment area under such section 107(d) after December 31, 1997, and -

(1)

(A) if the Secretary, after consultation with the Administrator of the Environmental Protection Agency, determines, on the basis of information published by the Environmental Protection Agency pursuant to section 108(f)(1)(A) of the Clean Air Act (other than clause (xvi) of such section), that the project or program is likely to contribute to -

(i) the attainment of a national ambient air quality standard; or

(ii) the maintenance of a national ambient air quality standard in a maintenance area; or

(B) in any case in which such information is not available, if the Secretary, after such consultation, determines that the project or program is part of a program, method, or strategy described in such section;

(2) if the project or program is included in a State implementation plan that has been approved pursuant to the Clean Air Act and the project will have air quality benefits;

(3) the Secretary, after consultation with the Administrator of the Environmental Protection Agency, determines that the project or program is likely to contribute to the attainment of a national ambient air quality standard, whether through reductions in vehicle miles traveled, fuel consumption, or through other factors;

(4) to establish or operate a traffic monitoring, management, and control facility or program if the Secretary, after consultation with the Administrator of the Environmental Protection Agency, determines that the facility or program is likely to contribute to the attainment of a national ambient air quality standard; or

(5) if the program or project improves traffic flow, including projects to improve signalization, construct high occupancy vehicle lanes, improve intersections, and implement intelligent transportation system strategies and such other projects that are eligible for assistance under this section on the day before the date of enactment of this paragraph.

No funds may be provided under this section for a project which will result in the construction of new capacity available to single occupant vehicles unless the project consists of a high occupancy vehicle facility available to single occupant vehicles only at other than peak travel times. In areas of a State which are nonattainment for ozone or carbon monoxide, or both, and for PM-10 resulting from transportation activities, the State may obligate such funds for any project or program under paragraph (1) or (2) without regard to any limitation of the Department of Transportation relating to the type of ambient air quality standard such project or program addresses.

(c) States Receiving Minimum Apportionment. -

(1) States without a nonattainment area. -

If a State does not have, and never has had, a nonattainment area designated under the Clean Air Act (42 U.S.C. 7401 et seq.), the State may use funds apportioned to the State under section 104(b)(2) for any project eligible under the surface transportation program under section 133.

(2) States with a nonattainment area. -

If a State has a nonattainment area or maintenance area and receives funds under section 104(b)(2)(D) above the amount of funds that the State would have received based on its nonattainment and maintenance area population under subparagraphs (B) and (C) of section 104(b)(2), the State may use that portion of the funds not based on its nonattainment and maintenance area population under subparagraphs (B) and (C) of section 104(b)(2) for any project in the State eligible under section 133.

(d) Applicability of Planning Requirements. -

Programming and expenditure of funds for projects under this section shall be consistent with the requirements of sections 134 and 135 of this title.

(e) Partnerships With Nongovernmental Entities. -

(1) In general. -

Notwithstanding any other provision of this title and in accordance with this subsection, a metropolitan planning organization, State transportation department, or other project sponsor may enter into an agreement with any public, private, or nonprofit entity to cooperatively implement any project carried out under this section.

(2) Forms of participation by entities. -

Participation by an entity under paragraph (1) may consist of -

(A) ownership or operation of any land, facility, vehicle, or other physical asset associated with the project;

(B) cost sharing of any project expense;

(C) carrying out of administration, construction management, project management, project operation, or any other management or operational duty associated with the project; and

(D) any other form of participation approved by the Secretary.

(3) Allocation to entities. -

A State may allocate funds apportioned under section 104(b)(2) to an entity described in paragraph (1).

(4) Alternative fuel projects. -

In the case of a project that will provide for the use of alternative fuels by privately owned vehicles or vehicle fleets, activities eligible for funding under this subsection -

(A) may include the costs of vehicle refueling infrastructure, including infrastructure that would support the development, production, and use of emerging technologies that reduce emissions of air pollutants from motor vehicles, and other capital investments associated with the project;

(B) shall include only the incremental cost of an alternative fueled vehicle, as compared to a conventionally fueled vehicle, that would otherwise be borne by a private party; and

(C) shall apply other governmental financial purchase contributions in the calculation of net incremental cost.

(5) Prohibition on federal participation with respect to required activities. -

A Federal participation payment under this subsection may not be made to an entity to fund an obligation imposed under the Clean Air Act (42 U.S.C. 7401 et seq.) or any other Federal law.

Appendix E - Commission Resolution

TC-807

WHEREAS, the Congestion Mitigation and Air Quality (CMAQ) improvement program was developed under the Intermodal Surface Transportation Efficiency Act (ISTEA) and has been continued with the Transportation Equity Act for the 21st Century (TEA-21); and

WHEREAS, the purpose of the CMAQ program is to provide a flexible funding source for spending on transportation projects and programs that help to meet the Clean Air Act requirements and that help to reduce transportation-related emissions for state and local governments; and

WHEREAS, funding is available for both non-attainment areas (areas not in compliance with the National Ambient Air Quality Standards) and maintenance areas (areas that were formerly in non-compliance and are now in compliance); and

WHEREAS, current resource allocation forecasts indicate that Colorado can expect to receive \$145,875,000 in CMAQ funds between Fiscal Year (FY) 2001–2006; and

WHEREAS, federal regulations state how the money can be spent; and

WHEREAS, CMAQ money is allocated to the state of Colorado to be distributed within the state among the eligible areas as determined by the State in consultation with non-attainment areas, local governments, MPOs and the state; and

WHEREAS, in the past, CMAQ money has been allocated to the carbon monoxide non-attainment area MPOs based on 50 percent Vehicle-Miles Traveled (VMT) and 50 percent population; and

WHEREAS, based upon TEA-21 provisions that allow CMAQ money to be used in PM-10 non-attainment areas, last year the Commission allocated a total of \$2 million over 3 years (FY 1998-2000) to the five rural PM-10 non-attainment areas; and

WHEREAS, CDOT's budget is now required by the Joint Budget Committee of the General Assembly to include performance measures describing the results of CDOT's various programs and projects; and

WHEREAS, CMAQ funds have not yet been allocated beyond FY 2000.

NOW THEREFORE BE IT RESOLVED, the Commission has determined that for the remainder of TEA-21 (FY 2001 – 2003):

A total of \$1,000,000 per year of CMAQ funds be allocated among the five rural PM-10 non-attainment areas;

the remaining balance of CMAQ funds will be allocated to the three non-attainment MPOs based on the 50% VMT and 50% population as follows:

DRCOG	76.31%
PPACG	18.13%
NFRT&AQPC	5.56%

project selection for CMAQ funds will be at the local level: in the non-attainment MPOs, projects, including eligible CDOT and transit agency projects, will be selected by the MPOs cooperatively with CDOT and the public transit agencies; and, in the rural non-attainment areas, projects will be selected by local governments cooperatively with their respective CDOT Regions.

