

Transportation Deficit Report 2013



Prepared pursuant to §43-4-813, C.R.S. 2009

April 2013

Cover Photo: I-70 bridge replacement near Dotsero

Transportation Deficit Report 2013



Table of Contents

Overview	1
Update	2
Repairing Highways	3
Repairing Bridges	7
Maintenance	12
Conclusion	17

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Overview

Pursuant to §43-4-813, C.R.S. 2009, the Colorado Department of Transportation (CDOT) hereby delivers its annual Transportation Deficit Report for 2013. Under guidelines set forth in the enabling legislation—the Funding Advancement 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 these goals, the report includes:

- 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 the rate and 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) 2014 program budgets and projected revenues and performance as approved by the Transportation Commission in November 2012, before budget submittal to the Governor's office. The report also includes performance results for State fiscal year 2012, the most recent year available. These results are used to estimate the costs to sustain conditions and reach goals and visions in the coming years.

In developing its FY 2014 budget proposal, CDOT relied on revenue forecasts available at that time. For FASTER receipts, CDOT projects it will receive nearly \$200 million in revenue from fees and surcharges in FY 2014. 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 Governor's Office of State Planning and Budgeting.

Note to Readers

This report incorporates Fiscal Year (FY) 2014 program budgets and projected revenues and performance as approved by the Transportation Commission in November 2012, before 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.

Update

In reviewing this report, readers should note:

- The Governor's December 2012 announcement of the Responsible Acceleration of Maintenance and Partnerships (RAMP) initiative will change how CDOT programs and expends funds. This has increased projections for certain program budgets in this year's Deficit Report. The report assumes that FY 2014 RAMP levels will be sustained throughout the five-year initiative. *See sidebar (right) for more on RAMP.*
- With the passage of Moving Ahead for Progress in the 21st Century (MAP-21) in June 2012, transportation programs had a federal authorization bill for the first time since 2009. The bill streamlined federal funding sources significantly and eliminated the federal requirement for certain programs, such as the On-System Bridge and Enhancement programs. The bill also included a new Transportation Alternatives Program. Funding under MAP-21 is at levels similar to the previous authorization (SAFETEA-LU). The MAP-21 authorization expires September 30, 2014, and uncertainty remains in the federal outlook afterward.
- The Governor's Office of State Planning and Budgeting and the Colorado Legislative Council issue State of Colorado revenue estimates quarterly. CDOT does not update its own revenue projections with each quarterly update. Unless otherwise noted, projected revenues and expenditures are stated in year-of-expenditure dollars and rounded.
- The Transportation Commission is currently reviewing its own Policy Directive 14, which established various performance goals for CDOT. This review likely will lead to new performance goals for next year's Deficit Report. The current metric for evaluating pavement, which focuses on the percent of pavement in good or fair condition, may be replaced with a metric more representative of the driver's experience on the highway.

RAMP: Changing How CDOT Budgets

Under its Responsible Acceleration of Maintenance and Partnerships (RAMP) initiative, CDOT is changing how it programs and expends funds for multi-year transportation projects. The Department will begin to fund multi-year projects based on year of expenditure. This is a change from current practice, which requires that the total amount of a project's cost be in place before any funds can be spent.

The RAMP approach is a more effective and efficient way to budget and will provide CDOT with a one-time opportunity, over a five-year period, to increase its annual funding by up to \$300 million each year.

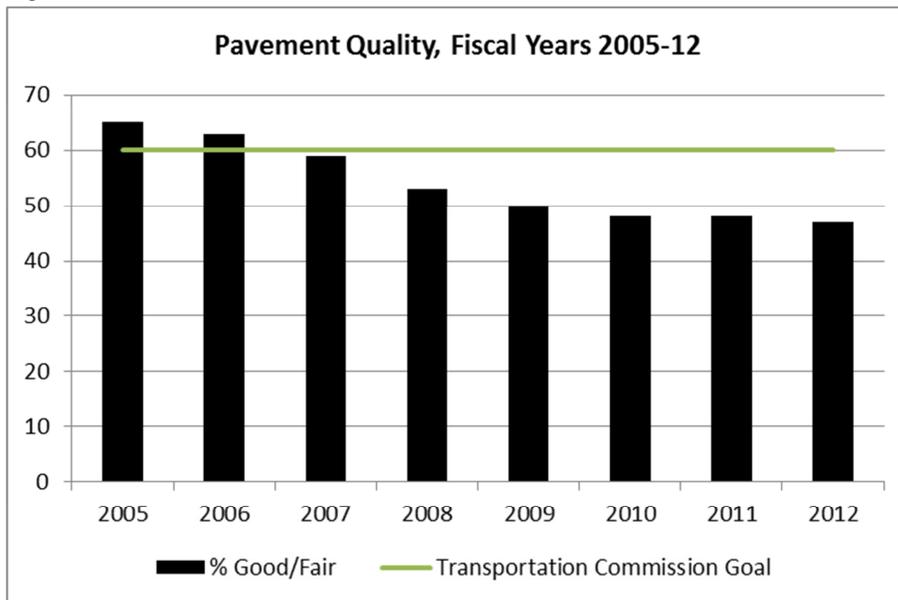
A large portion of these funds will be used for system preservation. While this change in fiscal management will help fill the transportation maintenance-funding gap for awhile, it is not permanent, nor is it nearly large enough to meet Colorado's longer term system-preservation and capacity needs.

Repairing Highways

The Department's Surface Treatment Program maintains about 23,000 lane miles of the State highway system. The Transportation Commission strives to maintain 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 flat or declining program budgets and rising resurfacing costs have contributed to system-wide deterioration.

