

2014 Transportation Deficit Report



COLORADO
Department of Transportation

Transportation Deficit Report 2014

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Overview

Pursuant to the Funding Advancement for Surface Transportation and Economic Recovery Act (FASTER), the Colorado Department of Transportation (CDOT) presents its Transportation Deficit Report for 2014. The annual Deficit Report addresses the goals of repairing deficient highways and bridges and sustaining existing transportation system performance levels.

Included in the report are:

- The estimated costs and resulting deficits or surpluses for sustaining current conditions over the next 10 years.
- The estimated costs and resulting deficits or surpluses for achieving certain fiscally constrained and aspirational goals of the Colorado Transportation Commission within the next 10 years. These goals are stipulated in the commission's Policy Directive 14.
- The annual increase and rate of increase of these costs.
- Factors contributing to the costs, including the rate and distribution of population growth, vehicle size and weight, land-use policies and work patterns. Techniques and tools for mitigating these factors also are discussed.

This report incorporates state fiscal year 2015 (FY15) draft program budgets and projected revenues and performance as approved by the Transportation Commission in November 2013. More recent data are used when available, including budget projections from asset-management workshops and CDOT's "Program Distribution" planning document.

Also included in the report are performance results for fiscal year 2013. These results are used to estimate the cost to sustain conditions and to achieve fiscally constrained and aspirational goals (or "Vision" conditions) over the next 10 years.

In developing its fiscal year 2015 budget proposal, CDOT relied on revenue forecasts available at the time. For FASTER receipts, CDOT projects it will receive \$194 million in revenue from fees in fiscal year 2015. Pursuant to FASTER legislation, \$10 million of the \$194 million will be used for statewide transit projects, and \$5 million will be apportioned to local governments in the form of grants for local transit projects.

Note to Readers

This report incorporates fiscal year 2015 draft program budgets and projected revenues as approved by the Transportation Commission in November 2013, although more recent budget data are used when available. The transportation system's performance is projected primarily in conjunction with annual budget development. Forecasts for any costs and revenue sources may change throughout the year.

Update

In reviewing this year's report, readers should note:

1. CDOT in 2013 adopted a new system for reporting pavement condition. This system is not directly comparable to the methodology used in previous Deficit Reports, and the change affects both cost estimates and pavement condition estimates. The Department now reports pavement condition in terms of Drivability Life, an indication in years of how long a highway will have acceptable driving conditions based on an assessment of smoothness, pavement distress and safety. CDOT previously reported pavement condition in terms of Remaining Service Life. (See page 5 for a discussion of the new system.)
2. The Department also has changed the way it reports bridge condition. Conditions are now reported by calculating how much bridge-deck area, or riding surface, is "Not Structurally Deficient". Structurally Deficient bridges do not meet minimum standards for condition or load-carrying capacity. They often have one or more structural members—a beam or a truss, for example—in deteriorated or damaged condition. CDOT previously reported bridge condition in terms of Good, Fair and Poor. (See pages 11-12 for a discussion of the new measure.) The change in measures was made to align the Department's reporting with the most recent federal transportation authorization. Under the authorization, national performance measures, including the Not Structurally Deficient measure, are being established. The Federal Highway Administration is scheduled to publish rules on the new measures in spring 2014.
3. Performance targets (or "Goals" and "Visions") in previous Deficit Reports relied on objectives contained in the 2008 iteration of the Transportation Commission's Policy Directive 14 (PD14) and the 2035 Statewide Transportation Plan, which also was issued in 2008. Goals and Visions in this year's report are based on objectives in a new draft of Policy Directive 14 last reviewed by the commission in January 2014. These targets are based on the new methodologies for evaluating pavement and bridge conditions. The targets incorporate current budget and performance expectations.

CDOT presses forward on RAMP program rollout

CDOT's new cash-management system made possible the Department's Responsible Acceleration of Maintenance and Partnerships (RAMP) program. RAMP represents an increase in project construction of about \$300 million per year for the next five years. Under the new cash-management system, CDOT will fund multi-year projects based on year of expenditure. This is a change from previous practice, which required the total amount of a project's cost to be in place before any funds were spent.

The increase in construction activity stemming from RAMP is from existing, already programmed dollars, not new funding sources or new transportation revenue.

RAMP Partnership and Operations projects were approved by the Transportation Commission in October 2013. Since then, CDOT and its local partners have refined the scope, schedule and budget for these projects. Local partners recently have reaffirmed their commitment and contributions to the projects.

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4. CDOT has created a Portfolio, Cash, and Program Management initiative to provide the management infrastructure to implement the cash-based programming and budgeting that makes possible the increase in construction related to the Department's five-year Responsible Acceleration of Maintenance and Partnerships, or RAMP, program (see sidebar). The initiative provides the management for scheduling and monitoring CDOT's total capital construction program. In this report, the total budgets for the Surface Treatment and Bridge programs include RAMP funds.
5. CDOT's first Risk-Based Asset Management Plan is complete and, as of early calendar year 2014, undergoing final review by the Transportation Commission before submission to the Federal Highway Administration. The plan focuses on the efficient and effective preservation of the transportation system using a risk-based/lowest life-cycle cost approach to assets including bridges, pavement, maintenance assets, buildings, road equipment, tunnels, retaining walls, culverts, rockfall mitigation sites, signals and Intelligent Transportation Systems (ITS) equipment.
6. Flooding of historic proportions in September 2013 severely damaged the transportation infrastructure in northern and eastern Colorado. More than 240 miles of state highway and 120 state bridges were damaged, and 29 roadways were closed. CDOT has reopened all highways affected by the flood, but the Department anticipates full and permanent reconstruction will take several years. Systemwide bridge, pavement and maintenance conditions used in this report are based on fiscal year 2013 surveys completed before July 2013, so they do not include flood damage. Much of the reconstruction cost will be paid for through federal emergency-relief funds, but CDOT will be required to match federal funds on certain projects.
7. With passage of the Moving Ahead for Progress in the 21st Century Act (MAP-21) in June 2012, transportation programs had a federal authorization bill for the first time since 2009. However, the MAP-21 authorization expires Sept. 30, 2014, and uncertainty remains in the federal outlook afterward. Funding under MAP-21 was set at levels similar to the previous authorization (SAFETEA-LU).
8. Investments or lack thereof in a given year may not instantly change the performance of the transportation system. Neglecting surface treatment on newer road segments, for example, may not cause noticeable deterioration in those segments this year.

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Fiscal year 2015 RAMP funds for maintaining the transportation system ("Capital Maintenance") were allocated to asset management programs in November 2013.

RAMP funds are included in the Bridge and Surface Treatment program budgets in this year's Deficit Report. A large portion of these funds will be used for system preservation.

While the RAMP program will help fill the transportation maintenance funding gap for a while, it is not permanent, nor is it nearly large enough to meet Colorado's longer term system-preservation and capacity needs.

Repairing Highways

CDOT's Surface Treatment program maintains about 23,000 lane miles of the state highway system. The program, part of CDOT's Materials and Geotechnical Branch, ensures the quality of the system through a range of techniques that include thin maintenance treatments, rehabilitation techniques and reconstruction.

Overall pavement conditions on the system have been deteriorating since peaking in 2005, and that trend is expected to continue in the short term. However, the Department forecasts that under current funding projections—about \$240 million per year for the Surface Treatment program—pavement conditions will return to current conditions around 2027.

CDOT in 2013 began reporting highway pavement conditions in terms of Drivability Life. *(See sidebar for an explanation of this metric).* Previous Deficit Reports focused on the Remaining Service Life metric for evaluating pavement.

The move to Drivability Life was made to:

- Apply a system that recognizes financial resources and limitations.
- Achieve optimal treatments for each type of roadway and level of traffic, using a lowest life-cycle cost approach.
- Use a system that better reflects roadway quality as experienced by drivers.
- Increase the frequency of surface treatment on low-volume highways. Under the previous system, such highways would deteriorate until full reconstruction was required.