CMAQ fund recipients will report annually in writing to the Commission on the effectiveness of the CMAQ fund expenditures.

CDOT will continue developing performance measures as part of its on-going resource allocation and budget requirements, including measures related to the CMAQ program, seeking input from external stakeholders.

If performance measurement of the CMAQ program indicates concerns regarding the effectiveness of the use of CMAQ funds, the Commission reserves the option for reviewing and altering the allocation formula.

FURTHER, for the period 2004 through 2020, the above formula can be used for planning purposes but is not a budget allocation.

Appendix F - Reporter Overview



Congestion Mitigation and Air Quality (CMAQ) Program

The purpose of the federal CMAQ program is to fund transportation projects that assist non-attainment and maintenance areas in meeting the National Ambient Air Quality Standards (NAAQS) established by the Clean Air Act (CAA). The focus for CMAQ funding is for areas designated as non-attainment or maintenance for ozone, carbon monoxide or PM-10. Funding is available for improvements to the transportation system that will have a tangible emission reduction.

What projects are eligible for CMAQ funding?

CMAQ Projects are typically strategies to lessen the pollutants emitted by motor vehicles. The funds are intended primarily for new facilities, equipment and services aimed at generating new sources of emission reductions. Operating funds that support these projects are generally limited to a three-year period. Projects categorized as maintenance, rehabilitation, and highway capacity improvements for single occupant vehicles (SOVs) are not eligible because they will not result in emission reductions. Following is a list from the Federal Highway Administration (FHWA) of projects eligible for CMAQ funding.

1. Transportation Activities in an approved State Implementation Plan (SIP)
 2. Transportation Control Measures (TCMs)
 3. Extremely Low-Temperature Cold Start Programs
 4. Public-Private Partnerships
 5. Alternative Fuels
 6. Traffic Flow Improvements
 7. Transit Projects
 8. Bicycle and Pedestrian Facilities
 9. Travel Demand Management
 10. Outreach and Rideshare Activities
 11. Telecommuting
 12. Fare/Fee Subsidy Programs
 13. Intermodal Freight
 14. Planning and Project Development Activities
 15. Inspection / Maintenance (I/M)
 16. Magnetic Levitation Transportation Technology Deployment Programs
 17. Experimental Pilot Programs
- (Excerpt from Federal Register, February 23, 2000, pg. 9047 – 9051)

What is the CMAQ Reporter?

The CMAQ Reporter is a web-based tool developed by the Colorado Department of Transportation and CMAQ recipients to meet the Federal Highway Administration (FHWA) and Colorado Transportation Commission reporting requirements. CDOT is required to report to FHWA annually on the amount of CMAQ funds obligated and the amount of emissions reduced through the implementation of CMAQ funded projects.

The CMAQ Reporter tracks measurable emission reduction results, on a consistent basis, for most Colorado CMAQ fund recipients. The Reporter allows most CMAQ recipients to use standardized formulas to calculate emission reductions and report obligated project funds. Using the CMAQ Reporter, information will be provided to FHWA and the Transportation Commission.

The next phase of the CMAQ Reporter will focus on developing an accurate picture of long-term air quality benefits and cost effectiveness. All CMAQ recipients will have the opportunity to make suggestions on how project life benefits should be calculated in the CMAQ Reporter. Long term benefits and cost effectiveness will not be reported until this phase of the CMAQ Reporter is completed.

What are the reporting requirements for CMAQ projects?

Project data is reported annually at the end of the calendar year. In October, CDOT supplies usernames, passwords, and other necessary information to CMAQ fund recipients. The MPOs and local sponsors report on their CMAQ projects on an annual basis in November and December. In turn, CDOT reports the CMAQ emission reduction results to FHWA at the end of January. Results are presented to the Transportation Commission as requested.

How does the CMAQ Reporter calculate emission reduction?

The Reporter calculates emissions for three types of projects: VMT Reduction, PM-10 / Road Dust Reduction, and Inspection/Maintenance. Projects that reduce VMT calculate emission reduction by applying a reduction factor to the VMT. Benefits for other types of projects such as ITS and Signal Timing are calculated manually by the project sponsor and entered directly into the Reporter.

VMT Reduction

$$\begin{array}{rcccl} \text{Annual VMT Reduction} & & \text{Emission Factor} & & \text{Emission Reduction} \\ \text{(AVMTR)} & \times & \text{CO, NO}_x, \text{VOC, PM-10} & = & \text{CO, NO}_x, \text{VOC, PM-10} \end{array}$$

Projects that reduce VMT include: carpool matching, vanpool matching, schoolpool matching, new or expanded transit service, construction of bike and ped facilities, construction of transit stations, HOV facilities, telecommuting/telework, bike share, and bike to work day.

PM-10 Road Dust Reduction

Projects that reduce PM-10 Road Dust include: paving, broom sweeping, deicing, vacuum sweeping, and reduced sanding. VMT is multiplied by various factors to determine the PM-10 reduction.

ITS and Traffic Control

ITS and Traffic Control projects reduce vehicle hours traveled (VHT) rather than VMT. Because of the complex calculations associated with these projects, the fund recipient calculates the emission reduction for each project manually. The amount of CO reduction is entered directly into the Reporter.

Inspection/Maintenance

Inspection and Maintenance projects reduce emissions by requiring improvements to high-emitter vehicles. For other projects such as fuel tank cap replacement and maintenance technician training, the fund recipient calculates the emission reduction for each project manually.

How is the CMAQ Reporter Accessed?

The Reporter is available at http://www.dot.state.co.us/App_CMAQ/. When asked from a username and password enter "view" for both fields. Specific user logins and passwords are distributed as necessary for reporting purposes.

Who should you contact if you have a question?

For questions about the CMAQ Reporter, contact CDOT Project Manager, Robert Vinton by phone at 303-757-9997 or email at robert.vinton@dot.state.co.us.

