Colorado FASTER

FUNDING ADVANCEMENTS for SURFACE TRANSPORTATION & ECONOMIC RECOVERY

Transportation Deficit Report

Prepared Pursuant to SB-108

June 30, 2009

CDOT

DEPARTMENT OF TRANSPORTATION

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Transportation Deficit Report

Overview

This report details factors impacting the budget of the Colorado Department of Transportation (CDOT), the current condition of Colorado's transportation system, the costs required to sustain current conditions and the costs of accomplishing the system's aspirational goals. A discussion is also included on options for reducing future transportation infrastructure costs. This report is authorized under SB 09-108, the Funding Advancements for Surface Transportation and Economic Recovery Act of 2009, commonly called FASTER.

Colorado has invested billions of dollars over the past century building a comprehensive transportation network. As a good steward of the public's tax dollars, CDOT works to deliver a system that is safe, moves people and goods efficiently and has capacity for sustainable growth and development. Rising demand and costs on one side and stagnating revenue sources on the other have resulted in an escalating resource gap that reduces CDOT's ability to keep up with the needs of Colorado's transportation system. This widening gap has brought the system to a critical point.

On the revenue side, the state motor fuel tax was last increased in 1991 and the federal motor fuel tax in 1993. These per-gallon taxes provide the majority of Colorado's transportation funding. They do not change with inflation. In 1991, a driver who bought 15 gallons of gasoline at a fill-up paid $3.30 into the state's Highway Users Tax Fund (HUTF). Eighteen years later, that same 15 gallons still brings $3.30. On top of this, new vehicles have become more fuel efficient. Average passenger vehicle mileage in 1991 was 21.2 miles per gallon; in 2006, it was 22.4 miles per gallon, according to the U.S. Bureau of Transportation Statistics. That means fuel consumption and fuel tax revenue per mile has dropped more than 5 percent while prices have gone up.

On the cost side, construction inflation has worn down the buying power of the fuel tax. Each dollar spent on construction in 1991 bought 41 cents worth in 2007, as measured by the Colorado Construction Cost Index (CCI). The $3.30 worth of transportation system maintenance and improvements for which that driver paid with each fill-up in 1991 bought $1.34 worth in 2007. On the demand side, Colorado's population has increased 50 percent since the 1990 Census. It topped 5 million this year with another 1.2 million people expected by 2020. Compounding this, actual use of the transportation system has increased faster than population growth, as measured by miles driven. In 2006, 28.5 billion miles were driven on state highways, a 60 percent increase from 1990.

The bottom line is this: Sustaining the existing transportation system and expanding it to meet the needs of current and future Coloradans cannot be done with the future revenues currently projected. Fulfilling Colorado's basic transportation needs through 2030 will require more than double the expected revenue over that time period.

In addition to increasing revenue to repair and replace our failing infrastructure, we need to continue to look at alternative methods to help reduce the need for increased revenue. Intelligent Transportation Systems (ITS), Transportation Demand Management (TDM), and increased use of transit are among the methods discussed in this report.

Factors Impacting CDOT's Budget

The Department's main source of funding comes from state and federal excise taxes on gasoline and diesel fuel. Receipts are deposited into the HUTF, from which CDOT is the largest beneficiary of monthly distributions. The fund also receives certain other motor vehicle fees. CDOT also receives federal apportionments of Highway Trust Fund (HTF) spending authority, subject to annual federal appropriations and obligation restrictions as outlined to six-year authorization bills.

Principal revenue source is nonflexible

Since January 1991, Colorado has levied 22 cents per gallon for gasoline and 20.5 cents per gallon for diesel fuel. Under current law, the state fuel tax is fixed and not indexed to inflation. This means the only significant factor that increases fuel tax revenue as transportation demand and infrastructure costs go up is increased fuel consumption. The Department's largest resource for adequately maintaining and improving the transportation system is fixed at a rate deemed adequate for 1991.

Federal fuel taxes are 18.4 cents per gallon on gasoline and 24.4 cents per gallon on diesel fuel, rates that have not changed since 1993. It is also a fixed rate that doesn't respond to inflation. In the federal FY 2008, Congress made an emergency transfer of $8 billion from the federal General Fund to cover a deficit in the HTF. It is projected that the HTF will become insolvent in the current fiscal year unless Congress transfers again from the General Fund, severely restricts spending authority, or both. The current transportation authorization bill expires September 30, 2009. There is significant uncertainty about whether funding in federal FY 2010, beginning October 1, will be done through a continuing resolution or a new reauthorization. If the former, CDOT will face short term uncertainty, making project planning more difficult. If the latter, the manner of federal transportation funding could face fundamental changes.

The trends affecting Colorado's HUTF mirror those at the national level. Nationwide, vehicle miles traveled (VMT) has increased significantly but increases in fuel economy have made revenues lag behind VMT growth. In addition, the growth potential of electric, hybrid and other alternative fuel vehicles will result in reduced oil consumption and subsequent fuel tax revenues.

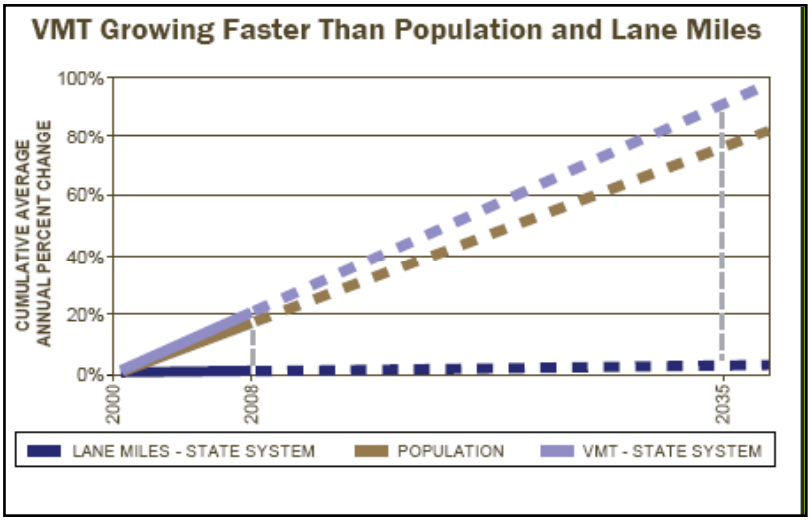
Growth in driving outpaces population

Colorado's population has grown more than 50 percent since 1990, while the miles driven on state highways, reflected in VMT, outpaced that by increasing 60 percent from 1990 to 2006. The trend of VMT growing faster than population is expected to continue through 2035. Growth in VMT is driven by several factors, all of which lie outside the control of CDOT:

- Commercial trucks, which deliver goods for the state and the nation's expanding population, drove 2.7 billion miles on the state highway system in 2007, a 10.5 percent increase over 1998. These heavier vehicles not only increased their VMT, they also exert more stress on road surfaces than passenger vehicles, leading to accelerated road surface deterioration;
- More people move into Colorado than leave. The net gain in population from people moving to Colorado has been greater in recent years than the natural increase from having more births over

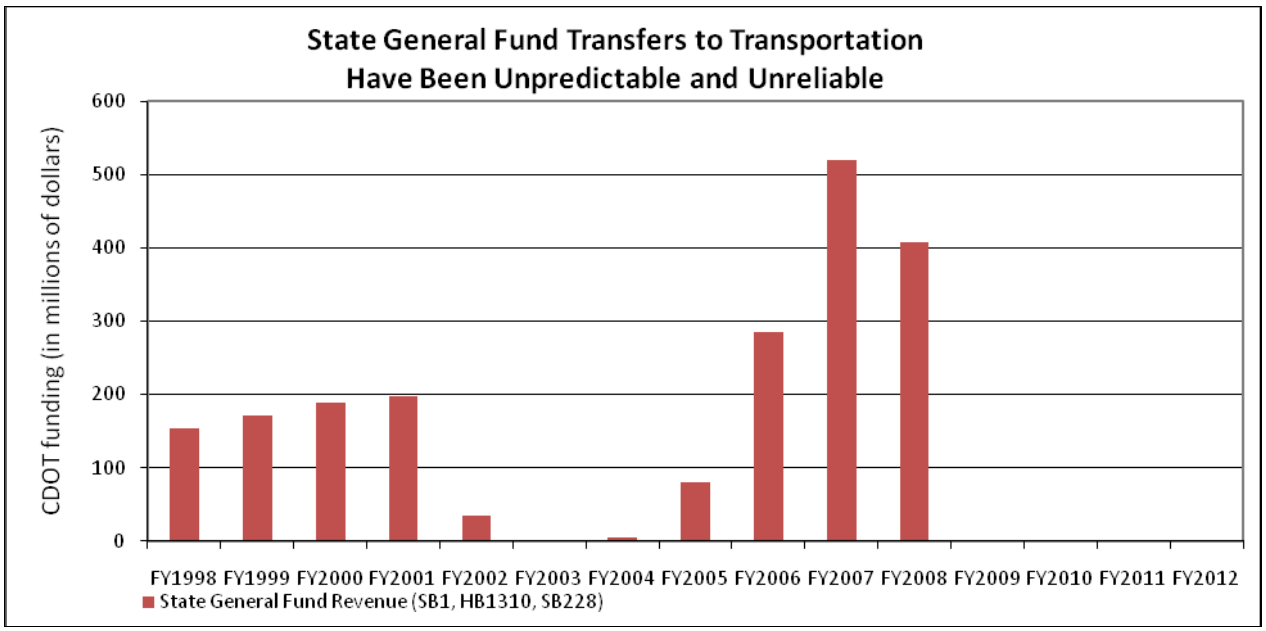
deaths, according to the State Demography Office in the Department of Local Affairs. Net in-migration historically leads to greater dispersion of the population;

- Passenger VMT growth is heavily influenced by land use planning, which lies almost completely outside the control of state government. As people move increasingly farther from work centers and commercial nodes, the result is longer average trip lengths and greater infrastructure needs.



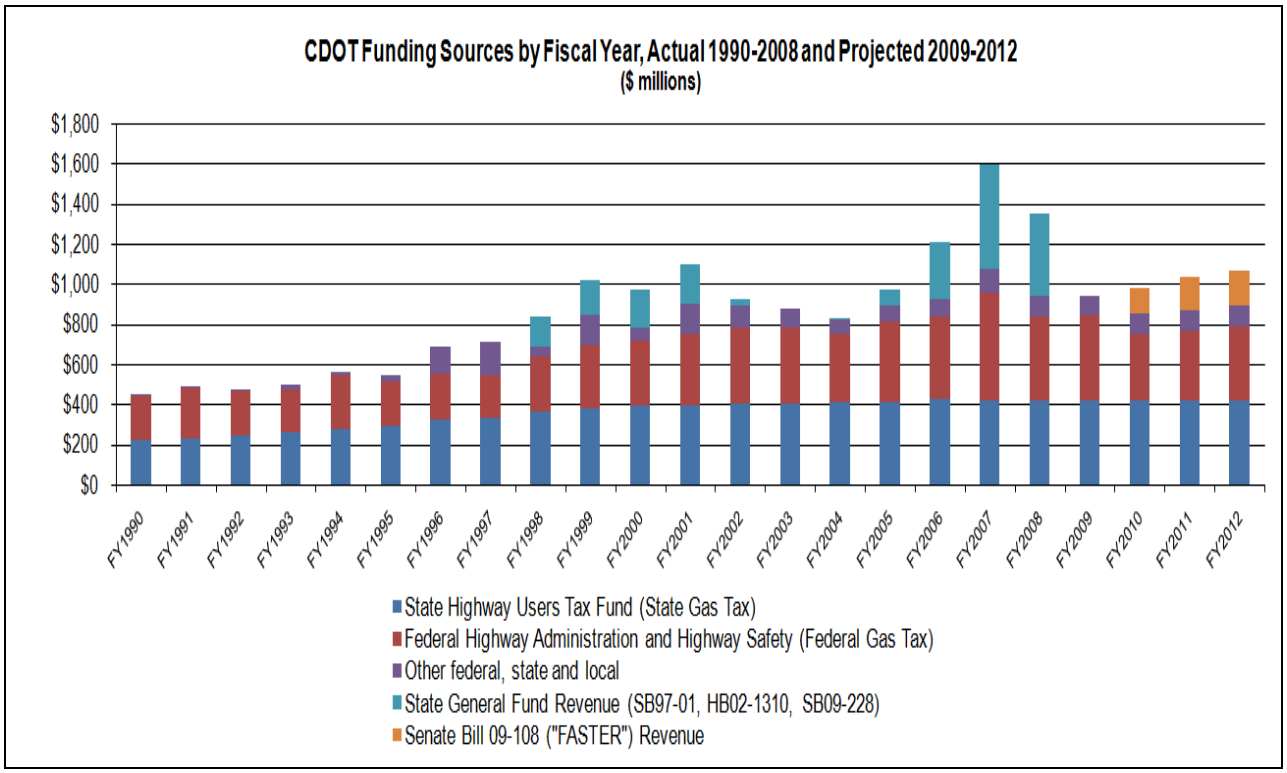
This trend has led to congestion and accelerated deterioration of road surfaces. These conditions are injurious to the economy and quality of life in Colorado. Delays in commuting and the delivery of goods and services lead directly to higher costs for business and the public. If the trend of VMT growth outpacing population growth in the last decade continues through 2035, VMT will have jumped 90 percent, to 34.2 billion, while population will have increased 75 percent, to 7.8 million. That will have occurred with virtually no increase in lane miles, a steady erosion of the Department's purchasing power and increased relative wear and tear on the system.

Inconsistent funding



Over the past 12 years, Colorado has taken measures to bolster CDOT's resources through transfers of General Fund revenues. In 1997, the General Assembly enacted Senate Bill 1, directing up to 10.355 percent of annual state sales tax receipts to the State Highway Fund contingent upon meeting the

Arveschoug-Bird allocation limit and statutory reserve requirements. In 2002, the General Assembly enacted House Bill 1310, directing to the State Highway Fund two-thirds of any excess General Fund revenues beyond the amount necessary to fully fund the Arveschoug-Bird limit, the statutory reserve and a full Senate Bill 97-001 transfer. While these bills brought significant new revenues, they had thresholds that made them highly sensitive to the economy's ups and downs. As a result, they were unpredictable and unreliable, causing wide fluctuations in annual funding for CDOT's programming of projects. This inconsistent feast/famine funding inhibits efficient planning and construction.