The Drivability Life metric also helps engineers make project choices that maintain the road quality expected by the public.

The Transportation Commission's objective for pavement on the state highway system is to achieve 80 percent High or Moderate Drivability Life. This goal recognizes financial constraints. The Department has no official "vision" condition, or "aspirational objective", for pavement condition on the state highway system overall. However, aspirational goals for pavement on key subcategories of the state highway system—the Interstate and the National Highway System in Colorado—are both set at 90 percent High/Moderate Drivability Life.

A New System for Rating Pavement

CDOT in 2013 turned to a methodology for evaluating pavement condition known as Drivability Life.

Drivability Life is an indication in years of how long a highway segment will have acceptable driving conditions based on an assessment of pavement smoothness, surface cracking, rutting and safety.

*Pavement with **High Drivability Life** is predicted to have acceptable driving conditions for more than 10 years.*

*Pavement with **Moderate Drivability Life** is predicted to have four to 10 years of acceptable driving conditions.*

*Pavement with **Low Drivability Life** is predicted to have fewer than four years of acceptable driving conditions.*

Having "unacceptable" driving conditions doesn't mean that a highway is impassable. However, drivers may need to endure rough rides, reduce speeds to navigate around potholes and other types of pavement damage, or otherwise compensate for deteriorating conditions.

Figure 1. Statewide Pavement Goals and Condition by Category

State Highway System Categories*	Goal (Fiscally Constrained)	Vision (Aspirational)	FY13 Condition
National Highway System, non-Interstate	80% High/Moderate Drivability Life	90% High/Moderate Drivability Life	83% High/Moderate Drivability Life
Interstate	80%	90%	86%
Entire State Highway System	80%	N/A**	82%

*Interstates and National Highway System roadways in Colorado are part of the state highway system. **The Transportation Commission's Policy Directive 14, currently under revision, has no aspirational objective for the entire state highway system.

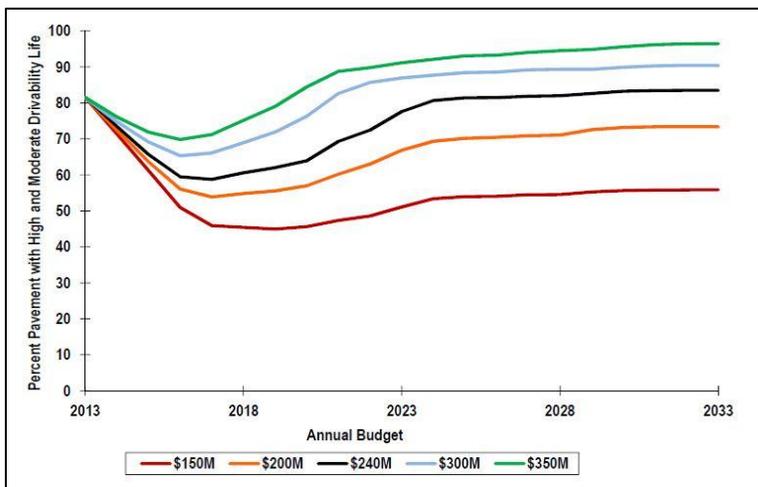
The Surface Treatment program ended fiscal year 2013 with 82 percent of pavement on the state highway system with High or Moderate Drivability Life. However, more than half of CDOT's highways now have a Drivability Life of between just four and seven years. Because of this, the Department expects a large amount of miles to soon move into the Low Drivability Life category.

No historical data is available for comparing current Drivability Life to historical conditions. Future Deficit Reports will begin tracking and reporting Drivability Life over time. See Figure 2 (below) for a look at pavement conditions achievable under different funding levels over the next 10 years.

Cost of Achieving Goal

Achieving the Department's goal of 80 percent High/Moderate Drivability Life in 2024 will require about \$2.4 billion over the next ten years, or an average annual budget of about \$240 million. Against the projected revenue allocation for the Surface Treatment program for the next 10 years, there is an anticipated deficit of about \$9 million, with the entire deficit accumulating in fiscal years 2015 and 2016. (See Figure 4 on page 8.)

Figure 2. Pavement Drivability Life versus Funding



The chart at left shows pavement conditions on the state highway system that are possible under five different funding levels. A budget of \$240 million per year would achieve CDOT's goal of 80 percent High/Moderate Drivability Life around 2024.

Cost of Sustaining Condition

CDOT in 2013 exceeded its goal for pavement condition, so the cost of sustaining current conditions is higher than achieving that goal.

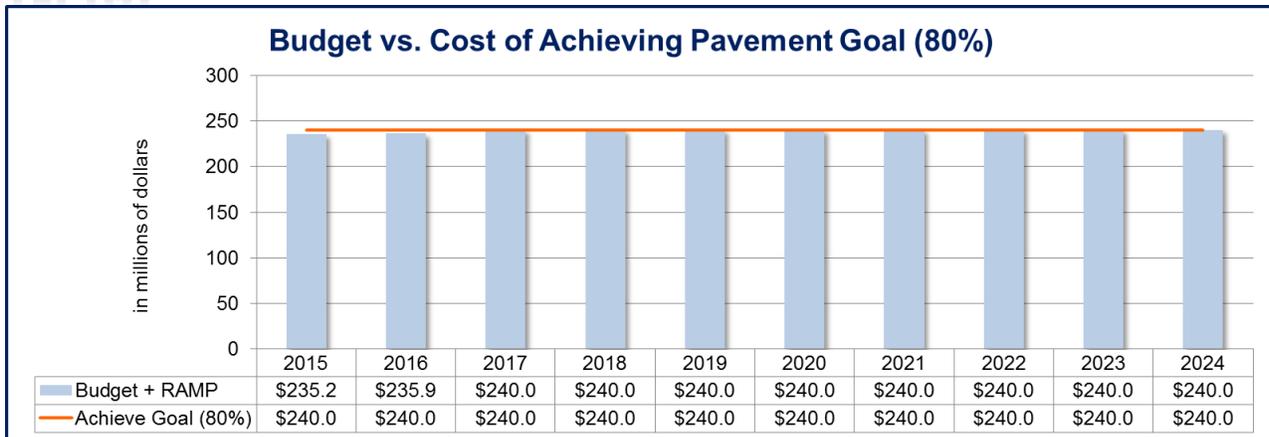
Achieving the current pavement condition of 82 percent High/Moderate Drivability Life in 2024 will require \$2.45 billion over the next ten years, or an average annual budget of about \$245 million. Against the projected budget for the Surface Treatment program for the next 10 years, there is a deficit of \$59 million, or an average of about \$5.9 million per year. (See *Figure 6* on page 8.)

Under this estimate, pavement condition would not remain static over the 10-year period. The condition would dip to 59 percent High/Moderate Drivability Life in fiscal year 2017, but return to 82 percent by fiscal year 2024. As previously mentioned, pavement conditions are expected to fall in the near term, because more than half of CDOT's highways have a Drivability Life of between just four and seven years.

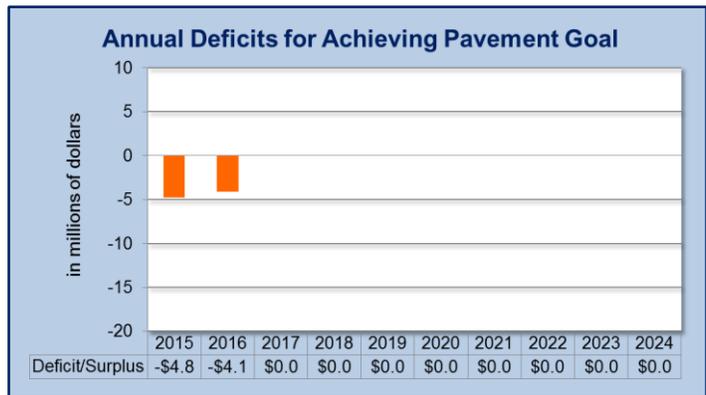


This stretch of Highway 59 between Sedgwick and Haxtun is a Low-Volume Highway with a Drivability Life of nine years. CDOT's new system for managing pavement, which uses the Drivability Life metric, recommends a chip seal for this road in 2016. A chip seal is a thin layer of chipped rocks and bitumen that adds additional wearing surface to pavement and seals the substructure from moisture infiltration. Under CDOT's previous approach to evaluating pavement, this segment would have deteriorated until it required costly reconstruction, which wouldn't have been possible because of competing projects. CDOT's new approach uses more frequent treatments to extend roadway life.