Appendix G - Reporter Formulas

Phase II Formulas extracted on August 19, 2003

Paving

PM10 Emissions Reduction (kg) = AVMT * (EFi - EFi*(1-RF))

Variable	Default	Units	Description
AVMT	-	miles	Total annual vehicles miles of travel affected by the project for the year
EFi	0.606	kg/VMT	Emissions Factor before Paving
RF	0.9818	unitless	Percent Reduction in Emissions entered as a decimal (This value should not be changed)
WF	0.5443	unitless	Weight factor (This value should not be changed)

Broom Sweeping (ADT > 5000)

PM10 Emissions Reduction (kg) = AVMT * (EFi - EFf)

Where:

Ei = Initial Emissions Factor = $k*(SLi/2)^{0.65}*WF$

Ef = Final Emissions Factor = $k*(SLf/2)^{0.65}*WF$

SLf = Final Silt Loading Factor = $((SLi-0.5)*(1-RF/100))+0.5$

Variable	Default	Units	Description
AVMT	-	miles	Total annual vehicles miles of travel affected by the project for the year
k	0.0073	kg/VMT	Particle size range base emission factor (This value should not be changed)
SLi	-	kg/m2	Initial Silt Loading Factor entered by the administrator
RF	0.32	unitless	Percent Reduction in Emissions entered as a decimal (This value should not be changed)
WF	0.5443	unitless	Weight factor (This value should not be changed)

Broom Sweeping (ADT < 5000)

PM10 Emissions Reduction (kg) = AVMT * (EFi - EFf)

Where:

Ei = Initial Emissions Factor = $k*(SLi/2)^{0.65}*WF$

Ef = Final Emissions Factor = $k*(SLf/2)^{0.65}*WF$

SLf = Final Silt Loading Factor = $((SLi-3.0)*(1-RF/100))+3.0$

Variable	Default	Units	Description
AVMT	-	miles	Total annual vehicles miles of travel affected by the project for the year
k	0.0073	kg/VMT	Particle size range base emission factor (This value should not be changed)
SLi	-	kg/m2	Initial Silt Loading Factor entered by the administrator
RF	0.32	unitless	Percent Reduction in Emissions entered as a decimal (This value should not be changed)
WF	0.5443	unitless	Weight factor (This value should not be changed)

Deicing (ADT > 5000)

$$\text{PM}_{10} \text{ Emissions Reduction (kg)} = \text{AVMT} * (\text{Efi} - \text{Efi})$$

Where:

$$\text{Ei} = \text{Initial Emissions Factor} = k * (\text{SLi}/2)^{0.65} * \text{WF}$$

$$\text{Efi} = \text{Final Emissions Factor} = k * (\text{SLfi}/2)^{0.65} * \text{WF}$$

$$\text{SLfi} = \text{Final Silt Loading Factor} = ((\text{SLi} - 0.5) * (1 - \text{RF}/100)) + 0.5$$

Variable	Default	Units	Description
AVMT	-	miles	Total annual vehicles miles of travel affected by the project for the year
k	0.0073	kg/VMT	Particle size range base emission factor (This value should not be changed)
SLi	-	kg/m2	Initial Silt Loading Factor entered by the administrator
RF	0.2	unitless	Percent Reduction in Emissions entered as a decimal (This value can vary between .20 and .90)
WF	0.5443	unitless	Weight factor (This value should not be changed)

Deicing (ADT < 5000)

$$\text{PM}_{10} \text{ Emissions Reduction (kg)} = \text{AVMT} * (\text{Efi} - \text{Efi})$$

Where:

$$\text{Ei} = \text{Initial Emissions Factor} = k * (\text{SLi}/2)^{0.65} * \text{WF}$$

$$\text{Efi} = \text{Final Emissions Factor} = k * (\text{SLfi}/2)^{0.65} * \text{WF}$$

$$\text{SLfi} = \text{Final Silt Loading Factor} = ((\text{SLi} - 3.0) * (1 - \text{RF}/100)) + 3.0$$

Variable	Default	Units	Description
AVMT	-	miles	Total annual vehicles miles of travel affected by the project for the year
k	0.0073	kg/VMT	Particle size range base emission factor (This value should not be changed)
SLi	-	kg/m2	Initial Silt Loading Factor entered by the administrator
RF	0.2	unitless	Percent Reduction in Emissions entered as a decimal (This value can vary between .20 and .90)
WF	0.5443	unitless	Weight factor (This value should not be changed)

Vacuum Sweeping

$$\text{PM}_{10} \text{ Emissions Reduction (kg)} = \text{AVMT} * (\text{Efi} - \text{Efi})$$

Where:

$$\text{Ei} = \text{Initial Emissions Factor} = k * (\text{SLi}/2)^{0.65} * \text{WF}$$

$$\text{Efi} = \text{Final Emissions Factor} = k * (\text{SLfi}/2)^{0.65} * \text{WF}$$

$$\text{SLfi} = \text{Final Silt Loading Factor} = \text{SLi} * (1 - \text{RF}/100)$$

Variable	Default	Units	Description
AVMT	-	miles	Total annual vehicles miles of travel affected by the project for the year
k	0.0073	kg/VMT	Particle size range base emission factor (This value should not be changed)
SLi	-	kg/m2	Initial Silt Loading Factor entered by the administrator
RF	0.34	unitless	Percent Reduction in Emissions entered as a decimal (This value should not be changed)
WF	0.5443	unitless	Weight factor (This value should not be changed)

Reduced Sanding or Sweeping

$$\text{PM10 Emissions Reduction (kg)} = \text{EF} * 907 * \text{APN} * \text{RF} * 240$$

Where:

907 is the conversion factor from tons to kilograms

240 is the number of days in the PM10 season. Multiplying by this factor will provide a yearly reduction.

Variable	Default	Units	Description
EF	102.1	tons/day	Uncontrolled emissions factor for the region
APN	-	unitless	Agency's percent of the reported sanding network for all reporting agency's. If you don't know this value, ask RAQC
RF	-	unitless	Percent of PM10 emissions reduced from the baseline level (1989). If this value is not known, it can be calculated by the following equation:

$$\text{RF} = (1 - (0.36 * (1 - (\text{SRC} * \% \text{ Swept}))) + (0.64 * (1 - \% \text{ Sand Reduction})^{0.8} * (1 - (\text{SRC} * \% \text{ Swept}))))$$

where:

0.36 is dust fraction of emissions and 0.64 is sand plus residual sand fraction of emissions

SRC = Sweeping equipment emissions reduction credit; currently recommended as 0.37 for Mechanical and Combination equipment or 0.61 or Vacuum and Regenerative Air equipment.