The program concluded FY 2012 with 47 percent of pavement in Good/Fair condition, down one percentage point from a year earlier. This slide in condition portends a costly backlog of repair. Repairing and maintaining highways in poor condition is more costly than doing the same for highways in good and fair condition.

Figure 1. Historic Pavement Condition



The Transportation Commission has preliminarily allocated a baseline budget of \$150.6 million for FY 2014 to the Surface Treatment Program. Additional funding will be advanced through RAMP. Commission goals, as most recently adopted in October 2009, and FY 2005-12 performance levels are depicted above in Figure 1.

Making a measurable, long-term difference in pavement surface-treatment quality requires additional funding that is significant and consistent over many years.

How CDOT Rates its Highways

CDOT's model of rating pavement condition relies on an engineering-based Remaining Service Life estimate that helps engineers make maintenance and repair decisions. In 2013, CDOT plans to adjust this model to reduce maintenance and repair costs on some of Colorado's less traveled roads, while better reflecting the condition as experienced by the traveling public. CDOT anticipates this will result in evaluations of pavement conditions that indicate a better overall condition for the State highway system as early as next year.

Figure 2. FY 2012 Statewide Pavement Condition by Category

State Highway Category	Goal % G/F	FY 2012 Condition % G/F
Network	60	47
NHS* non-Interstate	70	65
Interstate	85	60
Other	55	34

Note: The Transportation Commission sets the Network goal. The three remaining goals are found in the Colorado 2035 Statewide Transportation Plan State Highways Technical Report.

**National Highway System*

Cost of Sustaining Current Condition over Next 10 Years

Reaching the current condition of 47 percent Good/Fair in 2023 will require \$3.3 billion for the next ten years, requiring an *average* annual budget of about \$330 million. Against projected revenue allocations for surface treatment for the next 10 years, the deficit is about \$1.1 billion, or an average of \$110 million annually. See *Figure 3*.

Cost of Achieving Goal over Next 10 Years

The cost to achieve the goal of 60 percent Good/Fair within 10 years is about \$4.5 billion, thus requiring an average annual budget of about \$450 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$2.3 billion, or an average of \$230 million annually. See *Figure 4*.

Cost of Achieving Vision over Next 10 Years

The cost to achieve the vision of 75 percent Good/Fair within 10 years is about \$6 billion, requiring an annual budget of about \$600 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$3.8 billion, or an average of \$380 million annually. See *Figure 5*.

Annual Increase and Rate of Increase of this Cost

This year's cost estimate for sustaining conditions represents an increase from the estimate in last year's report, due mostly to a change in methodology. For the 2013 report, the Department is relying on a 10-year analysis that keeps pavement in a condition close to current conditions throughout. The 2012 analysis relied on a 20-year analysis that allowed conditions to drop significantly before rising to current levels in 2033.

The addition of RAMP funds has partially offset the increase from the methodological change. In addition, this year's report assumes annual cost inflation of 3 percent, while last year's report assumed inflation of 3.5 percent. This change subtracted \$77 million from the cost to sustain conditions.