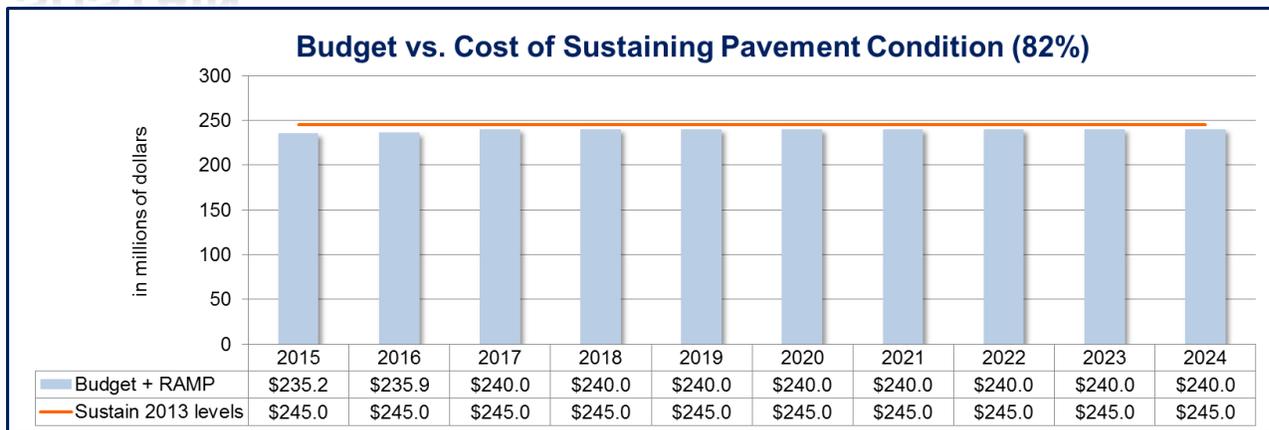
GOAL



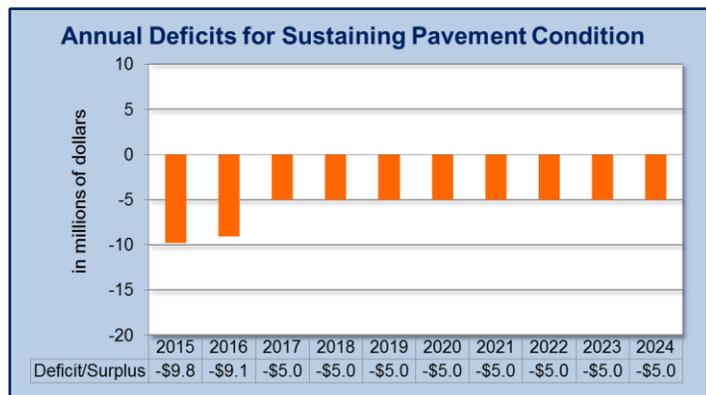
Figures 3 (above) and 4 (right): The chart above shows the cost of meeting the Transportation Commission's fiscally constrained goal for pavement condition on the state highway system over 10 years, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$9 million, all of it accumulated in the first two years.



SUSTAIN



Figures 5 (above) and 6 (right): The chart above shows the cost of sustaining the current condition of pavement on the state highway system over 10 years, as compared to anticipated funding. As shown at right, a deficit of about \$10 million in the first year of the analysis shrinks to a deficit of \$5 million in years three through 10. The deficit over 10 years is \$59 million.



Annual Cost Increase and Rate of Increase

The cost estimates for sustaining the current pavement condition and meeting CDOT's goal have fallen significantly from last year's report. However, these estimates are not directly comparable. This year's estimates are based on new goals and a new system for evaluating and managing pavement condition.

In addition, projected deficits in this year's report are lower in part because the anticipated program budget in this year's report is about \$180 million higher over the 10-year analysis, or \$18 million higher per year on average.

Factors Contributing to Costs

Materials 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 two years.

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 Annual Average Daily Traffic (AADT) on state highways and the wear and tear on pavement surfaces.

Population statewide is expected to grow to 6.4 million by 2025, when it would be about 24 percent higher than in 2012. The Department expects total Vehicles Miles Traveled to grow at about the same rate, because the number of Vehicle Miles Traveled per capita is expected to remain flat.

According to the State Demographer, population growth going forward is expected to be most rapid in the North Front Range, followed by the Western Slope and the Central Mountains.

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

Surface-Treatment Approach Varies by Road Category

CDOT prioritizes roads into four categories that define potential surface-treatment options. The best treatment option is determined based on Drivability Life ratings, treatment costs, and site-specific design variables. This approach to surface treatment—more cost-effective than the Department's previous approach—helps maximize the experience of the traveling public on the state's highways. The four categories are:

1. Interstates are CDOT's most important highways. These national networks provide interconnectivity across the state and nation. Interstate projects are built, rehabilitated and maintained according to Pavement Design Standards of the American Association of State Highway and Transportation Officials (AASHTO), ensuring they meet federal standards and provide reliable service.

2. High-Volume Highways are used by more than 4,000 vehicles per day (as calculated by Average Annual Daily Traffic, or AADT), or more than 1,000 trucks per day. These highways serve a large segment of the traveling public and provide critical routes for the transportation of goods and services across regional boundaries. These projects also follow AASHTO Pavement Design Standards.

infrastructure, maintenance, repair and improvements. Roadways are designed and constructed for their anticipated traffic loads. Any changing pattern of AADT 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.

Looking Ahead

2013 was the first year that CDOT used the Drivability Life metric for reporting pavement condition. Ongoing refinements to Drivability Life calculations will continue as the Department gains experience with the metric. Improvements in coming years will result in changes to assessments of pavement condition and predictive analyses. These improvements will ensure the quality of the Pavement Management System that is used to calculate Drivability Life and to predict future pavement deterioration rates.

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3. Medium-Volume Highways have AADT of between 2,000 and 4,000 and/or truck traffic between 100 and 1,000 vehicles. These projects are treated primarily with minor rehabilitation and pavement maintenance treatments. Major rehabilitation is considered when drivability is poor and project-level analysis reveals compromised pavement structure.

4. Low-Volume Highways have AADT of less than 2,000 and truck traffic of less than 100. These highways are maintained at acceptable drivability standards with pavement-maintenance treatments. Isolated repairs are used to address localized distresses that cannot be fixed with thin pavement preservation treatments. If formally approved by CDOT's Chief Engineer, minor rehabilitation treatments may be used as needed to return the pavement to acceptable drivability condition.

Managing Bridges

CDOT's Bridge program maintains 3,437 major vehicular bridges on the state highway system. These bridges have a total deck area of 32.7 million square feet. Both the number of bridges and the amount of deck area (or riding surface) managed by CDOT change over time as new bridges are put into service and bridge ownership is transferred between the Department and local agencies.

The Department each year submits information on the condition of bridge-deck area to the Federal Highway Administration's National Bridge Inventory. The percentage of deck area on the state highway system rated Not Structurally Deficient in the past four years has been:

- 2010: 91.3 percent.
- 2011: 91.5 percent.
- 2012: 93.4 percent.
- 2013: 94.1 percent.

See the sidebar at right for an explanation of the Not Structurally Deficient metric.

Improvement from 2010-13 is primarily due to replacements funded by the Colorado Bridge Enterprise, which operates as a government-owned business within CDOT. (See page 12 for more on the Bridge Enterprise.)