% Swept = % of Network Swept in 4 days, [as reported in section E of the annual Street Sand Use Report].

$$\% \text{ Sand Reduction} = ((\text{Baseline Rate} - \text{Material Application Rate}) / \text{Baseline Rate}) * 100$$

Baseline Rate (lbs./lane mile) = (Sand applied in tons * 2000) / Miles driven in 1989 for each entity. If Baseline is not know, contact the RAQC or APCD.

$$\text{Material Application Rate (lbs./lane mile)} = (\text{Material applied, as corrected total in tons} * 2000) / \text{Miles Driven}$$

Material Applied, as corrected in tons (Solids Only) = Sand/Salt and Ice Slicer shall be recorded as actual tons applied. Realite shall be multiplied by a factor of 1.1. All the above totals of solid material in tons shall be summed for the corrected total. Can be found in Section B of annual Street Sand Use Report

Miles Driven if do not know, can be found Section D of Annual Street Sand Use Report

The power of 0.8 is the EPA factor used to calculate emissions reduction credit from the reduction of applied sand.

240 is the number of days in the PM10 season, multiplying by this factor will provide a yearly reduction.

Carpool Matching

$$\text{AVMTR} = (N + \text{Nt-1} + 0.75 * \text{Nt-2}) * P * (1/\text{AVO}) * ((\text{S-1})/\text{S}) * (\text{F}/\text{W}) * \text{Nt} * \text{Nd} * \text{D}$$

Variable	Default	Units	Description
N		people	The average number of carpool commuters at any given time during the year.
Nt-1		applications	Number of carpool matching applications processed in the

			previous year (i.e. 2001 if N = 2002)
Nt-2		applications	Number of carpool matching applications processed in the year prior to the previous year (i.e. 2000). The final portion of the equation is then multiplied by 0.75 to account for months 24 - 33 of carpool operation.
P	0.16	unitless	Ongoing placement rate. The proportion (expressed as a decimal) of matching applicants placed in carpools.
AVO	1.08	people	Average vehicle occupancy for work trips.
S	2.74	people	Average carpool size (including the driver).
F		days	Average number of days per week that carpool is used instead of driving alone.
W	5	days	Number of workdays in a week.
D	19.5	miles	Average one-way trip distance.
Nd	240	days	Number of benefit days per year.
Nt	2	trips	Number of one-ways trips per day.

Vanpool Matching

$$AVMTR = N * (1/AVO) * ((S-1)/S) * (FW) * Nt * Nd * D$$

Variable	Default	Units	Description
N	-	people	The average number of vanpool commuters at any given time during the year.
AVO	1.08	people	Average vehicle occupancy for work trips.
S	-	people	Average vanpool size (including the driver).
F	-	days	Average number of days per week that vanpool is used instead of driving alone.
W	5	days	Number of workdays in a week.
Nt	2	trips	Number of one-ways trips per day.
Nd	240	days	Number of benefit days per year.
D	19.5	miles	Average one-way trip distance.

School Pool

$$AVMTR = N * P * ((S-1)/S) * D * W * Nw * ((P2 * Nt) + (1 - P2) * Nf)$$

Variable	Default	Units	Description
N	-	people	Number of families in the database
P	0.2424	unitless	The proportion (expressed as a decimal) of families in the database that form carpools
S	2.13	people	Average carpool size (including the driver).
D	-	miles	Average one-way trip distance.
W	4.81	days	Number of carpool days in a week.
Nw	-	weeks	Number of weeks in a school year
P2	0.49	unitless	The proportion (expressed as a decimal) of two-way trip carpools. The remainder of carpools is assumed to be four-way trip carpools
Nt	2	trips	Number of one-ways trips per day for the two-way trip carpool
Nf	4	trips	Number of one-ways trips per day for the four-way trip carpool

New or Expanded Transit Service

$$AVMTR = (((Rf - Ri) * (1 - GR) * D * Nt * PSOV) - (EF * DBVMT)) * Nd$$

Variable	Default	Units	Description
Rf	-	people	Average daily ridership after project
Ri	-	people	Average daily ridership before project
GR	-	unitless	Yearly population growth rate (expressed as a decimal) for the surrounding community. For example, .2 = 20% growth, -.3 = 30% loss
D	19.5	miles	Average one-way trip distance.
Nt	2	trips	Number of one-ways trips per day.
PSOV	-	unitless	Proportion of users (expressed as a decimal) that formerly commuted by single occupant vehicle
EF	-	unitless	Emission factor of transit vehicle (i.e., bus) relative to automobiles. For example, 3 = transit emits three times as much as automobiles.
DBVMT	1	miles	Average daily transit vehicle (i.e., bus) miles traveled, including route mileage and mileage to and from garage
Nd	290	days	Number of benefit days per year.

Bike Ped

$$\text{AVMTR} = \text{PSOV} * \text{Nd} * \text{D}$$

Variable	Default	Units	Description
PSOV	-	unitless	Proportion of users (expressed as a decimal) that formerly commuted by single occupant vehicle
Nd	252	days	Number of benefit days per year.
D		miles	Total number of miles traveled on new facility per day (for all users)

New Transit Station

$$\text{AVMTR} = \text{N} * \text{Cs} / \text{CI} * \text{PSOV} * \text{Nd} * \text{D}$$

Variable	Default	Units	Description
N	-	people	Number of new trips traveling through the station
Cs		dollars	Cost of station
CI	-	dollars	Total cost of transit lines feeding into station
PSOV	-	unitless	Proportion of users (expressed as a decimal) that formerly commuted by single occupant vehicle
Nd	290	days	Number of benefit days per year.
D	19.5	miles	Average one-way trip distance.

HOV Lanes

$$\text{AVMTR} = \text{N} * (\text{PSOV} - (1/\text{S})) * \text{Nd} * \text{D}$$

Variable	Default	Units	Description
N	-	vehicles	Average total number of vehicles traveling on HOV facility per day
PSOV	-	unitless	Proportion of users (expressed as a decimal) that formerly commuted by single occupant vehicle
S	2.74	people	Average carpool size (including the driver).
Nd	290	days	Number of benefit days per year.

D	19.5	miles	Average one-way trip distance.
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Telework / Telecommute

$$AVMTR = N * P * D * Nt * W * Nw$$

Variable	Default	Units	Description
N	-	people	Total number of employees that work at companies with a telework program
P	0.0536	unitless	Percentage (expressed as a decimal) of employees that telework
D	19.5	miles	Average one-way trip distance.
Nt	2	trips	Number of one-ways trips per day.
W	1.62	days	Average days per week that employees telework instead of commuting
Nw	50	weeks	Number of work weeks per year

Bike Share

$$AVMTR = PSOV * Nd * D$$

Variable	Default	Units	Description
PSOV	-	unitless	Proportion of users (expressed as a decimal) that formerly commuted by single occupant vehicle
Nd	252	days	Number of benefit days per year.
D		miles	Average daily number of miles traveled on shared bicycles

Bike to Work Day

$$AVMTR = N * R * D * Nt * Nd$$

Variable	Default	Units	Description
N	-	people	The average number of bike to work participants
R	0.59	unitless	Percentage (expressed as a decimal) of participants who already regularly bike to work
D	19.5	miles	Average one-way trip distance.
Nt	2	trips	Number of one-ways trips per day.
Nd	4.21	days	Number of benefit days per year. Equal to the number of days that participants biked to work during the initial event plus any months following the event.

