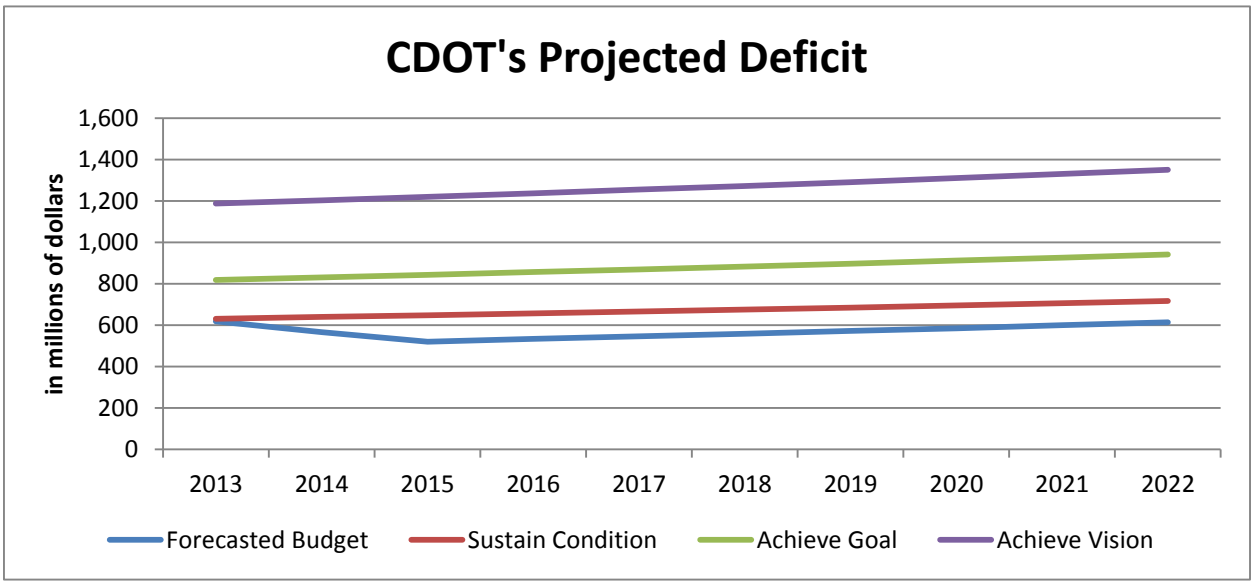
Transportation Deficit Report

2012



Prepared pursuant to SB 09-108

March 1, 2012

DOT
DEPARTMENT OF TRANSPORTATION

Colorado FASTER
FUNDING ADVANCEMENT for SURFACE TRANSPORTATION & ECONOMIC RECOVERY

Overview

Pursuant to §43-4-813, C.R.S. 2009, the Colorado Department of Transportation (CDOT) hereby delivers its annual Transportation Deficit Report for 2012. Under the guidelines set forth in the enabling legislation – the Funding Advancements for Surface Transportation and Economic Recovery Act (FASTER) – this report addresses the goals of:

- Repairing deficient highways and bridges; and
- Sustaining existing transportation system performance levels.

For each of the above goals, the report includes the following:

- Estimated costs (and resulting deficits) of sustaining the current condition over the next 10 years;
- Estimated costs (and deficits) of achieving the goal of the Transportation Commission (TC) within the next 10 years as stipulated in Transportation Commission Policy Directive 14;
- Estimated costs (and deficits) of achieving the Accomplish Vision Scenario within the next 10 years as stipulated in the 2035 Statewide Transportation Plan;
- Annual increase and rate of increase of this cost; and
- Factors contributing to the costs including rate/distribution of population growth, vehicle size and weight, land use policies, and work patterns, as well as techniques and tools for mitigating these factors.

This report incorporates Fiscal Year (FY) 2013 programmatic budgets and projected revenues and performance as approved by the Transportation Commission in October 2011 prior to budget submittal to the Governor's office. Though forecasts for any one of the Department's revenue sources may change at various times throughout the year and though costs change regularly, the system's performance is projected primarily in conjunction with annual budget development.

In developing the FY 2013 budget proposal, CDOT relied on revenue forecasts available at that time. With regard to FASTER receipts, CDOT projects it will receive $192.4 million (all figures rounded) in revenue from the fees and surcharges in FY 2013. Of this, $70.1 million will be from the road safety fee on vehicle registrations, $93.0 million will be from the bridge safety fee on vehicle registrations, and $29.2 million will be from the daily vehicle rental fee, overweight and oversize vehicle permit fee surcharges, and fees and fines on late vehicle registrations. Under FASTER, $5 million dollars will be from HUTF local government apportionments for transit purposes. With the exception of certain dedicated funding for transit, these figures can change with each quarterly forecast from the Office of State Planning and Budget.

Update

In reviewing this report, the reader must note the following:

- Investments – or lack thereof – in a given year may not instantly result in a change in performance of the system or funding deficit. Neglecting surface treatment of newer road segments, for example, may not noticeably deteriorate those segments this year. But this year's neglect will result in more rapid deterioration over time and more costly reconstruction years from now.
- The Office of State Planning and Budgeting and Legislative Council issue State of Colorado revenue estimates quarterly. CDOT does not update its own revenue projections with each quarterly update.
- The Bridge Enterprise issued bonds late in calendar year 2010. This report assumes that the Department utilizes those bond proceeds through 2014, and thus Bridge revenues – including bond proceeds – are depicted to decline before stabilizing in 2015, when the Bridge Enterprise and the bridge program will then rely only on annual revenues.
- As this report is being published, Federal Authorization of the next transportation bill remains the greatest unknown revenue factor for Colorado and other states, and could have significant impacts on revenue projections once passed. The House and Senate have each proposed new federal authorization, though neither bill proposes *significant* new funding sources.
- Also, as this report is being published, CDOT is embarking on an enhanced Asset Management and Performance Reporting effort that could result in an improved method for delivering this information in future Transportation Deficit Reports.
- Unless otherwise noted, projected revenues and expenditures are stated in year-of-expenditure dollars and rounded.

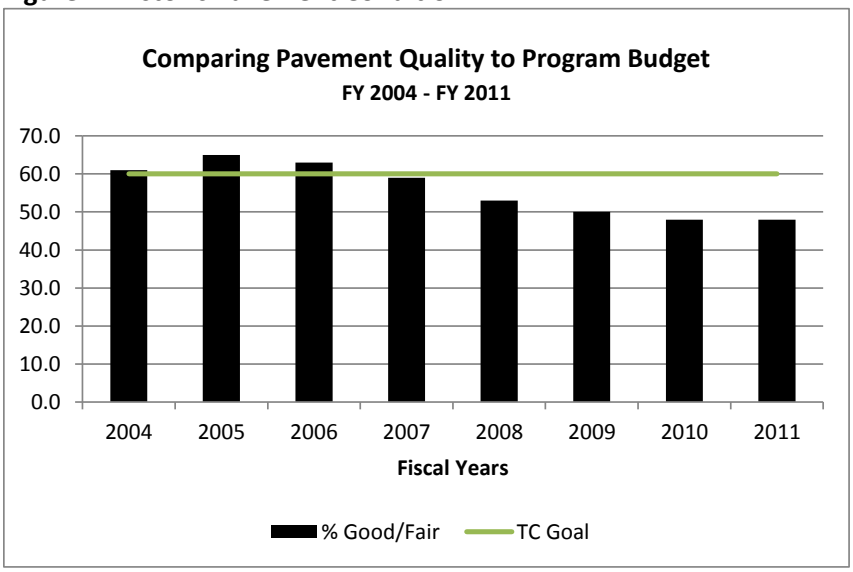
Table of Contents

3 Repairing Highways
9 Repairing Bridges
13 Sustaining Performance Levels
19 CDOT Efforts to Mitigate Congestion and Other Cost Escalation
22 Conclusion

Repairing Highways

The Department's Surface Treatment Program maintains approximately 23,000 lane miles of the State highway system. The Transportation Commission endeavors to preserve 60 percent of this system in good or fair condition, recognizing that financial resources cannot practically support a significantly higher performance. After peaking at 65 percent Good/Fair condition in 2005, the State's paved highway condition has regressed annually as declining program budgets and rising resurfacing costs have contributed to system-wide deterioration. The program concluded FY 2011 with a 48 percent Good/Fair condition, maintaining the prior year's level, due in large part to completion of projects funded with the American Reinvestment and Recovery Act (ARRA). The current year (FY 2012) is projected to finish with a 45 percent Good/Fair condition.

Figure 1. Historic Pavement Condition



The Transportation Commission has preliminarily allocated $159.7 million in FY 2013 to the Surface Treatment Program. The Transportation Commission has also allocated $5.0 million in Safety Surface Treatment funds, to garner efficiencies by performing necessary safety work in conjunction with surface treatment work. This funding level is forecasted to result in approximately a 43 percent Good/Fair condition for FY 2013. While several ARRA projects helped slow the decline of the system, the funding streams were not adequate to make a measurable difference on the system's long-term condition. To make a measurable difference that can be

How CDOT Rates its Highways

*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 a highway segment has a Remaining Service Life (RSL) greater than or equal to 11 years; a **fair** rating indicates an RSL of 6 to 10 years; and a **poor** evaluation represents an RSL of less than 6 years. There are a number of poor-rated highways that have an RSL of zero, meaning the highway has no remaining service life. A poor highway segment is one that has a compromised base or sub-base. In this case, the only remaining economically viable option is major rehabilitation or complete reconstruction. Major rehabilitation or reconstruction costs 10 to 20 times more per lane mile 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. The relative value of pavement preservation treatments is approximately three to four times greater than a major rehabilitation or reconstruction. CDOT obtains a better return on 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.*

identified and tied directly to one source of funding, the funding would need to be significant and consistent over many years.