Between 1997 and 2009, the two measures directed a total of $2 billion in General Fund revenue to CDOT, including $63.1 million for transit purposes. However, because the thresholds for triggering the transfers were procyclical to the Colorado economy, the annual amounts ranged from zero to more than a half billion dollars in the years this statute remained in law. This volatility made it difficult for CDOT to conduct effective long-range planning. In 2009, the General Assembly passed Senate Bill 228, which eliminated the Arveschoug-Bird limit, Senate Bill 97-001 and House Bill 02-1310. Instead, between FY 2012-13 and FY 2016-17, up to 2 percent of gross General Fund revenues (roughly $170 million to $210 million per year) will be transferred to the State Highway Fund if certain statewide economic and fiscal conditions are met. There are no automatic transfers of General Fund revenues to CDOT in FY 2009-10 through 2011-12, and no transfers are presently anticipated in those years.

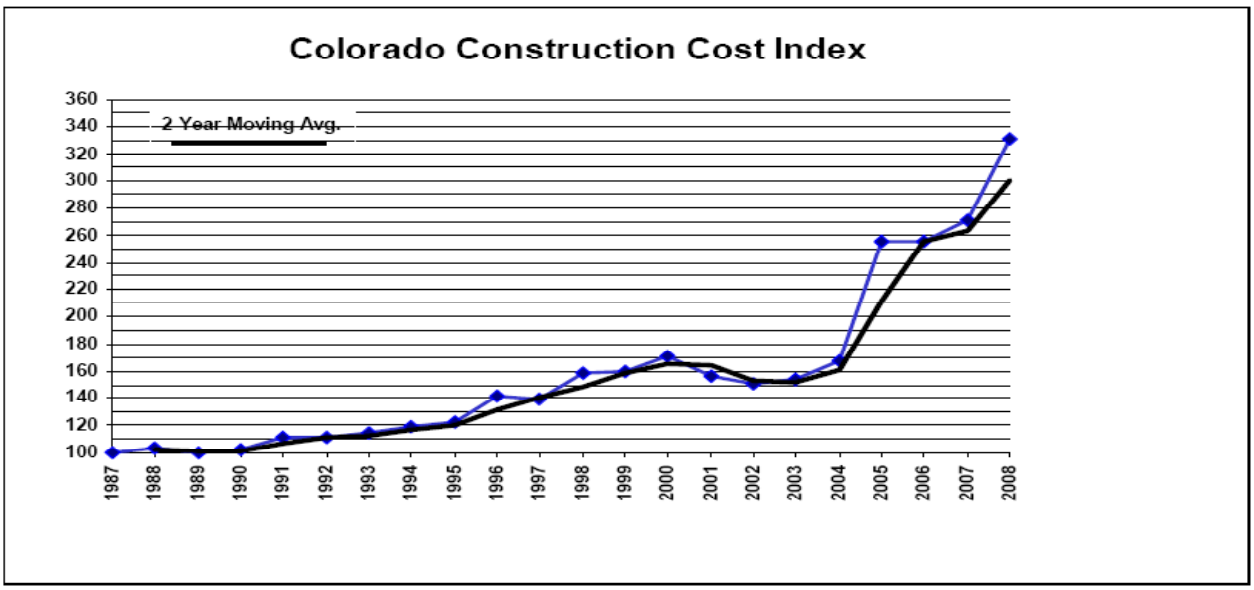
Senate Bill 09-108, the FASTER bill passed this year, provides CDOT and local governments with a new funding source that is stable and predictable. Through increased vehicle registration fees and other funding mechanisms, CDOT and local governments will receive funding dedicated to repairing structurally deficient bridges and making important road safety improvements, including $15 million per year directed to state and local transit-related improvements.

Revenue Projections for Senate Bill 09-108			
Fiscal Year	**FY 2009-10**	**FY 2010-11**	**FY 2011-12**
Road Safety Surcharge Revenues			
to CDOT	$73,465,967	$73,465,967	$73,465,967
to Counties	$26,937,521	$26,937,521	$26,937,521
to Cities	$22,039,790	$22,039,790	$22,039,790
Total Road Safety Surcharge Revenue	**$122,443,278**	**$122,443,278**	**$122,443,278**
Bridge Enterprise Revenue	**$50,581,085**	**$75,669,742**	**$100,931,612**
Other Revenue			
to CDOT	$21,006,500	$21,006,500	$21,006,500
to Counties	$3,119,050	$3,119,050	$3,119,050
to Cities	$2,551,950	$2,551,950	$2,551,950
Total Other Revenue	**$26,677,500**	**$26,677,500**	**$26,677,500**
Grand Total SB09-108 Revenue	**$199,701,863**	**$224,790,520**	**$250,052,390**
Distribution by Governmental Type			
to CDOT[1]	$94,472,467	$94,472,467	$94,472,467
to Counties	$30,056,571	$30,056,571	$30,056,571
to Cities	$24,591,740	$24,591,740	$24,591,740
to Bridge Enterprise	$50,581,085	$75,669,742	$100,931,612
Grand Total SB09-108 Revenue[2]	**$199,701,863**	**$224,790,520**	**$250,052,390**

[1]$10.0m per year must be spent on transit-like improvements, and $5.0m per year is credited to the State Transit and Rail Fund created in SB09-108.
[2]Does not reflect accrual adjustments due to timing lags between when revenues are generated and when they are recorded. Total recorded revenue is projected to be $183.1 million in FY 2009-10, $222.7 million in FY 2010-11, and $231.3 million in FY 2011-12.

Climbing construction costs

CDOT continually measures the cost of transportation construction through tabulation of all bids it receives. This is reported in the Colorado Construction Cost Index (CCI). The CCI shows that since the last increase in the state's fuel tax in 1991, CDOT has faced construction cost inflation that not only has outpaced its slow-growing revenue sources, but also broader measures of inflation such as the Denver/Boulder/Greeley Consumer Price Index for Urban Consumers (CPI-U). As a result, $1 in motor fuel tax revenue in 1991 would purchase only 41 cents of highway improvements in 2007.



Yearly Colorado Construction Cost Index, 1985=100. Source: CDOT.

There are several reasons why highway construction costs have increased more rapidly than broader measures of inflation, principally burgeoning global demand for commodities such as oil, aggregates and steel. To the extent that populous countries like Brazil, Russia, India and China continue to industrialize at a rapid pace, demand for the materials associated with physical infrastructure will keep prices high for the foreseeable future. Labor costs have also increased, but at a slower rate than materials. Growing global demand for CDOT's core construction materials such as asphalt, concrete and steel led to an unprecedented spike in Colorado transportation construction costs of 52 percent in 2005 alone. The spike in the CCI can be seen graphically in the chart on the previous page.

The balance of this report presents costs related to attaining departmental objectives and goals for bridge, pavement, safety, and maintenance. In each section the baseline is what the department currently anticipates spending for that particular activity between 2009 and 2019. The basis of these predicted numbers is the department's current resource allocation plan which was adopted in December 2005. This plan used predicted 2008 dollars as its base. The expenditure dollars for each program are adjusted off of this 2008 base year using either the predicted Colorado Construction Index (CCI) or Denver-Boulder-Greeley Consumer Price Index for Urban Consumers (CPI-U) and presented as dollars available in the year of expected expenditure.

In the years since adoption of the current resource allocation plan actual revenues, both the CCI and CPI, and actual expenditures by dollar amount and investment category have varied substantially from the baseline predictions. The following sections take the currently planned dollars from the resource allocation adopted in December 2005 and apply them based upon the system's most current conditions. Consequently, the numbers used in the following chapters do not correlate with those the department has presented in past documents such as the Department's 2035 Long Range Plan, and the Colorado Transportation Finance and Implementation Panel's Report to Colorado which was published in January 2008.

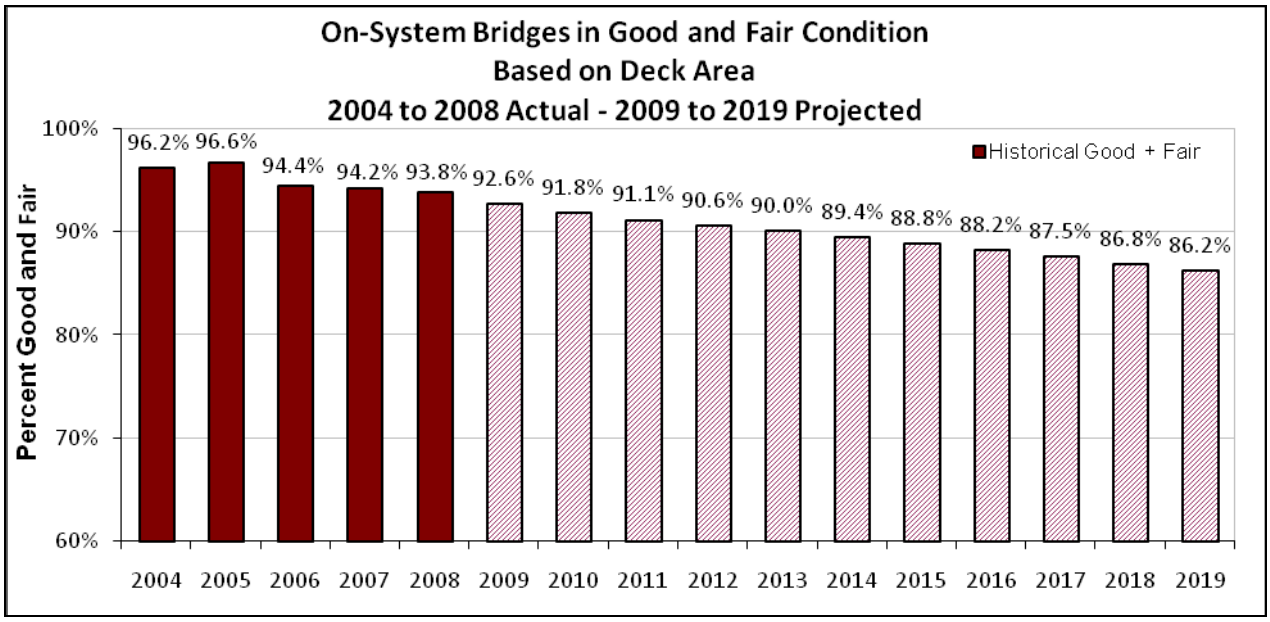
Moving forward, this first Transportation Deficit Report will serve as a good baseline for which future Deficit Reports may be compared against.

Bridge

How we rate/grade bridge condition

The condition of CDOT's major vehicular bridges is inventoried and classified using standards in the National Bridge Inventory, established by Federal Highway Administration (FHWA). CDOT reports bridge data by the percent of total bridge deck area statewide in good or fair condition. The condition of major vehicular bridges is based on a sufficiency rating of 0-100 and a status of not deficient, functionally obsolete, or structurally deficient. Bridges rated poor have a sufficiency rating from 0-50. They do not meet all safety and geometry standards and require reactive maintenance to ensure their safe service. Poor bridges are eligible for replacement and are the basis for determining bridge funding needs.

Bridges in fair condition have a sufficiency rating from 50 to 80 and a status of structurally deficient or functionally obsolete. Bridges rated fair marginally satisfy safety and geometry standards and either require preventative maintenance or rehabilitation. Bridges in good condition include all those remaining. They generally meet all safety and geometry standards and typically only require preventative maintenance.



A structurally deficient bridge is typically one where deterioration has resulted in a portion of the bridge being in poor condition; for example, where water leaking through an expansion joint has caused the end of a steel girder to rust. Having only a small portion of a bridge in poor condition can result in the entire bridge being classified as structurally deficient. Bridges classified as functionally obsolete often have inadequate roadway shoulders, insufficient number of lanes to handle current traffic volumes, overhead clearance less than the required minimum height or inadequate width between bridge foundations for such things as roadways or streams passing underneath.

Bridges classified as functionally obsolete often require height or speed restrictions, traffic control devices or additional guardrails to ensure safety.

Current Condition

For FY 2008, the percent of major vehicular bridge deck area statewide in good and fair condition was 93.8 percent, matching the Transportation Commission's objective for the year. The goal was 95 percent good and fair. The trend, based on projected revenue through 2035 including the FASTER Bridge Enterprise Special Revenue Fund, is downward to 86.2 percent good or fair condition in 2019. Legislators and the general public may remember Colorado's bridge conditions by a more widely reported statistic. In 2008, Colorado had 125 "poor" bridges on its highway system. That number grew from 116 in 2007, and is expected to continue to grow.

Percent of Major Vehicular Bridge Deck Area Statewide in Good and Fair Condition

Goal	95% Good/fair	Trend, 2003-2007 inclusive, based on
2008 Actual	93.8%	CDOT 2007 Annual Performance Report

2008 Actual Bridge Deck Condition by Category

	% Deck Area	Count	NHS*	Non-NHS	Interstate	Non-Interstate
Good or Fair	93.8%	3,281	1944	1337	1067	2214
Poor	6.2%	125	78	47	37	88
Total	100.0%	3,406	2,022	1,384	1,104	2,302

** -- NHS is National Highway System category*

How we got to this condition

Exposure of bridges to the elements is the single most significant factor impacting bridge conditions. Bridges are designed to withstand the wear and tear of very high volumes of traffic operating under current and historical weight and size limits. Deterioration of bridges due to exposure affects their ability to carry high volumes of traffic over time. The following four factors, specified in Senate Bill 09-108, are examined in relation to bridge condition:

- ***Population Growth and Distribution.*** These factors have substantial effect on the Average Daily Traffic (ADT) that crosses over a bridge. ADT is one of the many factors used to determine sufficiency rating, particularly from a functional perspective. Growth in population and where that population chooses to travel can result in changes in ADT for structures and advance or delay the onset of functional obsolescence.

- ***Vehicle Size and Weight.*** Under current vehicle laws, changes to bridge ratings due to vehicle weight restrictions or vertical clearance would be minimal. More likely, structural deterioration due to exposure would be the factor that adds new bridges to the restricted list. Ratings do not take

into account the number of permitted overweight or over-height vehicles on structures, and their overall impact on a bridge's condition is not quantifiable. On average, 47,487 Oversize or Overweight permits were issued annually between FY 2004 and 2008. Non-permitted over-height vehicles have hit bridges and caused enough damage to drop bridge condition ratings until repairs are accomplished. In addition, non-permitted overweight vehicles can cause overstress damage to bridges if the load is in excess of the bridge's carrying capacity.