Marketing

$$AVMTR = N * P * (R / E) * PSOV * Nt * Nd * D$$

Variable	Default	Units	Description
N	-	items	Number of items (e.g., pamphlets, flyers, etc.) distributed by the project
P	0.6	unitless	Proportion (expressed as a decimal) of items that are seen by the target audience. Default value is from Coloradoan.
R	0.27	unitless	Percent (expressed as a decimal) recall of multiple ads. Default value is from Riger Knowledge Base Media.
E	3	items	Minimum number of exposures needed to incite action in the target audience. Default value is from Riger Knowledge Base Media.

PSOV	-	unitless	Proportion of users (expressed as a decimal) that formerly commuted by single occupant vehicle
Nt	2	trips	Number of one-ways trips per day.
Nd	240	days	Number of benefit days per year.
D	19.5	miles	Average one-way trip distance.

Inspection and Maintenance (I/M)

$$\text{AVMTR} = \text{ADT} * \text{P} * (\text{J1} - \text{J2}) * \text{D} * \text{Nd}$$

Variable	Default	Units	Description
ADT	-	trips	Average number of trips per day
P	-	unitless	Proportion of vehicles (expressed as a decimal) subject to I/M
J1	-	unitless	Before I/M emission speed factor
J2	-	unitless	After I/M emission speed factor
D	-	miles	Average one-way trip distance.
Nd	252	days	Number of benefit days per year.

ITS and Traffic Controls

This formula allows for direct entry of CO emission reduction. The project sponsor provides calculations.

Variable	Default	Units	Description
VHT		hours	Total number of vehicle hours eliminated by the project during the year.
CO		kg	Total kilograms of carbon monoxide eliminated by the project during the year.

Common PM 10 Formula

$$\text{PM10 Emissions Reduction (kg)} = (\text{TPEF} + (\text{SLEF} / 1000)) * (1 - \text{RF}) * \text{AVMTR}$$

Variable	Default	Units	Description
TPEF	-	kg/mile	Tailpipe PM10 emissions factor entered by administrator
SLEF	-	g/vmt	Uncontrolled emissions factor for the region
RF	-	unitless	Percent PM10 reduction by the Agency, entered as a decimal

Appendix H - Reporter Emission Factors

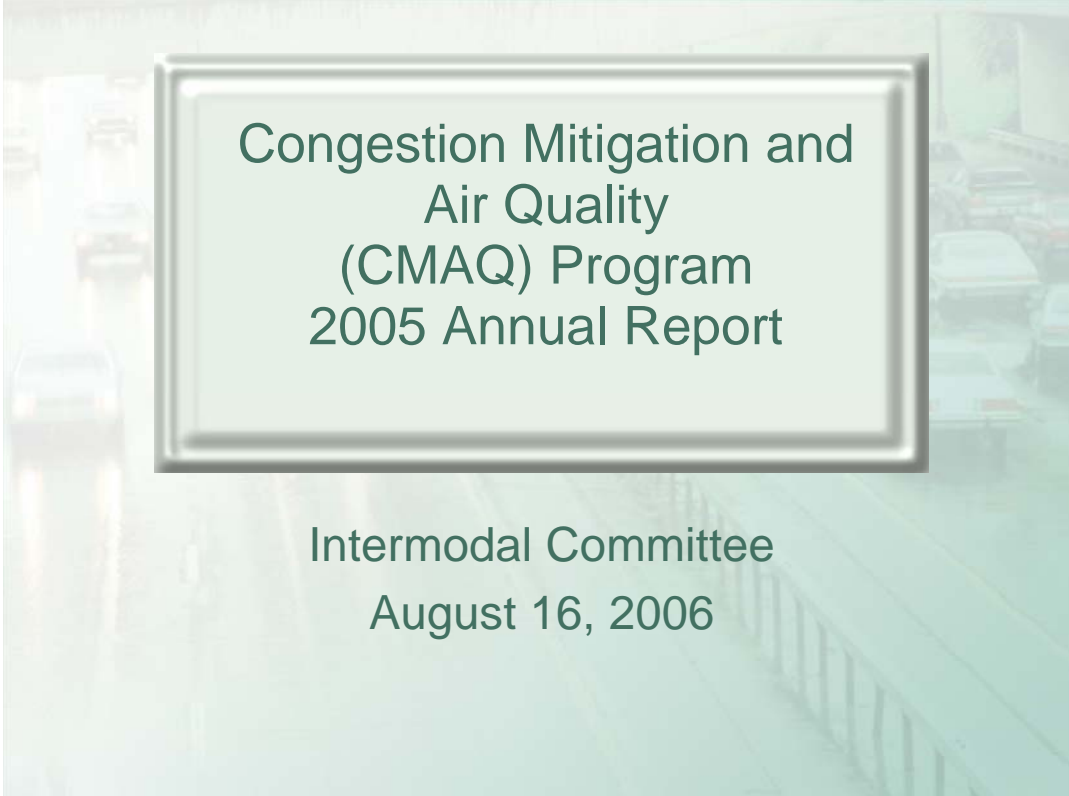
Tailpipe Emission Factors

Emission Region	Year	CO	NO _x	VOCs	PM ₁₀
		(kg/mile)	(kg/mile)	(kg/mile)	(kg/mile)
Colorado Springs	2002	0.02807	0.00155	0.00197	3.00E-05
	2003	0.0273	0.00132	0.00184	3.00E-05
Denver Metro	2002	0.02419	0.00155	0.00192	3.00E-05
	2003	0.02387	0.0013	0.00179	3.00E-05
Fort Collins	2002	0.02807	0.00155	0.00197	3.00E-05
	2003	0.0273	0.00132	0.00184	3.00E-05
Other	2002	0.02097	0.00197	0.00244	0.001
	2003	0.02097	0.00197	0.00244	0.001

Silt Loading Factors

Emission Region	Silt Loading Factor	Silt Loading Factor
	2002 (g/m ²)	2003 (g/m ²)
Aspen - Local Streets	10.7	10.7
Aspen - Main St. (SH 82 in town)	15.2	15.2
Aspen - SH 82 Outside City	7.15	7.15
Canon City - Local Streets	9.714	9.714
Canon City - US 50	29.98	29.98
Pagosa Springs - Local Streets	9.714	9.714
Pagosa Springs - US 160 Through Town	29.98	29.98
Pitkin County Roads	14.84	14.84
Steamboat Springs - Lincoln Ave.	29.98	29.98
Steamboat Springs - Local streets	9.714	9.714
Steamboat Springs - US 40 Outside City	4.96	4.96
Telluride - SH 145 Near Society Turn	32.47	32.47
Telluride and Mountain Village Local Streets	9.714	9.714