Figure 2. 2011 Statewide Pavement Condition by Category

State highway category	TC Goal % G/F	FY 2011 Condition % G/F
Network	60	48
Interstate	85	65
NHS* non-interstate	70	64
Other	55	33

** --NHS is National Highway System category*

The Transportation Commission's decision to maintain different components of the system at different performance levels is one result of insufficient funding. Commission goals, as most recently adopted in October 2009, and FY 2011 performance levels are depicted above in Figure 2.

Cost of Sustaining Current Condition over Next 10 Years

The cost to sustain the current condition of 48 percent Good/Fair over the next 10 years is approximately $2.8 billion, thus requiring an *average* annual budget of $280 million (this and the other cost projections for pavement are significantly less than last year's estimate due primarily to inflation assumptions. See below for more detail). The projected revenue allocation for surface treatment over that time period is approximately $1.9 billion or an average of $190 million per year. The deficit, therefore, is approximately $0.9 billion or $90 million annually. See Figure 3A on the following page.

Cost of Achieving Goal over Next 10 Years

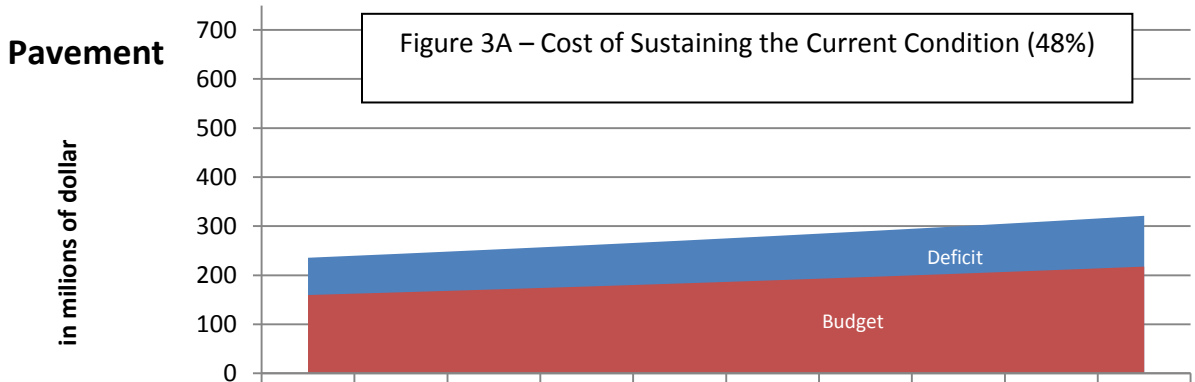
The cost to achieve the goal of 60 percent Good/Fair within 10 years is approximately $4.6 billion, thus requiring an average annual budget of approximately $460 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $2.8 billion or an average of $280 million annually. See Figure 3B.

Cost of Achieving Vision over Next 10 Years

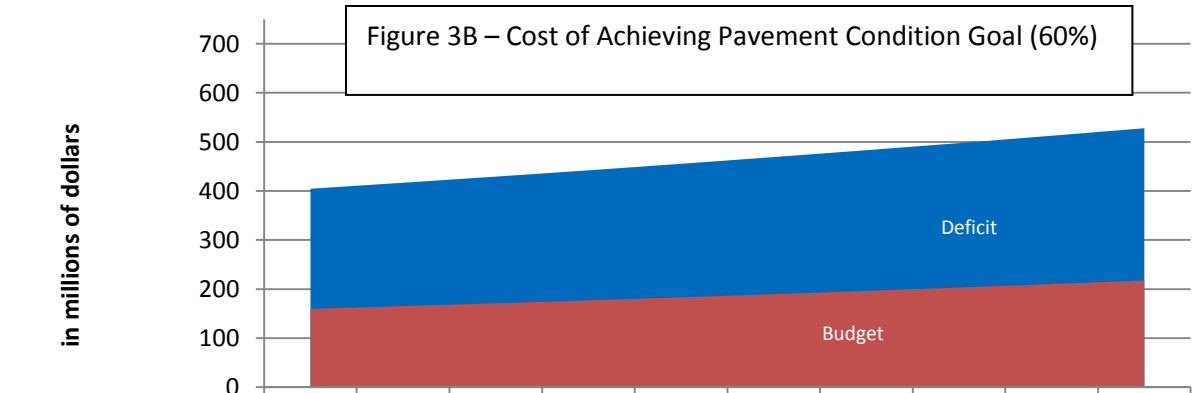
The cost to achieve the vision of 75 percent Good/Fair within 10 years is approximately $6.1 billion, requiring an annual budget of approximately $610 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $4.3 billion or an average of $430 million annually. See Figure 3C.

Annual Increase and Rate of Increase of this Cost

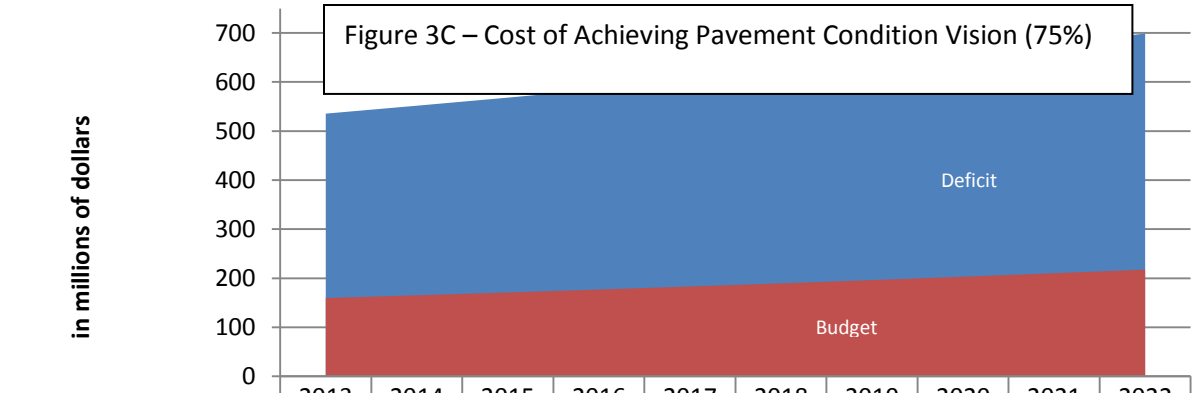
The three projected deficits fell significantly from the 2011 Transportation Deficit Report, reflecting primarily a change in the assumption on asphalt inflation. Now that prices appear to have stabilized over recent years, the ashphalt inflation rate has been lowered. The Pavement Management Model used for projecting future conditions now assumes an annual inflation rate of 3.5 percent.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sustain 2011 (48%)	235.7	243.9	252.5	261.3	270.4	279.9	289.7	299.8	310.3	321.2
Forecasted Budget	159.7	165.3	171.1	177.1	183.3	189.7	196.3	203.2	210.3	217.7
Deficit	76.0	78.6	81.4	84.2	87.1	90.2	93.4	96.6	100.0	103.5



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Achieve Goal (60%)	404.6	416.8	429.3	442.1	455.4	469.1	483.1	497.6	512.6	527.9
Forecasted Budget	159.7	165.3	171.1	177.1	183.3	189.7	196.3	203.2	210.3	217.7
Deficit	244.9	251.5	258.2	265.0	272.1	279.4	286.8	294.4	302.3	310.2



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Achieve Vision (75%)	535.6	551.7	568.2	585.3	602.8	620.9	639.5	658.7	678.5	698.8
Forecasted Budget	159.7	165.3	171.1	177.1	183.3	189.7	196.3	203.2	210.3	217.7
Deficit	375.9	386.4	397.1	408.2	419.5	431.2	443.2	455.5	468.2	481.1

