

2016 Transportation Deficit Report



COLORADO
Department of
Transportation

Transportation Deficit Report 2016

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Overview

Pursuant to the Funding Advancement for Surface Transportation and Economic Recovery Act (FASTER) of 2009, the Colorado Department of Transportation (CDOT) presents its Transportation Deficit Report for 2016. The annual Deficit Report addresses the goals of repairing deficient highways and bridges and sustaining existing transportation system performance levels. Included in this report are:

- The estimated costs, budgets and resulting deficits for sustaining current conditions over the next 10 years.
- The estimated costs, budgets and resulting deficits for achieving certain fiscally constrained and aspirational goals (visions) of the Colorado Transportation Commission within the next 10 years. These goals are stipulated in CDOT’s revised Policy Directive 14, which was adopted by the Commission in February 2015.
- The annual increases of the costs above.
- Factors contributing to the costs, such as the rate and distribution of population growth and vehicle size and weight. Techniques and tools for mitigating cost factors also are discussed.

Also included in this report are key CDOT performance results for fiscal year 2015. These results are among the data 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 2017 budget proposal, CDOT relied on revenue forecasts available at the time. For FASTER receipts, CDOT projects it will receive about \$210 million in revenue from fees in fiscal year 2017. Pursuant to FASTER legislation, \$10 million of the \$210 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 2017 draft program budgets approved by the Transportation Commission in November 2015. More recent budget data—such as drafts of planning budgets for asset management—are also used when available. The transportation system’s performance is projected primarily in conjunction with annual budget development. Cost and revenue forecasts may change throughout the year.

Update

CDOT's "big three" asset categories—pavement, bridges and maintenance—comprise roughly half the Department's annual budget. As such, the funding and performance of these programs are critical to meeting Department goals. In reviewing this year's report, readers should note the following items that may affect the condition and budgets of these assets.

FAST Act Signed

An act authorizing federal highway, transit and rail programs from 2016-20 was signed into law by President Obama in December 2015. These programs fund much of the work of state transportation departments nationwide, including CDOT. The law—the Fixing America's Surface Transportation (FAST) Act—is the first long-term, comprehensive surface transportation legislation since 2005. FAST is a five-year, \$300 billion bill. Nationwide, the act provides about \$225 billion in contract authority over five years for the federal-aid highway program. The bill continues the previous practice of distributing nearly 93 percent of all federal-aid highway program contract authority to state transportation departments through formula programs.

For Colorado, the bill increases highway-formula funding from \$516 million in 2015 to \$542 million in 2016 and grows to \$592 million in 2020. Over the five years of the bill, this represents an increase of about \$250 million over funding levels provided by the Moving Ahead for Progress in the 21st Century Act, a federal transportation bill passed in June 2012.

The American Association of State Highway and Transportation Officials, a trade group for transportation departments, continues to anticipate funding challenges for transportation departments moving forward. "Long-term, sustainable funding for transportation is yet to be achieved," the association said in a statement on its website. "Because the (FAST) bill relies on \$70 billion of General Fund support, the expected annual gap between (federal) Highway Trust Fund income and spending in 2021 is expected to reach \$20 billion."

Senate Bill 228 Funding Uncertain

Recent forecasts from the Office of State Planning and Budgeting (OSPB) and Legislative Council project that CDOT will receive roughly \$200 million in revenue from state Senate Bill 228 (SB 228) in fiscal year 2016 and \$106 million the following year. Future amounts remain uncertain. The Colorado Legislature in 2009 passed SB 228, which provides funding for

CDOT Flood Recovery Efforts Continue

The Department in early 2016 continues to repair damage to the transportation infrastructure from the September 2013 floods in northern and eastern Colorado. Almost 490 miles of CDOT roadway were affected by the flood event, and 39 roadways were temporarily closed. More than 200 bridges and culverts were damaged. To date, the U.S. Congress has allocated \$450 million in emergency relief funding related to the flood. The balance for the flood recovery program is being shared by CDOT, local agencies and the Office of Emergency Management. As of early 2016, CDOT has completed six permanent repair projects, and 14 more are scheduled to be completed by summer 2018. The design phase for twelve more such projects will be completed, but those projects will not move to construction due to a shortfall in total program dollars. The Flood Program would require \$200 million from the Federal Highway Administration's emergency relief program or other funding to complete full program repairs.

strategic transportation projects through five years of state General Fund transfers if certain economic triggers are met.

Initial forecasts projected CDOT would receive roughly \$200 million per year for five years. But the Department now faces significantly reduced projections for SB 228 funds. This is due to a provision of the law that reduces or eliminates funds in years that the Taxpayer Bill of Rights requires a General Fund refund to taxpayers. Several legislative proposals in early 2016, if successful, may increase the likelihood of SB 228 funding in subsequent years.

The Department in November 2014 identified candidate projects for SB 228 funding. However, the \$306 million expected for fiscal years 2016 and 2017 is dwarfed by the Department's estimated needs. Over the next 10 years, these needs include \$8.6 billion for highway expansion. (*See page 30.*) The Department has identified the Interstate 70 East project, which includes replacing the viaduct in north Denver, for \$180 million of the first \$200 million in SB 228 funding. Ten percent, or \$20 million, will fund transit projects.

CDOT continues to weigh priorities for potential SB 228 funds. The Transportation Commission in January 2016 reaffirmed that a focus on mobility and economic vitality is the appropriate way to prioritize candidate projects.

Asset Management Refinements

The Department's asset models, performance targets and performance metrics have changed significantly since the first Transportation Deficit Report was published in 2009. Cost estimates contained in this report are therefore not comparable to estimates from that period and earlier.

The Department continues to refine its Asset Investment Management System (AIMS) model, which includes bridges, pavement and other assets. AIMS was used to calculate the estimates for bridge costs and conditions used in the Deficit Report, the second year the system has been used for this purpose. The Department continues to improve the system's ability to optimize budgets across assets.

Cash and Program Management Initiative

CDOT continues to develop its Cash and Program Management Initiative. The initiative provides the management infrastructure to implement the cash-based programming and budgeting that allow the Department to maximize the amount of highway preservation and improvements possible.

In 2015, the Colorado Statewide Transportation Improvement Program (STIP) was modified to accommodate cash-management principles. The STIP is a

planning document that identifies transportation projects CDOT intends to fund for the next four years. It is prepared with local governments, including Transportation Planning Regions and Metropolitan Planning Organizations.

Starting with the fiscal years 2016-19 STIP, CDOT will fully update the STIP every four years. In interim years, the original first year of the STIP will drop off, and the Department will add a new fourth year. The new approach will give CDOT more flexibility to move projects between years to best use the cash available to fund those projects.

Incremental funding on large, multi-year construction projects has also been introduced. Previous practice required the full amount of a project to be saved up before spending began. CDOT is currently using incremental funding on construction projects that are valued at more than \$7 million and that cross into at least two fiscal years. These are self-imposed criteria that can be adjusted to meet CDOT's financial needs. Compared to previous practice, the use of incremental funding allows CDOT to advance more projects sooner to construction without additional resources.

RAMP and TRANs Bonds

The conversion to a cash-based approach made it possible for CDOT to support its \$1.5 billion Responsible Acceleration of Maintenance and Partnerships (RAMP) program in recent years. The program has supported the temporary expansion of funding allocated for highway construction projects done in partnership with local governments, operations projects that increase the efficient movement of highway traffic, and preservation projects ("asset management" projects). The Department's target is for RAMP spending to largely end before December 2017.

Also in 2017, retirement of CDOT's Transportation Revenue Anticipation Notes (TRANs bonds) will enable the funds that have been paying those obligations to be redirected to asset management. This will allow CDOT to replace some asset management funds that have been supplied in recent years by RAMP, thereby allowing the Department to continue working toward its asset condition goals, despite severely limited funding. If CDOT were to use the TRANs bonds funds for other purposes, the deficits forecast in this report would grow larger and asset condition would deteriorate more than currently projected.

Policy Directive 14

Goals and visions in this year's report were taken from the Department's Policy Directive 14 (PD-14). The Transportation Commission adopted an updated version of the directive in February 2015. The PD-14 goals include aspirational goals for bridge condition, pavement condition and maintenance service levels for the entire state highway system. The aspirational goals align with CDOT's Risk-Based Asset Management Plan.

Lag of Investment Impact

Investment—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. The effects of that neglect, however, will ripple into subsequent years.

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 pavement quality through a range of techniques that include thin maintenance treatments, rehabilitation techniques and reconstruction.

Overall pavement conditions on the system have been deteriorating since 2005, and that trend is expected to continue in the short term. The Department forecasts that under long-term funding projections—about \$215 million per year on average for the Surface Treatment program—the goal of ensuring that 80 percent of highway system pavement has High or Moderate Drivability Life will be reached around 2031.