Appendix I –PowerPoint Presentation



Congestion Mitigation and Air Quality (CMAQ) Program 2005 Annual Report

Intermodal Committee
August 16, 2006

Program Purpose

- Created by ISTEA, expanded by TEA-21, and continued under SAFETEA-LU to help air quality non-attainment and maintenance areas meet National Ambient Air Quality Standards (NAAQS)
- Annual report of air quality benefits required by FHWA



Commission Action

- CMAQ Resolution adopted January, 2000
 - Program Goal to implement cost effective projects that reduce air pollution
 - Increase accountability for expenditure of CMAQ funds
 - Annual report to Intermodal Committee
 - Select projects with highest benefit/cost ratio



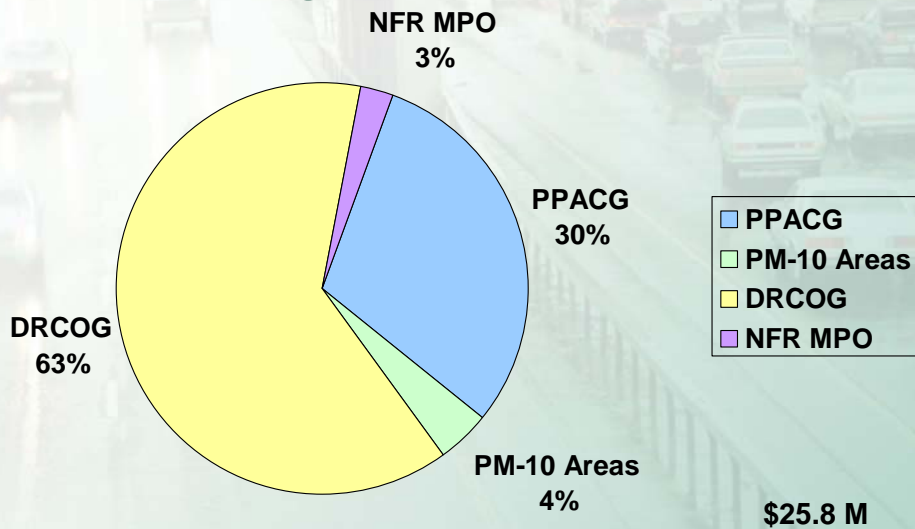
Pollutants

- Carbon Monoxide (CO) caused by motor vehicle incomplete fuel combustion
- Nitrogen Oxides (NO_x)
 - precursors for ozone (smog) and PM-10
 - contributes to brown cloud
- Volatile Organic Compounds (VOC)
 - precursors for ozone & toxic air pollutants
- Particulate Matter (dust) smaller than 10 microns (PM-10)
 - contributes to brown cloud

CMAQ Eligible Areas

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	X
Canon City	-	-	-	X
Colorado Springs (PPACG)	X	-	-	-
Denver (DRCOG)	X	X	X	X
Fort Collins (NFR MPO)	X	-	-	-
Pagosa Springs	-	-	-	X
Steamboat Springs / Routt County	-	-	-	X
Telluride / Mountain Village	-	-	-	X

2005 Obligated Funds by Area



Source: Transportation Commission Resolution TC-807



CMAQ Project Categories

- Intelligent Transportation Systems (ITS)
 - Traffic signal improvements
- Transit
 - New or expanded transit services
- Transportation Demand Management (TDM) / Other
 - Marketing and outreach efforts to reduce single occupant vehicle travel demand (carpool / vanpool)
 - Ozone education & reduction efforts
- PM-10 Projects
 - Paving, street sweeping, liquid de-icing



Intelligent Transportation Systems (ITS) Projects

- DRCOG (2005) Traffic Signal Improvements
- DRCOG ITS Pool
- PPACG Citywide Congestion Management



Transit Projects

- Arvada Call-n-Ride
- Acquisition of Denver Union Station
- Bus Route 153 Expansion
- Englewood Shuttle Service
- C-Line Operating Assistance
- Downtown Colorado Springs Circulator
- Front Range Express - FREX
- Telluride / Mountain Village Transit



TDM / Other Projects

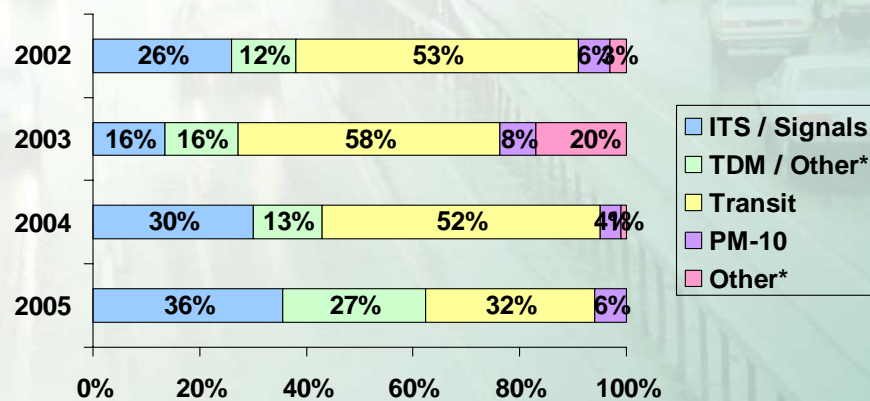
- DRCOG RideArrangers
- DRCOG TDM Pool (Program Monitorship)
- RAQC Ozone Reduction
- Smart Sign*
- Clean Yellow Fleets for Blue Skies*
- Fort Collins TDM Outreach
- Fort Collins Carpool & Vanpool
- PPACG Ridefinders

*Note: These projects are not considered to be "traditional" TDM efforts. The SmartSign project is a tailpipe emission notification effort, and the Clean Yellow Fleets for Blue Skies is a diesel retrofitting program (equipment replacement) to reduce diesel emissions.