Figure 3. Cost of Sustaining Pavement Current Condition

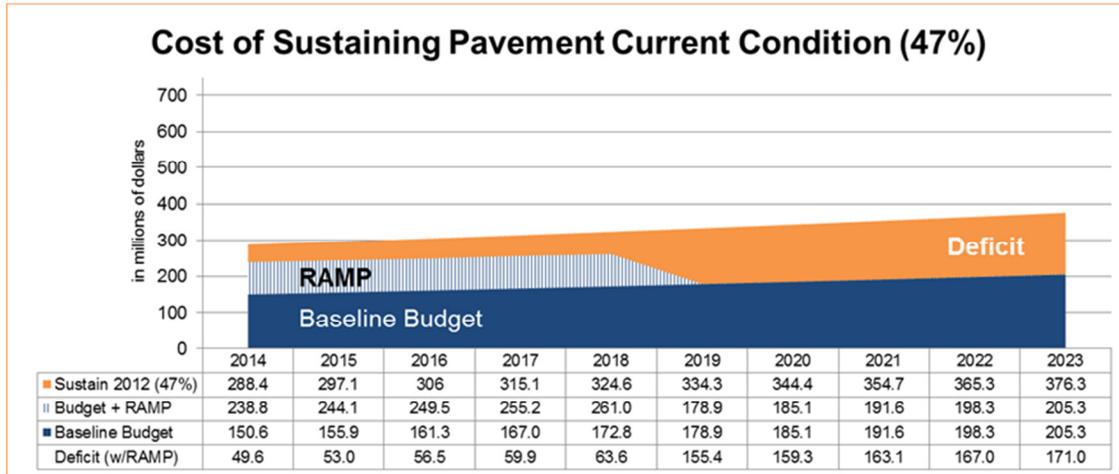


Figure 4. Cost of Achieving Transportation Commission Goal

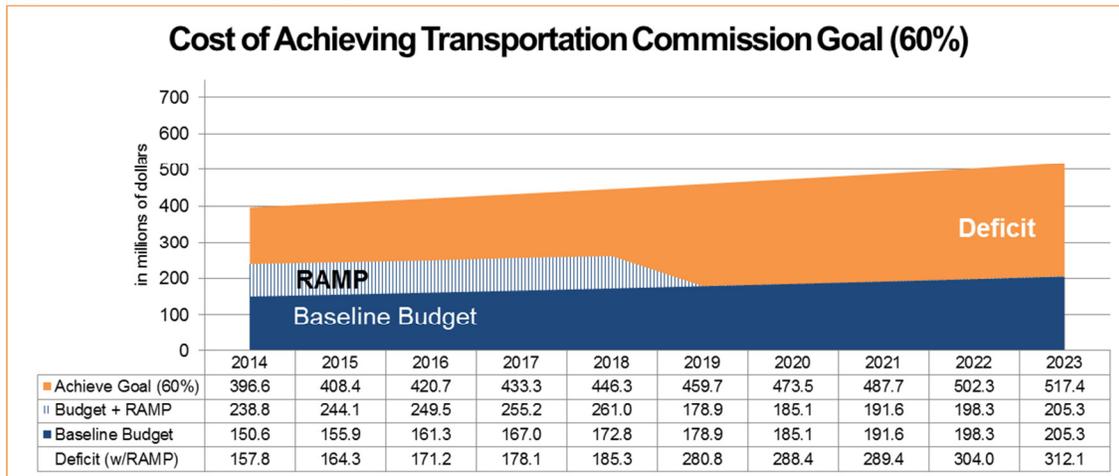
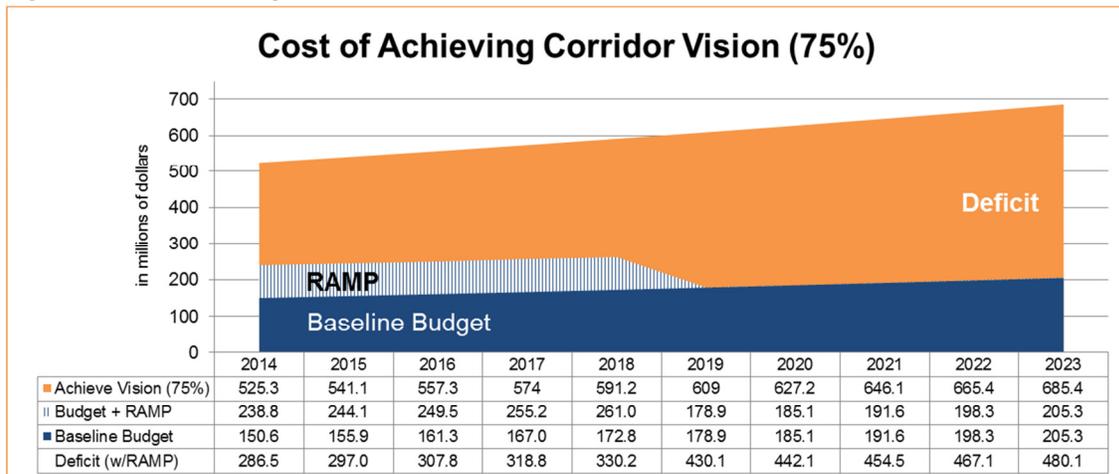


Figure 5. Cost of Achieving Pavement Condition Vision



Factors Contributing to Costs

Material Prices. Pavement costs are driven largely by the cost and available supply of Portland Cement, asphalt binder and aggregates. Asphalt binder prices fluctuate greatly and are somewhat correlated to petroleum prices. Overall, however, the cost of treating Colorado's highways has remained stable for the past year.

Population Growth and Distribution. Surface-treatment resources are allocated based on cost/benefit considerations and roadway characteristics such as the volume of truck traffic. In addition, a growing population increases the Average Daily Traffic (ADT) on State highways and the wear and tear on pavement surfaces. According to U.S. Census Bureau data, Colorado's population in 2012 grew to 5.2 million, a 1.4 percent increase from a year earlier. Sustaining this annual rate for the current decade would bring Colorado's population close to 5.8 million by 2020. According to the State Demographer, population growth will be most rapid in the North Front Range, followed by the Western Slope and the Central Mountains. CDOT anticipates this growth, along with a gradual decline in the unemployment rate as the economy recovers from the Great Recession, will cause an increase in Vehicle Miles Traveled (VMT) of 27 percent by 2020.

Vehicle Size and Weight. Vehicle size and weight dictate the design quality of highway segments and are even 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 handling 80,000 cars and no trucks each day requires just seven inches of pavement. A stretch with a daily count of only 8,000 cars, but 4,000 trucks, requires eight inches. The impact of commercial vehicle traffic is a large 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.

Repairing Bridges

The Department's bridge program maintains 3,447 major vehicular bridges on the State highway system. The Transportation Commission's goal is to maintain 95 percent of the bridges, as represented by deck area, in good or fair condition. In FY 2012, the program ended with 96.4 percent of bridge-deck area in good or fair condition, up from 94.5 percent the year earlier.

Bridge conditions improved in 2012 partly because of a major repair to the Interstate 70 viaduct. This viaduct represents 1.7 percent of the bridge-deck area owned by CDOT, and the repair improved the structure's condition to fair from poor. The viaduct repair, however, is not permanent; the structure will still require replacement. Discounting this repair, about 95 percent of CDOT's bridge-deck area would be in good/fair condition, which is similar to FY 2011's conditions.

The effect of the repair illustrates the limitations of the model employed to arrive at the cost estimates that follow. The model, which is based in part on a population average, works best for long-term predictions, or those closer to the average life span of an asset, which in the case of bridges is 65 years. However, Pursuant to §43-4-813, C.R.S. 2009, the Transportation Deficit Report must include "a listing of the annual costs for each of the next 10 fiscal years."

Colorado Bridge Enterprise Improvements

Replacements funded by the Colorado Bridge Enterprise also drove improved bridge conditions in 2012. CBE funds can only be used on structures rated as poor. (See sidebar for an explanation of conditions.)