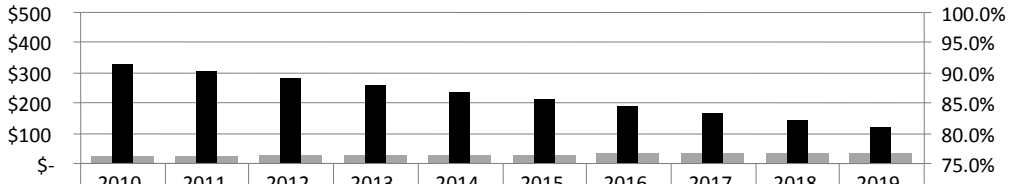
- ***Land Use Policies.*** Land use policies can have an effect on ADT, which is one of the many factors used to determine a bridge's sufficiency rating and is indirectly used to determine functional obsolescence.

- ***Work Patterns.*** Commuting routes, which can change with growth in population and development, affect ADT, which, as stated above, is one of the many factors used to determine sufficiency rating. ADT is indirectly used to determine functional obsolescence.

Ten-year future conditions

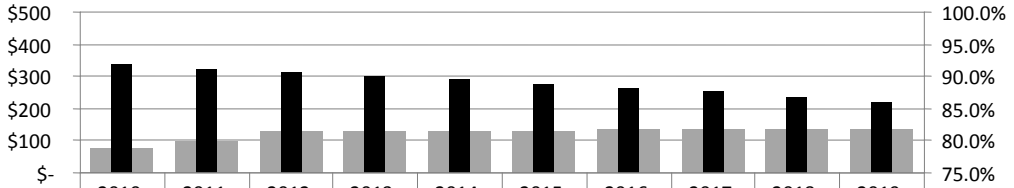
The current model used to predict bridge condition only predicts long term trends, those greater than 40 years. It does not accurately predict short term conditions for less than 20 years. Improvements to the model are underway.

Condition Based on 2035 Revenue Forecast



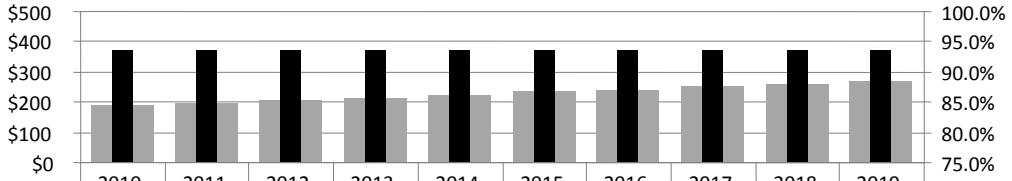
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$25	$22	$27	$28	$29	$30	$32	$32	$33	$34
Percent Good and Fair	91.5%	90.3%	89.1%	87.9%	86.8%	85.6%	84.4%	83.3%	82.1%	80.9%

Condition Based on 2035 Including FASTER Revenue Forecast



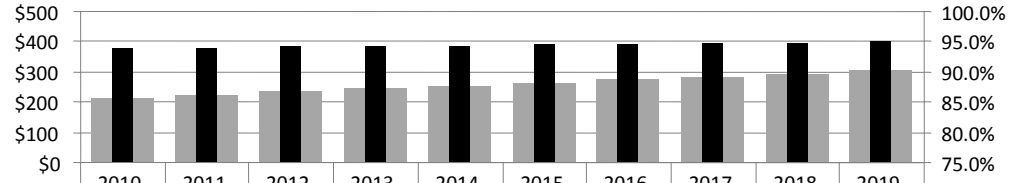
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$75	$97	$128	$129	$130	$131	$133	$133	$134	$135
Percent Good and Fair	91.8%	91.1%	90.6%	90.0%	89.4%	88.8%	88.2%	87.5%	86.8%	86.2%

Cost to Sustain Current 93.8% Good/Fair



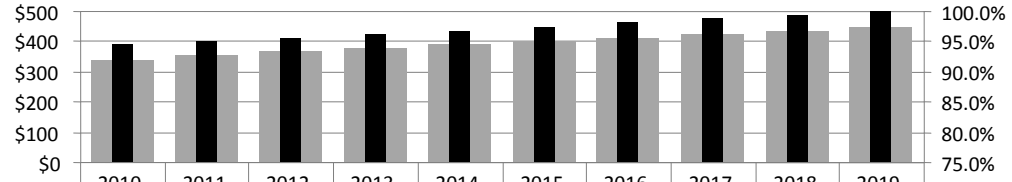
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$188	$197	$206	$215	$224	$233	$242	$251	$260	$270
Percent Good and Fair	93.8%	93.8%	93.8%	93.8%	93.8%	93.8%	93.8%	93.8%	93.8%	93.8%

Cost to Repair to 95% Good/Fair



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$215	$225	$234	$245	$254	$264	$274	$284	$294	$304
Percent Good and Fair	93.9%	94.0%	94.2%	94.3%	94.4%	94.5%	94.6%	94.8%	94.9%	95.0%

Cost to Achieve Vision of 100% Good/Fair



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$342	$353	$365	$378	$390	$402	$414	$426	$438	$450
Percent Good and Fair	94.4%	95.0%	95.7%	96.3%	96.9%	97.5%	98.1%	98.8%	99.4%	100.0%

Pavement

How we rate/grade pavement condition

CDOT evaluates the condition of highway pavement based on how many years of service life remain before reconstruction is the only economically viable option. A rating of good means there is a Remaining Service Life (RSL) of more than 11 years; a fair rating indicates RSL of 6 to 10 years and a poor evaluation represents RSL of less than 6 years. There are a number of poor-rated highways that have RSL 0, meaning the highway has no remaining service life. A poor highway segment is one that has a compromised base or sub-base. The only remaining economically viable option is major rehabilitation or complete reconstruction. Major rehabilitation and reconstruction costs 10 to 20 times more per lane mile, depending on variables, than pavement preservation treatment applied to a road still in good or fair condition. The value of a roadway treatment is measured by the ratio of relative cost to the relative years of service that the treatment adds to the roadway. With a relative value of a pavement preservation type treatment that is around three to four times greater than that of a major rehabilitation or reconstruction, CDOT obtains a better return on its investment when it systematically maintains roadways. The primary measure of pavement quality is the percent of pavement statewide that is in good or fair condition.

Current condition

CDOT maintains approximately 23,000 lane miles of roadway. In 2008, the entire pavement network was rated 53 percent in good and fair condition. At 47 percent, poor-rated roadways comprise about 10,800 lane miles. The cost to replace or fully rehabilitate them, in 2008 dollars, would be approximately $13.7 billion. Gains made from 1993 to 2005 allowed the system quality to peak that year at 65 percent good/fair. However, the trend has reversed since 2005. Using RSL, the projected condition in 2009 is 49 percent good/fair, which is a 4 percentage-point decline from this year.

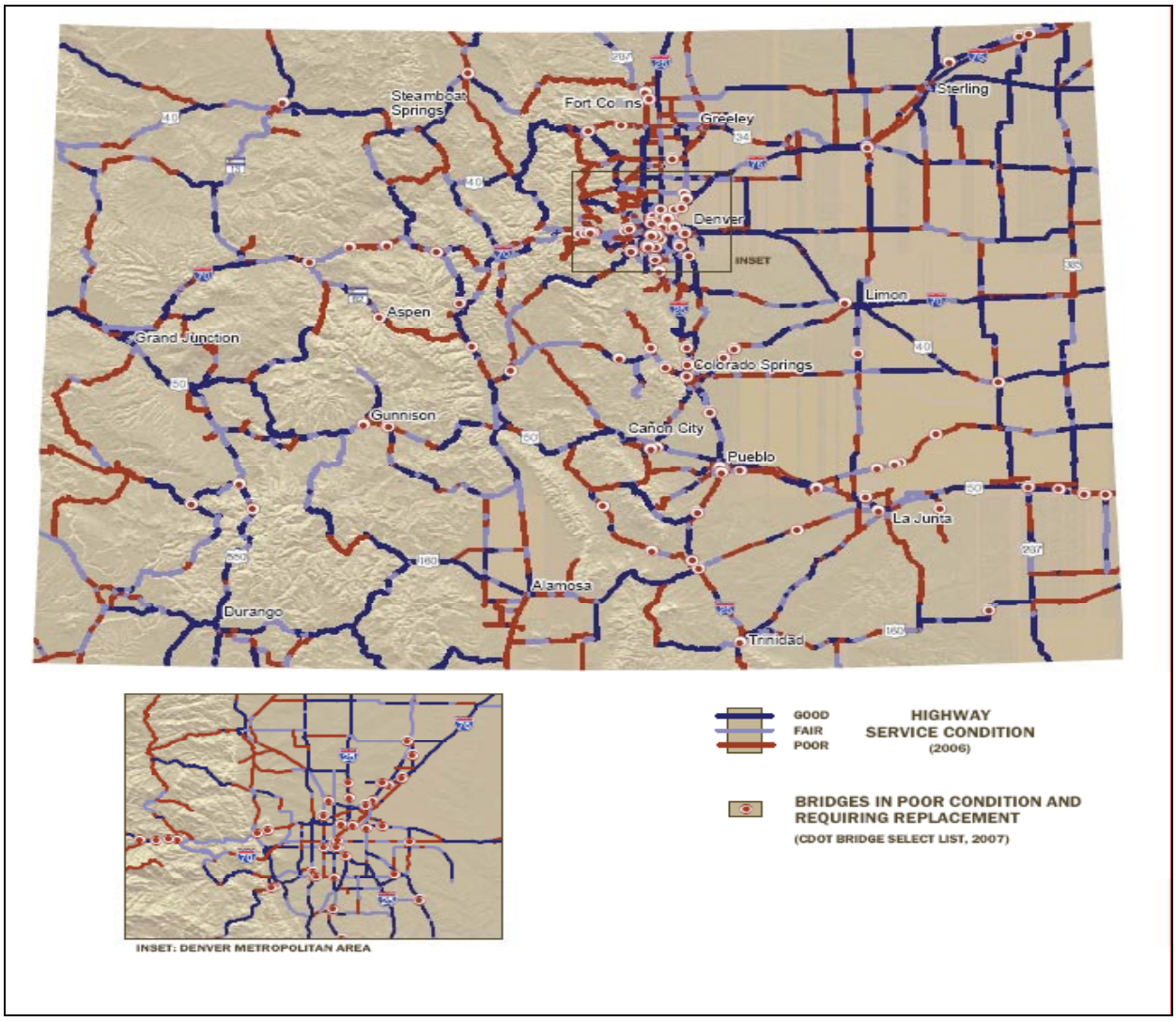
Percent of Pavement Statewide in Good and Fair Condition

Goal	60%	Trend, 2003-2007 inclusive, based on
2008 Actual	53%	CDOT 2007 Annual Performance Report

How we got to this condition

Construction inflation and other factors have eroded the value of treatment dollars. Since 2005, when construction costs spiked, CDOT has lacked sufficient resources to improve or maintain the percentage of good/fair roadways. In response, CDOT attempts to optimize its resources by selecting the appropriate treatment. Applying the appropriate fix in a timely manner will maximize additional service life of a roadway. Using the “right treatment, right time, right location” philosophy will substantially slow the rate of deterioration.

Sometimes, however, there are safety, economic or other circumstances that require choosing less than optimal treatment, locations and times for this work. These types of projects do not maximize the gain in overall system longevity. With less revenue, declining buying power and construction cost escalation, CDOT



Colorado highway pavement surface condition, with locations of poor bridges, 2006. Source: CDOT

must make difficult tradeoffs that pit the delivery of projects that have substantial long-term value against keeping existing roads in a safe and operational condition. The funds sacrificed in lean years to cover reactive maintenance activities, which have a lower rate of return in terms of improvements, result in a requirement for more funds in future years. In FY 2010, CDOT will be able to fund only about 20 percent of identified surface treatment needs required to maintain existing system condition.

The following factors in Senate Bill 09-108 are examined in relation to pavement condition:

- ***Population Growth and Distribution.*** A growing population means increasing ADT and increased wear and tear on pavement surfaces. However, the weight of those vehicles is a more significant factor on surface condition of the pavement than the number alone. Population growth and distribution is a more significant factor in the determination of capacity improvements.

- ***Vehicle Size and Weight.*** Size and weight of vehicles are among the most significant factors affecting pavement condition and cost. Pavement thickness is a direct result of the anticipated

truck traffic volume. All CDOT highway pavements are structurally designed to meet the needs of commercial vehicles. The impacts of passenger vehicles on pavement condition are minimal. A low-traffic highway with ADT of 5,000 vehicles but no trucks would call for a pavement thickness of about five inches. However, if 10 percent of those vehicles were trucks, a pavement thickness of about eight inches would be required, a significant added cost. A high-traffic highway with ADT of 80,000 vehicles and no trucks would require seven inches of pavement thickness. The same highway with 10 percent truck traffic would require about twelve inches. CDOT incurs additional pavement construction costs when as little as 5 percent of the highway's traffic volume is commercial motor vehicles. This can be illustrated by the following example.

I-70 through Limon carries about 12,000 vehicles per day, a relatively low volume. CDOT's current standard is for a minimum eight-inch pavement thickness. If there were no trucks using that stretch of highway, adequate pavement depth based on ADT alone would be about five inches. However, trucks account for about 35 percent of the total traffic through Limon. As a result, pavement thickness needs to be closer to 12 inches. The additional seven inches over a "no trucks" scenario would add more than $2 million per mile to the cost of pavement. The additional four inches over CDOT's minimum depth would add more than $1 million per mile.

Trucks also cause a disproportionate amount of highway repairs. One delivery truck causes the same amount of damage as about 1,500 passenger vehicles. One tandem axle truck, such as a dump truck, causes the same damage as nearly 3,000 passenger vehicles. A typical 18-wheeler, five-axle combination truck causes the same damage as over 5,000 passenger vehicles. CDOT estimates that about 90 percent of the cost of repairing pavement damage is due to commercial motor vehicle use.

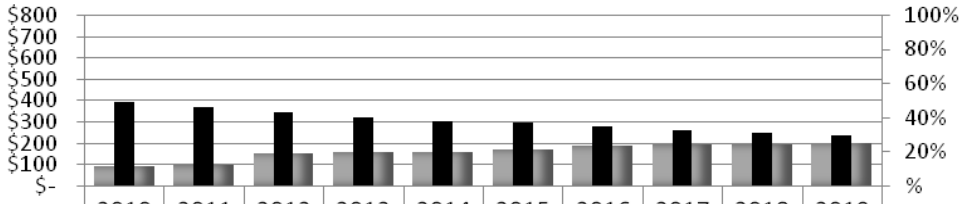
- ***Land Use Policies.*** This has little relative impact on pavement needs and repairs, except to the extent that it affects the travel of commercial vehicles.