Like replacement, preservation is an important component of ensuring bridge quality. As of early 2014, there are 141 bridges for which preservation work is planned. This includes work such as repairing or replacing bridge-expansion joints identified as leaking; installing waterproofing membrane on decks that have asphalt overlays but no such membranes; and sealing bare concrete decks.

The Transportation Commission's objective for bridges is to maintain 90 percent or more of deck area on the state highway system in a condition that is Not Structurally Deficient. This goal is consistent with the minimum bridge condition level for the National Highway System established as part of the federal Moving Ahead for Progress in the 21st Century Act (MAP-21). CDOT will achieve the goal through a mix of preventive maintenance strategies, bridge repair/rehabilitation, and bridge replacements.

The commission has not established a "vision" or "aspirational objective" for bridge condition on the entire state highway system. The aspirational objective for deck area on the National Highway System in Colorado, which is part of the state highway system, has been set by the commission at 95 percent or more to be Not Structurally Deficient.

A New Approach for Reporting Bridge Condition

*CDOT in 2013 began reporting major vehicular bridge condition by the percentage of bridge-deck area statewide that is **Not Structurally Deficient**. The Department had previously used the classifications of Good, Fair and Poor to indicate condition.*

Structurally Deficient bridges do not meet minimum standards for condition or load-bearing capacity. They also often have one or more damaged or deteriorated structural members, such as a girder, truss or deck.

The Moving Ahead for Progress in the 21st Century Act (MAP-21), the federal transportation authorization passed in 2012, sets a minimum condition level for bridge condition. If more than 10 percent of a state's bridge-deck area on the National Highway System is Structurally Deficient, certain federal funds must be used by that state for improving condition. CDOT's target for bridge condition was revised in 2013 to align with this goal, so 90 percent Not Structurally Deficient is now the Department's goal for deck area condition on the state highway system. This includes bridge deck area on the National Highway System in Colorado.

Colorado Bridge Enterprise

The Colorado Bridge Enterprise was created by FASTER legislation to finance the repair and reconstruction of state-owned vehicle bridges. It does so using revenue from an annual bridge-safety fee on vehicle registrations. The fee has been the primary source of revenue for the Bridge Enterprise since it began in 2009.

To receive Bridge Enterprise funding, bridges must be in “Poor” condition. Bridges in Poor condition have a Sufficiency Rating of less than 50 (out of 100) and a status of Structurally Deficient or Functionally Obsolete. They do not meet all safety and geometric standards and require reactive maintenance to ensure their safe service. These bridges have typically exceeded their economically viable service life and require replacement or major rehabilitation.

From the creation of the Bridge Enterprise in 2009 until the end of calendar year 2013, 179 bridges statewide had become eligible for funding through the enterprise. Of those, 130 were eligible for FASTER funding. (The remaining structures had other funding sources, or funding had not been determined.)

At the end of 2013, 68 bridges had been repaired or replaced with FASTER funds. In addition, 10 bridges funded by FASTER were in construction; four bridge designs were completed; 26 bridges were in the design stage; and 22 bridge projects were waiting to be scheduled. A list of current FASTER bridge projects and a map of their locations is at www.coloradodot.info/programs/BridgeEnterprise.

The Department is anticipating that the Bridge Enterprise will provide significant funding for the Interstate 70 viaduct replacement project east of downtown Denver. Cost estimates for the bridge-related elements of the project are in the \$1.1 billion range, although the exact cost will depend on the distance the project extends east of the viaduct and on dollars available outside of Bridge Enterprise funding.

A detailed financing plan has not been developed yet for the viaduct project. Current proposals limit the maximum impact to bridge funds to \$895 million. However, to account for the project’s needs until a detailed financing plan is available, CDOT in this report has included cost assumptions of \$110 million per year over 10 years for the viaduct’s bridge elements.

National Bridge Inventory

Classifications

CDOT uses National Bridge Inventory standards established by the Federal Highway Administration to inventory, inspect and classify the condition of major vehicular bridges. The classification is based on a Sufficiency Rating of 0 to 100 and a status of Structurally Deficient, Not Deficient or Functionally Obsolete.

***Structurally Deficient** bridges do not meet minimum standards for condition or load-bearing capacity and often have one or more structural members (a girder, truss or deck, for example) in deteriorated or damaged condition. A Structurally Deficient bridge is a candidate for repair, major rehabilitation or replacement. The action considered depends on the portion of the bridge that caused the entire bridge to be classified as Structurally Deficient. Major rehabilitations include work such as replacement of the bridge deck, which is the riding surface of a bridge. Other examples include replacement of the superstructure, which comprises the supports immediately below the driving surface, and rehabilitation or strengthening of the substructure, which comprises the foundation and supporting posts and piers of the bridge.*

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Cost of Achieving Goal

The cost to achieve CDOT's goal for bridge condition on the state highway system at the end of 10 years is about \$1.54 billion, or \$154 million per year. Compared to projected budgets including RAMP funds, this forecasts a 10-year surplus of about \$347 million, or an average of \$34.7 million annually, to achieve this goal. (See Figure 8 on page 14.)

Included in the 10-year estimate is \$1.1 billion for bridge-related elements of replacing the Interstate 70 viaduct. Replacing the viaduct is a significant component of the cost of keeping deck area at the target level. (See the Colorado Bridge Enterprise section on page 12 for more information on the viaduct.)

The first priority for bridge funding will be achieving the 90 percent Not Structurally Deficient goal for the state highway system. Remaining funds may be applied to additional bridge needs, such as working toward CDOT's aspirational objective for bridges on the National Highway System and mitigating risks posed by Low Vertical Clearance Bridges, Load-Restricted Bridges and Scour-Critical Bridges. (See page 15.)

Cost of Sustaining Condition

The cost to sustain the current bridge condition of 94 percent Not Structurally Deficient is about \$2.26 billion over 10 years, which would require an average annual budget of about \$226 million. Included in the 10-year estimate is \$1.1 billion for the bridge-related elements of replacing the Interstate 70 viaduct.

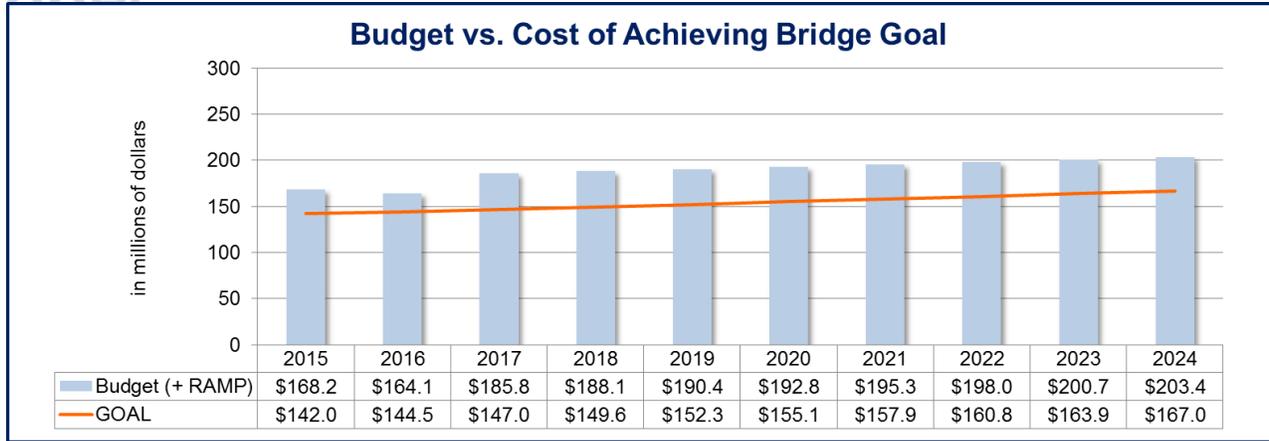
Compared to forecast bridge-program distributions, including the FASTER Bridge Enterprise Special Revenue Fund and RAMP funds, the Department projects a 10-year deficit of about \$375 million, or an average of \$37.5 million annually. (See Figure 10 on page 14.)