Colorado Bridge Enterprise was created by FASTER legislation 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 generated increased revenue over its three-year phase from 2009-11. To receive Bridge Enterprise funding, bridges must be rated in poor condition and selected by the Bridge Enterprise Board. By the end of FY 2012, 160 bridges had become eligible since the Colorado Bridge Enterprise was created. Fifty bridges have been repaired or replaced through the initiative, and 29 are projected to be completed in FY 2013. A list and location of current FASTER bridges can be found at <http://www.coloradodot.info/programs/BridgeEnterprise>.

How CDOT Rates 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.

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. Poor bridges can be funded by the Colorado Bridge Enterprise.

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 requires preventative maintenance or rehabilitation. Fair bridges are not eligible for Colorado Bridge Enterprise funding.

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FASTER legislation has helped to sustain Good/Fair percentages in the short- to mid-term. However, projected trends, based on forecasted revenue including the FASTER Bridge Enterprise Special Revenue Fund, are for bridge conditions to slide to 93.9 percent Good/Fair condition in 2023.

Cost of Sustaining Current Condition for Next 10 Years

The cost to sustain the current condition of 96.4 percent Good/Fair over the next 10 years is about \$2 billion, thus requiring an annual budget of about \$200 million. Against projected revenue allocations including FASTER bond proceeds and RAMP funds, this forecasts a 10-year deficit of about \$620 million, or an average of \$62 million annually. See Figure 6.

Current conditions exceed the Transportation Commission's goal of maintaining 95 percent of bridge deck area in Good/Fair condition. The Department seeks only sufficient funding to maintain conditions that meet this goal. Funding that would result in exceeding the goal will be devoted to preventative maintenance. Such maintenance must be performed on CDOT-owned bridges in good and fair condition to extend their useful lives and to maximize the efficiency of Bridge Enterprise funding by reducing the rate at which structures become poor.

Cost of Achieving Goal over Next 10 Years

The cost to achieve the goal of 95 percent Good/Fair condition within 10 years is about \$1.6 billion, thus requiring an annual budget of about \$160 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$140 million, or an average of \$14 million annually. See Figure 7.

Cost of Achieving Vision over Next 10 Years

The cost to achieve the vision of 100 percent Good/Fair condition within 10 years is about \$3.3 billion, thus requiring an annual budget of about \$330 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$1.9 billion, or an average of \$190 million annually. See Figure 8.

Annual Increase and Rate of Increase of this Cost

The cost for sustaining current conditions has grown since last year's Deficit Report, in part because the percent of bridge-deck area rated Good/Fair increased. In addition, the bridge population is aging, and many Eisenhower-era structures will be reaching the end of their useful lives starting in 2022. (See sidebar.)

How CDOT Rates its Bridges

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*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.*

The cost to achieve the vision and goal decreased because the improved condition of the bridge population in 2012 compared to 2011 makes the 100 percent Good/Fair vision and the 95 percent Good/Fair goal less costly to obtain.

A lower inflation rate also helped temper this year's cost estimates. The model used for projecting future bridge conditions now assumes an annual inflation rate of 3 percent for costs, instead of the average of 3.7 percent used last year. This change caused the 10-year cost to sustain conditions to be \$67 million less than it would have been under the rate used in last year's report. The cost per square foot to replace bridge-deck area also decreased between 2012 and 2013, but not enough to offset the cost of the increase in poor deck area anticipated in coming years.

Along with lower costs, an infusion of RAMP funds has helped to create a smaller projected deficit of money available to meet the goal and vision conditions for bridges.

Readers should note that a significant portion of the annual bridge budget is consumed each year for the structure inspection programs and for the repayment of bond debt. For this year's Deficit Report, \$25 million has been deducted from the annual bridge budgets to account for these expenditures, which are not related to bridge replacement or major rehabilitation. Such funds were not deducted in previous Deficit Reports.

Replacing Eisenhower-era bridges

A tremendous investment in infrastructure undertaken during President Dwight D. Eisenhower's administration (1953-61) left Colorado with a large number of structures that will be reaching the end of their useful lives starting in 2022. For CDOT, the average replacement age for structures is 65 years. This means that cost estimates for sustaining bridge conditions are expected to grow in coming Transportation Deficit Reports, as 10-year projections will then be accounting for even more of the Eisenhower-era bridges aging far into their life cycles.