Factors Contributing to the Costs

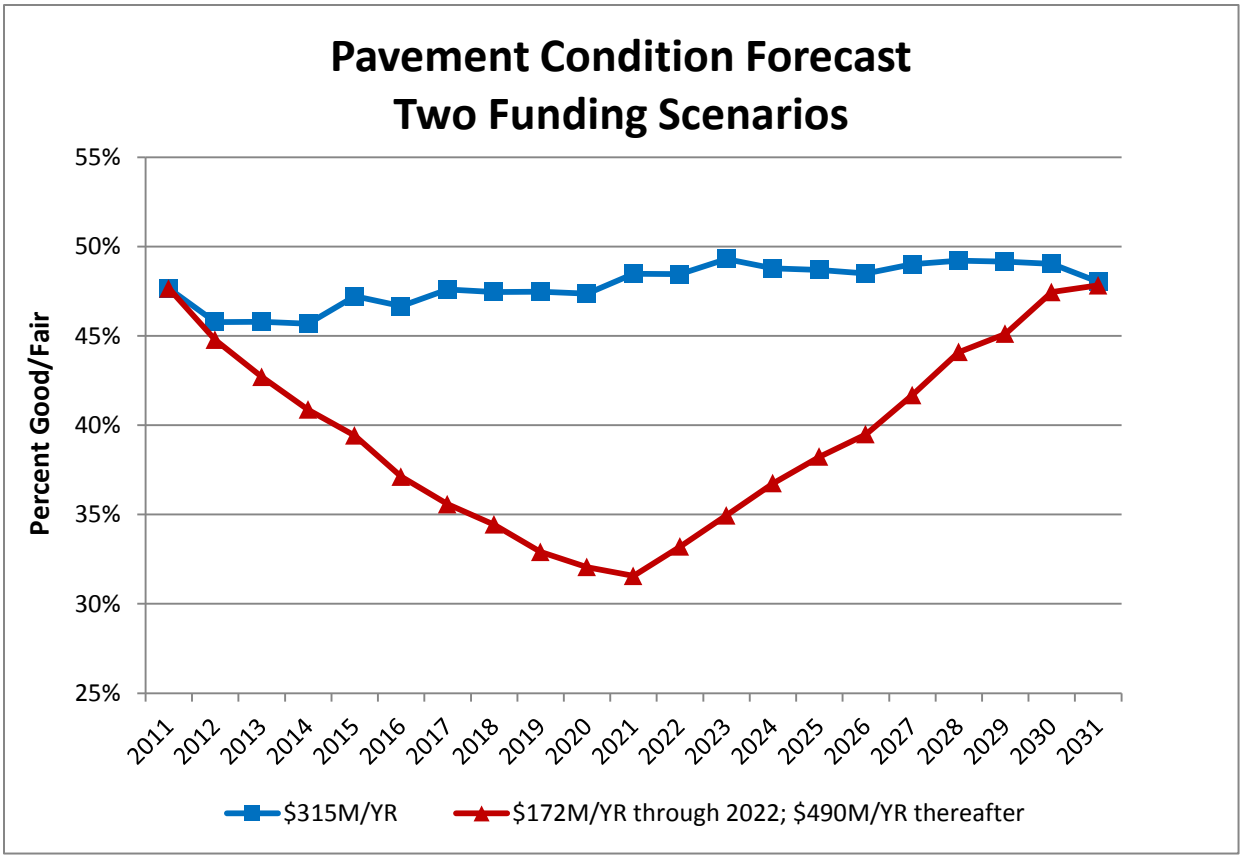
Material Prices. Pavement costs are driven largely by the costs and available supply of Portland Cement, asphalt binder, and aggregates. Asphalt binder prices fluctuate greatly, and are somewhat correlated to petroleum prices. Recent changes or upgrades at oil refineries have decreased the amount of oil which is economically viable to convert to asphalt binder. Other factors, such as competition, also impact resurfacing and reconstruction of the State's highway system. The economic downturn in FY 2009, and the associated stabilization of pavement costs that followed, provided some short-term cost relief to the Surface Treatment Program.

Population Growth and Distribution. While surface treatment resource allocations are dependent heavily on measures of remaining service life and highway categories depicted in Figure 2, a growing population translates to increased Average Daily Traffic (ADT) on State highways and increased wear and tear on pavement surfaces. According to U.S. Census Bureau estimates, Colorado's 2011 population grew to 5,116,796, representing a 1.7 percent increase during the year. While this may sound small, sustaining this annual rate over the next decade would exceed the prior decade's growth and bring Colorado's population close to 6 million by 2020. According to the State Demographer, population growth is expected to be most rapid on the Western Slope, in the Central Mountains, and in the Front Range outside of Denver. CDOT anticipates this population growth, coupled with a gradual decline in the unemployment rate as the economy recovers from the Great Recession, will cause a rapid increase in Vehicle Miles Traveled (VMT) of 24 percent by 2020.

Vehicle Size and Weight. Vehicle size and weight dictate design quality of highway segments and are more significant determinants in surface quality deterioration than population growth and distribution. Pavement thickness, in fact, is the direct result of anticipated truck freight traffic volume. A stretch of highway, for example, that handles *80,000* cars and no trucks each day requires seven inches of pavement. Conversely, a stretch with a daily count of only *8,000* cars, but 4,000 trucks, requires eight inches of pavement. The impact of commercial vehicle traffic therefore is a significant factor in the calculation of costs to the Surface Treatment Program.

Land Use Policies and Work Patterns. Land use patterns have a strong impact on travel demand and on the need for transportation infrastructure, maintenance, repair, and improvements. Roadways are designed and constructed for their anticipated traffic loads. Any changing pattern of ADT or of increased truck traffic due to commercial, manufacturing, or energy development can alter the projected impacts. When land use policies evolve and result in redistribution or new access points, increasing traffic on roadways designed for fewer vehicles has an impact, causing unanticipated deterioration and redirection of maintenance resources. Sprawling development patterns act to increase VMT at rates faster than population growth. The result is an increase in demand on transportation infrastructure that exceeds the growth in resources available to provide and maintain that infrastructure.

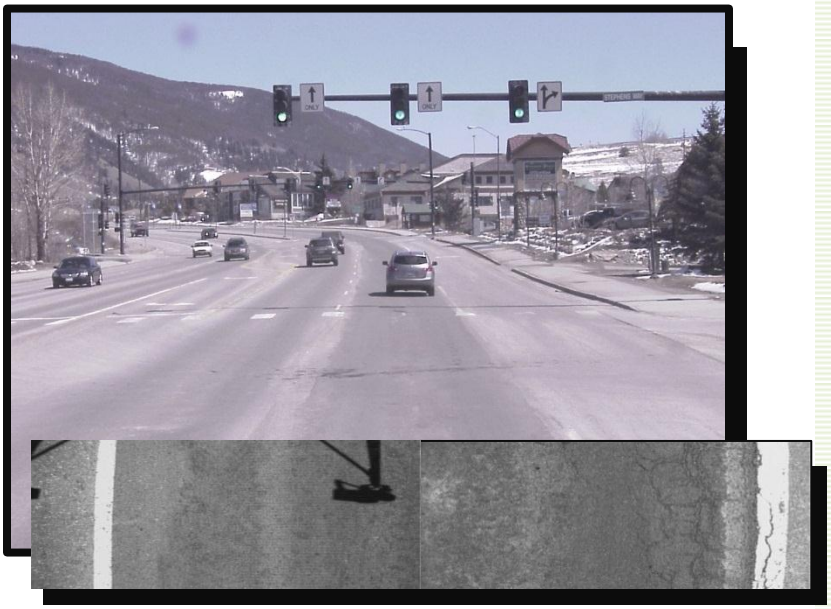
Figure 4. Pavement Condition Forecast



Today, an average stretch of Colorado highway has approximately 6.7 years of remaining service life (RSL) before requiring costly reconstruction. Using a recently proposed grading scale for pavement, CDOT considers this a C level of service. At current funding levels, the average life will drop to 4.9 years by 2022. CDOT considers this a D level of service, also under the recently proposed grading scale.

As stated above in "How CDOT Rates its Highways," CDOT categorizes its pavement by condition into Good, Fair, and Poor categories based on RSL. The Department has historically reported condition based on percentage of total lane miles in Good or Fair condition. Figure 4, above, depicts the impact of underfunding in terms of reduced Good/Fair pavement percentages.

If Colorado continues funding pavement at current levels ($172 million per year) for the coming decade, condition will drop from 48 percent Good/Fair to nearly 30 percent Good/Fair by 2021. CDOT will then have to spend approximately $490 million per year over the following decade only to return to today's condition. Therefore, over the next 20 years, maintaining the current condition will cost CDOT $6.3 billion, while allowing deterioration and reconstructing later will cost $6.6 billion. The net impact to Coloradans will be reduced levels of service every year and an additional cost of $300 million dollars over the next 20 years. Investing now in this valuable Colorado asset will benefit Coloradans today *and* for years to come.



C Level of Service

Middle-aged pavement displaying signs of visual distress, as evidenced by the moderate severity fatigue cracking along the right pavement stripe.

Pavement with a C level of service is a candidate for minor rehabilitation, such as a two-inch overlay, which will double the RSL of this section and cost a fraction (1/5) of reconstruction. Reconstruction will be necessary if this segment remains untreated for another 7 years.

D Level of Service

Older pavement with service levels of distress, as evidenced in the pavement photos. The pavement structure, including pavement, base, and sub-base, will become compromised if this segment goes untouched.

Pavement with a D level of service is a candidate for major rehabilitation, which is more expensive than its minor counterpart, but still significantly cheaper than reconstruction. Reconstruction will be necessary once the pavement structure is compromised.

Treatment Type	Example
Preventative Maintenance	Chipseal
Minor Rehabilitation	2” Overlay
Major Rehabilitation	4” Overlay
Reconstruction	Removal and Replacement

Repairing Bridges

The Department's bridge program maintains 3,447 major vehicular bridges on the State highway system. The Transportation Commission has a goal of maintaining 95 percent of the bridges, as represented by deck area on these structures, in good or fair condition. As in FY 2010, the program ended FY 2011 with 94.5 percent of bridge deck area in good or fair condition.

The projected trend, based on forecasted revenue including the FASTER Bridge Enterprise Special Revenue Fund, is downward to 92.8 percent good or fair condition in 2022. FASTER legislation has, however, helped to sustain Good/Fair percentages in the short- to mid-term.