CDOT in 2013 began reporting highway pavement condition in terms of Drivability Life. (See sidebar for an explanation of this metric.) Deficit Reports published before 2014 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 helps engineers make project choices that maintain the road quality expected by the public.

The Transportation Commission's goal is for 80 percent of state highway pavement to have High or Moderate Drivability Life. The “vision” condition, or aspirational objective, is for 90 percent of state highway pavement to have High or Moderate Drivability Life.

Drivability Life Ratings

CDOT's methodology for evaluating pavement condition is 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 Condition and Performance Targets by Category, 2015

State Highway System Categories	2015 Pavement Condition (Percentage of pavement with High or Moderate Drivability Life)	Goal	Vision
National Highway System, (NHS) non-Interstate*	78%	80%	90%
Interstate	91%	80%	90%
Entire State Highway System	79%	80%	90%

The chart above shows the percentage of pavement with High or Moderate Drivability Life for various categories of state highway. Drivability Life is a measure of the remaining time that pavement will have acceptable driving conditions.

*Does not include NHS outside of the State Highway System.

The Surface Treatment program ended fiscal year 2015 with 79 percent of pavement on the state highway system with High or Moderate Drivability Life, up from 73 percent the previous year. This 6 percentage point increase in condition was caused by a technical update to the pavement models, not improvement in the condition of pavement on state highways. Specifically, pavement models were updated so that thresholds that define smooth and rough pavement "ride" were better aligned with federal definitions and with Colorado's construction requirements.

Forty percent of CDOT's highways have a Drivability Life of between just four and seven years. Because of this, the Department expects a large amount of additional miles to soon move into the Low Drivability Life category. Optimized models show that the best long-range strategy for CDOT's highways is a preservation strategy. Under this strategy, the agency will focus resources on keeping roads with High and Moderate Drivability Life in good condition by using less expensive maintenance treatments. At the same time, the Department will slowly address more costly repairs on roads with Low Drivability Life.

Due to a change in metrics, no historical data is available for comparing current Drivability Life to conditions before fiscal year 2013. See the chart on the following page for a look at pavement conditions achievable under different funding levels over the next 20 years.

Cost of Sustaining Condition

CDOT in 2015 was just below its goal for pavement condition. The cost of sustaining current conditions is therefore lower than achieving the Department's goal and vision. Achieving the current pavement condition of 79 percent High/Moderate Drivability Life in 2026 will require \$2.5 billion over

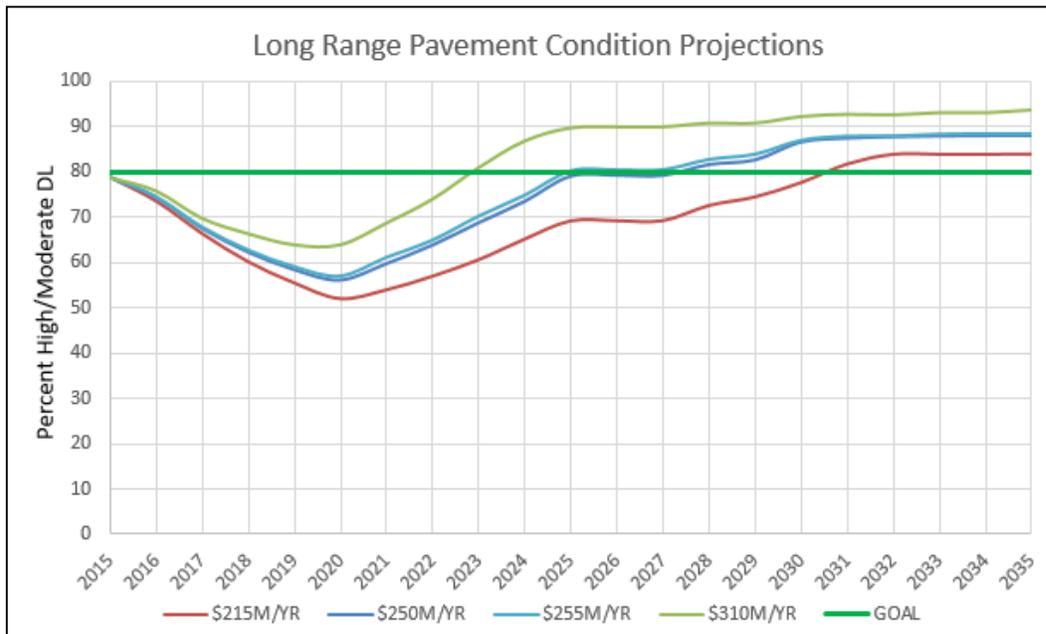


Figure 2: The chart at left shows pavement conditions on the state highway system that are possible under four different funding levels. Average annual budgets for the next 10 years (fiscal years 2017-26) are estimated at just over \$215 million.

the next 10 years, or an average annual budget of about \$250 million. Against the projected budget for the Surface Treatment program for the next 10 years, there is a deficit of \$335 million, or an average of about \$33.5 million per year. (See Figure 4 on page 11.)

Under this estimate, conditions would dip to a low of 56 percent High/Moderate Drivability Life in fiscal year 2020, but return to 79 percent by fiscal year 2025. As previously mentioned, conditions are expected to fall in the near term, because 40 percent of CDOT’s highways have a Drivability Life of between just four and seven years, and the Department is pursuing a preservation-first treatment approach. Under this approach, High and Moderate Drivability Life roads are prioritized over Low Drivability Life roads, due to the cost-effective nature of preservation treatments.

Cost of Achieving Goal

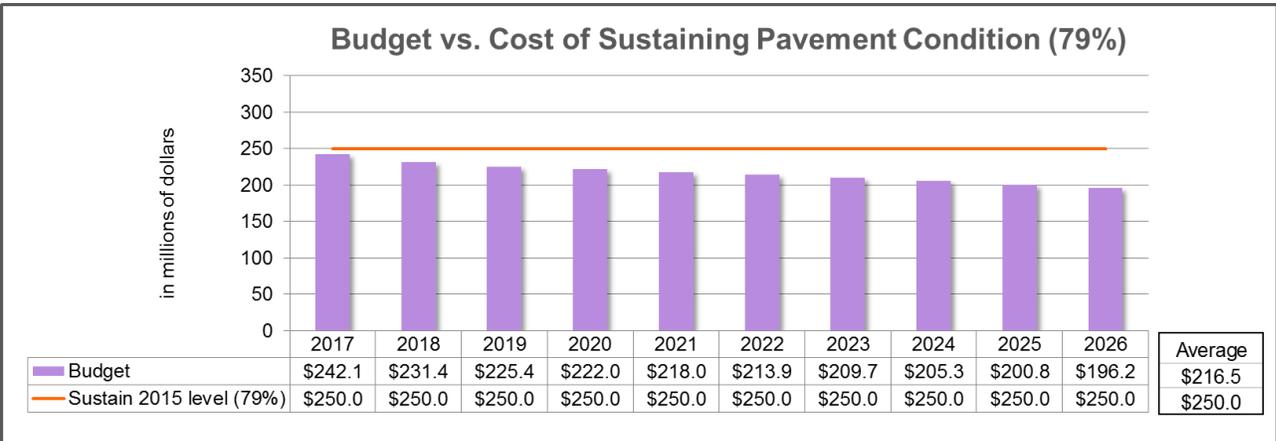
Achieving the Department’s goal of 80 percent High/Moderate Drivability Life in 2026 will require about \$2.55 billion over the next 10 years, or an average annual budget of about \$255 million. Against the projected revenue allocation for the Surface Treatment program for the next 10 years, there is an anticipated deficit of about \$385 million, or an average of \$38.5 million per year. (See Figure 6 on page 11.)