U.S. 6 Brush Creek Bridge

Figure 6. Cost of Sustaining Bridge Current Condition

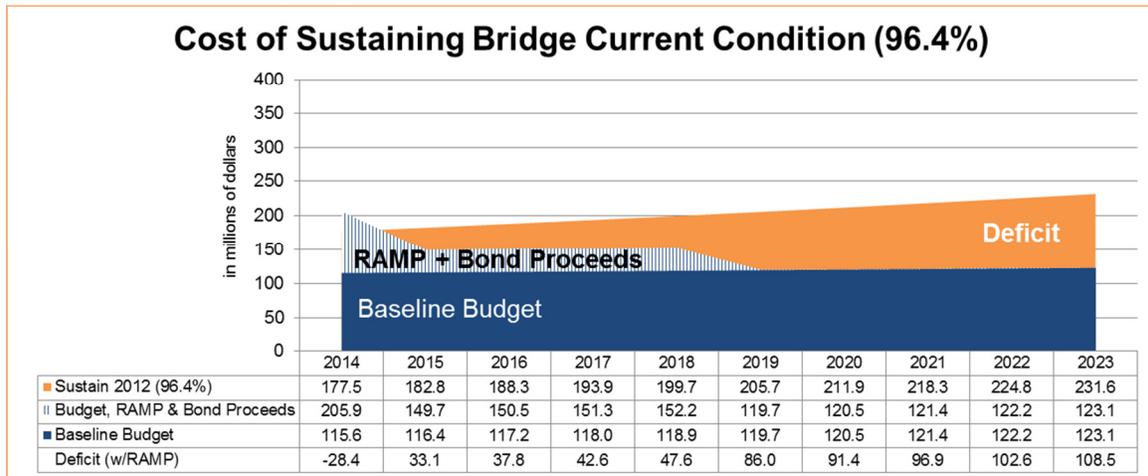


Figure 7. Cost of Achieving Transportation Commission Goal

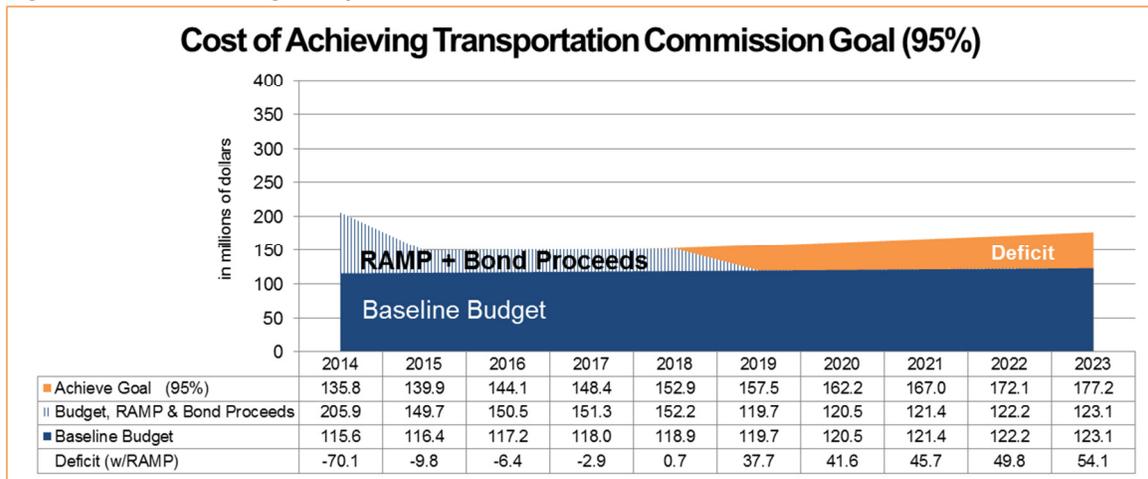
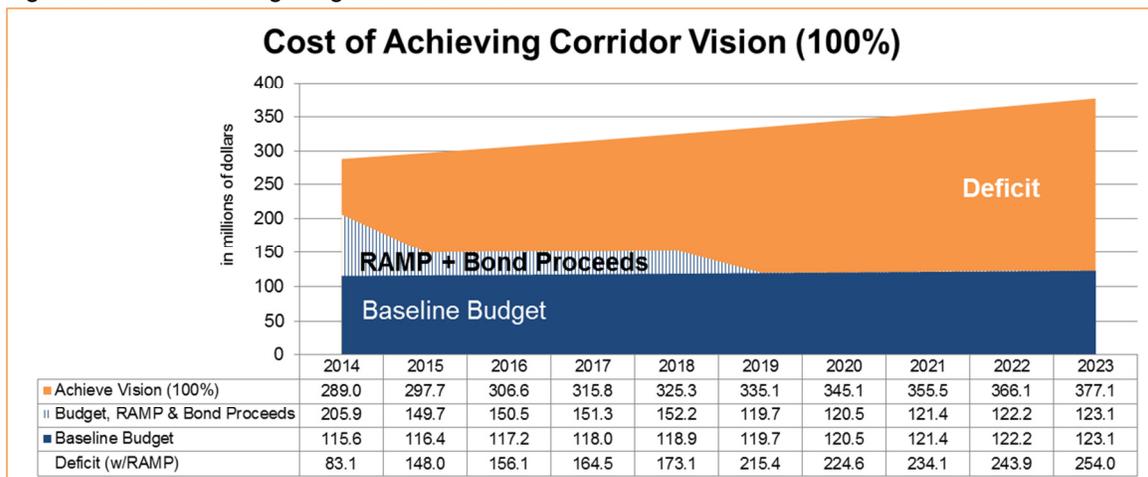


Figure 8. Cost of Achieving Bridge Condition Vision



Factors Contributing to Costs

Exposure to the Elements. Exposure to the elements is the most significant factor affecting 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 weakens their abilities 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 Annual Average Daily Traffic (AADT) that crosses over a bridge. AADT is one of many factors that determine a sufficiency rating. Growth in population and the popularity of travel routes can result in changes in AADT and advance or delay the onset of functional obsolescence, which is defined in the sidebar on page 8.

Vehicle Size and Weight. Significant structural defects as a result of deterioration can result in posted weight limits that may limit truck routes and the movement of commerce. CDOT issues tens of thousands of oversize or overweight permits annually, but non-permitted overweight vehicles can cause damage to bridges if the load is more than the bridge's carrying capacity. In addition, non-permitted overheight vehicles have hit bridges and caused enough damage to drop bridge-condition ratings and require bridge repair. Legislation signed by the Governor in March 2013 increased Colorado's legal gross vehicle weights.

Land-Use Policies and Work Patterns. Bridges are affected by land-use policies and work patterns in a similar fashion as pavement. Land-use policies can have an effect on ADT, which is one of 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.

Maintenance

The baseline budgets for CDOT's "big three" asset categories—Pavement, Bridge and Maintenance—comprise about half of the Department's annual budget. Sustaining Maintenance performance levels is analyzed below much like the Pavement and Bridge programs.

With a proposed FY 2014 budget of just more than \$249 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.