The State Bridge Enterprise was created by FASTER to finance the repair and reconstruction of State-owned vehicle bridges using revenues from an annual bridge safety surcharge on vehicle registrations. The entire bridge safety fee is expected to generate increased revenue over its three-year phase in. To qualify for Bridge Enterprise funding the bridges must be rated in poor condition and selected by the Bridge Enterprise Board. At the conclusion of FY 2011, 154 bridges had become eligible for FASTER funding since the Bridge Enterprise was created, 125 were in poor condition, and the remaining were repaired or reconstructed. A list and location of current FASTER bridges can be found at http://www.coloradodot.info/programs/BridgeEnterprise/documents/BridgesbyCounty.

Loy Gulch Bridge

How CDOT Rates its Bridges

CDOT reports major vehicular bridge condition by the percent of bridge deck area Statewide that is in good or fair condition. The National Bridge Inventory standards established by the Federal Highway Administration are used to inventory and classify the condition of major vehicular bridges. The classification is based on a sufficiency rating of 0 to 100 and a status of not deficient, functionally obsolete, or structurally deficient. See definitions on following pages.

Major vehicular bridges in ***poor condition*** *have a sufficiency rating of less than 50 and status of structurally deficient or functionally obsolete. Bridges in poor condition do not meet all safety and geometric standards and require reactive maintenance to ensure their safe service. For the purpose of determining bridge-funding needs it is assumed that bridges in poor condition have exceeded their economically viable service life and require replacement or major rehabilitation.*

Major vehicular bridges in ***fair condition*** *have a sufficiency rating from 50 to 80 and a status of structurally deficient or functionally obsolete. Bridges in fair condition marginally satisfy safety and geometric standards and either require preventative maintenance or rehabilitation.*

(continued on next page)

Cost of Sustaining Current Condition over Next 10 Years

The cost to sustain the current condition of 94.5 percent Good/Fair over the next 10 years is approximately $1.8 billion, thus requiring an annual budget of approximately $180 million. Against projected revenue allocations including FASTER bond proceeds, this forecasts a 10-year deficit of approximately $0.6 billion or on average $60 million annually. See Figure 5A on the following page.

Cost of Achieving Goal over Next 10 Years

The cost to achieve the goal of 95 percent Good/Fair within 10 years is approximately $2.0 billion, thus requiring an annual budget of approximately $200 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $0.8 billion or on average $80 million annually. See Figure 5B.

Cost of Achieving Vision over Next 10 Years

The cost to achieve the vision of 100 percent Good/Fair within 10 years is approximately $4.3 billion, thus requiring an annual budget of approximately $430 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $3.1 billion or on average $310 million annually. See Figure 5C.

Annual Increase and Rate of Increase of this Cost

The projected 10-year costs to sustain the current condition and to achieve the vision and goals increased only slightly from last year's report.

It should be noted that annual FASTER revenues have not met initial projections and the results of bonding in late 2010 are now reflected in FY 2013 and 2014 revenue projections. Conditions as projected with FY 2013 budget development are displayed in Figure 6 on page 12.

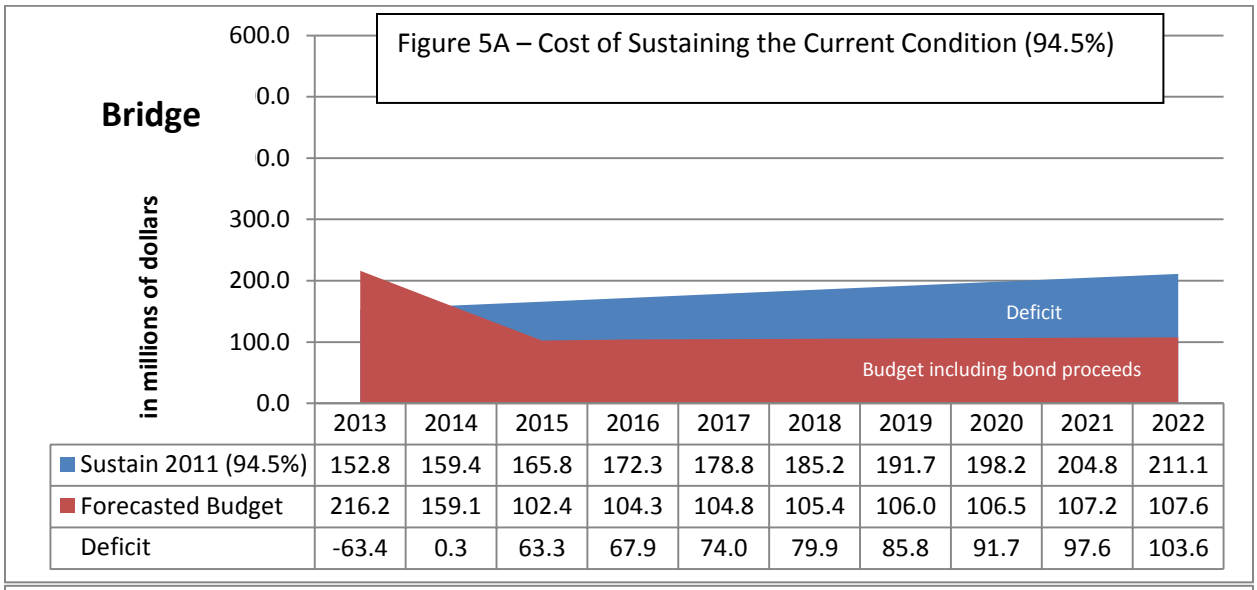
How CDOT Rates its Bridges

(continued from prior page)

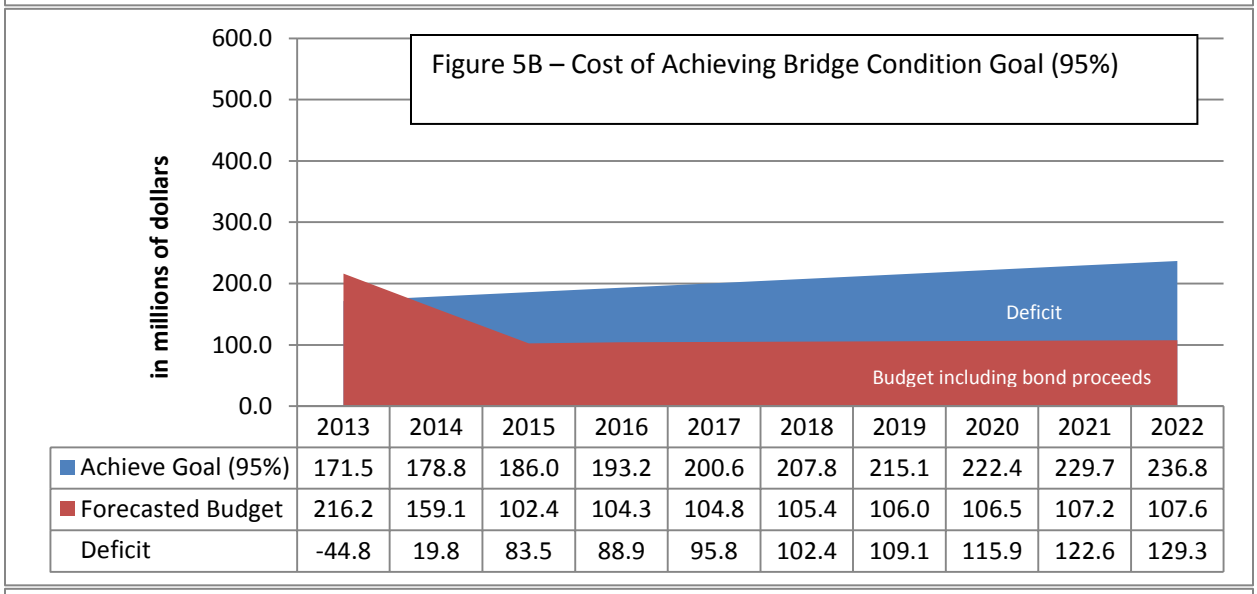
*Major vehicular bridges in **good condition** are all remaining major bridges that do not meet the criteria for poor or fair. Bridges in good condition generally meet all safety and geometric standards and typically only require preventative maintenance.*

*A bridge is **structurally deficient** if it does not meet minimum standards for condition or capacity. A structurally deficient bridge often has one or more members in deteriorating or damaged condition. Having only a small portion of a bridge in poor condition can result in the entire bridge being classified as structurally deficient.*