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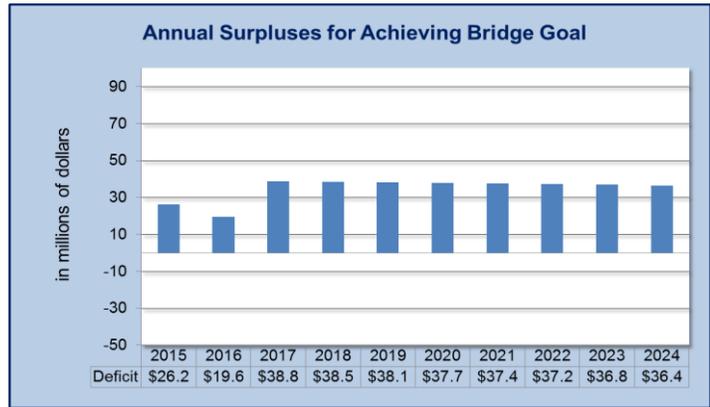
*A major vehicular bridge that is **Not Deficient** will be a candidate for preservation actions many times during its service. Preservation actions slow or temporarily arrest the deterioration of a bridge. Most preservation actions stop or limit water with de-icing chemicals from getting to structural members. Preservation actions include work such as fixing leaking expansion joints and resealing damaged bridge-deck seals.*

***Functionally Obsolete** bridges do not meet current minimum geometric requirements and often have inadequate roadway shoulders, insufficient number of lanes to handle current traffic, overhead clearances that are less than minimums, or inadequate widths for roadways or streams underneath. These bridges are candidates for widening or replacement. The action considered depends on why the bridge is classified as Functionally Obsolete. A Functionally Obsolete bridge is typically not a candidate for preservation actions unless the reason for it being Functionally Obsolete can't be addressed, such as an urban bridge that can't be widened due to high right-of-way costs.*

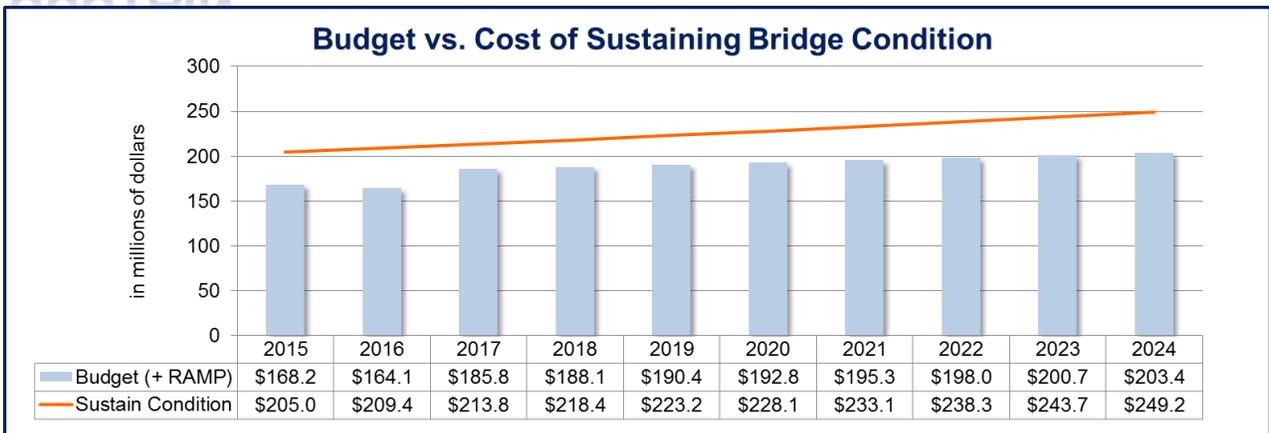
GOAL



Figures 7 (above) and 8 (right): The chart above shows the cost of achieving CDOT's goal for bridge condition on the state highway system in 10 years, as compared to anticipated funding. As shown at right, the surplus after achieving this goal is \$347 million over 10 years, or an average of \$34.7 million per year. These surplus funds may be used for additional needs such as making progress on achieving CDOT's aspirational objective for bridges on the National Highway System or mitigating risks discussed on page 15.



SUSTAIN



Figures 9 (above) and 10 (right): The chart above shows the cost of sustaining the current condition of bridges on the state highway system over 10 years, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$375 million, or an average of \$37.5 million per year.

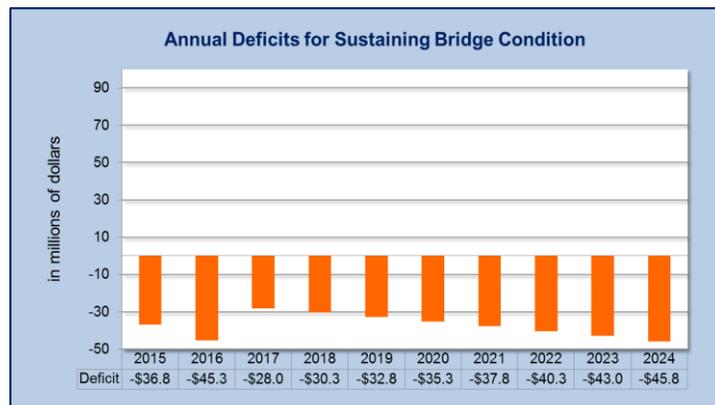
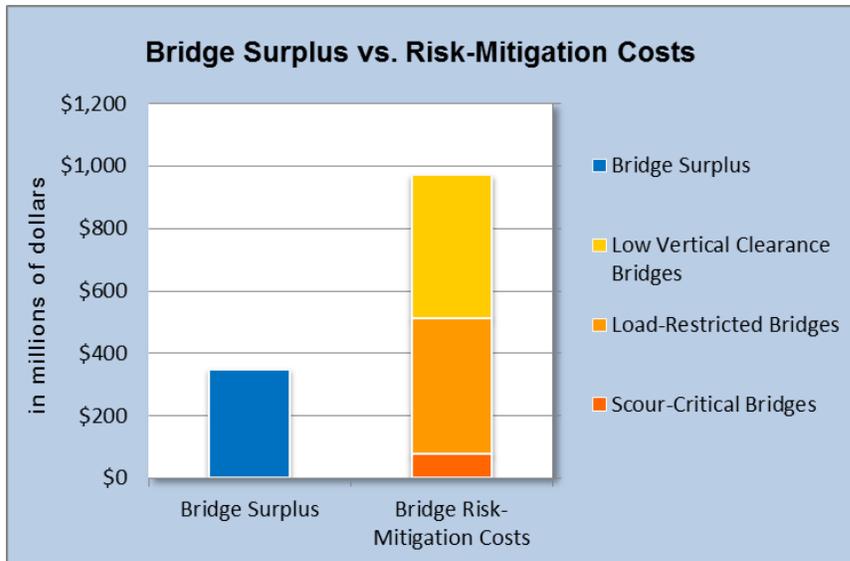


Figure 11: Risk Mitigation Expenses



The blue column at left shows the anticipated 10-year surplus left after meeting CDOT's goal of ensuring that at least 90 percent of bridge-deck area on the state highway system is Not Structurally Deficient. Surplus funds may be used for additional bridge needs, such as mitigating the risks shown in the orange column. The cost of addressing these risks is projected to total almost \$970 million.

Additional Costs: Risks in Asset Management Plan

As mentioned, mitigating risks identified in the Department's new Risk-Based Asset Management plan is one potential use for bridge funds remaining after achieving CDOT's goal for bridges on the state highway system. See the chart above for a comparison of the surplus to the expense of mitigating these risks.

The risks include:

- **Low Vertical Clearance Bridges**, which are bridges located above state highways that do not provide the standard vertical opening of 16 feet. Such bridges are at risk from sustaining repeated hits from commercial vehicles. CDOT has identified 51 Low Vertical Clearance Bridges, and replacing these structures is projected to cost a total of \$459 million.
- **Load-Restricted Bridges**, which are bridges whose current capabilities to support legal highway loads are inadequate. These bridges restrict the movement of commerce. CDOT has identified 87 Load-Restricted Bridges. Replacing these structures is projected to cost about \$435 million.
- **Scour-Critical Bridges**, which are bridges whose foundations are at risk of failure due to erosion. Scour is the most common cause of bridge failure. CDOT currently has 153 Scour-Critical Bridges. Addressing these bridges is projected to cost a total of \$75 million.