Cost of Achieving Vision

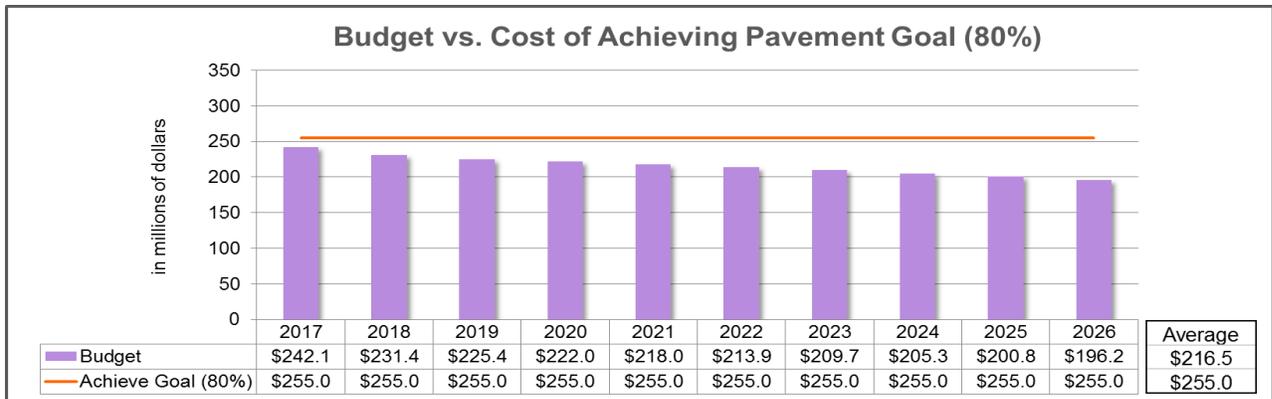
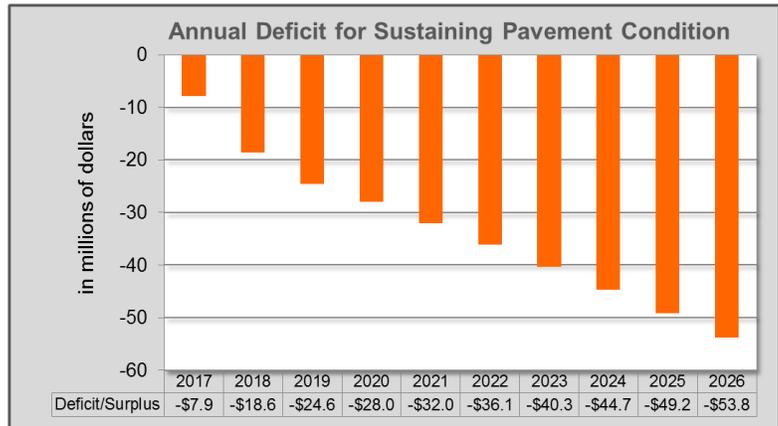
Achieving the Department's vision of 90 percent High/Moderate Drivability Life in 2025 will require about \$3.10 billion over the next 10 years, or an average annual budget of about \$310 million. Against the projected revenue allocation for the Surface Treatment program for the next 10 years, there is an anticipated deficit of about \$935 million, or an average of \$93.5 million per year. (See Figure 8 on page 12.)



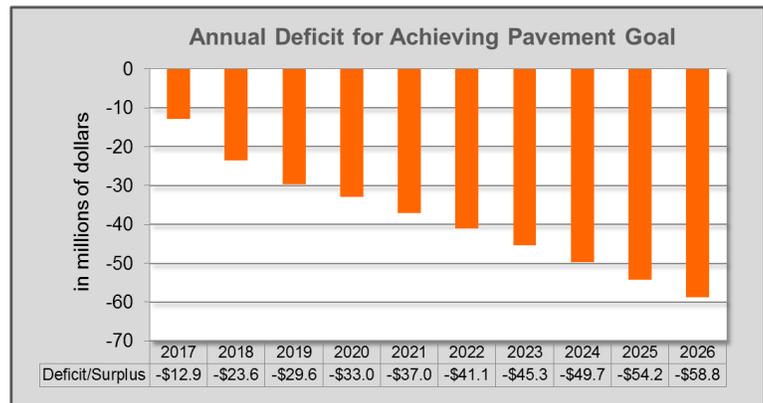
The pavement at left has 11 years of Drivability Life, which is classified as High Drivability Life. At right, just one mile north, is pavement with a Drivability Life of two years due to extensive cracking on the pavement surface. Drivability Life of two years places this pavement in the Low Drivability Life category. Both photos are from State Highway 2C, which forms the northwest boundary of Rocky Mountain Arsenal National Wildlife Refuge.

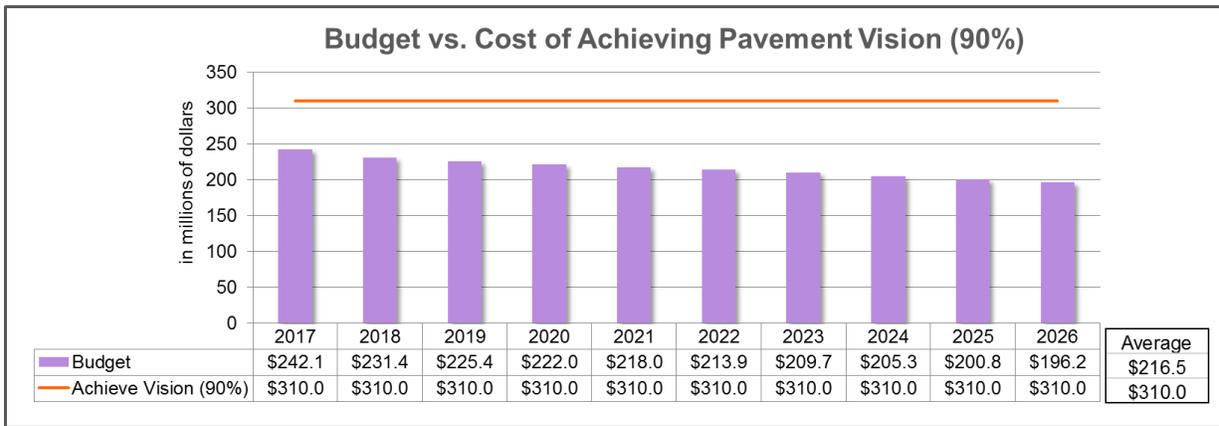


Figures 3 (above) and 4 (right): The chart above shows the cost of sustaining the 2015 condition of pavement on the state highway system within 10 years, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$335 million, or an average of \$33.5 million per year.

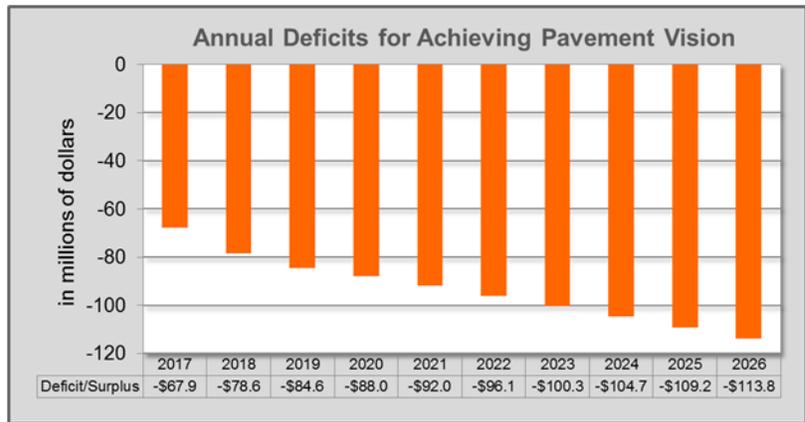


Figures 5 (above) and 6 (right): The chart above shows the cost of reaching CDOT's goal for pavement condition on the state highway system within 10 years, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$385 million, or an average of \$38.5 million per year.





Figures 7 (above) and 8 (right): The chart above shows the cost of reaching CDOT's vision for pavement condition on the state highway system within 10 years, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$935 million, or an average of \$93.5 million per year.



Factors Contributing to Costs

For a general discussion of inflationary pressures facing CDOT's construction program, see page 30. Below are factors that drive surface treatment 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.

In 2015, the Department's Pavement Management Technical Committee performed an in-depth review of the treatment costs to update the assumptions used by the pavement performance models. The committee reviewed recently completed construction projects and estimates for upcoming projects. As a result, modeled costs for surface seals and rehabilitation treatments increased.

Treatment Type	Lane Mile Cost	
	2014	2015
Surface Seal	\$38,720	\$52,800
Ultra-thin overlay	\$140,800	\$140,800
Preventive Maintenance	\$49,280	\$49,280
Minor Rehabilitation	\$214,720	\$246,400
Major Rehabilitation	\$369,600	\$422,400
Reconstruction	\$992,640	\$992,640

Figure 9: Treatment costs used in CDOT's pavement models increased in 2015.

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 on state highways and the wear and tear on pavement surfaces.

In 25 years, there will be just under eight million Coloradans. That's a population increase of about 47 percent from 2015-40. There will be 4.5 million jobs by that time, an increase of 42 percent from current levels, according to a Colorado State Demography Office estimate in 2015. Although the number of miles per capita traveled in Colorado is expected to remain flat, the increase in population and employment means the demand for travel will increase by about 47 percent. Such growth puts unique demands on our transportation system.

Colorado's highest population growth is anticipated to occur primarily along the North Front Range in Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer and Weld Counties, along with Mesa County, from 2010-40, according to the Demography Office. Highway corridors located in the counties listed above and identified as experiencing some level of traffic congestion (based on having a volume-to-capacity ratio greater than 0.85) include, but are not limited to:

- Interstate 25
- Interstate 70
- Interstate 76
- Interstate 225
- Interstate 270
- State Highway 7
- State Highway 470
- U.S. Highway 24
- U.S. Highway 34
- U.S. Highway 36
- U.S. Highway 85

Surface-Treatment Approach Varies by Road Category

CDOT prioritizes roads into four categories that define potential surface-treatment options. The best option is determined based on Drivability Life ratings, treatment costs, and site-specific design variables. This approach to Surface Treatment improves cost-effectiveness and 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.