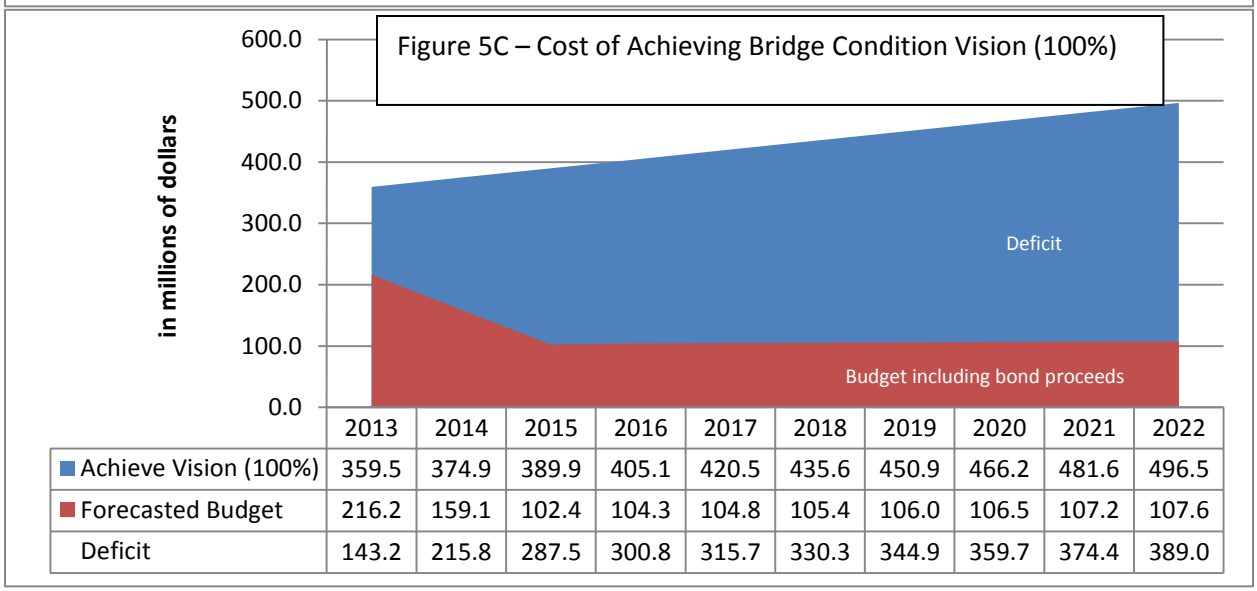
*A bridge is **functionally obsolete** if it does not meet current minimum geometric requirements. Bridges classified as functionally obsolete often have inadequate roadway shoulders, insufficient number of lanes to handle current traffic volumes, overhead clearances less than minimums, or inadequate widths for roadways or streams passing underneath.*



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sustain 2011 (94.5%)	152.8	159.4	165.8	172.3	178.8	185.2	191.7	198.2	204.8	211.1
Forecasted Budget	216.2	159.1	102.4	104.3	104.8	105.4	106.0	106.5	107.2	107.6
Deficit	-63.4	0.3	63.3	67.9	74.0	79.9	85.8	91.7	97.6	103.6

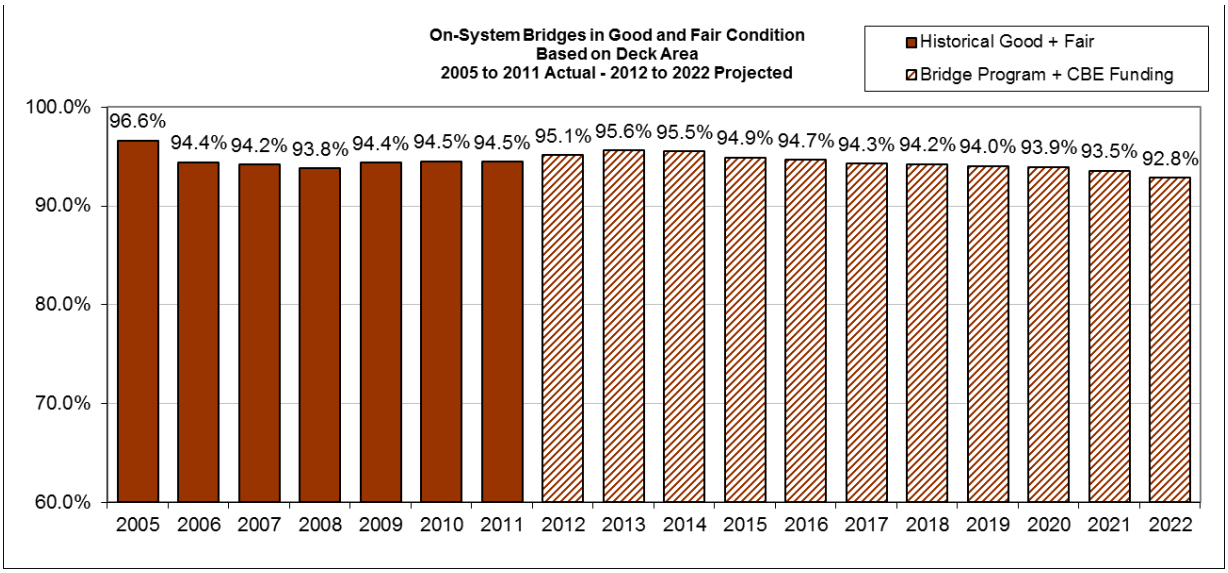


	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Achieve Goal (95%)	171.5	178.8	186.0	193.2	200.6	207.8	215.1	222.4	229.7	236.8
Forecasted Budget	216.2	159.1	102.4	104.3	104.8	105.4	106.0	106.5	107.2	107.6
Deficit	-44.8	19.8	83.5	88.9	95.8	102.4	109.1	115.9	122.6	129.3



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Achieve Vision (100%)	359.5	374.9	389.9	405.1	420.5	435.6	450.9	466.2	481.6	496.5
Forecasted Budget	216.2	159.1	102.4	104.3	104.8	105.4	106.0	106.5	107.2	107.6
Deficit	143.2	215.8	287.5	300.8	315.7	330.3	344.9	359.7	374.4	389.0

Figure 6. Historic and Projected On-System Bridge Condition



**– CBE is the Colorado Bridge Enterprise*

Factors Contributing to the Costs

Exposure to the Elements. 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 and can result in weight restrictions.

Population Growth and Distribution. These factors have a 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, and advance or delay the onset of functional obsolescence, as defined on page 11.

Vehicle Size and Weight. Deterioration can result in posted weight limits that affect truck routes and detours. CDOT issues tens of thousands of oversize or overweight permits annually, but non-permitted overweight vehicles can cause overstress damage to bridges if the load is in excess of the bridge's carrying capacity. In addition, non-permitted oversize vehicles have hit bridges and caused enough damage to drop bridge condition ratings and require repair.

Land Use Policies and Work Patterns. Bridges are affected by land use policies and work patterns in similar fashion to pavement. 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. Likewise, a bridge's sufficiency rating is affected by shifts in ADT and truck traffic due to changes in commuting and commercial routes resulting from population growth and development.

Sustaining Performance Levels

Discretionary funds account for just over half of CDOT's FY 2013 budget. Nearly 40 percent of discretionary funds will be expended in the ongoing maintenance of the entire State transportation system, including removal of snow and ice. The "big three" asset categories – Pavement, Bridge, and Maintenance – hence comprise a significant portion of all funds over which the Transportation Commission must make investment decisions. Sustaining Maintenance performance levels therefore is analyzed in this report much like Pavement and Bridge.

Safety and Mobility are two other key areas of transportation performance. As "intangible" assets which are influenced by a multitude of factors often outside of CDOT's control, the link between investments in Safety and Mobility and performance outcomes is less direct and more difficult to measure than investments in Pavement, Bridge, and Maintenance. Because the connection between investment and performance is not as strong in these performance areas, sustaining Safety and Mobility performance levels is discussed after Maintenance, without graphs quantifying budgetary gaps as used for Pavement, Bridge, and Maintenance.

Maintenance

With a proposed FY 2013 budget of just over $240 million, CDOT's maintenance of the State highway system represents one of the Department's largest annual investments. The Maintenance program is designed to keep the system open and safe for the traveling public.

The overall Statewide Maintenance Levels of Service annual objective grade for FY 2012 is a B- and for FY 2013 is a C+. When additional dollars have recently been allocated to Maintenance, they are often done so to strive for a B level of service for Snow & Ice removal, which is financially the largest of the nine maintenance program areas (see Figure 8 on page 16).

How CDOT Rates 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 nine ***Maintenance Program Areas,*** *with examples:*

- ***Roadway surface***
  Patching and sealing potholes
  Blading unpaved surfaces
- ***Roadside facilities***
  Cleaning drainage structures
  Repairing eroded slopes
- ***Roadside appearance***
  Controlling vegetation
  Sweeping road surface
  Trash removal
- ***Traffic services***
  Maintaining roadway signs
  Maintaining roadway lighting
  Guardrail repair
- ***Structure maintenance***
  Painting bridges
- ***Snow and ice control***
  Plowing
  Avalanche control
- ***Equipment and buildings***
  Rest areas
- ***Tunnel activities***
  Tunnel maintenance
- ***Planning and training***
  Performance budgeting
  Maintenance staff training

Cost of Sustaining Current Condition over Next 10 Years

The cost to sustain the current condition of a B- level of service over the next 10 years is approximately $2.7 billion, thus requiring an annual budget of approximately $270 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $70 million or on average $7 million annually. See Figure 7A on the following page.

Cost of Repairing to Goal over Next 10 Years

The cost to achieve the goal – to improve gradually from a B- to B level of service – within 10 years is approximately $2.9 billion, thus requiring an annual budget of approximately $290 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $300 million or on average $30 million annually. See Figure 7B.

Cost of Repairing to Vision Next Year and Sustaining for Nine Years

The cost to achieve the vision – to improve to a B level of service next year and sustain that level over the following nine years – is approximately $3.4 billion, thus requiring an annual budget of approximately $340 million. Against projected revenue allocations, this forecasts a 10-year deficit of approximately $800 million or on average $80 million annually. See Figure 7C.