Bridge inspection at U.S. Highway 85 near Nunn, Colo.

Annual Cost Increase and Rate of Increase

The projected 10-year cost to sustain the current bridge condition has increased compared to last year's estimate, while the cost to meet the Department's goal has fallen. This year's estimates, however, are not directly comparable to those in last year's Deficit Report. This year's estimates incorporate changes including a new metric and a new goal for evaluating bridge condition, as well as a new model for projecting future condition.

CDOT has moved from a replacement-only model to a model that considers replacement and preservation actions. The model now used for projecting future bridge conditions predicts the time for each bridge to become Structurally Deficient and includes the effect of preservation actions on each bridge.

Factors Contributing to Costs

Factors affecting costs for maintaining, repairing and replacing bridges include:

- **Exposure to the elements.** Exposure of bridges 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 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 Annual Average Daily Traffic (AADT) that crosses a bridge. AADT is one of the primary factors that drive a bridge to become Functionally Obsolete. Growth in population and where that population chooses to travel can result in changes in AADT and advance or delay the onset of Functional Obsolescence.
- **Vehicle size and weight.** Deterioration can result in posted weight limits that affect 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 overstress damage to bridges if the load exceeds the bridge's carrying capacity. Non-permitted oversize vehicles can hit bridges and cause damage that lowers bridge condition and requires repair. CDOT performs inspections to identify bridges that require restrictions based on vertical clearance or vehicle weight.

- **Land-use policies and work patterns.** Land-use policies affect AADT, which is one of the many factors that determine a bridge's sufficiency rating and is indirectly used to determine Functional Obsolescence. A bridge's sufficiency rating is affected by shifts in AADT and truck traffic due to changes in commuting and commercial routes stemming from population growth and development.

Annual Maintenance

Baseline budgets for CDOT's "big three" asset categories—pavement, bridges and maintenance—comprise roughly half of the Department's annual budget. Sustaining performance levels of the Maintenance program is analyzed in this report much like the Surface Treatment and Bridge programs.

The Maintenance program, which is overseen by CDOT's Maintenance and Operations Branch, has a proposed fiscal year 2015 budget of \$251.3 million, representing one of the Department's largest annual investments. The program is designed to keep the state highway system open and safe for the traveling public.

CDOT assigns a letter grade to evaluate the performance of individual maintenance areas (see sidebar), as well as a grade to evaluate overall maintenance service. For both fiscal years 2014 and 2015, the Department's target for overall Maintenance Levels of Service is a B-. These targets are estimates of what can be achieved with current funding levels. They align with new fiscally constrained goals in the Transportation Commission's Policy Directive 14. Goals in the directive have been revised since last year's Deficit Report, which was based on goals set in 2008.

The Transportation Commission also sets a long-term vision, or "aspirational objective", in Policy Directive 14. This current vision—to achieve a B in overall Maintenance Levels of Service over the next 10 years—is more ambitious than the fiscally constrained target.

Separately, the commission has set goals for Snow and Ice Control. The fiscally constrained goal for this Maintenance Program Area is a B, and the "aspirational objective", or vision, is a B+. CDOT achieved a level of service of B for Snow and Ice Control for fiscal year 2013.

Cost of Achieving Goal

The cost to achieve the Department's goal of sustaining a B- for Maintenance Levels of Service for the next 10 years is \$2.88 billion, or an average annual budget of \$288 million. Against anticipated program budgets, this forecasts a 10-year deficit of about \$45 million or an average of \$4.5 million annually. (See Figure 13 on page 21.)

In this analysis, the overall Maintenance Levels of Service grade—but not each individual Maintenance Program Area (MPA)—is kept at a B-. Individual areas are maintained at what they are anticipated to be under fiscal year 2015 budget levels, when the overall grade is expected to be a B-.

How CDOT Rates Maintenance

CDOT's 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 right-of-way fences.

Maintenance activities are separated into nine Maintenance Program Areas (MPAs):

- **Roadway 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 operations
- **Planning and Scheduling**
 - Performance budgeting
 - Maintenance staff training

CONTINUED

An estimate for keeping all Maintenance Program Areas at a B- every year would be considerably more expensive—about \$200 million more over 10 years.

Cost of Sustaining Current Condition/Achieving Vision

The cost to sustain the fiscal year 2013 overall grade of B for Maintenance Levels of Service over the next 10 years is \$2.92 billion, requiring an average annual budget of \$292 million. Against anticipated program budgets, this forecasts a 10-year deficit of about \$82 million, or an average of \$8.2 million annually. (See *Figure 15 on page 21.*)

This estimate sustains individual Maintenance Program Areas at their fiscal year 2013 grades for every year of the 10-year analysis. Therefore, while the overall grade for Maintenance Levels of Service is maintained at the B level of service, grades for individual areas (such as Traffic Services, Structure Maintenance, Roadside Facilities and Roadside Appearance) are not all at a B level.

Because it achieves a B grade for overall Maintenance Levels of Service, this estimate also meets CDOT's vision, or "aspirational objective". A 10-year forecast that meets the overall B grade but also achieves a B in every program area each year would require more investment. Such a scenario would require \$3.5 billion over 10 years, or about \$660 million more than the previously mentioned "sustain" analysis.

Annual Cost Increase and Rate of Increase

CDOT since last year's Deficit Report has revised its goals for maintenance to recognize current budget realities and expected performance. The cost of achieving these objectives is lower, but not directly comparable, to estimates in last year's Deficit Report. Last year's report was based on goals established in 2008.

Many factors each year influence budget estimates, cost estimates, and deficit estimates for achieving various grades for Maintenance Levels of Service. As examples:

- The estimate of the cost to achieve a particular maintenance grade in the future is based on the actual cost of achieving that grade in the previous year.
- The estimate of the cost to achieve a particular grade depends heavily on the current grade. The overall maintenance grade for fiscal year 2013 was a B, up from a B- in fiscal year 2012. If other factors are unchanged, it is less expensive to achieve a B if the maintenance program begins with a B instead of a B-.

CONTINUED

CDOT measures the performance of maintenance service with a "report card" style grading system called Maintenance Levels of Service (MLOS). Each individual maintenance area is given a grade, and those grades are used to determine an overall grade for maintenance. Higher grades can be achieved with higher funding levels.

The MLOS budget process consists of a survey of existing conditions, most recent costs and a recommendation of funding to reach the goal set by the Transportation Commission.

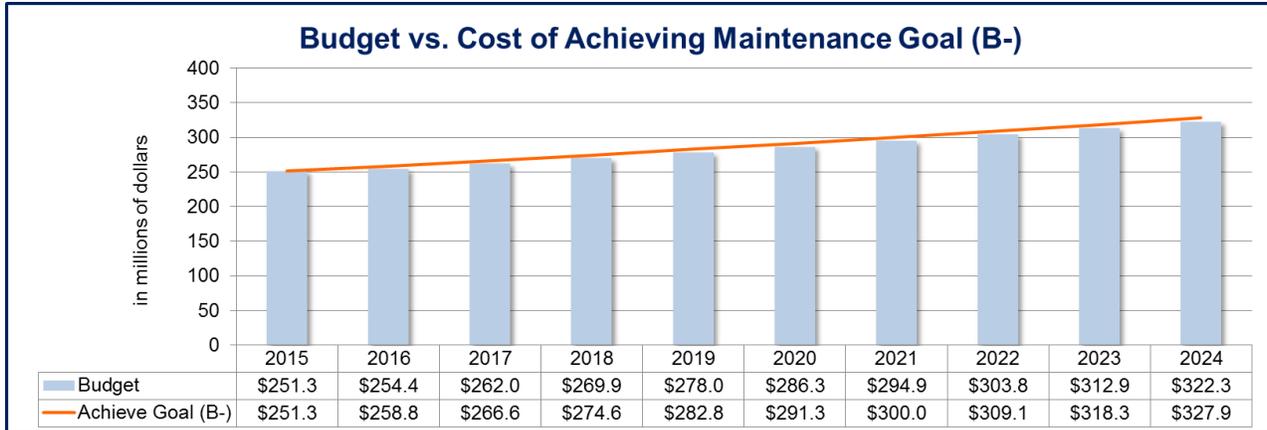
- The cost to achieve an overall maintenance grade is dependent on the mix of grades achieved in individual Maintenance Program Areas, which make up the overall grade.
- Smaller deficits in this year's Deficit Report are partly due to an assumption of 1.2 percent budget growth in fiscal year 2016 and 3 percent budget growth in the maintenance budget in fiscal years 2017-24. In contrast, last year's report assumed 2.2 percent growth. Had a 2.2 percent growth rate been used this year, over 10 years the maintenance budget would have been \$60 million less than current projections. A 3 percent growth rate is intended to enable the Maintenance program to keep pace with inflation. However, such budget growth is not certain, and performance may decline if funding does not keep pace with inflation.