- U.S. Highway 287

Vehicle size and weight. Vehicle size and weight dictate the design requirements 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 annual average daily traffic or of increased truck traffic due to commercial, manufacturing or energy development can alter the projected impacts. When land-use patterns change 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 can increase the number of vehicle miles traveled 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.



An asphalt paver places fresh, uncompacted asphalt pavement near the Twin Tunnels east of Idaho Springs.

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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 preventive 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 preventive-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.

Looking Ahead

2015 was the third year for CDOT to use the Drivability Life metric for reporting pavement condition. Lower-cost treatment strategies introduced at the same time as the metric are helping CDOT increase the number of lane miles it treats each year. Ongoing refinements to Drivability Life calculations will continue as the Department gains experience with the metric.

Managing Bridges

CDOT's Bridge program maintains 3,439 major vehicular bridges on the state highway system. These bridges have a total deck area of 33.2 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 five years has been:

- 2011: 92 percent.
- 2012: 93 percent.
- 2013: 94 percent.
- 2014: 94 percent.
- 2015: 94 percent.

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

Improvement in bridge condition from 2011-15 is primarily due to replacements funded by the Colorado Bridge Enterprise, which operates as a government-owned business within CDOT. (See below for more on the Bridge Enterprise.)

The Transportation Commission's fiscally constrained goal 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 aligns with the minimum condition that the Federal Highway Administration, in a Notice of Proposed Rulemaking, has proposed for bridges on the National Highway System. CDOT will achieve the goal through a mix of preventive maintenance strategies, bridge repair/rehabilitation, and bridge replacements.

CDOT's "aspirational objective" for bridge condition is for 95 percent of deck area on the entire state highway system to be Not Structurally Deficient.

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.

Reporting Bridge Condition

CDOT uses National Bridge Inventory standards established by the Federal Highway Administration to inventory, inspect, classify and report 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. They also often have one or more damaged or deteriorated structural members, such as a girder, truss or deck.

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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A bridge must be in "Poor" condition to be eligible for Bridge Enterprise funding. Bridges in Poor condition have a Sufficiency Rating of less than 50 (out of 100) and a status of Structurally Deficient or Functionally Obsolete. (See sidebar.)

From the creation of the Bridge Enterprise in 2009 until mid-January 2016, 192 bridges statewide had become eligible for funding through the enterprise. Of those, 119 have received FASTER funding, 34 structures had other funding sources, and funding had not been determined for the remaining 39 bridges.

As of January 2016, the status of the 192 bridges eligible to receive FASTER funding was as follows: 120 bridges had been repaired or replaced; 39 bridge projects were waiting to be scheduled or to have an action plan determined; 19 bridges were in construction; 12 bridges were in the design stage; and two bridge designs were completed and awaiting to go to construction.

A list and map of current FASTER bridge projects is at www.coloradodot.info/programs/BridgeEnterprise.

CDOT anticipates that the Bridge Enterprise will contribute much of the funding for the Interstate 70 viaduct replacement project east of downtown Denver. The current cost estimate for the portion of the project stretching from Interstate 25 to Chambers Road is \$1.17 billion. This includes the viaduct replacement and a new tolled express lane in each direction.

In the analyses that follow, \$50 million per year for fiscal years 2017-26 was assumed to represent the Bridge Enterprise fund contribution and financing for the viaduct. Current financing proposals limit the maximum impact to bridge funds for this project to \$850 million. The remaining funding would come from Senate Bill 228 funds (see page 3 for more on SB 228), a Transportation Infrastructure Finance and Innovation Act (TIFIA) loan, the Denver Regional Council of Governments (DRCOG) and the City of Denver.

Risk-Mitigation Goals for Bridges

While CDOT's primary performance metric for reporting bridge condition is the percentage of deck area that is Not Structurally Deficient, the Department also has metrics and targets related to

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Under a rule proposed by the Federal Highway Administration, no more than 10 percent of a state's bridge-deck area on the National Highway System can be Structurally Deficient. If a state misses this goal for three consecutive years, certain federal funds must be used by the state on projects for bridges on the NHS, according to an FHWA fact sheet.

CDOT's target for bridge condition aligns 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.

*A major vehicular bridge that is **Not Deficient** will be a candidate for preservation actions many times during its service life. 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

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bridge risks. These targets are identified in the Department's updated Risk-Based Asset Management Plan and the Transportation Commission-approved Policy Directive 14.

The cost of addressing these risks are included in CDOT's estimates of the cost to meet its goals and vision in the following pages. These risks include:

- **Bridges with vertical clearance lower than the minimum design requirement of 16 feet.** Such bridges are at risk from sustaining repeated hits from commercial vehicles.
- **Bridges with vertical clearance lower than the statutory maximum vehicle height of 14.5 feet.**
 - **Load-Restricted Bridges**, which are bridges whose current capabilities to support extra-legal highway loads are inadequate. These bridges restrict extra-legal weight commerce (i.e., permitted overweight vehicles) movement throughout our state.
 - **Load-Posted Bridges**, which are bridges whose current capabilities to support legal loads are inadequate. These bridges restrict legal load weight vehicle commerce movement throughout our state.
 - **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.
 - **Bridges with leaking expansion joints.**
 - **Bridges with unsealed or otherwise unprotected deck area.**

The number of load-posted bridges has increased compared to numbers cited in last year's Deficit Report, while the number of load-restricted bridges declined. These changes occurred due to reclassifications that were part of a ratings review of selected structures in calendar year 2015. The number of scour-critical bridges also decreased, which was due to scour-mitigation efforts that were conducted as part of CDOT's bridge repair projects. For CDOT's current performance and targets for performance metrics related to bridge risks, see figure 10 on the following page.

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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.

Bridge Risk Metric	Current Performance	Fiscally-Constrained Target	Aspirational Target
Percentage of bridges over Interstates, U.S. Routes and Colorado state highways with vertical clearance lower than 16 feet	4.8%	4.8%	2%
Percentage of bridges over Interstates, U.S. Routes and Colorado state highways with vertical clearance lower than 14.5 feet	0.4%	0.4%	0%
Percentage of CDOT-owned bridges that are load-restricted	1.3%	3%	1%
Percentage of CDOT-owned bridges that are load-posted	0.2%	0%	0%
Percentage of CDOT-owned bridges over waterways that are scour-critical	6.5%	5%	1%
Percentage of CDOT-owned bridges with leaking expansion joints	18.8%	15%	5%
Percentage of CDOT-owned bridges with unsealed/otherwise unprotected deck area	31%	30%	5%

Figure 10. Listed above are CDOT's risk-mitigation goals for bridges, which are taken from the Department's Risk-Based Asset Management Plan.

Cost of Sustaining Condition

The cost to sustain the current bridge condition of 94 percent Not Structurally Deficient is about \$1.60 billion over 10 years, which would require an average annual budget of about \$160 million. Compared to forecast bridge program budgets, including the FASTER Bridge Enterprise Special Revenue Fund, CDOT projects a 10-year surplus of about \$43 million, or an average of \$4.3 million annually. (See Figure 12 on page 21.) Should such a budget surplus materialize, CDOT would direct those funds to risk-mitigation efforts.

Included in the estimate is \$50 million per year to help finance replacing the Interstate 70 viaduct. The estimate for sustaining conditions does not include costs for meeting CDOT's risk-mitigation targets for bridges.

This year's "sustain" analysis—as well as the "goal" and "vision" analyses below—includes updates to the Bridge Enterprise revenue forecast and the bridge condition forecasting model, including updates to treatment costs.

Cost of Achieving Goals

The cost to achieve CDOT's fiscally constrained goals for bridge condition and mitigation of bridge risks on the state highway system at the end of 10 years is about \$769 million, or \$76.9 million per year. Compared to projected budgets, this forecasts a 10-year surplus of about \$873 million, or an average of \$87.3 million annually. (See Figure 14 on page 21.) This is due to the fact that CDOT is currently exceeding its main bridge condition goal for 90 percent of deck area to be Not Structurally Deficient. Should such a budget surplus materialize, CDOT would direct those funds to additional risk-mitigation efforts.

Included in the 10-year cost estimate is \$50 million per year to help finance replacing the Interstate 70 viaduct. Replacing the viaduct is a significant component of the cost of keeping deck area at the target level. Risk-mitigation costs of \$4.8 million per year also are included in the estimate for the goal.