PM-10 Projects

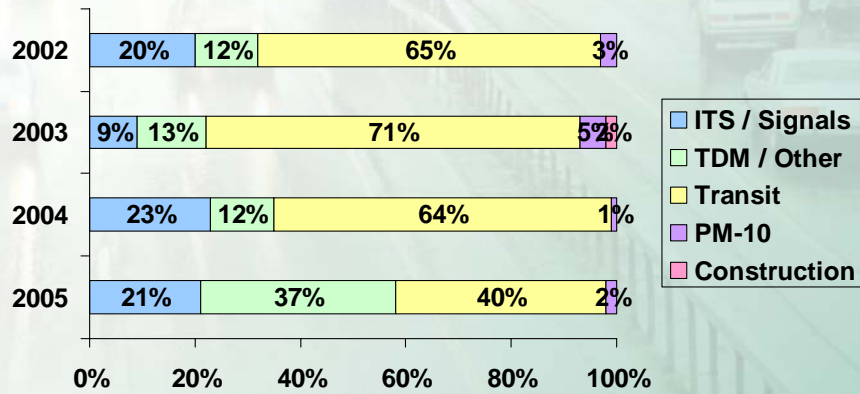
- Aspen Flush Truck
- Canon City Paving
- DRCOG Region 1 Sweepers
- Castle Rock Sweepers Expansion
- Pagosa Springs Paving
- Pagosa Springs Magnesium Chloride
- Steamboat Springs Paving
- Mountain Village Combo Unit

CMAQ Funds by Project Type Statewide



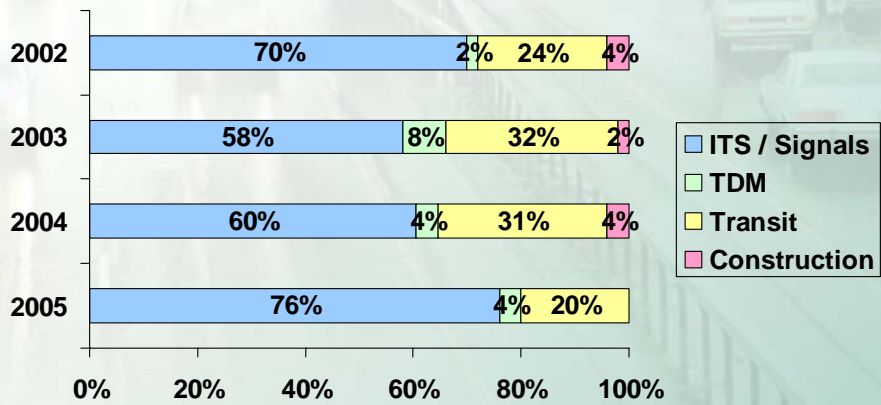
*Note: Other Category included Construction Projects in 2002, 2003, & 2004. Ozone outreach projects were included in TDM / Other in 2005
 Source: Obligated funds by project type for FY 2005, 2004, 2003 and programmed funds in FY 2002.

CMAQ Funds Obligated by Project Type DRCOG (\$16.4 M)



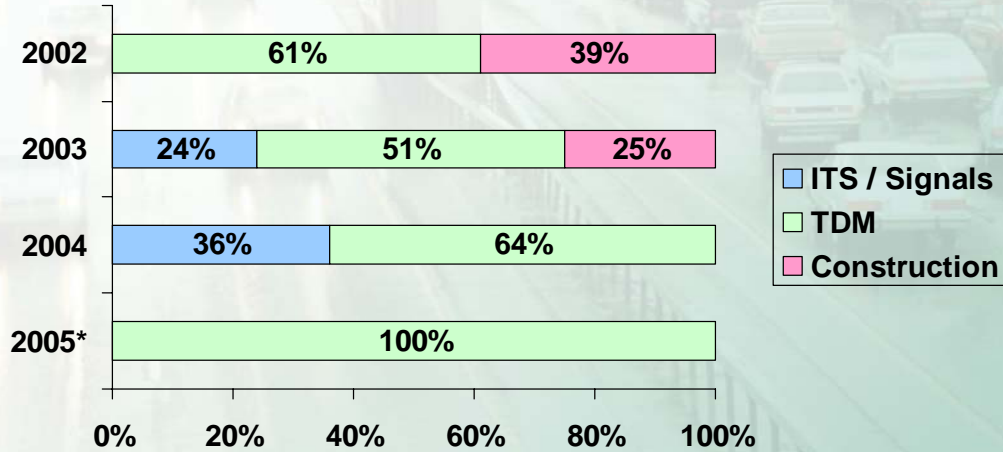
Source: Obligated funds by project type for FY 2005, 2004, 2003 and programmed funds by projects type FY 2002.

CMAQ Funds Obligated by Project Type PPACG (\$7.6 M)



Source: Obligated funds by project type for FY 2005, 2004, 2003 and programmed funds by projects type FY 2002.

CMAQ Funds Obligated by Project Type NFR (\$616 K)



Note: *Two construction Projects were delayed in 2005 and are not shown in FY '05 obligated figures.
 Source: Obligated funds by project FY 2005, 2004, 2003 and programmed funds by projects FY 2002.

CMAQ Funds Obligated by Project Type PM-10 Areas (\$1.1 M)



Note: Other includes Telluride Vanpool Program
 Source: Obligated funds by project type for FY 2005, 2004 and 2003

2003 Project Results (Emission Reductions Realized in 2003)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	3
Canon City	-	-	-	10
Colorado Springs (PPACG)	3,633	-	-	-
Denver (DRCOG)	3,544	34	170	736
Fort Collins (NFR MPO)	178	-	-	-
Pagosa Springs	-	-	-	86
Steamboat Springs / Routt County	-	-	-	284
Telluride / Mountain Village	-	-	-	1
2003 TOTAL	7,355	34	170	1,120

Source: 2003 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year

2004 Project Results (Emission Reductions Realized in 2004)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	results pending
Canon City	-	-	-	26
Colorado Springs (PPACG)	581	-	-	-
Denver (DRCOG)	1,590	47	44	1
Fort Collins (NFR MPO)	1,116	-	-	-
Pagosa Springs	-	-	-	65
Steamboat Springs / Routt County	-	-	-	0
Telluride / Mountain Village	-	-	-	639
2004 TOTAL	3,287	47	44	730

Source: 2004 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year

2005 Project Results (Emission Reductions Realized in 2005)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM-10
Aspen / Pitkin County	-	-	-	2
Canon City	-	-	-	16
Colorado Springs (PPACG)	1,311	-	-	-
Denver (DRCOG)	3,982	145	232	26
Fort Collins (NFR MPO)	111	-	-	-
Pagosa Springs	-	-	-	12
Steamboat Springs / Routt County	-	-	-	14
Telluride / Mountain Village	-	-	-	48
2005 TOTAL	5,405	145	232	117

Source: 2005 CMAQ Reports from Project Sponsors
 Note: Emission reduction expressed in 1000 kilograms per year