- ***Work Patterns.*** This also has little relative impact on pavement, except to the extent that it affects the travel of commercial vehicles.

Ten-year future conditions

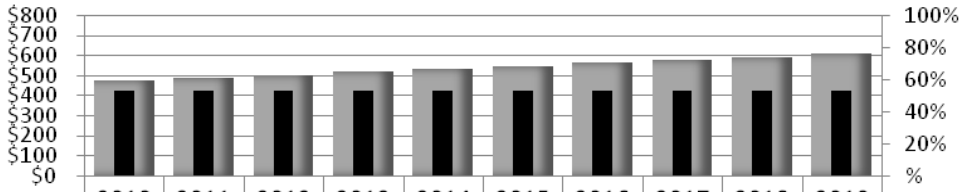
Under current revenue forecasts, pavement condition will decline to 29 percent good/fair by 2019. Maintaining the current condition rating of 53 percent would cost more than triple the current forecast revenue. Achieving the goal of 60 percent good/fair or reaching the vision of 75 percent as recommended by the Colorado Transportation Finance and Implementation Panel each would cost significantly more.

Condition Based on 2035 Revenue Forecast



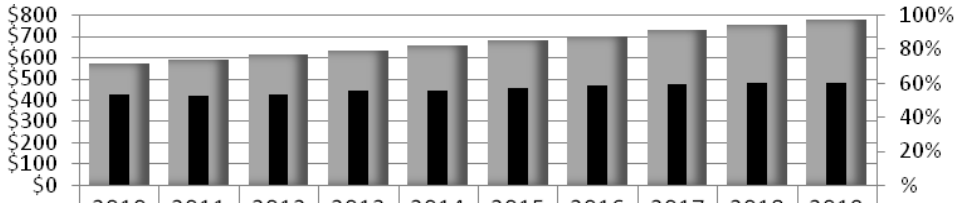
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$93	$99	$152	$155	$157	$167	$187	$191	$195	$200
Percent Good and Fair	49	46	43	40	38	37	35	32	31	29

Cost to Sustain Current 53% Good/Fair



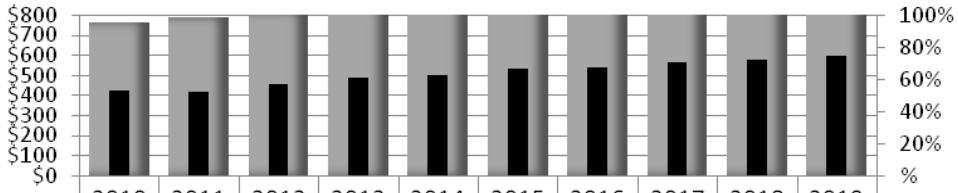
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$470	$485	$500	$515	$530	$545	$560	$575	$590	$610
Percent Good and Fair	53	53	53	53	53	53	53	53	53	53

Cost to Repair to 60% Good/Fair



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$569	$589	$610	$631	$653	$676	$700	$724	$750	$776
Percent Good and Fair	53	52	53	55	55	57	58	59	60	60

Cost to Achieve Vision of 75% good/fair in 10 years



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Annual Cost in Millions	$761	$787	$815	$843	$873	$904	$935	$968	$1,002	$1,037
Percent Good and Fair	53	52	57	61	62	66	67	70	72	74

Maintenance

How we rate/grade maintenance

The CDOT Maintenance Program is designed to keep the state highway system open and safe for the traveling public. This involves all activities from the centerline of the highway to the right-of-way fences. Maintenance activities are separated into eight Maintenance Program Areas: Roadway surface, roadside facilities, roadside appearance, traffic services, structure maintenance, snow and ice control, equipment and buildings, and tunnel activities. Each of these areas is subdivided into such tasks as patching, cleaning drainage structures, controlling vegetation, sign maintenance, bridge deck repair, snow fence repair, rest area building maintenance and tunnel operations. CDOT measures the performance of maintenance service with a school report card style grading system called Maintenance Levels of Service (MLOS) that estimates the achievable grade with available budget. Higher grades could be achieved with higher funding levels. MLOS is a performance-based budget process consisting of a survey of existing conditions, most recent costs and a recommendation of funding to reach the goal set by the Transportation Commission.

Statewide Overall MLOS Goal as determined by the Transportation Commission

Goal	B	Trend, 2003-2007 inclusive, based on
2008 Actual	B-	CDOT 2007 Annual Performance Report

Maintenance strives for LOS A:

And for LOS B:

Maintenance works hard to avoid LOS D:

LOS F is our worst nightmare:

Similarly, reduced funding for new or reconstruction of existing infrastructure increases the workload on maintenance to keep up older roadways. CDOT's infrastructure is designed to a certain lifespan such as 30-year pavements or 50-year structures. Although the Department's intent is to replace infrastructure after it has served its life, program reductions in new and reconstructed infrastructure essentially defer that work. This transfers to maintenance the task of keeping up those roadways after they have aged beyond their service life cycle, until they can be programmed for reconstruction or replacement. On top of that, it costs more to maintain infrastructure that has reached or exceeded its design life than to maintain newer infrastructure, forcing disproportionate allocation of resources into maintaining older roads and leaving less available for other maintenance.

A significant variable for CDOT's maintenance section is snow and ice control, a vital task in light of our geography. This program area alone consumes a significant percentage of the total maintenance budget and remains unpredictable from year to year. For FY 2010, 29 percent of the maintenance budget is allocated to snow and ice control. Unlike other maintenance activities, there is no lasting positive effect on the physical state of the infrastructure from snow and ice control measures. Its purpose is simply to maintain safe travel conditions during inclement weather. However, there is a negative cumulative effect caused by scraping plow blades across the pavement. It is common for snow removal efforts, as an example, to result in removal of pavement markings.

How we got to this condition

The following factors in Senate Bill 09-108 are examined in relation to maintenance:

- ***Population Growth and Distribution.*** A growing Colorado population and economy have increased the number of vehicle trips, including truck trips. As detailed in earlier sections of this report, the increase in trips has been exponential rather than linear with the increase of population. This increase in vehicle trips has a disproportionate impact on the existing infrastructure designed to serve a smaller population.

- ***Vehicle Size and Weight.*** Pavements are designed and constructed to accommodate an expected total of Equivalent Single Axle Loads (ESAL) of 18,000 pounds each over a specific period. The design assumes regular maintenance and typical environmental conditions. As the number, size

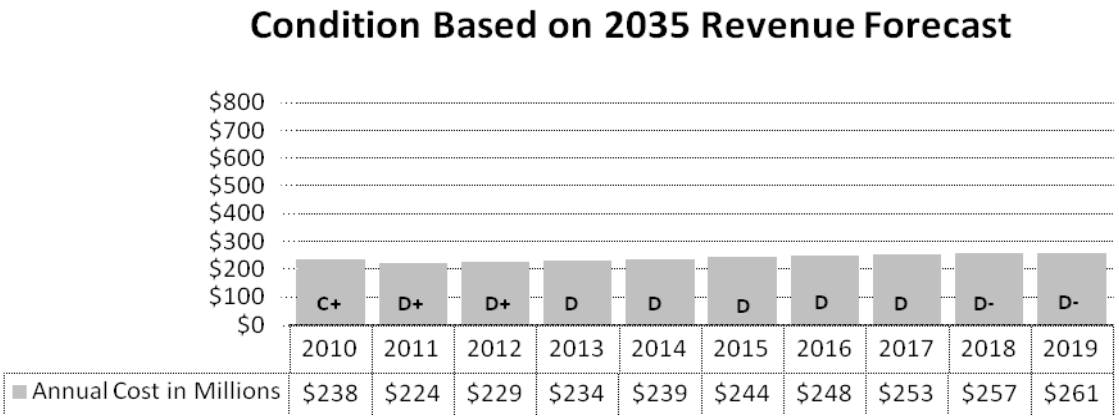
and weight of vehicles increases, so does the deterioration rate of pavement. The rate of deterioration is accelerated by reductions in required maintenance, and increases in severity of climatic conditions experienced.

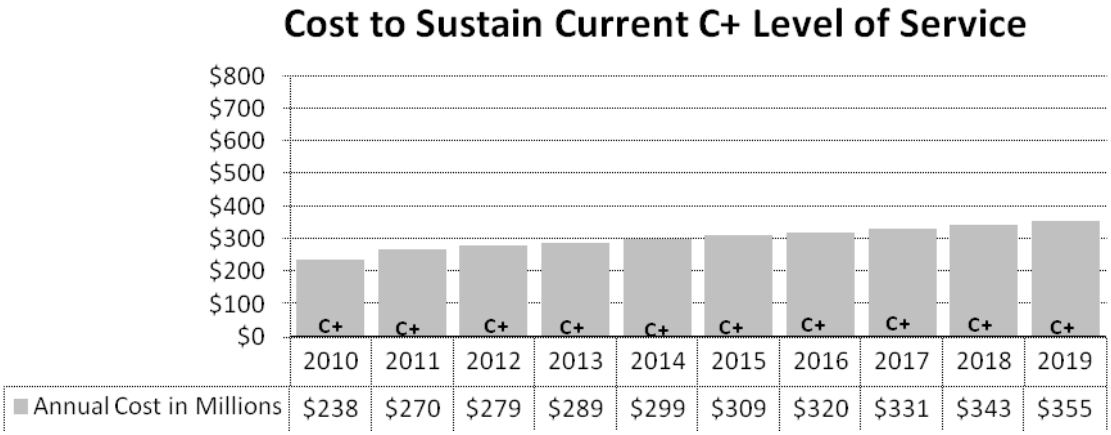
- ***Land Use Policies.*** The impact of land use policies on transportation infrastructure maintenance is the same as that outlined in the surface section of this report. To the extent that land use policies evolve and result in redistribution and increases in traffic to roadways designed for less, this has an impact on unanticipated deterioration and redirection of maintenance resources.

- ***Work Patterns.*** Roadways are designed and constructed for their anticipated traffic loads. Any changing pattern of heavier peak-hour traffic alters the projected impacts.

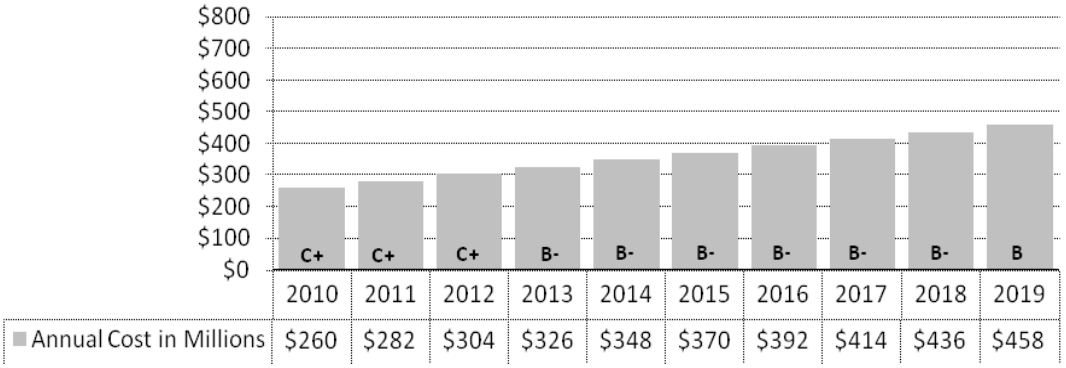
Ten-year future conditions

MLOS continues to trend downward at current funding levels, which reflects previous year's funding plus inflation. By FY 2019, the Level of Service is projected to be D- under current funding. The third and fourth charts also aim for MLOS B but the third shows the 10-year cost of ramping up to that goal while the fourth shows the cost to achieve that vision in the first year and sustain it over 10 years.



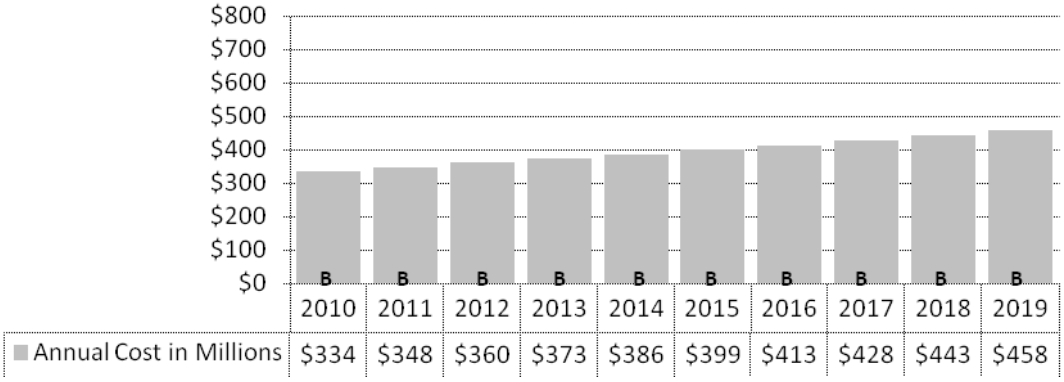


Cost to Repair to B Level of Service



Cost to Achieve Vision of B Level of Service

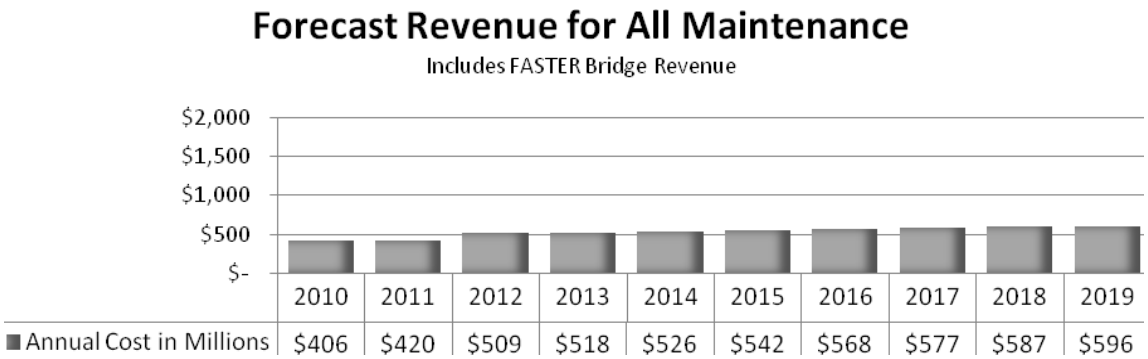
Based on Transportation Finance and Implementation Panel recommendation