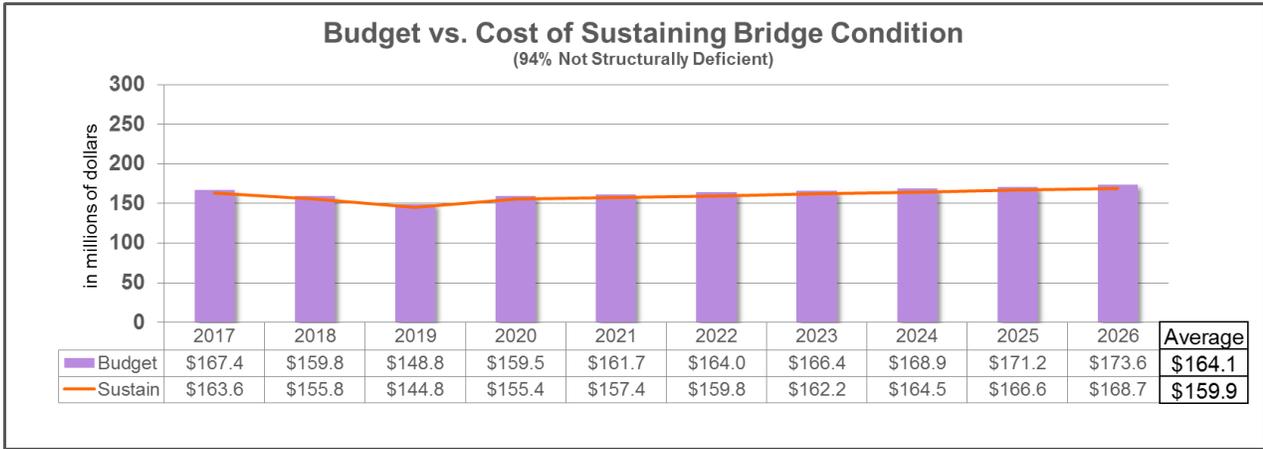
Cost of Achieving Visions

The cost to achieve CDOT's visions for bridge condition and mitigation of bridge risks is about \$2.42 billion over 10 years, which would require an average annual budget of about \$242 million. Compared to projected budgets, this forecasts a 10-year deficit of about \$778 million or an average of \$77.8 million annually. (See Figure 16 on page 22.)

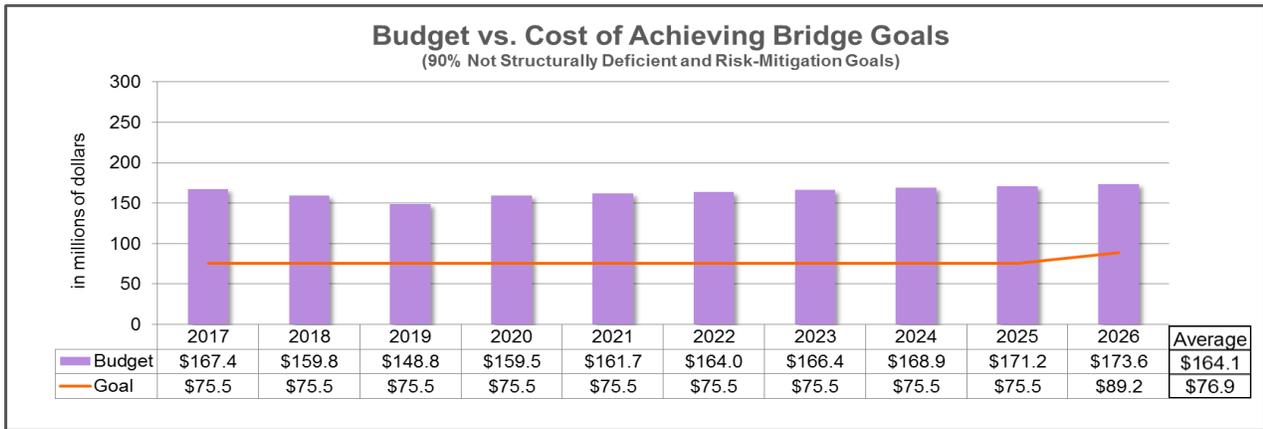
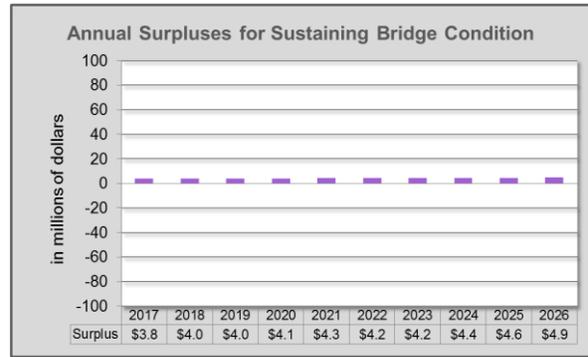
Included in the 10-year cost estimate is \$50 million per year to help finance replacing the Interstate 70 viaduct. Risk-mitigation costs of \$42.4 million per year also are included.



Bridge over the Purgatoire River in southern Colorado.

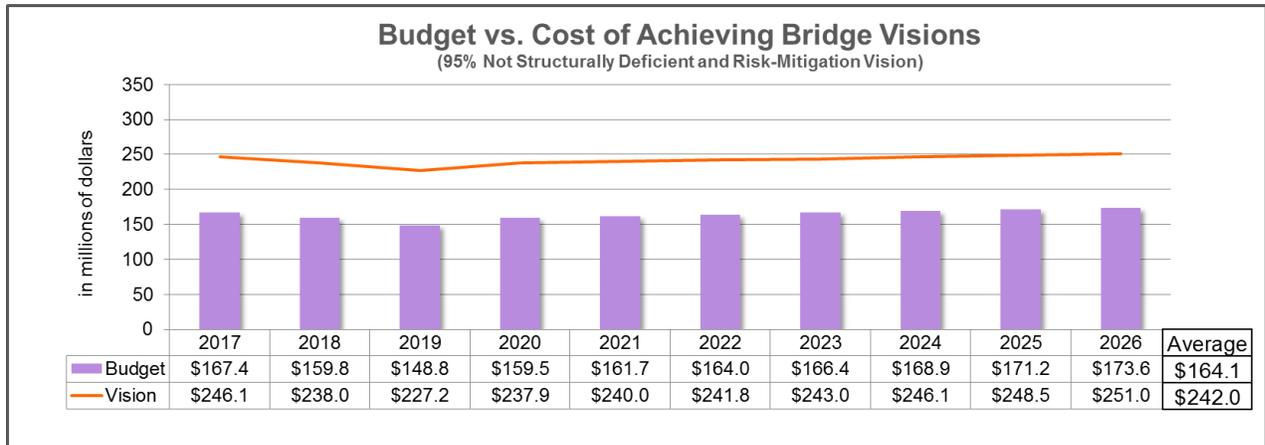


Figures 11 (above) and 12 (right): The chart above shows the cost of sustaining 2015 bridge conditions as compared to anticipated funding. As shown at right, the surplus over 10 years is about \$43 million, or an average of \$4.3 million per year.

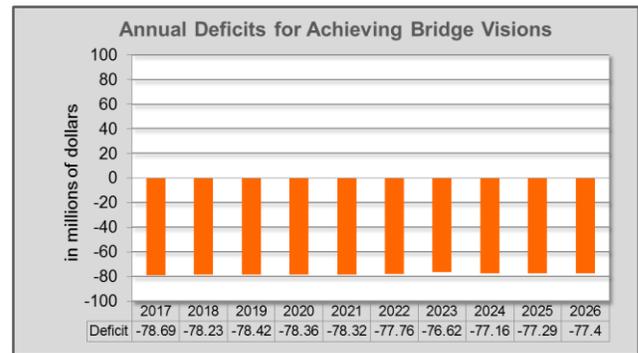


Figures 13 (above) and 14 (right): The chart above shows the cost of achieving the fiscally constrained goal for bridge condition, as compared to anticipated funding. As shown at right, the balance over 10 years is a projected surplus of about \$873 million, or an average of \$87.3 million annually. Should such funds remain after meeting the goal, the Department will direct them toward meeting its vision targets for bridges.





Figures 15 (above) and 16 (right): The chart above shows the cost of meeting the bridge visions as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$778 million, or an average of \$77.8 million per year.



Factors Contributing to Costs

For a discussion of inflation facing CDOT’s construction program, see page 30.

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 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 traffic volumes over time and can result in weight restrictions. Scour is the most common cause of bridge failure. CDOT faces a significant number of scour-critical bridges, which are bridges whose foundations are at risk of failure due to erosion. The Federal Highway Administration defines scour as "the result of the erosive action of flowing water, excavating and carrying away material from the bed and banks of streams."
- 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 necessitates repair. Seven on-system bridges required essential repairs in fiscal year 2015 after sustaining such hits. 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 Division of Highway Maintenance, has a proposed fiscal year 2017 budget of \$263 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 fiscal years 2016 and 2017, the Department forecasts overall Maintenance Levels of Service grades of C and C+, respectively. These projections are estimates of what can be achieved with current funding levels. The goal in the Transportation Commission’s Policy Directive 14 is a B-.