How CDOT Rates Maintenance

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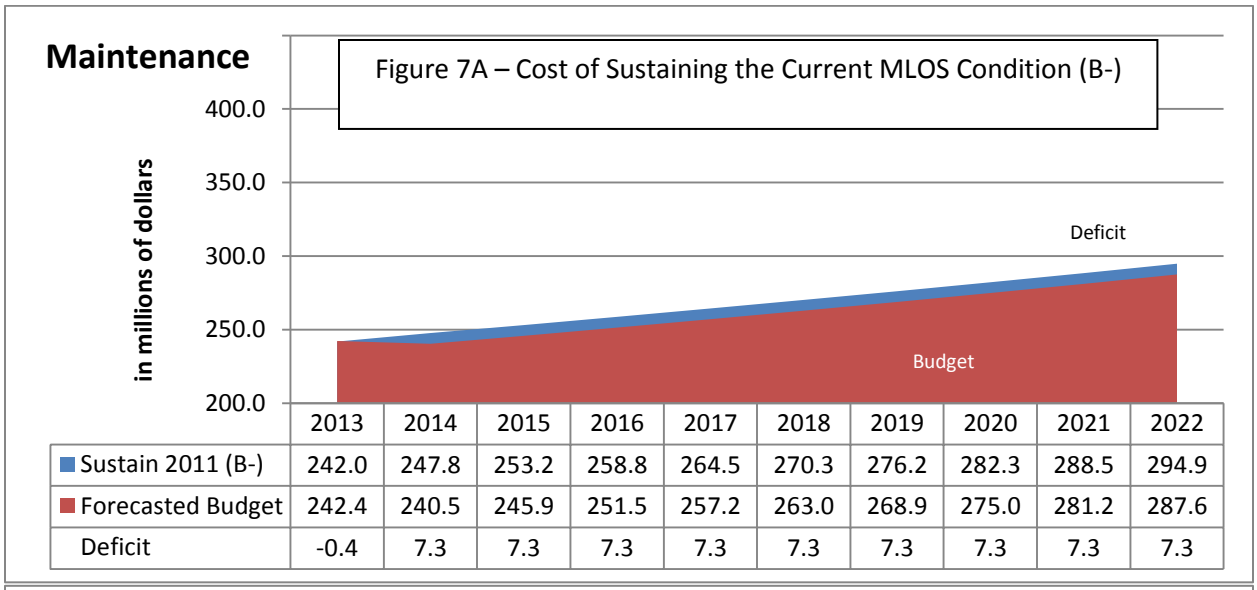
CDOT measures the performance of maintenance service with a school report card style grading system called ***Maintenance Levels of Service (MLOS)*** *that estimates the achievable grade with available budget. Higher grades could be achieved with higher funding levels. MLOS is a performance-based budget 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.*

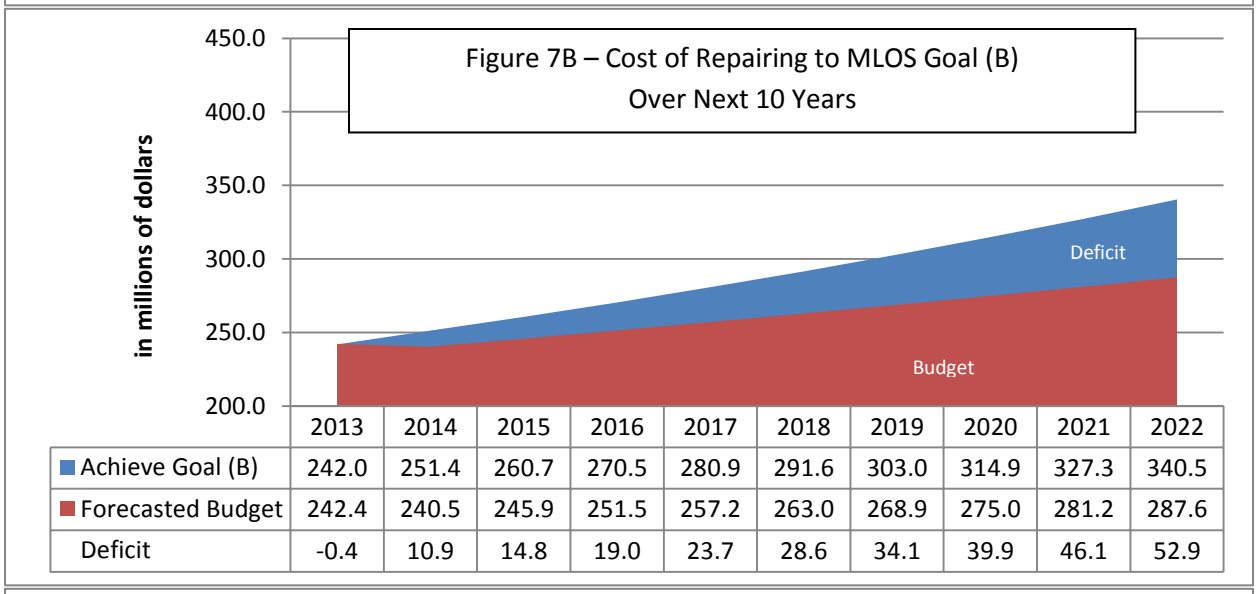
Annual Increase and Rate of Increase of this Cost

The cost to sustain the current level of service has fallen slightly from the 2011 Transportation Deficit Report, due in part to the benefits of bridge reconstruction by the Bridge Enterprise and to moderate winters in urban areas.

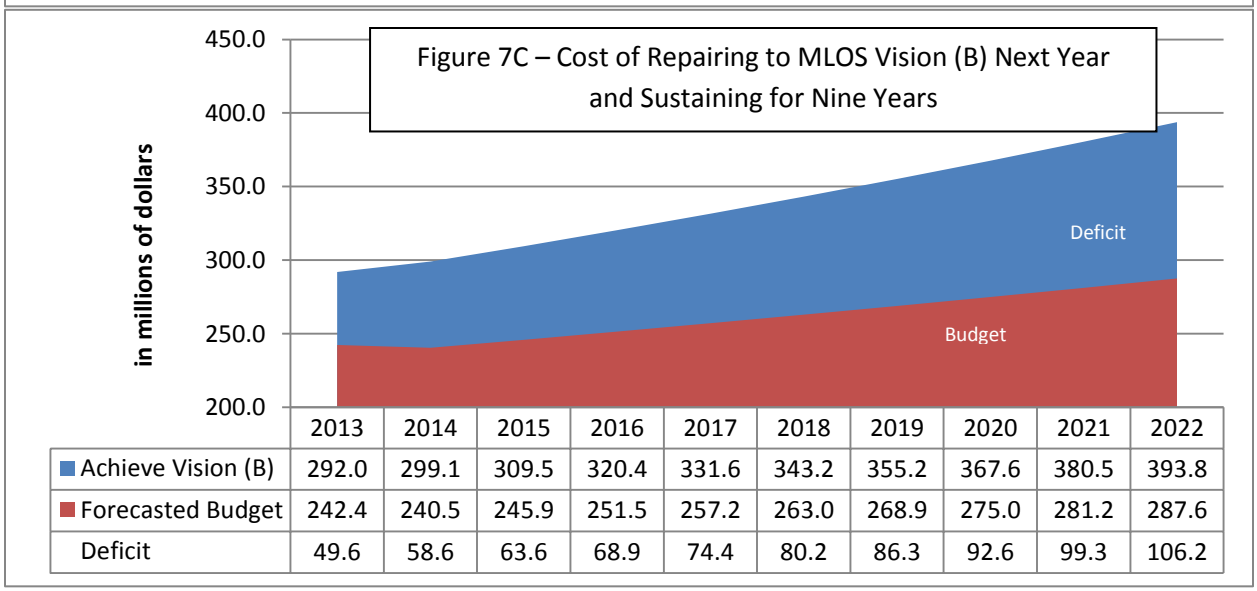
The consequences of underfunding Pavement and Bridge programs will over time more severely impact the Maintenance program, which will be responsible for more pavement lane miles and bridges in need of reactive repair. Keeping a poor road in working condition is more expensive than maintaining a good or fair road.