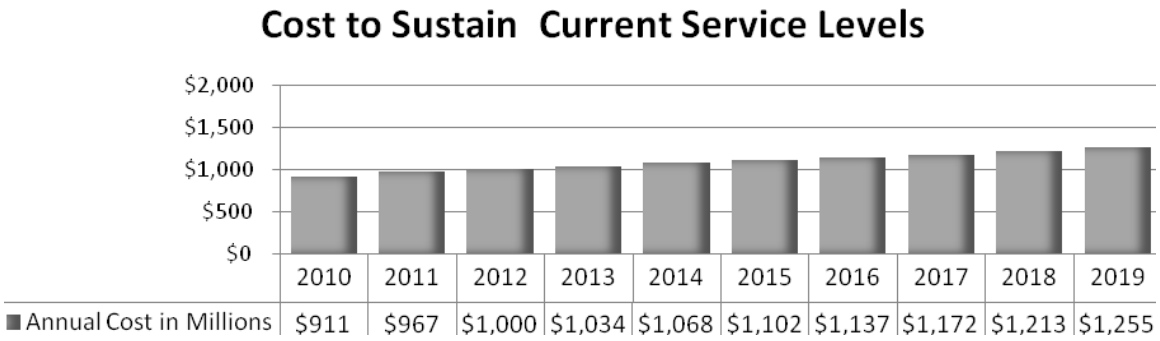


Combined Cost of Upkeep

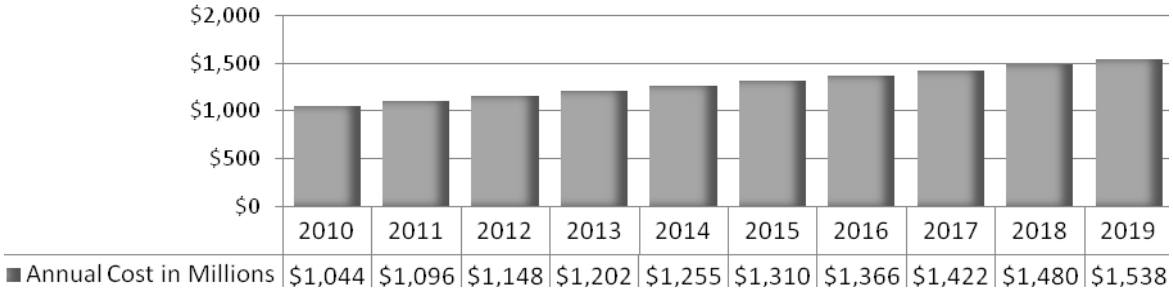
The combined cost estimates for basic upkeep of the transportation infrastructure Colorado currently has in place show a gap of $1.35 billion annually by 2019 between the revenue the Department projects it will have under current mechanisms versus the amount of revenue it would take to achieve the vision of higher and sustained levels of service for bridge, pavement and highway maintenance.

In 2019, under current revenue streams including the Bridge Enterprise Special Revenue Fund within FASTER, CDOT projects that it will have $596 million available annually for basic upkeep. By comparison, the projected annual cost of merely sustaining the service levels of 2008 is a combined $1.25 billion, twice the amount currently expected. The projected cost of repairing the system to the goals for 2019 is $1.54 billion, while the projected cost of achieving the vision set by the Transportation Finance and Implementation Panel is $1.95 billion.

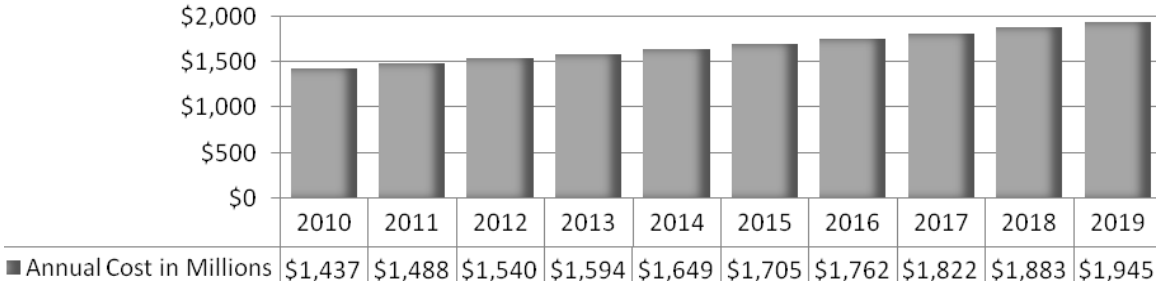




Cost to Repair to Higher Goal Levels



Cost to Achieve Vision



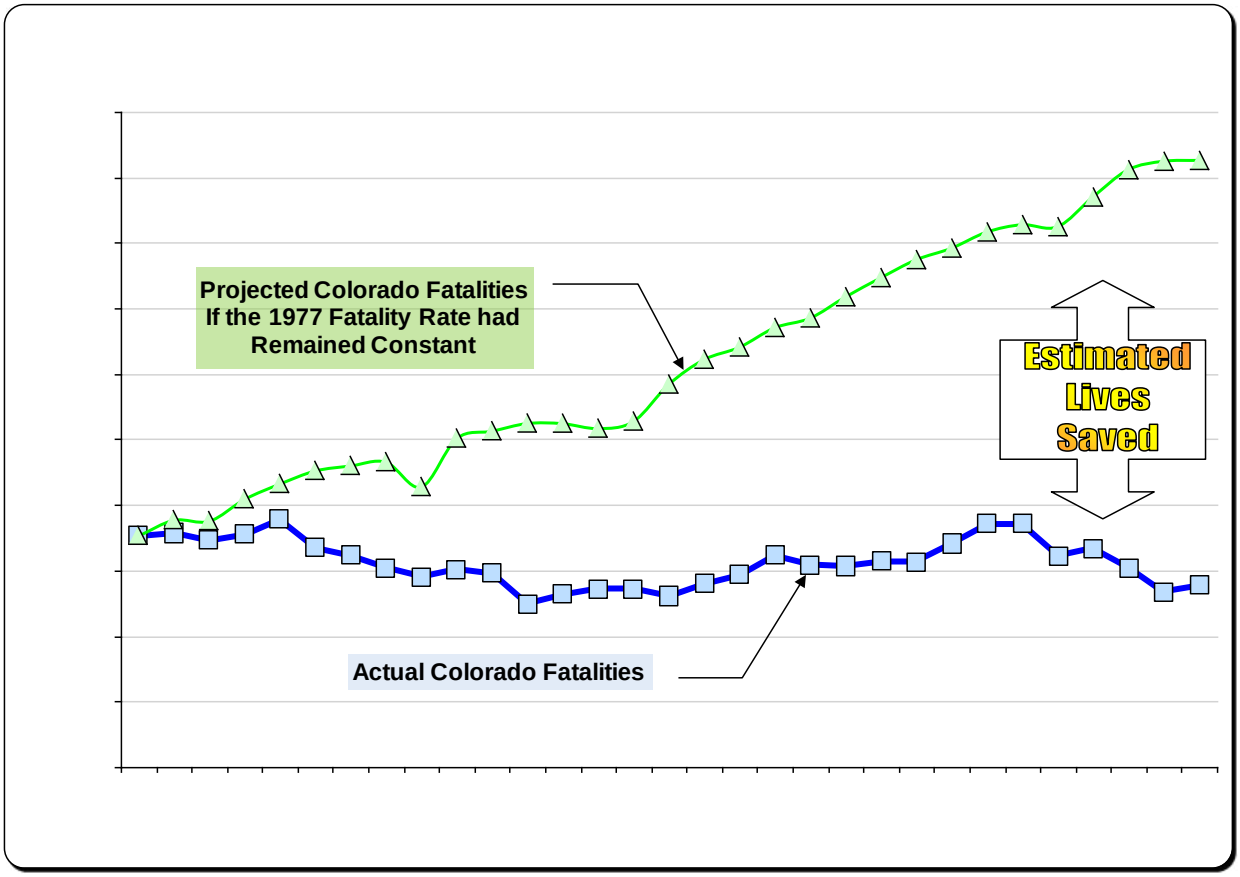
Safety

How we rate/grade safety

The statewide fatality rate is the primary means of measuring the Department's effectiveness in increasing safety for users of the state highway system. Providing a safe and secure transportation system is CDOT's highest priority. The fatality rate is the number of fatalities per 100 million Vehicle Miles Traveled (VMT) on Colorado highways.

Current condition

Colorado leads the nation in fatality reduction, according to a recent comparative study by the Standing Committee on Performance Management of the American Association of State Highway and Transportation Officials (AASHTO).



Colorado has made significant progress over the last three decades of safety work. In 1977, Colorado had 3.8 fatalities per 100 million VMT. By 2007, the rate declined to 1.14, based on the 2007 VMT. By comparison, if the 1977 fatality rate had remained unchanged and accounting for population and VMT growth, an estimated 1,850 persons would have died in 2007 compared to the actual number of 554. Cumulatively, CDOT estimates that more than 20,000 lives have been saved as a result of the steady reduction in statewide fatalities from the 1977 level. Over that time, the most serious challenges were impaired driving, the lack of use of occupant protection devices such as seat belts, young driver behaviors

and aggressive driving. In urban areas, rear-end, approach turns and broadside crashes were most prevalent. In rural areas, running off the road and hitting fixed objects or overturning were prevalent. Finally, motorcycle and commercial vehicle safety were areas of special concern.

Fatality Rate, Number of Fatalities per 100 Million VMT

Goal	1.00	Trend, 2003-2007 inclusive, based on
2007 Actual	1.14	CDOT 2007 Annual Performance Report

How we got to this condition

CDOT set specific goals in the late 1990s for reducing the fatality rate and identified three major objectives: Reduce fatal crashes per 100 million VMT from a rate of 1.62 in 1995 to 1.00 by year 2010; increase the overall rate of seat belt use from 55.5 percent in 1995 to 85 percent by 2010, and reduce alcohol-related fatal crashes as a percentage of all fatal crashes from 44.6 percent in 1995 to 38 percent by 2010.

The *National Cooperative Highway Research Program (*NCHRP) Project 20-24(37C) compared Colorado's safety performance results to other states in the US from the period 2000-2002 with those in 2005-2007. This draft report clearly shows how Colorado has emerged as a leader in roadway safety:

- 22 percent decrease in total fatalities
- 31 percent decrease in fatalities per 100 million VMT
- 35 percent decrease in speeding-related fatalities
- 30 percent decrease in young driver involvement in fatal crashes
- 20 percent decrease in alcohol-related fatalities (driver blood-alcohol content greater than 0.08)
- 35 percent decrease in unrestrained passenger fatalities, all seat positions
- 22 percent decrease in pedestrian fatalities

Some of these successes are due to the passage of important traffic safety legislation, such as lowering the blood-alcohol content (BAC) threshold to 0.08 percent in 2004 (HB 04-1021) and the law requiring a helmet for motorcyclists under 18 years of age and their passengers (HB 07-1117). Fines for failure to comply with child restraint and booster seat requirements and for seat belt violations were increased (HB 08-1010). Laws were passed to increase penalties for drunk driving (HB 08-1010), expand the use of interlock devices and to provide $2 million annually for increased high-visibility DUI enforcement (HB 08-1194). In addition, a number of improvements have been made to the Graduated Driver's License law for teen drivers, as well as other legislative changes to improve safety across the state. Grass roots organizations have had a significant impact, and public information programs have served to raise awareness of the risks and responsibilities of driving.

In addition, through innovative engineering practices, Colorado has reduced crashes within available budgets by making safety improvements at roadway locations where higher rates of crashes are detected. Evaluation methodologies such as pattern recognition analysis and roadway diagnostic safety assessments provide the current best practice in targeting appropriate locations for safety improvements. These methodologies address: Reducing the frequency of roadway departure-type crashes and mitigating the effects of leaving the road; reducing crashes at intersections, and selecting qualified sites for safety

improvement projects through such programs as Federal Hazard Elimination and High Risk Rural Roads. Hazard elimination is the largest component of the safety budget.

Only one of the four factors specified for this Transportation Deficit Report in the FASTER bill, vehicle size and weight, has any significant correlation to the costs of the safety program, and that is in an indirect manner.

- ***Population growth and distribution.*** There is no quantifiable impact of this factor on the safety program.

- ***Vehicle size and weight.*** This is a significant factor in crashes, especially with regard to crashes involving motorcycles or commercial trucks. There is significantly more potential for death and injury in a crash involving vehicles with disproportionate weights and unprotected open riders. Motorcycle safety is a special concern because last year, motorcycle fatalities comprised 18 percent of all traffic deaths in Colorado, despite representing only 3 percent of registered vehicles. CDOT programs resources into targeted safety programs, such as Live to Ride, aimed at motorcyclists.

- ***Land use policies.*** There is no quantifiable impact of this factor on the safety program.

- ***Work patterns.*** There is no quantifiable impact of this factor on the safety program.

The following charts track the progress from 1995 to 2007.

Fatalities per 100 Million Vehicle Miles Traveled

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		2010 Goal
Rate	1.83	1.71	1.62	1.60	1.54	1.63	1.73	1.71	1.48	1.46	1.26	1.10	1.14		1.00

Observed Seat Belt Use in Colorado

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		2010 Goal
%	55.5	55.6	59.9	66.0	65.2	65.1	72.1	73.2	77.7	79.3	79.2	80.3	81.1		85.0

Note: Based on CSU annual seat belt survey

Alcohol Related (A/R) Fatal Crashes

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		2010 Goal
%	44.6	40.7	39.0	40.4	39.1	38.1	45.6	43.1	40.9	37.2	40.4	41.2	41.1		38.0

Ten-year future conditions

CDOT is committed to being a national leader in creating innovative, measurable and effective safety programs. Here in Colorado, CDOT has developed a comprehensive approach to solving identified federal, state, and local roadway safety problems.

Future goals include:

- Maintaining a fatality rate of 1.0 or lower by continuing to reduce fatal crashes through 2019;
- Increasing the statewide overall seat belt use rate to 90 percent by 2019.
- Reducing the percentage of alcohol-related fatal crashes to 35 percent of all fatal crashes by 2019.

CDOT funding for safety programs comes from a variety of state and federal sources; however, significant shortfalls exist in fulfilling identified safety needs. For example, CDOT has budgeted $94.8 million dollars in FY 2010 in the safety investment category. CDOT regularly experiences unmet needs in the area of safety. Our Hazard Elimination Program uses sophisticated statistical methodology to identify those locations with potential for accident reduction, half of which focus on local roadway safety priorities. Each year, the Department receives on average $22 million dollars of applications for this program but is able to fund only about half of the projects. Another shortfall exists in the area of intersection safety improvements that involve signalization, which has a current backlog of $40 million dollars worth of eligible projects but can fund projects totaling only $1.1 million dollars. These are just two examples of the many unmet needs in CDOT's safety program.