The Transportation Commission also sets a vision, or “aspirational objective,” in Policy Directive 14. Achieving the current vision—a B in overall Maintenance Levels of Service over the next 10 years—would require significantly more resources than the goal. Separately, the commission has set goals for Snow and Ice Control. The 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 and B- for Overall Maintenance for fiscal year 2015.

Cost of Achieving Goal/Sustaining Conditions

The cost of sustaining a B- for Maintenance Levels of Service over the next 10 years is \$3.01 billion, requiring an average annual budget of \$301 million. Against anticipated program budgets, this forecasts a 10-year deficit of about \$178 million, or an average of \$17.8 million annually. (*See Figure 18 on page 26.*)

Because it achieves a B- grade for overall Maintenance Levels of Service, sustaining current conditions also meets CDOT’s goal.

Cost of Achieving Vision

The cost to achieve CDOT’s vision of a B for Maintenance Levels of Service over the next 10 years is \$4.08 billion, requiring an average annual budget of \$408 million. Against anticipated program budgets, this

How CDOT Rates Maintenance

CDOT’s maintenance program is designed to keep the state highway system open and safe for the traveling public. Maintenance activities are separated into nine Maintenance Program Areas (MPAs):

The Roadway Surface area includes patching and sealing potholes and blading unpaved surfaces.

The Roadside Facilities area includes cleaning drainage structures, repairing eroded slopes and repairing guardrails.

The Roadside Appearance area includes controlling vegetation, sweeping roadway surfaces and trash removal.

The Traffic Services area includes maintaining roadway signs and striping, maintaining traffic signals and maintaining roadway lighting.

The Structure Maintenance area includes painting bridges, repairing expansion joints and patching decks.

The Snow and Ice Control area includes plowing snow and avalanche control.

The Equipment and Buildings area includes maintaining rest areas, storage sheds, laboratories, offices and more.

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forecasts a 10-year deficit of about \$1.24 billion, or an average of \$124 million annually. (See Figure 20 on the following page.)

This estimate achieves a B in all individual Maintenance Program Areas every year of the 10-year analysis.

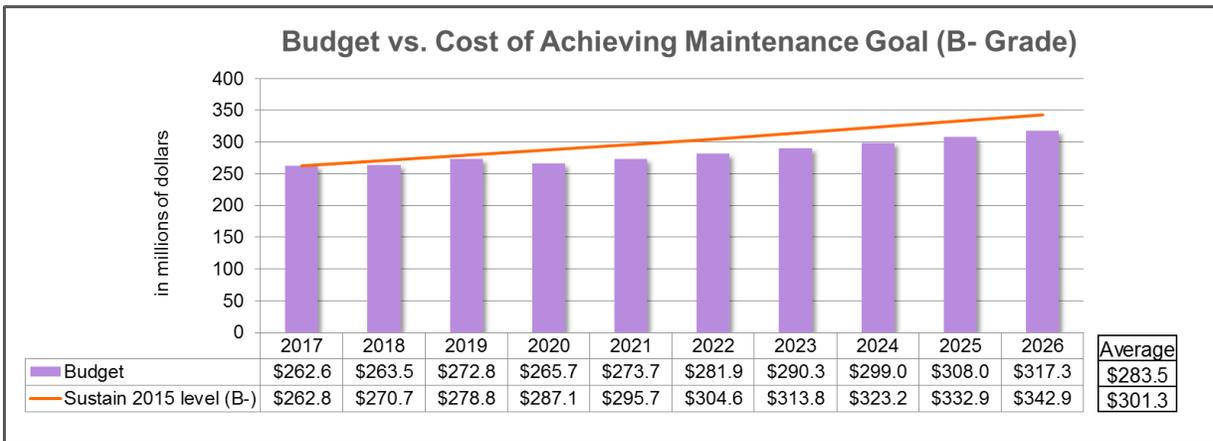
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*The **Tunnel Activities** area includes tunnel operations.*

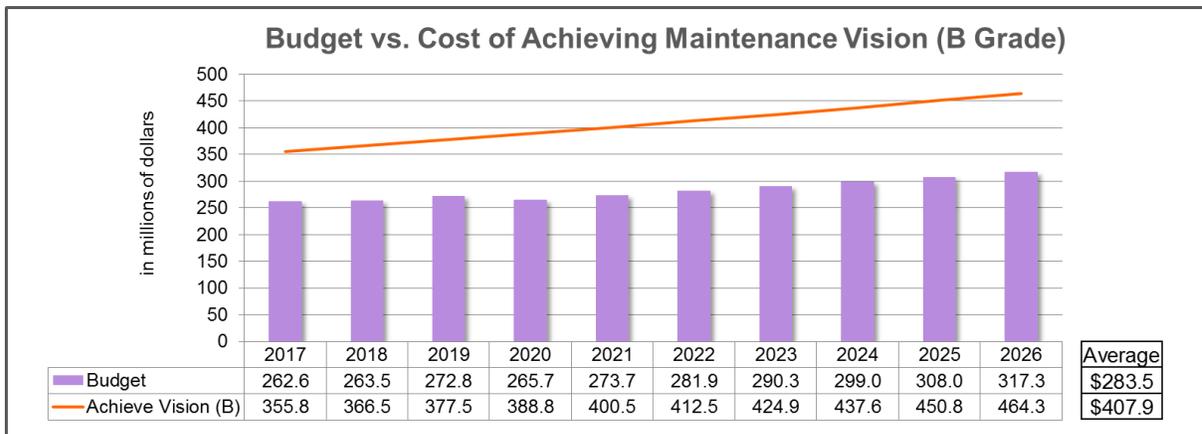
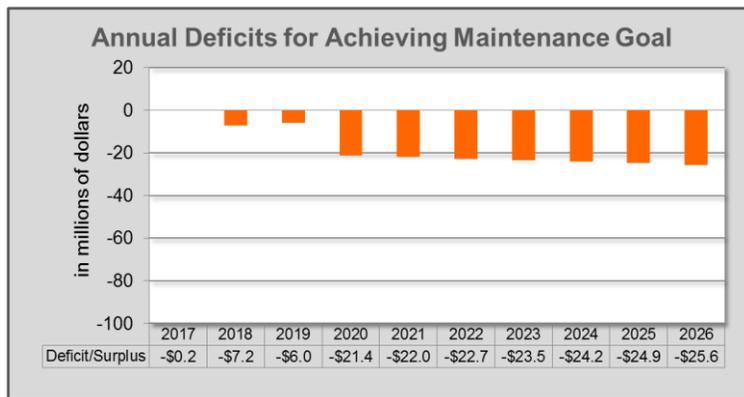
*The **Planning and Scheduling** area includes performance budgeting and maintenance staff training.*

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.

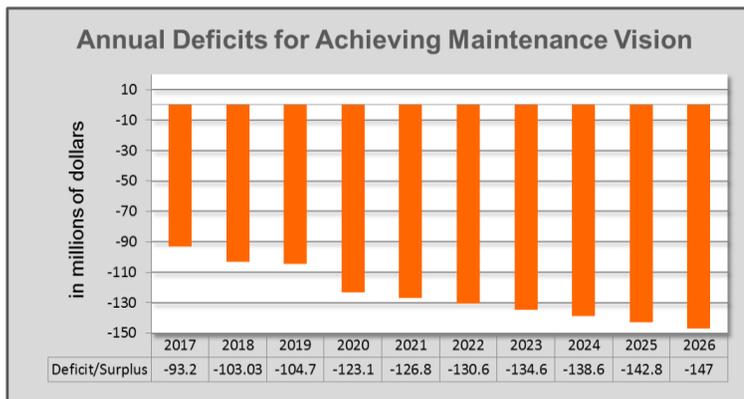
The MLOS budget process consists of a survey of existing conditions, most recent costs and a recommendation of funding to reach the goal set by the Transportation Commission.



Figures 17 (above) and 18 (right):
 The chart above shows the cost of achieving the goal of B- for Maintenance Levels of Service, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$178 million, or an average of \$17.8 million per year. This estimate also sustains the current maintenance grade, which was a B- in fiscal year 2015.



Figures 19 (above) and 20 (right):
 The chart above shows the cost of achieving the vision of B for Maintenance Levels of Service, as compared to anticipated funding. As shown at right, the deficit over 10 years is about \$1.24 billion, or an average of \$124 million per year.