For FY 2013, the overall Statewide Maintenance Levels of Service objective grade is C+, and a proposal of C+ also has been made for FY 2014. Objective grades are estimates of what can be accomplished with available funding. When additional money has been allocated to Maintenance recently, it often has been done so to strive for a B level of service for snow and ice removal. Financially speaking, Snow & Ice Control is the largest of the nine maintenance program areas. See Figure 12.

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 \$2.97 billion, thus requiring an annual budget of about \$297 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$210 million, or an average of \$21 million annually. See Figure 9.

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 just over \$3 billion, thus requiring an annual budget of about \$300 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$270 million, or an average of \$27 million annually. See Figure 10.

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

The cost to achieve the vision—to improve to a B-level of service next year and sustain that level for the following nine years—is about \$3.3 billion, thus requiring an annual budget of about \$330 million. Against projected revenue allocations, this forecasts a 10-year deficit of about \$570 million, or an average of \$57 million annually. See Figure 11.

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 center line of the highway to the right-of-way fences. Maintenance activities are separated into nine **Maintenance Program Areas**:*

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

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Annual Increase and Rate of Increase of this Cost

The cost to sustain the current level of service has increased from the 2012 Transportation Deficit Report.

This year's report assumes cost inflation of 3 percent, up from 2.2 percent assumed in last year's report for sustaining the service level. This change adds \$107 million in costs over the next 10 years.

The consequences of underfunding the Pavement and Bridge programs over time will 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.

How CDOT Rates Maintenance

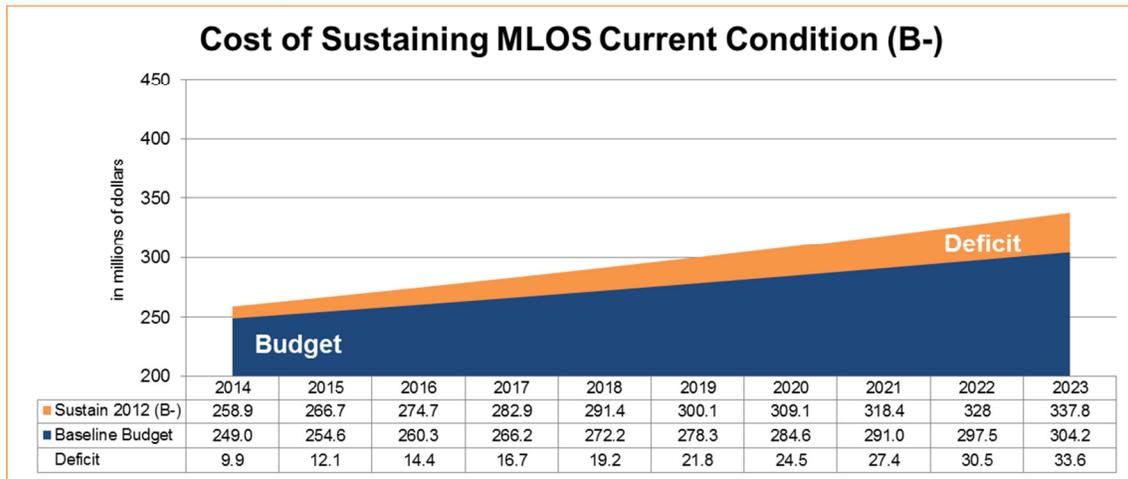
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*CDOT measures the performance of maintenance service with a school "report card" style grading system called **Maintenance Levels of Service (MLOS)**, which estimates the achievable grade with available budget. Higher grades could be achieved with 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.*



Plowing Boulder Canyon, State Highway 119

Figure 9. Cost of Sustaining MLOS Current Condition



Note: Chart represents annual maintenance activities not eligible for RAMP. RAMP focuses on maintenance through capital preservation.