The passage of a primary seat belt law would have a significant impact on efforts to enhance safety. Primary seat belt laws have a proven track record of increasing state seat belt use rates. In 2008, the average seat belt use rate in states with primary enforcement laws was 13 percentage points higher than in states with secondary enforcement laws.

Behavioral changes brought about by safety educational programs such as "The Heat is On" or by legislative action such as passage of a primary seat belt bill would reduce the financial costs to meet CDOT's safety goals.

Not included in this analysis are the FASTER Road Safety Surcharge revenues, projected to raise approximately $73 million for safety-related projects on Colorado's highways and $49 million for the state's local roads on an annual basis. As revenues begin to flow and the Colorado Transportation Commission continues to implement the various provisions of FASTER, we will have a better idea of the positive impact these funds will have on highway safety in Colorado.

Mobility/Congestion

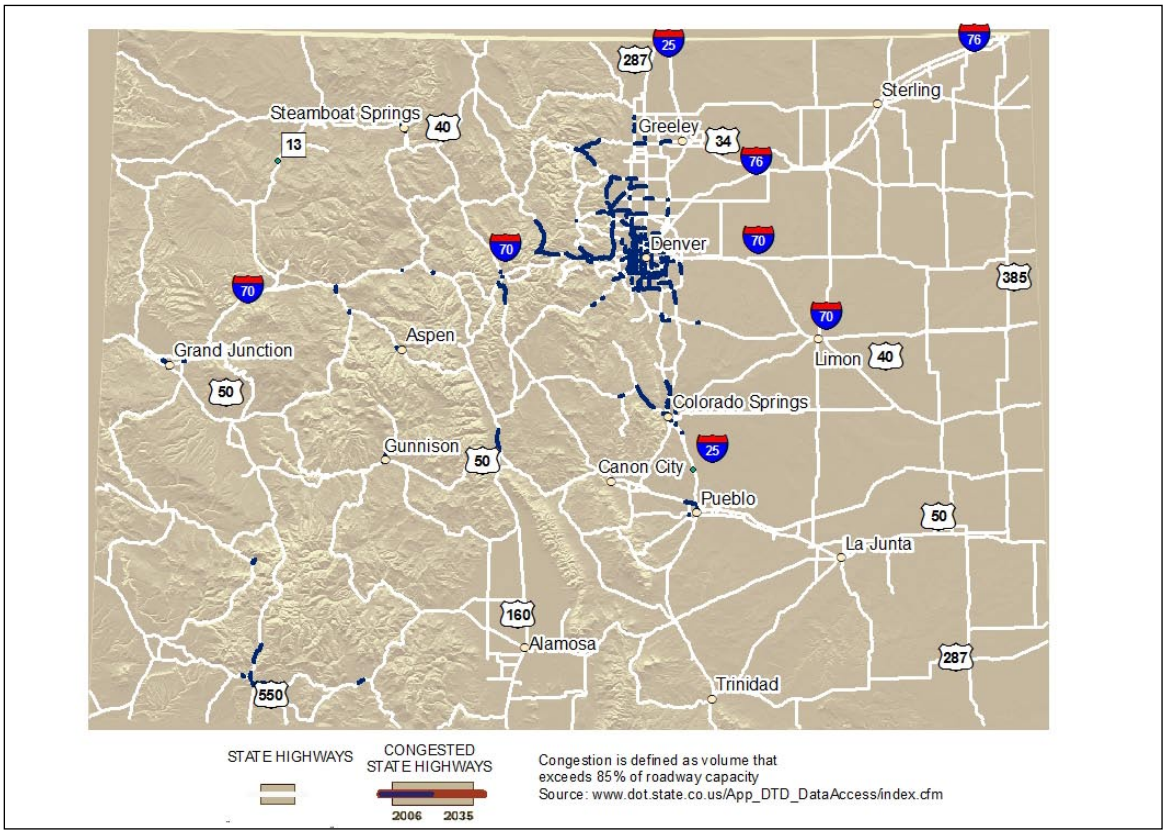
How we grade mobility/congestion:

Colorado's economic vitality depends on the ability of people and goods to move freely and efficiently. The Department's primary measure of mobility is minutes of delay per traveler in congested state highway segments. Travel time delay is the difference between travel time on highways at free-flow speed and the time it takes in heavy traffic. A highway is considered congested when the traffic volume is 85 percent or more of the capacity it was designed to handle. CDOT conducts an annual analysis of highways to identify congested roadway segments.

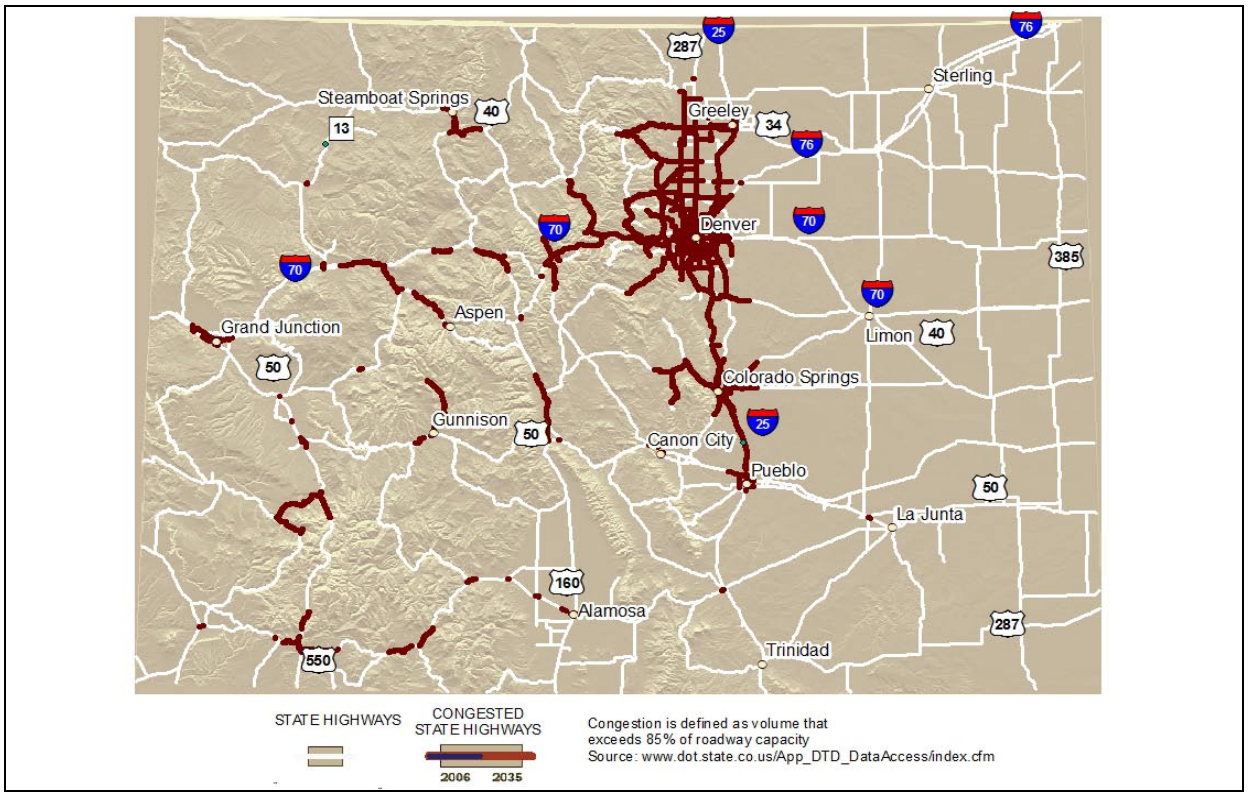
Current condition

CDOT's analysis identified 71 corridors around the state, representing 845 centerline miles that are congested. Congested corridors as of 2006 appear on the map below. The second map shows the corridors that are projected to be congested by 2035. More than 90 percent of total congestion delay occurs on urban highways during the weekday work commute.

These corridors are located primarily in metro areas along the Front Range including Denver, Colorado Springs and Fort Collins. The remaining 10 percent of delay occurs in recreational corridors during peak weekend traffic. Recreational corridors include I-70 West, ski area access corridors, and portions of roadway in Grand Junction and Durango among others. Average travel time delay in congested corridors



Congested state highways, 2006. Source: CDOT



Congested state highways, 2035. Source: CDOT

during peak hours in 2008 remained at 18 minutes, the same as 2007. This bucks the long-term trend. In 2006, the average delay was 22 minutes and by 2035 it is projected to increase to 70 minutes. When the price of gasoline reached over $4 per gallon in the summer of 2008, many people changed their driving habits through such strategies as consolidating trips, switching to transit, joining car pools and vanpools, and walking or bicycling to work or for errands. Also, Colorado's average unemployment rate climbed from 3.9 percent in 2007 to 4.9 percent in 2008 which meant fewer people were commuting to and from work resulting in less peak time congestion. According to the Denver Regional Council of Governments (DRCOG), these changes in driving habits resulted in an estimated 5 percent fewer miles driven in August 2008 compared to August 2007 in the Denver region. If the driving habits adopted by many people during the summer of 2008 become permanent the future growth in congestion may slow. However, over the next 30 years, travel time delay is expected to increase substantially.

Minutes of Delay per Traveler in Congested State Highway Segments

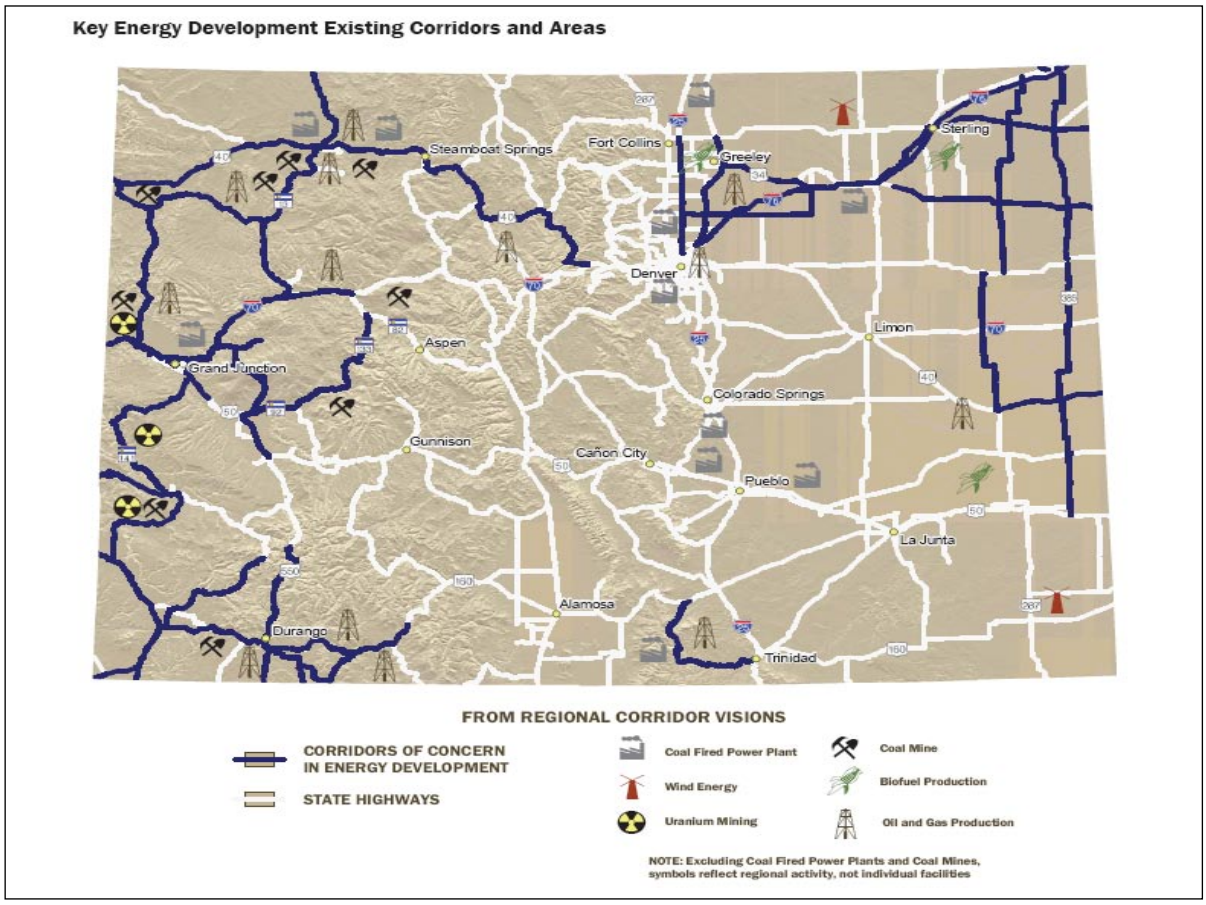
Goal	22 minutes or less	→	Trend 2005-2007inclusive, based on
2008 Actual	18 minutes		CDOT 2007 Annual Performance Report

How we got to this condition

- ***Population Growth and Distribution.*** Since 1990, Colorado's population has increased by 50 percent while lane miles on the state highway system have increased by only 2.5 percent. Additionally, vehicle miles traveled (VMT) continues to grow at a rate faster than population. Population and employment growth in the Denver region will continue to have a profound effect on the region's transportation system. The population of the Denver region is expected to increase

from about 2.7 million in 2005 to 4.2 million in 2035, an increase of more than 50 percent. Employment in the Denver region is expected to grow by 800,000 jobs by 2030. These new residents and added peak-hour trips will strain the roadway network, which is already congested, and the transit system. The number of vehicle miles traveled is expected to rise steadily between now and 2030 and the number of roadway segments in the region that experience pervasive, severe congestion is expected to more than double. A recent report by DRCOG estimates that by 2035, the average trip to work will take 33.7 minutes, up from 25 minutes in 2005. The Pikes Peak and North Front Range MPOs are experiencing similar trends in population growth, employment growth and congestion.