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sustain 2011 (B-)	242.0	247.8	253.2	258.8	264.5	270.3	276.2	282.3	288.5	294.9
Forecasted Budget	242.4	240.5	245.9	251.5	257.2	263.0	268.9	275.0	281.2	287.6
Deficit	-0.4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3

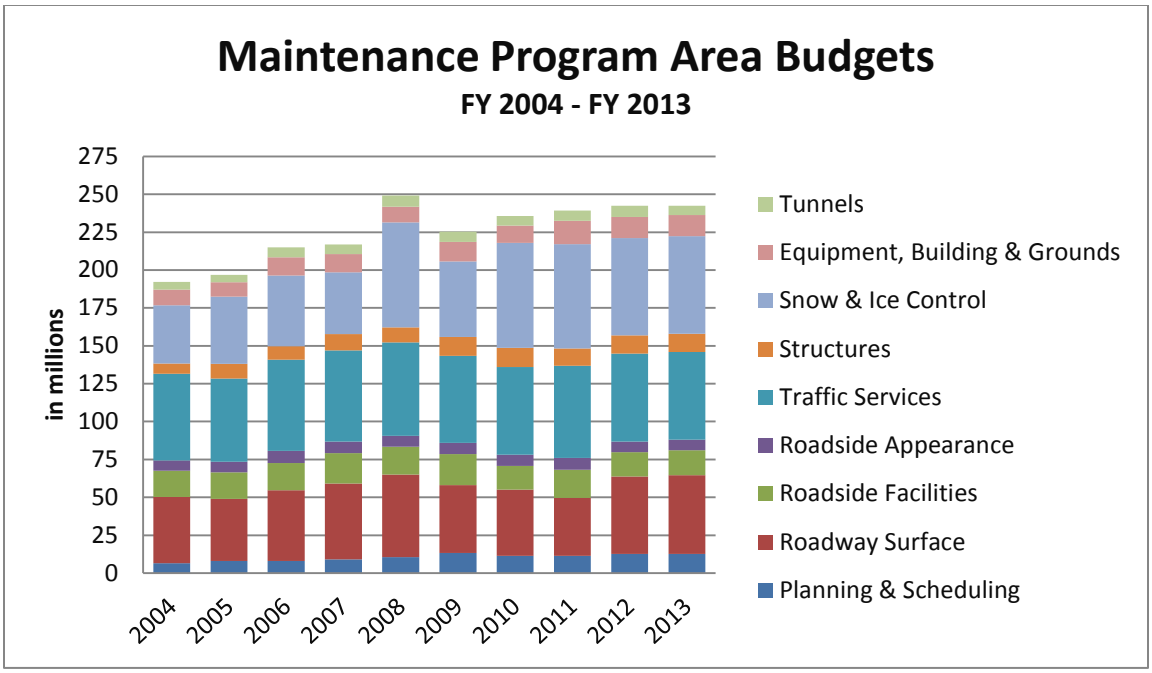


	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Achieve Goal (B)	242.0	251.4	260.7	270.5	280.9	291.6	303.0	314.9	327.3	340.5
Forecasted Budget	242.4	240.5	245.9	251.5	257.2	263.0	268.9	275.0	281.2	287.6
Deficit	-0.4	10.9	14.8	19.0	23.7	28.6	34.1	39.9	46.1	52.9



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Achieve Vision (B)	292.0	299.1	309.5	320.4	331.6	343.2	355.2	367.6	380.5	393.8
Forecasted Budget	242.4	240.5	245.9	251.5	257.2	263.0	268.9	275.0	281.2	287.6
Deficit	49.6	58.6	63.6	68.9	74.4	80.2	86.3	92.6	99.3	106.2

Figure 8. FY 2004 -2013 Maintenance Budgets by Program Area

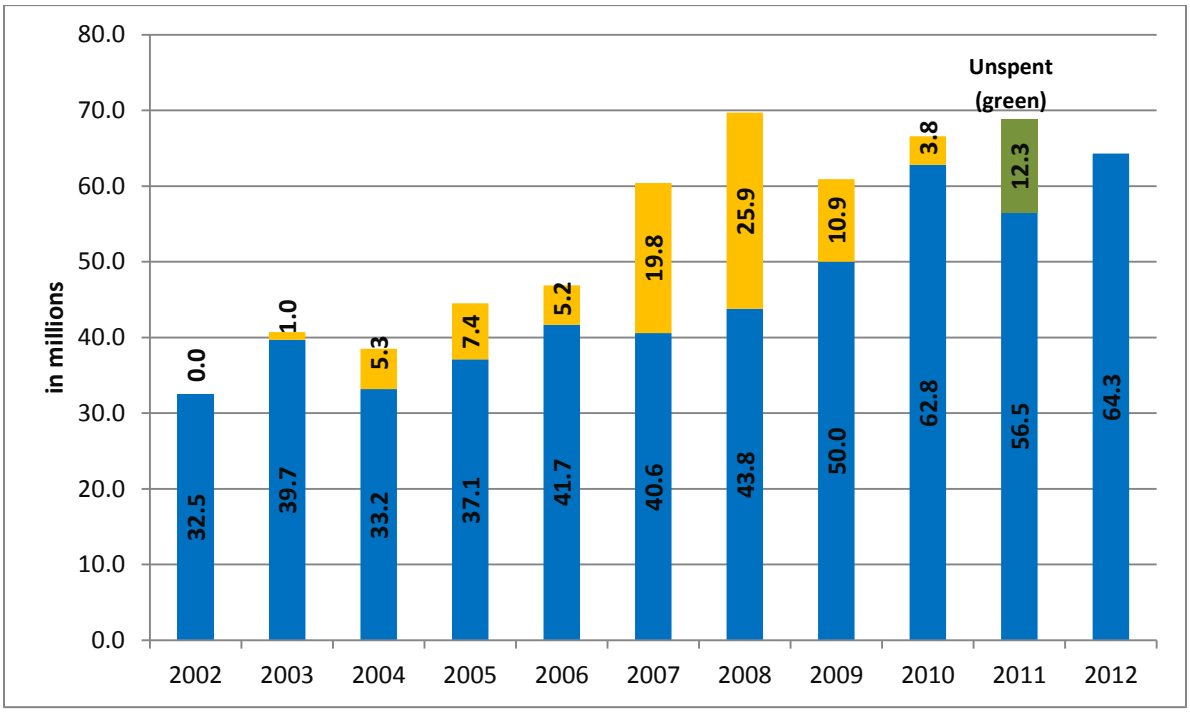


Factors Contributing to the Costs

Many factors impact maintenance costs. Weather conditions heavily impact snow and ice removal. Fuel prices and labor are significant components of nearly all maintenance activities. These and other factors have driven long-term cost trends upward for most programs areas. As depicted by the annual snow and ice removal budget in Figure 9 below, snow and ice control is a significant percentage of the total maintenance budget (27 percent for FY 2013). There is no lasting positive effect on the infrastructure from snow and ice control measures. Rather, there is a cumulative harmful effect caused by scraping the plow blades across the pavement, and in many cases damaging the pavement markings due to snow removal efforts. Deicing chemicals, such as magnesium chloride, can over time also accelerate the deterioration of infrastructure. Conversely, funds that provide for new construction or re-construction of transportation infrastructure have a positive impact on the maintenance program as new infrastructure typically requires less maintenance than aging infrastructure.

Keeping roads clear of snow and ice comprises the largest portion of the mobility budget and is planned to cost the Department $64.3 million in FY 2013. Due to cost inflation for fuel, deicing materials, and snow fighting technology such as RWIS (Road Weather Information System) and MDSS (Maintenance Decision Support System), the dollars required to keep roads clear during winter storms has increased substantially over the last decade. In 2001, the average cost per plow mile was $5.31. Though total snow & ice expenditure declined in 2011 due to moderate winter conditions, cost inflation drove the cost per plow mile to $10.16 for FY 2011, about $0.41 more than in FY 2010. While the Department would like to deliver an A level of service for snow and ice control, that is not practical with current revenues. The snow and ice control level of service achieved during FY 2011 was B.

Figure 9. Annual Snow and Ice History - Starting Budgets (Blue), Contingency Usage (Gold) and Unspent Budget (Green)



Population Growth and Distribution. Population growth and growth in VMT are significant factors in the cost of Statewide maintenance efforts. Particularly over the past decade, development of the tourism and energy industries has increased VMT in mountainous and rural areas, where the system can be more costly to maintain due to topography or the fact that infrastructure was not designed to carry the level of truck volume experienced in recent years. Population distribution also plays a key role, as limited resources may in certain circumstances focus on high volume segments in high population areas to alleviate significant mobility concerns.

Vehicle Size and Weight. One maintenance program area most impacted by vehicle size and weight is roadway surface, consisting of projects smaller than that typically undertaken by the Surface Treatment Program. Pavements are designed and constructed to accommodate an expected total of Equivalent Single Axle Load (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 regular maintenance and increases in severity of climatic conditions experienced.

Land Use Policies and Work Patterns. 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. Roadways are designed and constructed for their anticipated traffic loads. Growth in undeveloped areas as well as any changing pattern of ADT alter the projected impacts.

Safety

Despite declining revenues for transportation safety projects, Colorado has made significant progress over the last three decades in making our highways safer for motorists. Along with education and enforcement, targeted investments in engineering projects focused on improving safety have contributed to a significant decline in traffic fatalities over the last decade, despite the fact that more people are driving on Colorado's highways. Had these efforts not been made and past trends continued, it is estimated that 1,783 people would have been killed in traffic crashes in 2010 in Colorado. Instead, there were 449 deaths – still far too many, but a demonstration of the real benefits of investments in safety.

Transportation Commission goals for safety include:

- Maintaining a fatality rate of 1.0 per 100 million VMT or lower by continuing to reduce all 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 38.5 percent of all fatal crashes by 2019.

Currently there are fewer than 1.0 fatalities per 100 million VMT. Maintaining a rate of less than 1.0 fatality rate will most easily occur through continued investments by the Department in conjunction with changes in motoring behavior and law.

FASTER established a road safety surcharge imposed on motor vehicle registration that is projected to generate more than $150 million annually for the Highway Users Tax Fund (HUTF), distributed to municipalities, counties, and the State. For FY 2013, CDOT has budgeted $89.4 million of FASTER Safety funds that will be invested in projects with significant safety elements, reflecting the amount the State expects to receive after municipalities and counties have received their share of road safety surcharge funds. The Department will optimize use of FASTER Safety dollars and continue behavior campaigns that will work toward achieving its fatality benchmark.