Figure 10. Cost of Achieving Transportation Commission Goal

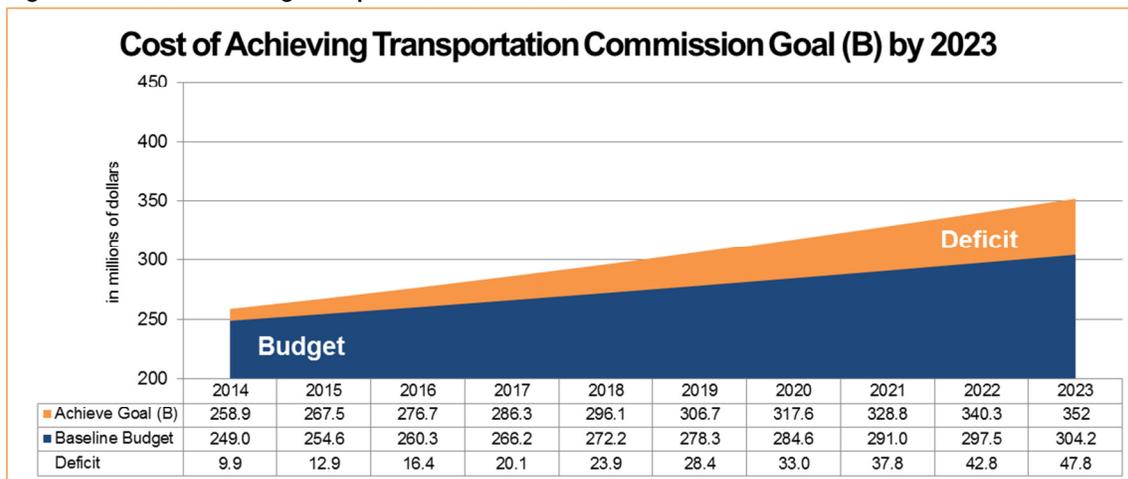


Figure 11. Cost of Achieving MLOS Vision

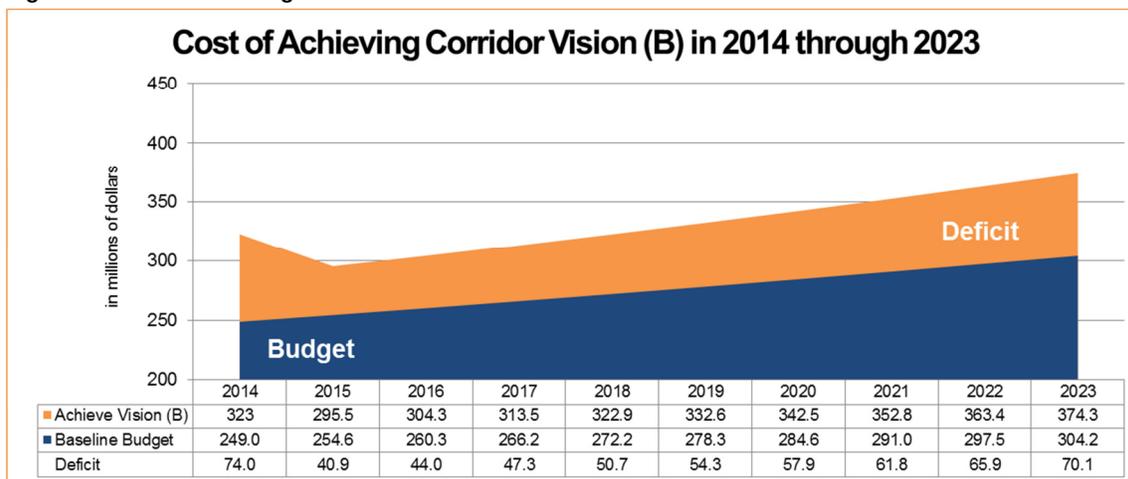
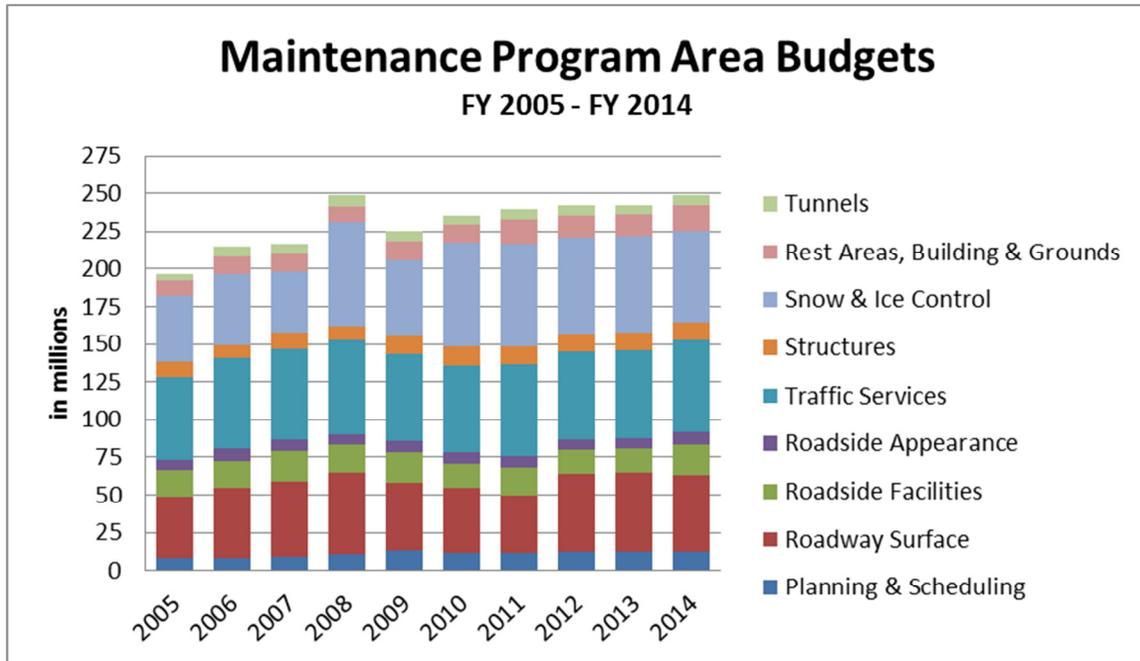


Figure 12. FY 2005-14 Maintenance Budgets by Program Area



Note: FY 14 figures from February 2013 draft budget.