- ***Vehicle Size and Weight.*** The total tonnage of freight hauled across Colorado highways and rail lines is expected to more than double by 2035 from today's levels, growing from 327 million tons annually to 812 million tons in 2035. This is attributable in part to an increase in the number of trucks on the road, as well as the greater size and transport capability of those trucks. Truck traffic has grown significantly in parts of Colorado as the result of recent growth in the energy industry. Colorado has substantial reserves of conventional fossil fuel and renewable energy resources, which are being developed rapidly with more than 70,000 employees and $17 billion in direct



revenues. From 2002 to 2007, the number of active wells in Colorado grew by 50 percent and new drilling permits tripled. Bringing one well into production requires up to 1,300 truck trips, depending on the location and type of well. The number of drill rigs and commercial trucks traveling highways and back roads puts increased stress on the infrastructure and creates mobility and safety issues for commuters and other travelers. These trucks, which tend to be very heavy, put loads on roadway surface and structures that accelerate deterioration and maintenance needs.

- ***Land Use Policies.*** As the state's population has expanded, the footprint of development has expanded at an even greater rate. Low density development and inefficient development patterns that lack connectivity limit the availability and use of transit as well as bicycle and pedestrian facilities. The absence of these alternatives, coupled with the spread of developed land area, also means more people commuting greater distances to and from work, resulting in more vehicle miles traveled and ultimately more congestion. The absence, in some areas, of a good balance of jobs and housing means that workers are unable to live near their work and may have to commute long distances to work in adjacent counties or cities. "*The Cost of Sprawl*," a report by the Transportation Research Board in 2000, quantified the financial consequences of uncontrolled versus controlled land development. Controlled growth is defined as limiting a significant share of development to already-developed counties or to areas as close to already-developed locations as possible. This can happen in two ways, through the establishment of an urban growth boundary or through creation of an urban service area, which limits the outward spread of development in a single county. The report estimated that under the uncontrolled development practice, the United States would need to spend more than $927 billion from 2000 through 2035 to provide necessary road infrastructure, adding 2 million lane miles of local roads. Under the more compact growth patterns of controlled growth, the report estimated that new road infrastructure could be reduced by 188,300 lane miles of local roads at a savings of $110 billion. This is a saving of 9.2 percent in local lane miles and 11.8 percent in local road costs.

Mode of Travel to Work Statewide	**Number of Persons**	**Percentage of Persons**
Total Colorado Workers	**2,191,626**	
Total Drove Alone	1,646,454	75%
Car Pooled	268,168	12%
Worked at Home	108,132	5%
Bike and Walk	82,573	4%
Public Transportation	69,515	3%
Other Means	16,784	1%

- ***Work Patterns.*** In 2006, CDOT conducted a statewide survey to determine current and possible future travel behaviors of Colorado residents. The mode most used was the Single-Occupancy Vehicle (SOV). Small variations were observed by area. Those in the Denver area were more likely to use transit than those in other areas, while Eastern Plains residents were more likely to walk. The median commute length of 8 miles has fluctuated throughout the years, but generally Metro Denver commuters drive the farthest, and Eastern-Plains commuters live closest to work. Workers from counties adjacent to the DRCOG area make more than 45,000 work trips each day into the Denver region, with nearly 13,000 others commuting the opposite direction, out of the Denver region to surrounding counties. This contributes to increased congestion.

Methods of Reducing Costs

Overview

There is an array of strategies CDOT and other agencies have used to reduce costs and achieve the goal of safe travel for people and goods across Colorado. Transit, managed toll lanes, travel demand reduction, intelligent transportation systems and others strategies help us to get the most out of the existing capacity in the system. There are other strategies being studied for implementation as well that allow for increased mobility and safety beyond traditional approaches of constructing more lanes.

Land use policy changes

Land use patterns have a significant impact on travel demand and on the need for transportation infrastructure maintenance, repair and improvements. Studies indicate that higher density development puts less strain on existing transportation facilities, affords greater accessibility to the transportation system and minimizes environmental impacts. Greater coordination between transportation and land use planning can result in more efficient, cost-effective and environmentally friendly development patterns and transportation investments. Several of the state's MPOs are engaged in efforts to better understand the relationship between development and transportation investment decisions. Examples include:

- Grand Valley MPO is using its travel demand model to test the transportation impacts of four land use scenarios developed as part of the City of Grand Junction's Comprehensive Plan process. VMT impact was among several measures it used to determine which scenario had the least impact to the transportation network.
- North Front Range MPO conducted land use and transportation scenario modeling to compare a base scenario with a Transit Oriented Development (TOD) scenario. TOD concentrates relatively compact and walkable, often mixed-use residential-retail-office developments around transit investments such as rail and bus transfer stations. The results of the scenario modeling showed that less land was consumed under the TOD scenario and that density increased over time as the TOD matures. Two measures were used to evaluate the different improvements for roadway performance: VMT and amount of congested lane miles. The largest reduction in VMT was shown in the TOD scenarios, however congested lane miles increased under the TOD scenario.
- Denver Regional Council of Governments (DRCOG) has developed an interactive computer tool called MetroQuest that allows policy makers, business leaders and the general public to visualize alternative future scenarios for the region. The tool looks at several factors that include development mix from low density to mostly compact, location, road network, transit system, urban form policy and environmental policy.
- As part of its transportation and land use plan update, DRCOG explored three scenarios reflecting different land use and transportation policies. On the land-use side, scenarios ranged from compact to expansive development patterns. On the transportation side, scenarios ranged from an emphasis on roadway improvements to an emphasis on transit improvements. Scenarios that favored compact development patterns and transit investments performed best on a variety of outcome

measures including transportation system performance, infrastructure costs, accessibility and environmental impacts. Scenarios that significantly expanded the urbanized footprint did not perform as well and resulted in greater overload of key regional transportation facilities. The results of the analysis influenced the DRCOG board to reduce the expansion of the region's Urban Growth Boundary from the 2030 to the new 2035 planning horizon to something less than originally proposed while still accommodating projected growth.

Multimodal mobility

Multimodal mobility is moving people and goods by more than one mode of transportation with the goal of relieving congestion, shortening travel times, improving safety and giving travelers more options.

Congested travel corridors that offer the public more than one mode choice provide alternatives to reduce travel time delay. Robust multi-modal corridors provide travelers choices based on their specific needs. Managed toll lanes provide fast, reliable, predictable and flexible transportation for those users willing to carpool or pay a fee for driving solo. Regional buses operating on dedicated lanes and light rail offer another reliable, predictable and energy efficient transportation option. Bike and pedestrian paths provide an alternative for users making shorter trips or connecting to another mode. Finally, general purpose lanes provide convenient and flexible transportation, although they may be congested during peak periods. Offering choices allows travelers to select the best mode for each trip. The Colorado Transportation Finance and Implementation Panel estimated an annual investment of $337 million to multimodal projects would reduce the average minutes of delay in 2035 by nearly 23 percent, from 70 minutes in the base scenario to 54 minutes.

Transportation demand reduction practices

Transportation Demand Management (TDM) is a critical element in developing a well-rounded transportation strategy. TDM encompasses a wide range of programs and services that make the most efficient use of existing transportation facilities by managing the "actual demand" placed on those facilities. Using strategies that promote alternative modes, increase vehicle occupancy, reduce travel distance, and ease peak-hour congestion, TDM efforts can extend the useful life of transportation facilities, enhance community mobility, and improve air quality. TDM approaches include strategies to promote alternative modes of travel, such as carpooling, vanpooling, transit, bicycling and walking.

Increased use of transit

Transit reduces congestion in the transportation network because it takes vehicles off the roads, especially at the key peak hours. In 2007, the Regional Transportation District (RTD) in metro Denver reported 90 million boardings on its bus and light rail system. Many of these trips replaced travel in single occupant vehicles. From the statewide prospective, Colorado urban transit providers had an approximate 33-percent increase in total boardings between 1996 and 2007. Increasing transit use can be accomplished by expanding transit systems and boosting demand. On the demand side, programs such as the RTD EcoPass program increase transit ridership. The EcoPass is an annual pass sold by RTD that allows users unlimited regional, express or local bus and light rail service at a discount. It is offered to area employers to

encourage the use of transit and help reduce congestion. More than 100,000 employees at nearly 2,000 participating businesses in the RTD service area are eligible for EcoPass. CDOT participates in the EcoPass program, providing 1,487 passes to employees during the current year.

As population growth and other variables generate demand for more trips, some of this increased demand can be met through the addition of transit capacity.

Although trips are increasing, current transit systems in Colorado only partially meet existing needs. In 2006, transit need was estimated at 258 million trips annually statewide, growing to 436 million trips in 2035. Only 45 percent of the transit trip need was met in 2006, while only 31 percent of transit trip need will be met in 2035, based on existing revenue projections. The gap between transit need and availability is greatest in rural areas. While 48 percent of transit trip needs were met in urban areas in 2006, only 35 percent were met in rural areas. Acknowledging that significant rural transit needs exist, Eagle County provides a rural transit agency that meets the needs of a growing population. From 1998 to 2008, the Eagle County Regional Transportation Authority (ECO Transit) increased ridership from 600,000 trips per year to 1.2 million. At the same time ridership went up 100 percent, the county's population growth was 44.7 percent.

Based on recommendations from the Transportation Finance and Implementation Panel, and at CDOT's request due to the growing need for a "statewide" planning approach for transit and rail, SB09-94 was passed by the legislature which creates a Division of Transit and Rail within the CDOT. This new division will be charged with developing a statewide transit and passenger rail plan to be integrated with the statewide transportation plan as well as administer future dedicated ***state*** funds for transit and Federal Transit Administration grants.

Transportation Management Organizations

US 36 Corridor Annual Transit Ridership			
Route	2007	2008	% Change
80X	26,989	36,658	35.8%
82X	88,162	77,607	-12.0%
86X	192,694	207,919	7.9%
108X	39,544	45,300	14.6%
AB	271,124	312,820	15.4%
B	1,505,957	1,648,648	9.5%
DD	90,435	95,321	5.4%
DM	28,512	64,872	127.5%
HX	123,109	143,710	16.7%
L	268,816	301,658	12.2%
S	46,002	38,254	-16.8%
T	29,664	50,842	71.4%

Some corridors in the Denver metro area have Transportation Management Organizations (TMO). One that is well established is 36 Commuting Solutions, which brings together government and private sector stakeholders to work on reducing congestion and improving air quality and mobility on the US 36 corridor between Denver and Boulder. Strong EcoPass use on the corridor has helped boost ridership in what is RTD's most productive regional bus route in its system.

Established in 1998, 36 Commuting Solutions promotes alternative travel options for employees, employers and residents in order to shift solo drivers to transit, carpool, vanpool, bicycles and telecommuting. The

organization has implemented a commuter incentive program that pays solo drivers $2 per day over 90 days to switch to "green" commuting options. This is the first time an incentive program like this has been tried in Colorado. In its first year, the 36 Commuter CASH program attracted 341 participants and reports reductions in VMT on U.S. 36 by 215,853 miles and in carbon emissions by 211,816 pounds.

Vanpools and car pooling

Vanpool is a program in which groups of five to 15 individuals share a ride to work in a van that is provided and dedicated to their commute. Costs are shared among all members of the group and are generally based on the commute distance. Vanpool providers in Colorado cover 250 linear miles along the Front Range with approximately 175 vans. Current providers include DRCOG's RideArrangers, North Front Range MPO's VanGo, and the Pikes Peak Area Council of Governments' (PPACG) MetroRides.

Carpooling is the most common and flexible way for commuters to share a ride. Carpools generally have two or more passengers who live in the same area or along the same route using a private vehicle to travel to common or nearby destinations. DRCOG (RideArrangers), North Front Range MPO (SmartTrips), and PPACG (Metro Rides) currently offer carpool programs. Thousands of individuals are registered in these and other programs statewide.

Schoolpools, which act as carpools to transport children to school, are also effective and flexible rideshare programs. Schoolpool programs are offered through DRCOG, North Front Range MPO and PPACG.

DRCOG reports that in 2007, RideArrangers saved an estimated 50 million vehicle miles of travel, two million gallons of fuel, and 2.3 million pounds of air pollutants. Meanwhile, North Front Range MPO in 2006 managed over 400 VanGo vanpool riders in a fleet of 70 commuter vans that saved over nine million VMT in the North Front Range, Boulder and Denver metro areas.

Managed lanes/congestion pricing

Managed lanes, sometimes referred to as Express Lanes or High Occupancy Toll (HOT) lanes, offer choice to the traveler. Generally, a HOT lane facility is part of or parallel to a congested travel corridor and offers an alternative to travelers from the clogged general purpose lanes. As a user-pay facility, HOT lanes generate revenue to help offset operations and maintenance costs. Three mode choices are available to travelers: Transit bus, car pools and toll-paying solo drivers in Single Occupant Vehicles (SOV). Buses that use the managed lanes travel without charge and are guaranteed reliable travel times, an advantage to a fare-paying rider. Travelers who choose to car pool also use the lanes for free, as do motorcyclists. SOV drivers who

The I-25 Express Lanes offer free-flow travel to transit, car-pool and motorcycle users. It also offers choice to solo drivers willing to pay a toll to escape congestion in the general purpose lanes. CDOT photo.

choose to save time by not traveling in the congested general purpose lanes pay a toll. The tolls are collected electronically through open-road electronic readers that deduct from SOV drivers' pre-paid accounts, so there are no toll booths or stopping. The price typically varies by time so that the highest toll is collected during peak hours and the lowest during uncongested periods. This helps to manage the traffic volume and assure that all travelers in the lanes experience an uninterrupted trip at full highway speed when the adjacent general purpose lanes are clogged. Advanced applications may use real-time speed and volume data to change pricing dynamically to respond from minute to minute to variations in daily traffic.

CDOT operates one managed lane facility, the I-25 Express Lanes. The facility is approximately seven miles long in the median of I-25, between 20th Street in Denver's central business district and just north of US 36. It is a two-lane reversible facility with traffic southbound into Denver from 5 AM to 10 AM and northbound to Adams County from noon to 3 AM. The lanes originally opened in 1994 as a bus and car pool facility called the Downtown Express. In June 2006, toll equipment was deployed by CDOT and it was opened to SOVs. Since opening, traffic in the lanes has averaged from 11,000 to 12,500 vehicles per weekday, occasionally exceeding 14,000. This represents more than 15 percent of the total weekday person-trips on the corridor even though they are closed for two 2-hour periods to reverse their direction. During peak hours, they provide users with a typical travel time savings of 10 minutes.