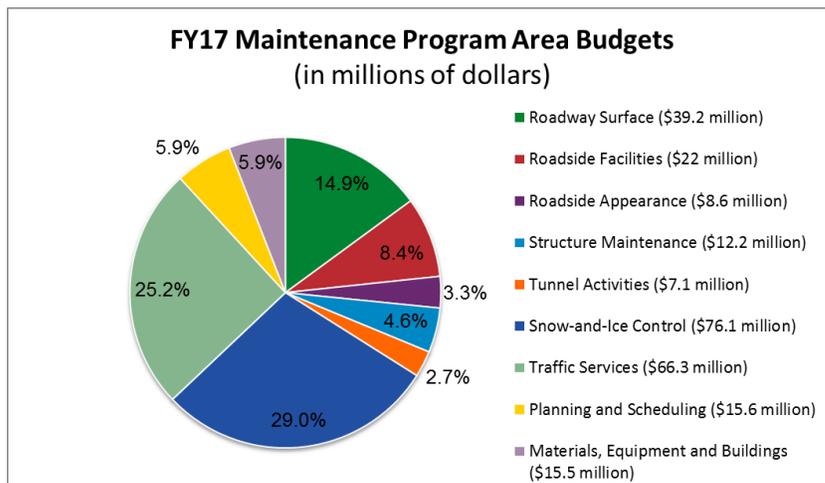
Factors Contributing to Maintenance Costs

Several 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 grade depends on the grade the previous year. If other factors are unchanged, achieving a high grade instead of a low grade in a given year makes it less expensive to achieve a particular grade the subsequent year. For example, it is less expensive to achieve a B if one achieved an A the previous year than if one achieved a D.
- The cost to achieve an overall maintenance grade is dependent on the mix of grades achieved in individual Maintenance Program Areas.
- An annual inflation rate of 3 percent is used for the 10-year cost projections shown on the previous page.
- Funding levels for the Surface Treatment and Bridge programs over time can significantly affect the Maintenance program. Maintaining roads and bridges that are in poor condition can be more expensive than doing the same for assets in better condition.

Weather conditions heavily affect the cost of snow and ice removal and roadway surface conditions. Due to high snowfall, for example, the Department may spend more on snow-and-ice control and still achieve a low Level of Service. Fuel prices and labor also are significant components of nearly all maintenance activities.

Figure 21. Maintenance Program Area Budgets



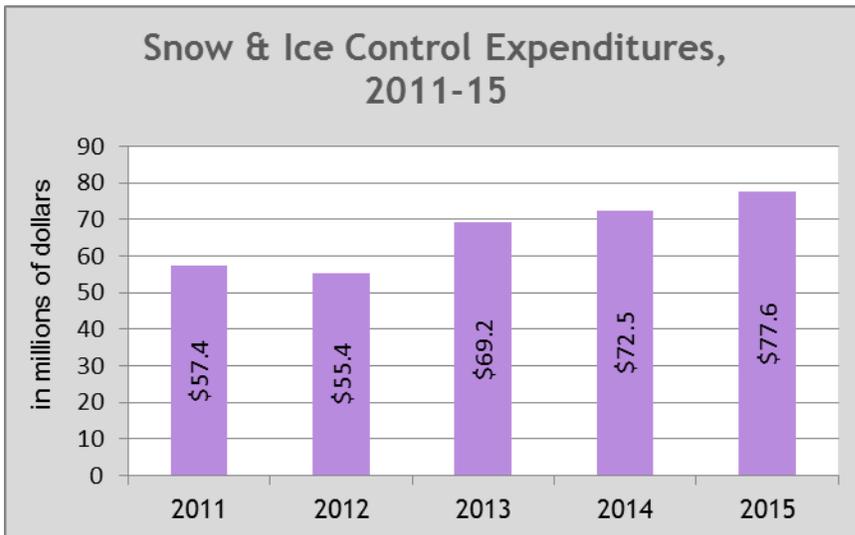


Figure 22. Spending on snow-and-ice control has increased 35 percent in the past five years.

As depicted in Figure 21 (see previous page), snow and ice control is almost a third 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. Sand used by local jurisdictions carries over to highways and accelerates stripe deterioration. Conversely, funds that provide for new construction or reconstruction of transportation infrastructure have a positive impact on the maintenance program, because new infrastructure requires less maintenance than aging infrastructure.

Keeping roads clear of snow and ice is expected to cost the Department \$76.1 million in fiscal year 2017, according to CDOT’s proposed budget. 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 over the past 15 years due to factors including the expense of de-icing materials and snow-fighting technology such as RWIS (Road Weather Information System) and MDSS (Maintenance Decision Support System). The Department has made such investments to increase future efficiencies. The average cost per plow mile was \$11.54 in fiscal year 2015, up from \$5.31 in 2001. Among the factors that have contributed to this increase are higher equipment costs and the expense of meeting higher performance expectations.

Population growth and distribution. Population growth and growth in Vehicle Miles Traveled (VMT) are significant factors in the cost of maintenance efforts. Population distribution also plays a key role. 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 number of Equivalent Single Axle Loads (ESALs) 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 further strain maintenance resources.



Corridor Vision

As part of the 2040 Colorado Statewide Transportation Plan, CDOT compared its 25-year needs to an estimate of transportation revenue available over the same period. Needs identified by CDOT for 2016-40 totaled \$46.0 billion. About \$20 billion of the \$46 billion need is related to expanding the transportation system. Meanwhile estimated revenue totaled \$21.1 billion, resulting in a funding gap of \$24.9 billion for the 25-year period.

For the next 10 years alone (2016-25), CDOT estimated needs of \$19 billion, with about \$8.6 billion of that related to expansion. The anticipated funding gap to reach the \$19 billion is about \$8.8 billion. The \$8.6 billion expansion estimate is an aggregate figure that includes all of Colorado's Transportation Planning Regions. The estimate was determined by incorporating information from 2040 or 2035 Regional Transportation Plan documents published by the planning regions and by Metropolitan Planning Organizations; from lists of needs developed by the planning regions; from CDOT Region project lists and data; and from other project lists.

As described elsewhere in this report, CDOT's current revenues are insufficient to sustain the condition of the transportation system. As such, the analysis of expansion needs included needs beyond what can be funded with existing resources. Expansion investments increase the capacity of (or significantly improve the functioning of) the multi-modal transportation system by enhancing existing facilities or creating new infrastructure and services. Such investments are generally related to achieving a vision for transportation in Colorado, rather than more routine investments that maintain existing conditions.

Rising Construction Costs

Colorado's economy has rebounded from the recession that ended in 2009 and continued to perform well in 2015. Growth in the state's Gross Domestic Product (GDP) was slightly above the national average in 2015, and Colorado's unemployment rate fell to its lowest point since the recession. The housing and professional sectors—the second- and third-largest sectors of the economy in terms of GDP—showed strong growth last year. Fueled by high consumer and business confidence, the construction sector is booming, responding to growing demand in residential and non-residential building and other infrastructure construction.

According to the U.S. Census Bureau, the transportation sector represents about 30 percent of public construction spending nationwide. In Colorado, CDOT has a significantly greater share of the public construction market. Excluding the price of oil, prices for major construction items increased

significantly in 2015. The increase in construction demand and the prices of major construction items led to a rise in the cost of project delivery for CDOT. Estimated inflation, based on the Colorado Construction Cost Index, was about 6 percent in calendar year 2015 compared to 2014.

Project-level analysis shows that CDOT in 2015 advertised about the same number of projects as in 2014. The average number of bidders for a project was also about the same, although lower than in 2013 and earlier years. In general, a lower number of bidders on a project results in higher average bids. Consequently, the average lowest bid was higher than CDOT's engineering estimate in 2015. These findings indicate that the market is saturated, and that contractors already have committed their capacity to other projects. To counter cost increases, CDOT in some cases has combined projects for cost efficiencies. The Department also has reduced project scopes, advertised projects at strategic times to obtain lower bids, and employed alternative project-delivery methods.

Mitigating Costs

CDOT expects financial resources for adding lane capacity or other expansions will remain limited. The high cost of transportation infrastructure and limited state and federal budgets make it critical to extract the most benefit possible from existing infrastructure. The Department is responding with multiple strategies to reduce costs, curb the growth of Vehicle Miles Traveled and increase mobility.

Increasing Operational Efficiencies

As part of such efforts, CDOT formed its Division of Transportation Systems Management & Operations (TSM&O) in 2013. The division focuses on implementing low-cost, high-value operational improvements that delay the need for highway expansion. Travel-time reliability and safety are greatly influenced by factors including traffic incidents and crashes, adverse weather, poor signal timing, bottlenecks, work zones and special events. Some strategies used to manage these factors are described below:

- CDOT's Traffic Incident Management program helps remove crashes and other incidents from the road. This helps highways return to pre-incident operating speeds. CDOT employs its Courtesy Patrol in the Interstate 70 Mountain Corridor and on Interstate 25 in the Denver metro area. The patrol locates and clears traffic-related incidents and provides roadside assistance. CDOT's Heavy Tow program removes distressed commercial motor vehicles from the Interstate 70 Mountain Corridor.
- CDOT implements programs for improved traveler information to help with operations, explain road closures, and provide real-time detour

suggestions. The Colorado Traffic Management Center provides continuous camera coverage through www.cotrip.org. The center also operates the 511 phone line to provide updates on traffic conditions. CDOT offers a free mobile application that provides information on highway conditions and closures. Other information is provided through Twitter and Facebook. These programs can reduce travel demand at peak times as travelers modify their behavior. The Department uses Intelligent Transportation Systems (ITS) devices, such as pavement friction sensors, to provide real-time weather and roadway information to travelers.