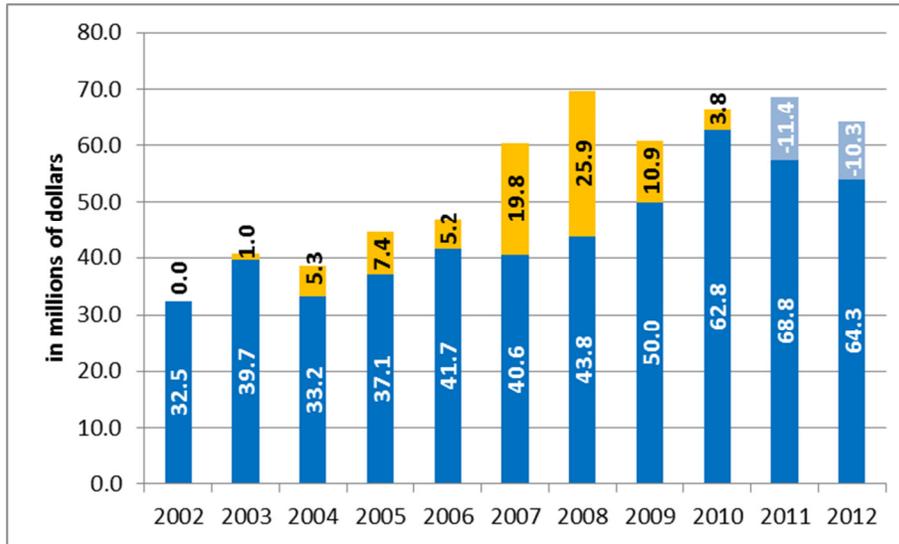
Factors Contributing to Costs

Many factors influence maintenance expenses. Weather conditions heavily affect the cost of snow and ice removal. Fuel prices and labor are significant components of nearly all maintenance activities. These and other factors have driven up long-term cost trends for most programs areas. As depicted by the annual snow and ice removal budget in Figure 12, snow and ice control is about 25 percent of the total maintenance budget. There is no lasting positive effect on the infrastructure from snow and ice control measures. Rather, there is cumulative harm caused by scraping plow blades across pavement and damaging pavement markings through snow-removal efforts. De-icing chemicals, such as magnesium chloride, also can accelerate the deterioration of infrastructure. Conversely, funds that provide for new construction or reconstruction of transportation infrastructure have a positive impact on the maintenance program, because new infrastructure typically requires less maintenance than aging infrastructure.

Keeping roads clear of snow and ice is expected to cost the Department \$63.9 million in FY 2014. An additional \$10 million is set aside for snow-and-ice contingency needs and reallocated by the Transportation Commission if not used for that purpose. The cost to keep roads clear during winter storms has increased substantially over the past decade due to cost inflation for fuel, de-icing materials, and snow-fighting technology such as RWIS (Road Weather Information System) and MDSS

(Maintenance Decision Support System). In 2001, the average cost per plow mile was \$5.31. Cost inflation drove the cost per plow mile to \$11.45 in FY 2012, up from \$10.16 in FY 2011. While the Department would like to deliver A level service for snow and ice control, an A grade is not practical with current revenue. CDOT achieved a level of service of B for snow and ice control during FY 2012.

Figure 13. Annual Snow-and-Ice Budget History



Key: Starting Budgets (Blue), Unspent Budget (Light Blue) and Contingency Use (Gold)

Population Growth and Distribution. Population growth and increasing VMT are significant factors in the cost of 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 infrastructure that was not designed to carry the truck volume of recent years. Population distribution also plays a key role, as limited resources may in some circumstances focus on high-volume segments in high population areas to alleviate mobility concerns.

Vehicle Size and Weight. A maintenance program area heavily impacted by vehicle size and weight is roadway surface, which undertakes projects smaller than those typically performed by the Surface Treatment Program. Pavements are designed and constructed to accommodate an expected total of Equivalent Single Axle Load 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 increase, so does the deterioration rate of pavement. The rate of deterioration is accelerated

by reductions in regular maintenance and increases in the 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 outlined in the surface-treatment section of this report. Changes in land-use policies can result in more traffic on roadways designed for less volume, which can affect deterioration and redirect maintenance resources.

Conclusion

With passage of MAP-21, federal revenue sources should be more certain for State fiscal years 2013-14, but the expiration of the federal authorization on September 30, 2014, leaves uncertainty in revenue projections beyond that time.

Meanwhile, demands placed on Colorado's transportation system are outpacing CDOT revenue. Over the past 20 years, Colorado's population has grown 49 percent, from 3.5 million people to 5.2 million people. An additional 2.1 million people are expected by 2035. Travel on the highway system has increased at an even greater rate in the past 20 years—a 54 percent increase from 18.2 billion to 28.0 billion miles of vehicle travel. This growth has occurred on a highway system with capacity that has grown by just 2 percent, from 22,564 to 23,023 lane miles of State highway.

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

Coloradans have enjoyed an adequate transportation infrastructure. The average work commute statewide is only 24 minutes, according to U.S. Census data. Our safety systems are improving, and our snow and ice control program is one of the nation's best. However, the transportation infrastructure is aging.

The ongoing economic recovery portends both positive and negative effects for the State's transportation system. Colorado's economy continues to recover from the recession at a faster clip than the national economy. The state had the fifth-fastest job growth of any state from June 2011 to June 2012, according to U.S. Bureau of Labor Statistics data.



A CDOT maintenance crew member cleans a bridge just outside of Aurora as part of the bridge-preservation program. Research shows that maintenance tasks as simple as regular cleaning can significantly reduce life-cycle costs.

In a December 2012 report, Colorado's Office of State Planning and Budgeting forecast "continued modest growth" for the state. This will continue to boost transportation-related revenue in State fiscal years 2013-14, including revenue from new vehicle registrations and "modest growth" in fuel tax receipts, the Office said. More travel and more vehicles, however, will increase congestion and maintenance needs.

Thankfully, influxes of revenue from the federal government and new State funding sources in Colorado, such as FASTER fees and the new RAMP initiative, are helping to prevent accelerated deterioration of highways and bridges. But those sources have contributed primarily to maintaining the system. Adding capacity in Colorado will require CDOT to seek new funding sources.

In summary, the Department estimates it will require an additional \$1.45 billion over the next 10 years to sustain pavement conditions and current levels of maintenance, as well as to continue meeting the bridge-condition goal. This includes:

- \$1.1 billion to sustain highway conditions (pavement);
- \$210 million to sustain maintenance levels; and
- \$140 million to continue meeting the goal for bridges.

In aggregate, this deficit estimate fell from 2012's Transportation Deficit Report projection, in part as a result of funding made available through the RAMP initiative.

Colorado and other states must continue to look for innovative ways to optimize the efficiency of their transportation networks and to minimize the impact of continued deterioration.

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