Traffic volumes grew approximately 24 percent from July 2006 to June 2007, then stabilized in 2008 and have remained fairly consistent since. The following table is a representative sample of average daily and monthly traffic volumes:

Month	Avg. Daily Traffic	Monthly Traffic
Jun 2008	12,723	324,245
Dec 2008	10,358	282,616
May 2009	11,555	290,179

The I-25 Express Lanes generated $2.2 million in FY 2007 and $3.5 million in FY 2008. This revenue was used to pay for all costs of operations of the lanes, which include toll collection, violation processing, law enforcement, directional switching and video monitoring. It also funded maintenance costs that were previously borne by RTD. CDOT performs maintenance such as snow plowing, sweeping, pothole patching, bridge deck repair, sign maintenance, guardrail repair and lighting. Excess revenue is used to repay the Transportation Commission for the initial capital construction cost of implementing the HOT lanes and to create a reserve fund for major maintenance activities. As a result, approximately $1 million in taxpayer money that would have been dedicated to these lanes each year is now available for other highway and transit needs.

CDOT is engaged in a number of environmental studies that include managed or toll lanes as potential alternatives. These include US 36, I-70 East, C-470, I-70 West and I-25 North into Weld County.

Telecommuting

Telecommuting means working at home or at a location off the employer's physical site. According to the Bureau of Labor Statistics, just over 11 percent of Americans telecommuted at least one day per month in

2008, and increase from 8 percent in 2006. When people who work on contract, are self-employed or work at home or remotely are included, roughly 33.7 million Americans telecommute at least one day per month. In Colorado, several Metropolitan Planning Organizations (MPO) and Transportation Management Organizations (TMOs) provide assistance to employers in developing and implementing telecommute programs.

Increasing the number of Colorado workers who telecommute, work from home or from another remote location is an important element of Transportation Demand Management (TDM). The total number of employees statewide who telecommute is not available. But In the DRCOG region, RideArrangers has provided telecommute assistance to employers with 12,640 people who telecommute an average of 1.84 days per week. DRCOG reports that this has resulted in a VMT reduction of more than 13.9 million miles since September 2007.

Flextime

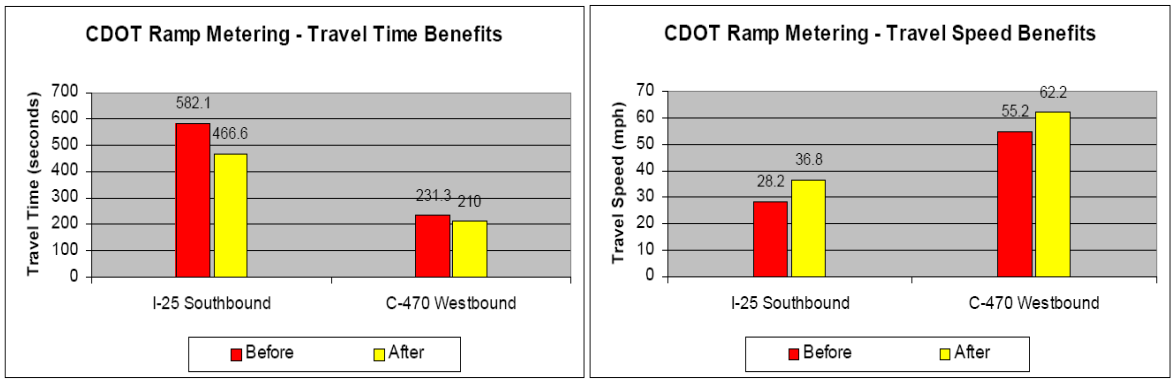
By varying the time of day or number of days that employees come to work, companies offer their employees more schedule flexibility. Flextime allows employees to choose when their workday starts and ends, and even which days they work. By offering compressed work weeks, employees can work four 10-hour days, three 12-hour days, or 80 hours of work in nine days. The effect of this is to reduce not only VMT but total trips taken, which reduces congestion.

Intelligent Transportation Systems (ITS)

Of all the methods listed in this section, use of ITS technologies is the one that CDOT has the most ability to implement on its own. CDOT's goal in deploying ITS technologies is to improve the productivity of the transportation system and to provide services that enhance and improve the mobility and safety of Colorado's traveling public. ITS is a cost-efficient and viable alternative to added capacity. It maximizes the operational efficiency and management of the existing roadway infrastructure through the use of devices and programs. Some practices involve methods of traffic control that help maintain flow, such as ramp metering and quick response to crashes and vehicle breakdowns. Other practices put real-time traffic information into the hands of motorists, empowering them to make their own decisions about when and where to travel to avoid congestion and make better use of their time. Colorado doesn't have the financial resources to continually expand roadway capacity. Nor is this necessarily the most effective or efficient strategy even when resources are available, due to right-of-way constraints and other environmental considerations that make unlimited expansion problematic. ITS helps CDOT squeeze more use out of what it already has.

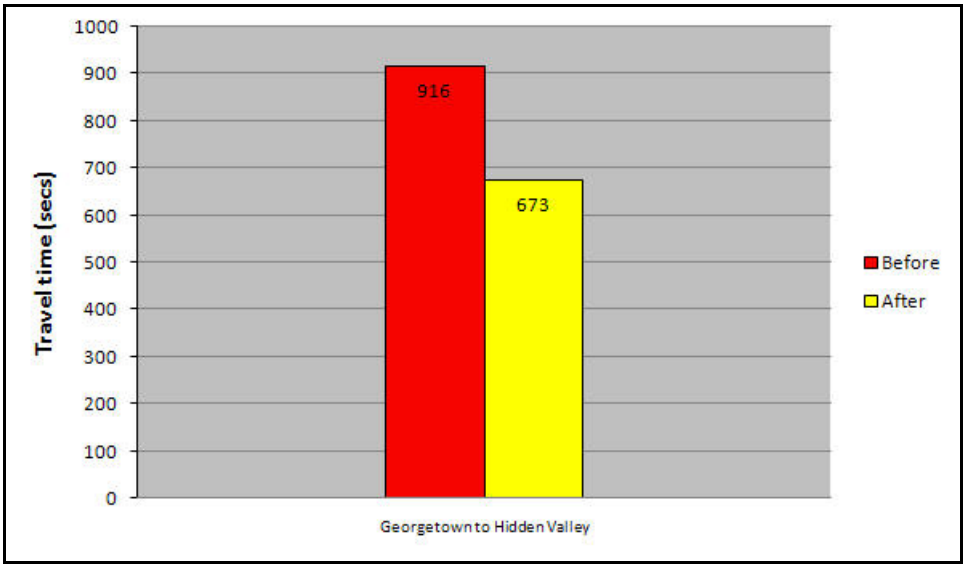
CDOT has invested significant resources in the deployment of ITS infrastructure and devices statewide. ITS infrastructure includes such devices as fiber optic cable along I-70, I-25 and in the Denver metro area, closed circuit television (CCTV) cameras, variable message signs (VMS), ramp meters, high-occupancy vehicle/high-occupancy toll lane (HOV/HOT) systems, road and weather information service, travel time indicators and highway advisory radio. Based on quantifiable benefits to traffic operations, safety and mobility that have been derived from active management of the transportation system, and the high benefits-to-cost ratio of the systems, CDOT plans to continue investing in ITS.

Ramp Metering. CDOT currently has 70 ramp metering sites statewide. In December 2003, CDOT implemented ramp metering during the morning peak period (6-8:30 a.m.) on I-25 southbound between 104th and 84th avenues and on C-470 westbound between Bowles and Quincy avenues. Prior to start-up, CDOT conducted travel-time studies on the two corridors to establish baseline conditions. In late January 2004, after implementation, travel times were again collected and studied. The results, shown in the figure below, were a significant gain in average traffic speed and lowering of travel time through those segments.



Ramp Metering Benefits (I-25 and C-470)

On the I-70 West corridor, the most significant problem aside from winter weather is severe congestion at certain peak periods, mostly weekend afternoons in the eastbound direction due to traffic returning to the Denver metro area from mountain resort and recreation areas. Typically, eastbound traffic queues back for several miles from bottleneck areas at the Eisenhower-Johnson Tunnels and at the twin tunnels east of Idaho Springs. In 2005, following a study to identify locations where the most benefit could be derived, CDOT installed three ramp meters at interchanges between Georgetown and Hidden Valley. The Department conducted before and after studies that found travel time in that segment during the peak period had shortened by just over four minutes following implementation.



Ramp Metering Benefits (I-70 West)

Courtesy Patrol. Beginning in 1992, CDOT implemented the Mile High Courtesy Patrol (MHCP) service on multiple highway segments in the Denver area. In 2003, a CDOT study showed that the service yielded a reduction of more than 500,000 hours of vehicle delay and saved motorists more than $9 million dollars annually as a result of MHCP assistance in more than 6,000 incidents.

Travel Time Applications. Multiple devices are used along the I-70 corridor to acquire data that CDOT can process into real-time traffic speeds and calculated travel times, which are then disseminated to drivers along the highway, to potential drivers and to others via the internet at www.cotrip.org and on various displays at mountain resorts.

Travel Time Application – Real-time travel times are posted on Variable Message Signs on the roadway and the traveler information website (www.cotrip.org) using data that is collected by ITS devices. There are about 300 VMS statewide, which are also used to post traffic, incident, regulatory and other relevant messages.

Typical Travel Message on Variable Message Sign

Travelers can use the information to modify their travel routes or times. Travel time applications are envisioned for other freeway corridors such as I-25 and freeways within the Denver area. For a typical freeway corridor that carries 100,000 vehicles a day, a 3-minute weekly reduction in travel time would reduce fuel consumption by approximately 120,000 gallons a year and carbon dioxide emissions by 300,000 pounds a year.

I-70 West Corridor – ITS Implementation. I-70 West is of vital importance to commercial motor vehicle transportation, both nationally and locally, and provides access to the many of Colorado's ski resorts and other mountain recreational activities. Growing volumes of both private and commercial vehicles, weather conditions and typical mountain highway geometrics of grades and curves combine to form operational and maintenance challenges. I-70 West has been identified as a priority corridor by the Colorado Transportation Commission and has been the focus of intensive study over the past 10 years. In the meantime, CDOT has also achieved operational benefits from several ITS applications.

The Department also has achieved operational improvements on the corridor, including various commercial motor vehicle applications. CDOT's program includes trucker chain-up stations, variable speed limits and heavy tow trucks. I-70's role as the principal east-west corridor through Colorado makes it important to the state's economic vitality. Commercial motor vehicles account for more than 10 percent of the vehicles on the I-70 West corridor. It is imperative to maintain traffic in the face of severe winter weather and mountain driving accidents. Keeping commercial trucks moving also benefits other drivers and businesses on the corridor. CDOT recently constructed 13 additional chain-up stations that can accommodate 137 trucks, bringing the total to 21 stations. The stations include lighting and signage. CDOT has installed 11 variable speed limit signs (VSL). VSL allows CDOT to post reduced speed limits in accordance with highway conditions in order to mitigate excessive speed and to smooth out disparate speeds among vehicles, which helps to reduce accidents. In 2007, CDOT implemented a heavy tow program that operates from

November through April. It responds to commercial vehicles that are stuck or blocking traffic in order to re-open the highway as quickly as possible. A recent study revealed that it costs businesses approximately $800,000 for every hour that I-70 is closed. That translates to a cost of about $3,300 per minute per lane. Based on this, data from the 2008-2009 season show that $21.4 million in potential economic losses were saved by the Heavy Tow Program. It moved 184 commercial vehicles out of traffic, clearing a total of 217 lanes in an average time of 29 minutes, compared with 52 minutes before the program started.

ITS Funding Needs and Deficiency. There is a considerable disparity between the amount of resources available and the amount required to meet program needs. The current budget for ITS maintenance, operations and capital replacements is about $6 million a year. This level is not sufficient to sustain regular maintenance and replacing existing devices that reach their life cycle. In order to cover this maintenance backlog, about $3.5 million a year is required for the next five years. Following that, nearly $9.5 million per year is needed to sustain the maintenance, operations and capital replacement of the existing infrastructure. This does not include any new infrastructure or added capacity to the roadway system.

Aviation

Aviation is not to be forgotten as an alternative mode of transportation. In fact, there are 800 daily roundtrip commercial airline seats from Durango to Denver everyday and over 3 million annual passengers who use the regional airports throughout Colorado (not including DIA and Colorado Springs).

Aviation's unmet need is relatively small compared to that of highways, because Colorado's aviation fund is indexed to the cost of fuel- the aviation fund grows with inflation thus allowing aviation revenues to grow. Due to this, Colorado's total statewide aviation revenue collections in 2003 were $12.1 and more than doubled in four years to $28.4 million with only a modest increase in activity. Because the aviation fuel is indexed, it allows aviation funding to better meet the construction needs of the airports statewide.

Conclusion

FASTER is an important first step in the effort to provide the stable and reliable funding sources needed to maintain a safe and efficient transportation system for all Coloradans and our travelers. But with its limited focus, it is only a first step.

It is important to appreciate that Colorado is not alone in facing this critical transportation infrastructure problem. Agencies all over the nation are deferring projects while trying to do more with less. This is due to a squeeze on financial resources from two directions. On one side is a reliance on an unchanging and dated per-gallon tax for primary revenue. On the other side is the recent unprecedented volatility in construction and maintenance costs that has eaten up the budgets funded by this tax.

CDOT is continually looking for alternative approaches to get more out of our existing network. As detailed in the report section on Methods of Reducing Cost, there are ways to use technology (ramp metering), encourage new travel and work behavior (flex time), innovate with programs (additional truck chain-up areas) and encourage traveler choices (HOT lanes) that yield greater benefits from the system we already have in place. Colorado must continue to recognize that without embracing these alternative methods, our roadways will continue to become more congested and less safe, and our highways and bridges will continue to deteriorate.

Continued use and expansion of these alternative methods, however, will not yield sufficient gains to meet the objectives, goals and vision for transportation that have been well identified through public planning processes. CDOT is confronted with a rapidly failing system of funding that, at current projections, will not allow the Department to sustain the existing condition of the transportation network even with these gains at the margins. If Colorado were to embrace, on a statewide basis, every one of those alternative methods, we would still have 115 bridges that are more than 75 years old and 6,282 lane miles of highway that need to be completely reconstructed or undergo major rehabilitation. Alternative methods would not produce enough savings over the next 10 years to repair or replace the aging infrastructure we still would have.

Using alternative methods to get the full benefit of our century-old investment in transportation systems works best when it is part of a comprehensive package that allows Colorado to deal with the aging and functionally obsolete elements of the broader system. We must find the revenue to bring these facilities into a state of good repair and maintain the system that we have, as well as fund targeted capacity improvements that will complement the increased use of alternative methods. The system can be brought up to standard by first achieving our measurable objectives and then reaching the goals and vision of a smoothly functioning 21st Century transportation network that facilitates economic vitality and good quality of life for Coloradans.