Mobility

Long-term Transportation Commission goals for mobility include "maintain an average of 22 minutes of delay per traveler in congested corridors." Minimizing congestion and maintaining the free flow of people and goods are essential to the quality of life in Colorado and the State's economic future. One of the Department's primary measures of mobility is average daily minutes of delay per traveler in congested State highway segments. In 2010, congested corridors constituted 492 centerline miles, representing 1,928 lane-miles, of the State highway system, and over 31 percent of travel occurred in congested corridors. Travel time delay is the difference between the travel time on highways at the free–flow speed and the time it takes to travel that same route in heavy traffic. CDOT defines a congested roadway segment as one with a vehicle volume-to-capacity ratio that equals or exceeds 0.85.

Though the total amount of delay in congested corridors on Colorado's State highways increased 11 percent between 2009 and 2010, the amount of time delay *per traveler* remained virtually unchanged. Total delays can increase without individual travelers experiencing an increased delay because total

vehicles on congested corridors can increase and travelers can change their travel behavior by, for example, traveling with more than one occupant in a vehicle.

CDOT's estimates for travel time delay per traveler have been revised downward since the 2035 Long-Range Plan was issued in 2008. At that time, travel time delay in 2010 was estimated to be an average of 28.3 minutes per traveler. However, when the estimated delay in 2010 was calculated based on 2009 actual data, the new time estimate was 18.4 minutes per traveler.

Even in view of this short term stabilization in minutes of delay, congestion was still costly in 2010. Based on the most recent Texas Transportation Institute's *National Urban Mobility Report*, it is estimated that congestion cost commuters in Boulder, Colorado Springs and Denver almost $2 billion in 2010. If the recent changes in driving habits become permanent, the future growth in congestion may slow. However, accounting for these changes, travel time delay is still expected to increase substantially and the number of roadway segments that experience pervasive, severe congestion is expected to more than double over the next 20 years.

CDOT Efforts to Mitigate Congestion and Other Cost Escalation

FASTER legislation requires that this report discuss CDOT's methods for reducing costs. CDOT interprets this requirement to intend to speak to the Department's efforts to respond to the escalating cost of supporting Colorado's transportation system. Leveraging the transportation system to get the most benefit out of the existing infrastructure will become increasingly important as financial resources available to expand the system are limited. There are many strategies that CDOT and other agencies are using to reduce costs, curb growth of VMT, and increase the mobility and safety of the existing system without making costly investments in added lane capacity.

CDOT's Intelligent Transportation Systems (ITS) are an important element of the Department's transportation demand management efforts. ITS maximizes the operational efficiency and management of the existing roadway infrastructure through the use of technology and special 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 decide when and where to travel to avoid congestion and make better use of their time.

CDOT's goal in deploying ITS is increased productivity of the transportation system and enhanced and improved mobility and safety. Based on high quantifiable benefit-to-cost ratios of the systems, CDOT plans to continue investing in ITS.

The ITS program has a FY 2013 capital budget of $5 million and an operating budget of $9.2 million, which is used to administer, manage, operate, and maintain (including capital replacement) the Colorado Transportation Management Center (CTMC) and Statewide ITS communications, network

systems, and equipment. ITS infrastructure includes such devices as fiber optic cable along highways, closed circuit television (CCTV) cameras, variable message signs, ramp meters, high-occupancy vehicle/high-occupancy toll lane (HOV/HOT) systems, road and weather information service, travel time indicators, and highway advisory radio.

Variable Message Signs. Highway overhead Variable Message Signs (VMS), which display real-time travel time information, cost about $300,000 to install. VMS also provide a myriad of other information, such as: road and weather conditions, incident-related and alternative route information, traffic-related messages, regulatory messages, event information and law enforcement safety-related information.

Ramp Metering. CDOT currently has 70 ramp metering sites Statewide including sites on I-25, I-70, and C-470. When used at appropriate locations, ramp meters can result in significant gains in average traffic speed and reductions in travel time.

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. Travelers use the information to modify travel routes or times to avoid congestion. A mobile phone application for I-70 and a travel time forecast program for the traveling public are currently under development by CDOT. These would provide real-time traveler information.

I-70 West Corridor ITS. I-70 West is of vital importance to interstate travelers including operators of commercial vehicles, both nationally and locally. The program provides information on highway conditions including travel time information. This has been beneficial to many patrons of the various Colorado ski resorts and other mountain recreational activities. CDOT's I-70 West ITS program includes information services at chain-up stations, variable speed limits, and communication assistance to the heavy tow trucks. CDOT recently constructed 13 additional chain-up stations that can accommodate 137 trucks, bringing the total to 21 stations. The Department has also installed 11 variable speed limit signs (VSLs) at the chain up stations. VSLs allow CDOT to post reduced speed limits on approach to these chain stations in accordance with highway conditions in order to mitigate excessive speed and to reduce accidents.

Courtesy Patrol. The Mile High Courtesy Patrol is composed of 16 recovery vehicles patrolling key areas of I-25, I-70, I-225, and 6th Avenue during weekday commute and weekend recreational traffic rush hours. The primary purpose of the patrol is immediate management of incidents during these hours of peak vehicle volume.

Managed Lanes/Congestion Pricing. Managed lanes, including High Occupancy Vehicle (HOV), Express Lanes, Tolled 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, though do not generate enough revenue to enable the construction of additional capacity. In Colorado, HOT lanes provide less congested lanes to transit buses, carpools, and toll-paying solo drivers in single occupant vehicles (SOV). During peak hours, the I-25 Tolled Express Lanes provide users with a typical travel time savings of 10 minutes.

Congestion Mitigation and Air Quality. The Congestion Mitigation and Air Quality Improvement Program (CMAQ) supports projects that reduce carbon monoxide, ozone, and particulate matter generated from transportation-related sources in several areas around the State. This is accomplished, in large part, by reducing congestion and thereby limiting the time that cars sit idling on roadways. In FY 2012, $32.7 million is budgeted for CMAQ. The types of projects eligible for CMAQ funding include:

- Traffic flow improvements (e.g., freeway management, high-occupancy vehicle lanes);
- Shared ride programs (e.g., regional ridesharing, vanpool programs, park-and-ride lots);
- Travel demand management (e.g., regional marketing, employer trip reduction programs);
- Bicycle/pedestrian facilities and programs;
- Transit (e.g., new bus services, new rail services/equipment, alternative fuel buses;); and
- Other projects (e.g., diesel engine retrofits, freight/intermodal projects, dust mitigation projects, and other qualifying projects, including experimental pilot projects which are allowed under the law as demonstrations to determine their benefits and costs).

Transit. In accordance with Senate Bill 09-094, CDOT has established a Division of Transit and Rail, which is charged with developing a Statewide transit and passenger rail plan that is integrated with the Statewide transportation plan and with administering dedicated State funds for transit and Federal Transit Administration grants.

The CDOT Regions, working cooperatively with the State's fifteen Transportation Planning Regions (TPRs) and Metropolitan Planning Organizations (MPOs), will assess and rank projects using the following criteria:

- Criticality;
- Financial capacity;
- Financial need;
- Project impacts;
- Readiness.

Conclusion

With continuation of federal transportation authorization expiring March 31, 2012, Colorado and nationwide revenue projections remain uncertain. Meanwhile, the demands placed on the transportation system are increasing to the point where the State can no longer provide the system Coloradans have come to expect. Over the past 20 years, Colorado's population has increased 55 percent – from 3.3 million people to 5.1 million people. An additional 2.4 million people are expected by 2035. Travel on the highway system has increased at an even greater rate in the last 20 years – a 57 percent increase from 17.8 to 27.9 billion miles of vehicle travel. This travel growth has occurred on a highway system with a capacity that has grown by just two percent, from 22,610 to 22,982 lane miles of State highway.

With very little increase in highway lanes to accommodate the growth of travel and people, Coloradans are spending more time in traffic and causing more wear and tear on roadways, many of which were not built to accommodate this increased demand.

Coloradans have enjoyed an adequate transportation infrastructure. The work commute Statewide average is only 17 minutes, our safety systems are improving, our snow and ice control is one of the nation's best. However, State highways are becoming more congested and transportation infrastructure is aging. The economic slide that began in FY 2009 has had both negative and positive impacts on the State of Colorado's transportation system. Decreased disposable household income and rising gas prices reduced vehicular travel and slightly alleviated some congestion in certain areas of the State. But this also reduced fuel tax revenues. Less economic activity helped stabilize raw material prices that previously had been accelerating at alarming rates, but those prices have begun to again escalate with resurging demand from other parts of the globe.

Thankfully, one-time influxes of revenue from the federal government and new State funding sources in Colorado such as FASTER have helped prevent accelerated deterioration of highways and bridges. But those sources have contributed primarily to maintaining the existing system, and adding capacity in Colorado requires CDOT to seek new funding sources.

In summary, sustaining the condition of the most significant components of the State's transportation infrastructure for the next decade will require an additional $3.3 billion over the next decade:

- $3.0 billion for highways (pavement);
- $200 million for bridges;
- and $95 million for maintenance.

In aggregate, this deficit estimate fell from 2011's Transportation Deficit Report, as the full effect of recessionary pricing helped plateau certain costs, at least temporarily. But states, including Colorado, must continue to look for innovative ways to optimize the efficiency of their transportation networks and minimize the impact of continued deterioration.

For questions concerning this report, please contact Scott Richrath, CDOT Performance and Policy Analysis Manager, at scott.richrath@dot.state.co.us.