Funding levels for the Pavement and Bridge programs over time can also significantly affect the Maintenance program. Maintaining assets that are in poor condition can be more expensive than doing the same for roads and bridges in better condition.

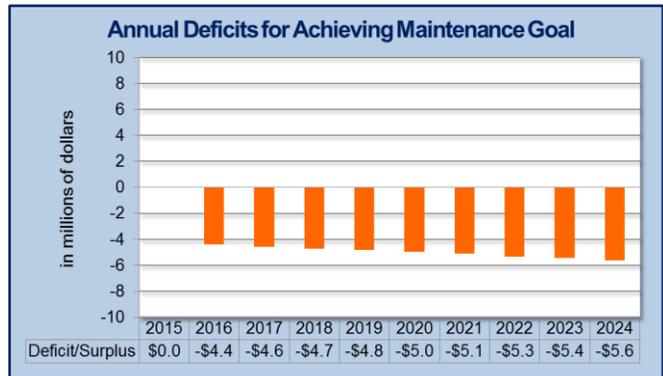


Red Mountain Pass, western Colorado.

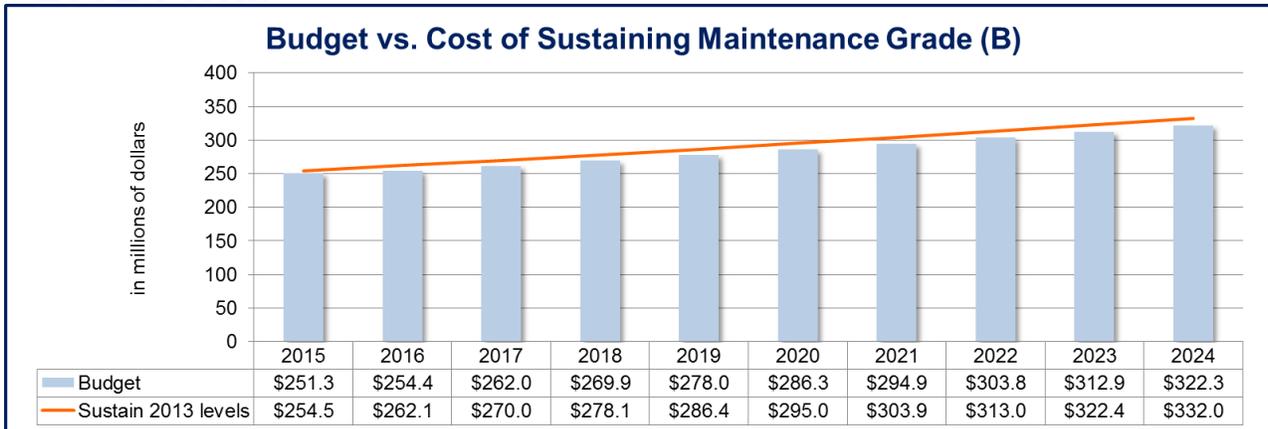
GOAL



Figures 12 (above) and 13 (right): The chart above shows the projected cost of achieving CDOT’s goal of maintaining a B-grade for maintenance on the highway system as compared to anticipated funding. As shown at right, the 10-year deficit is about \$45 million, or \$4.5 million per year on average.



SUSTAIN



Figures 14 (above) and 15 (right): The chart above shows the cost of sustaining the current “B” grade for maintenance over 10 years, as compared to anticipated funding. As shown at right, the 10-year deficit is about \$82 million, or \$8.2 million per year on average. CDOT’s vision, or “aspirational objective”, for maintenance also is a “B”, so the cost is the same as sustaining current conditions.

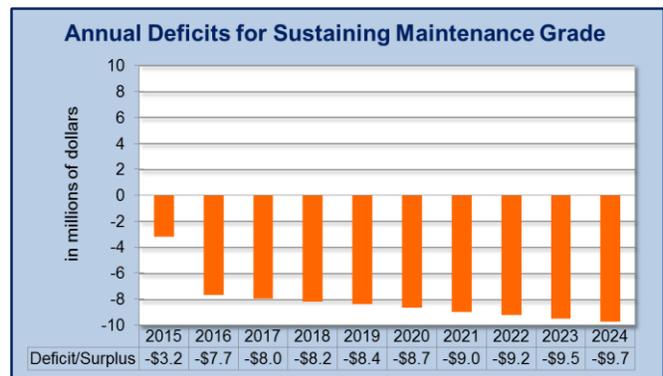
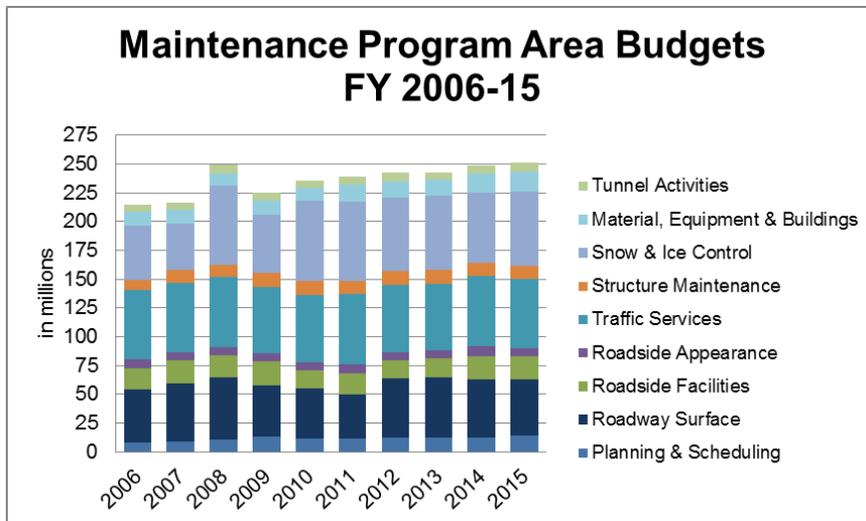


Figure 16. Annual Snow-and-Ice Budget History



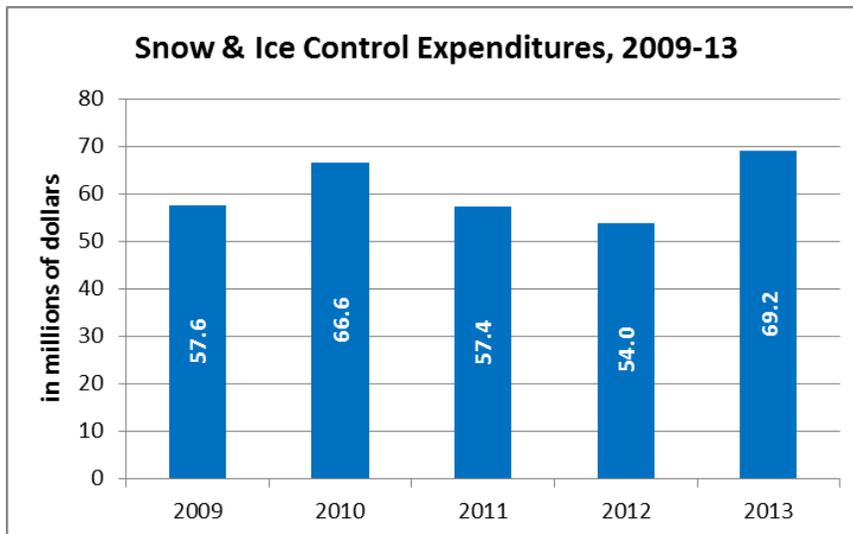
Note: 2015 figures are from fiscal year 2014-15 draft budget.