Future Benefits

- Previous report discussed capturing future benefits
- Future benefits reported when funds obligated
- Typical life spans for capital projects
 - Signal Timing / ITS Improvements – 5 years
 - Paving Soft Surface Roads – 10 years
 - Transit Stations – 20 years

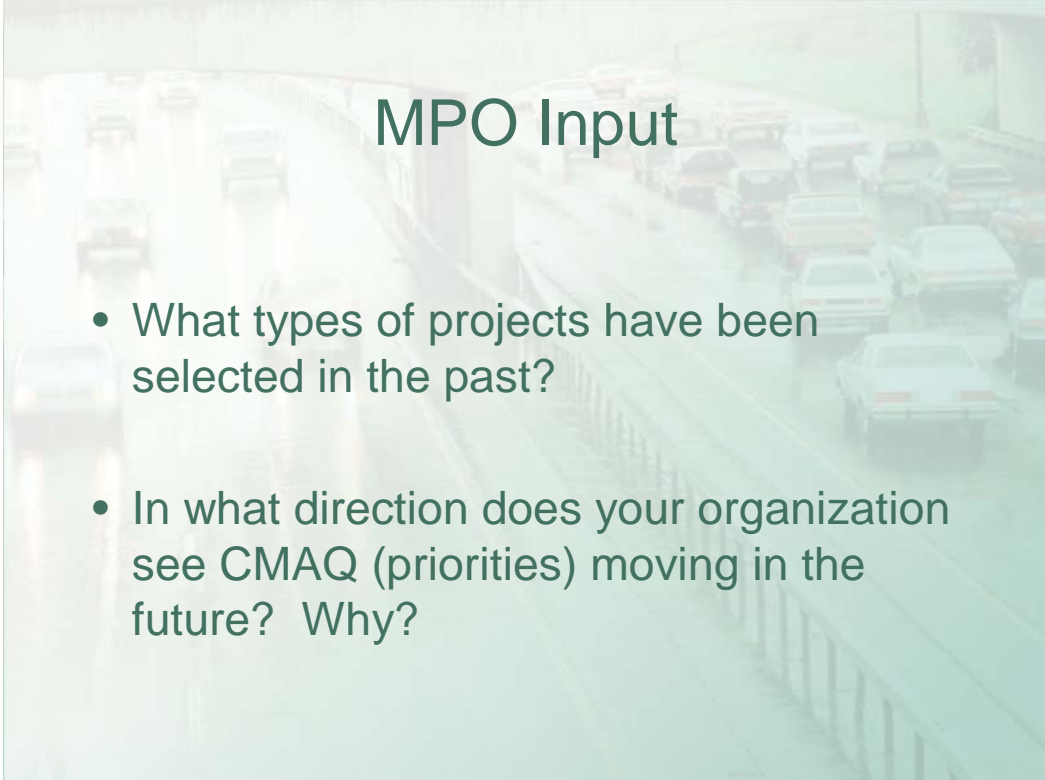
2005 Project Results (Emission Reductions in FY 2005 & Future)

Non-attainment / Maintenance Area	CO	NOx	VOC	PM
Aspen / Pitkin County	-	-	-	16
Canon City	-	-	-	163
Colorado Springs (PPACG)	3,378	-	-	-
Denver (DRCOG)	17,723	654	1,235	239
Fort Collins (NFR MPO)*	111	-	-	-
Pagosa Springs	-	-	-	111
Steamboat Springs / Routt County	-	-	-	143
Telluride / Mountain Village	-	-	-	143
2005 TOTAL	21,212	654	1,235	382

Source: 2005 CMAQ Reports from Project Sponsors

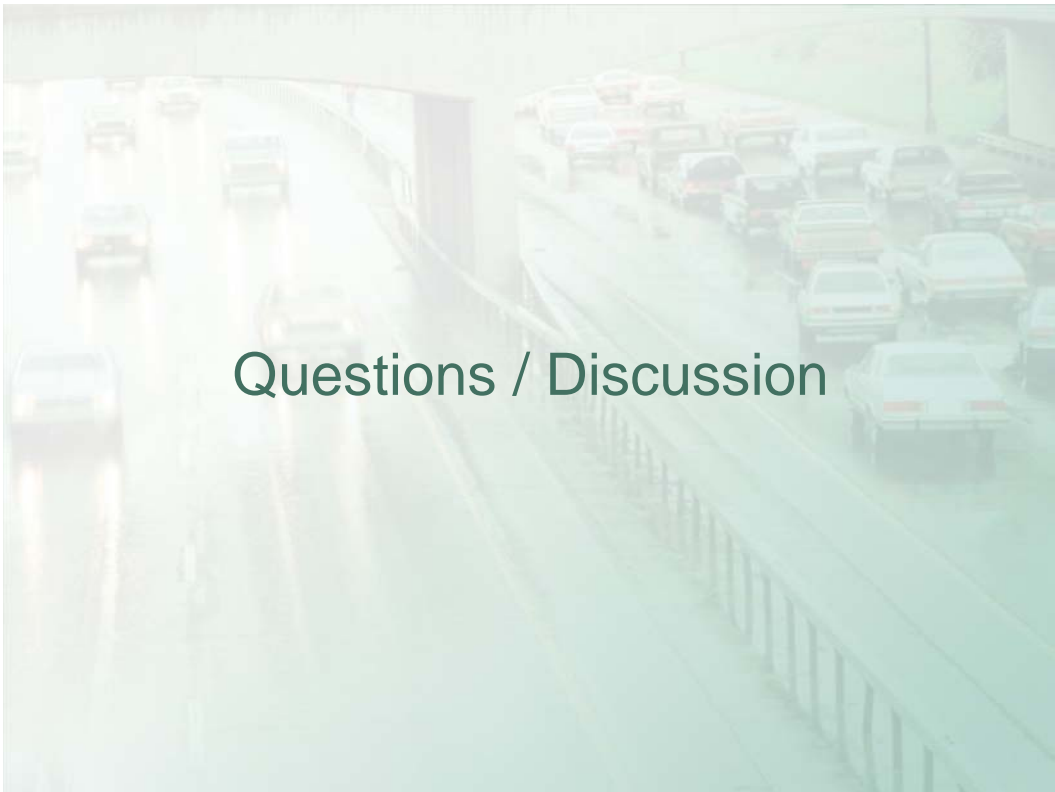
Note: Emission reduction expressed in 1000 kilograms per year

*NFR MPO had two projects that started in FY 2005 but benefits will be reflected in FY 2006 Report.



MPO Input

- What types of projects have been selected in the past?
- In what direction does your organization see CMAQ (priorities) moving in the future? Why?



Questions / Discussion