Factors Contributing to Maintenance Expenses

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 Maintenance Programs Areas. As depicted by the annual budget in Figure 16 (above), snow and ice control is about 26 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 \$64.3 million in fiscal year 2015. 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. The cost jumped to \$11.12 by fiscal year 2013. Among the factors that have contributed to this increase are higher fuel and equipment costs and the expense of meeting higher performance expectations.

Figure 17. Annual Snow and Ice Control Expenditures



Population Growth and Distribution. Population growth and growth in Vehicle Miles Traveled (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, and limited resources may in some circumstances be focused on high-volume segments in high population areas to alleviate mobility concerns.

Vehicle Size and Weight. A Maintenance Program Area heavily affected by vehicle size and weight is Roadway Surface, which undertakes projects smaller than those typically performed by CDOT's 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 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.

Mitigating Costs

CDOT expects that financial resources for adding lane capacity or undertaking other expansions will remain limited. Extracting the most benefit possible from existing transportation infrastructure is becoming increasingly important. The Department is responding to this challenge with multiple strategies to reduce costs, curb the growth of Vehicle Miles Traveled and increase mobility and safety within the existing system.

As part of these efforts, CDOT formed the Division of Transportation Systems Management & Operations (TSM&O) in 2013. The division focuses on implementing low-cost, high-value operational improvements to the transportation system. Initiatives include developing command-level partnerships with law enforcement and other stakeholders to implement integrated event, corridor and incident-management strategies.

Other initiatives include implementing peak-period shoulder lanes, improved operations through Active Traffic Management (ATM), managed lanes and programs such as the Courtesy Patrol and Heavy Tow programs. The Courtesy Patrol program provides services including locating and clearing traffic-related incidents and providing roadside assistance. The primary purpose of the patrol is immediate management of incidents during hours of peak vehicle volume. The Heavy Tow program provides standby heavy wreckers at strategic locations along Interstate 70, between Floyd Hill and Vail Pass. The wreckers move stalled and spun-out commercial vehicles from traffic lanes.

The new division includes CDOT's Intelligent Transportation Systems Branch. ITS systems are a key element of CDOT's demand-management efforts. ITS maximizes the operational efficiency and management of existing roadways through technology and special programs. Some practices involve methods of traffic control that help maintain flow, such as ramp metering and quick response to crashes. Other practices give real-time traffic information to motorists, empowering them to decide when and where to travel. ITS infrastructure includes devices such 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 services and travel-time indicators.

CDOT uses multiple devices along the Interstate 70 corridor to acquire data that help determine real-time traffic speeds and calculated travel times, which are then disseminated to drivers along the highway, to potential drivers and to others via COtrip.org and on various displays at mountain resorts. CDOT Mobile is a free mobile-device app that delivers real-time travel information from COtrip.org. Other tools for delivering traffic information include the 511 phone line and the Department's Facebook and

Twitter accounts. Travelers use information from these sources to modify travel routes or times.

CDOT also has turned to transit services to help reduce congestion. The Department's Division of Transit & Rail, created by FASTER legislation, has been working to integrate transit into the state's transportation system. In fiscal year 2013, Colorado's first Freight and Passenger Rail Plan was completed, and the first Statewide Transit Plan was initiated. The division also developed an Interregional Express Bus Plan. Under the plan, CDOT will become a transit/bus provider by using a private operator. The plan will provide express bus service along Interstate 25, connecting Fort Collins to Denver and Colorado Springs to Denver. In the Interstate 70 corridor, the bus service would connect Glenwood Springs, Eagle County, Vail and Frisco to Denver. Buses will be procured and a private operator selected. An opening day is planned for late 2014 or early 2015.

The Department continues to be the recipient of Federal Transit Administration (FTA) grants for Colorado rural and small urban areas. These funds, in combination with FASTER Transit funds, are distributed and administered by the division to local transit providers statewide.

Conclusion

The outlook for transportation revenue remains uncertain. Changing driving habits, greater fuel efficiency and cost inflation are weakening the ability of state and federal fuel taxes—which have not increased for two decades—to provide sufficient funding. And the expiration in September 2014 of the federal authorization contained in the Moving Ahead for Progress in the 21st Century Act (MAP-21) makes revenue projections difficult.

Demands placed on Colorado's transportation system are outpacing CDOT revenue. Over the past 20 years, Colorado's population has grown 47 percent, from 3.6 million people to 5.3 million people. An additional 2.5 million people are expected by 2040, according to Colorado's State Demography Office. Travel on the highway system has increased in the past 20 years by 42 percent, from 19.8 billion to 28.1 billion miles of vehicle travel. This growth has occurred on a highway system with capacity that has grown by just 2 percent, from 22,521 to 23,024 lane miles of state highway.

These trends mean that Coloradans can expect to spend more time in traffic. This will cause more wear and tear on roadways—many of which were not built to accommodate the increased demand—and more extensive maintenance needs.

Coloradans have enjoyed an adequate transportation infrastructure. The average work commute statewide is 24 minutes, compared to 25 minutes nationwide, 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, state highways are becoming more congested, and 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 tenth-fastest job growth of any state from November 2012 to November 2013, according to U.S. Bureau of Labor Statistics data. And Colorado will have the fifth-fastest growth in jobs for 2014, according to a Moody Analytics forecast cited by the Pew Charitable Trusts.

In a December 2013 report, Colorado's Office of State Planning and Budgeting forecast modest growth in vehicle registration fees because of more vehicle sales. Such sales will be driven by low interest rates, job growth, and increased household wealth from the recovery of the home market and growing stock market. The report forecast more "muted" increases in fuel tax collections in fiscal years 2015 and 2016. Such collections are being tempered in part by improved fuel efficiency. Another factor is the decline in the number of Vehicle Miles Traveled per person that has come with more young people living in cities and near public transportation routes, the report said.

Meanwhile, revenue from FASTER fees and CDOT's new RAMP funding program are helping to prevent accelerated deterioration of highways and bridges. But those sources are contributing primarily to maintaining the system, and RAMP funding is not permanent. Adding capacity to the transportation system will require CDOT to seek new funding sources.

In summary, CDOT's projected program budgets are close to meeting the cost of achieving the Department's goals for pavement and maintenance in the next 10 years. Meanwhile, a surplus of about \$347 million over ten years is projected for meeting the Department's bridge goal. Potential uses for these funds include meeting CDOT's "aspirational" goal for bridge deck area on the National Highway System, and mitigating risks posed by Low Vertical Clearance Bridges, Load-Restricted Bridges and Scour-Critical Bridges.

Since publication of the 2013 Deficit Report, the Transportation Commission has revised CDOT's goals for bridge, pavement and maintenance to reflect lower, more achievable targets that take into account the Department's stagnant revenues. Therefore, the estimates of the costs of meeting the goals contained in this year's report are not directly comparable to estimates in the 2013 report.

CDOT's revised bridge and pavement goals incorporate new performance metrics and treatment approaches. These changes have been made to align with new performance metrics being created by the Federal Highway Administration for the states, as well as to incorporate refinements made by CDOT to its asset preservation models to adjust to the aforementioned stagnant revenues.

Faced with flat or declining revenues, Colorado and other states 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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