- CDOT manages traffic through variable speed limits, toll lanes and High Occupancy Vehicle (HOV) lanes. The Department has operated the seven-mile Interstate 25 reversible lane north of Denver for several years. This lane has toll prices that depend on conditions. In July 2015, CDOT and a concessionaire opened managed lanes on U.S. Highway 36. In December 2015, CDOT opened tolled express lanes on Interstate 70. These lanes have produced improvements in mobility.
- CDOT's Active Traffic Management (ATM) strategies seek to increase vehicle throughput and safety on our highways through the use of integrated systems with new technology, such as dynamic routing, dynamic junction control, ramp meters, adaptive signal control and transit signal priority. To date, CDOT has installed 40 ramp meters in several areas to manage inflow demand on Interstate 70, from Vail to C-470, and on Interstate 25 in the Denver metro area.

Other Strategies

In addition to deploying the operational tools already mentioned, CDOT and other transportation agencies in Colorado are employing many other strategies to mitigate costs or increase the efficiency of our highways. These include:

Leveraging emerging technologies. Connected and autonomous vehicles represent great promise for increasing safety, reducing congestion and mitigating the impacts of vehicle emissions. Such benefits will likely outweigh the required technological investments if—as some experts predict—these systems double or triple the capacity of existing roadways. Nevertheless, the upfront investment in roadway striping and other infrastructure for autonomous vehicles could further strain the budgets of transportation departments.

CDOT's RoadX program aims to use new innovations to achieve crash-free, injury-free, delay-free and technologically-transformed travel. RoadX projects will combine public and private efforts to implement innovative Intelligent Transportation Systems and prepare CDOT for the more widespread use of connected, automated and autonomous vehicles. As an example, coordinated ramp metering between Interstate interchanges with

arterial traffic signal operation on Interstate 25 is currently in design under the Interstate 25 Managed Motorways Project. CDOT also plans to develop peak-demand managed corridors that use precise, real-time data to reduce congestion and improve the safety of freight transport.

Encouraging transit. CDOT also promotes transit service to help increase mobility, reduce congestion and mitigate factors that increase transportation costs. 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, the first Statewide Transit Plan was initiated. According to the American Public Transportation Association, costs related to congestion in almost 500 urban areas nationwide were a combined \$21 billion lower in 2011 than they would have been without public transportation, which includes buses, light rail, subways and other transportation modes.

Nationwide, ridership of public transit has risen 39 percent since 1995, the association said on its website—faster than both population growth and vehicle miles traveled. In Colorado, total transit ridership rose 7 percent from 2010-13, from 115 million trips to 123 million trips.

CDOT continues to be the recipient of Federal Transit Administration grants for Colorado's rural and small urban areas. These funds are distributed and administered by the Division of Transit & Rail to local transit providers statewide. The Division also administers \$15 million in FASTER transit funds, which includes \$10 million for statewide investment and \$5 million for regional investment.

In 2015, the Department launched Bustang. An interregional transit service operated by a private vendor, Bustang provides express bus service along Interstate 25, connecting Fort Collins to Denver and Colorado Springs to Denver. In the Interstate 70 corridor, Bustang connects Glenwood Springs, Eagle County, Vail and Frisco to Denver. The service connects the state's six largest transit agencies, using Denver Union Station as a hub. In fiscal year 2015, Bustang began receiving \$3 million annually in FASTER Statewide Funds to cover operations, maintenance and capital needs. The Bustang budget going forward also will include fares collected during operation. For the first six months of fiscal year 2016, Bustang collected enough fares to offset 38 percent of operating costs.

Encouraging vanpools. CDOT regularly encourages alternatives to single-occupancy vehicles. For example, through federal Congestion Mitigation and Air Quality (CMAQ) grants, the Department has provided \$1.9 million to the Denver Regional Council of Governments to fund Way to Go, a regional commuter vanpool program. As another example, CDOT's Division of Transit and Rail is providing a total of about \$426,000 in fiscal years 2016 and 2017 to

the North Front Range Transportation and Air Quality Planning Council for vanpool vehicle replacement.

Economic incentives. EcoPasses, sold by the Denver-based Regional Transportation District, offer unlimited rides on buses and light rail. The employer-sponsored annual passes can be paid for by employers or employees, or the cost can be shared. EcoPasses can reduce the number of commuting miles driven in personal vehicles. Savings in parking, fuel and vehicle costs are incentives for workers to use the passes. The passes can be bought with pre-tax money, which can lower payroll taxes and taxable income, according to the district's website.

Land-use policies. Increases in the growth of passenger vehicle travel is heavily influenced by land-use planning, but such planning is almost completely outside the control of state government. As people move increasingly farther from work centers and commercial nodes, the result is longer average trip lengths and greater infrastructure needs. Low-density development and inefficient development patterns that lack connectivity can limit the availability and use of transit, as well as bicycle and pedestrian facilities.

Telecommuting and teleconferencing. Telecommuting "occurs when paid workers reduce their commute by carrying out all, or part of, their work from their normal place of business, usually from home or a telework center," according to the Federal Highway Administration's website. About 6.5 percent of Coloradans worked from home in 2014, compared to 4.4 percent for the entire United States, according to U.S. Census numbers.

According to the Federal Highway Administration's website, however, "there is little literature about the effectiveness of public sector programs to promote telework, and there appears to be no literature that links the costs of public investment in telework programs to resulting declines in [Vehicle Miles Traveled]."

Conclusion

The demand in Colorado for smooth pavement, sound bridges and regular highway maintenance is outpacing CDOT's revenue growth. Even maintaining current conditions would lead to deficits in the scenarios described in this report, and would leave little to no funding for expansion.

In summary, CDOT projects a 10-year deficit of \$470 million to maintain current performance for bridges, pavement and maintenance service levels. Reaching the Department's "vision" targets for these assets would lead to a 10-year deficit of \$2.96 billion.

Because the Department lacks sufficient funds to achieve its vision, CDOT also has established lower, fiscally constrained targets for bridges, pavement and maintenance. Achieving these targets would result in a budget surplus for bridges over the next 10 years, but the pavement and maintenance programs would still face deficits. What's more, this would entail allowing bridge conditions to fall to 90 percent Not Structurally Deficient. For National Highway System bridges maintained by the Department, this condition level is just one percentage point above that at which penalties may be imposed under the National Highway Performance Program. Should CDOT have additional funds available after meeting its fiscally constrained targets for bridges, the Department will direct those funds toward meeting its vision targets for bridges.



The ability of federal and state fuel taxes to provide sufficient transportation funding has been weakened by changing driving habits, greater fuel efficiency and cost inflation. These taxes have remained unchanged since the early 1990s.

Meanwhile, Colorado's population continues to soar, growing 46 percent in the past 20 years, to 5.4 million in 2014. Highway travel has increased by roughly the same percent over the same period.

Continued growth means that roads and bridges will sustain increasing wear and tear. This makes it imperative to support these assets with funds that have been paying CDOT's obligations on Transportation Revenue Anticipation Notes (TRANS bonds), which will be retired in 2017. Using these funds for

other purposes would cause asset condition to deteriorate more than under the Department's current budget assumptions.

Even after these dollars are redirected to asset management, CDOT's funding streams will be almost entirely devoted to maintaining the existing transportation network. New revenue must be secured to fund expansion projects, and any such projects will increase the Department's maintenance expenses. A potential funding source for expansion projects is Colorado's Senate Bill 228, which was passed in 2009. SB 228 provides funding for strategic transportation projects through five years of General Fund transfers, provided certain economic triggers are met. Initial forecasts projected that CDOT would receive about \$200 million per year for five years. However, the Department now faces significantly reduced projections for SB 228 funds.

Faced with a constrained funding outlook, CDOT continues to think beyond fuel taxes and registration fees. The Department is seeking new revenue sources and technological innovations to improve Colorado's transportation network, such as facilitating the adoption of connected vehicles and opening toll lanes on U.S. 36 and Interstate 70. These solutions are just a few of the many new approaches that will be required for the Department to meet the transportation needs of our rapidly growing state.

For questions about this report, please contact William Johnson, Performance and Asset Management Branch Manager, at will.johnson@state.co.us, or Toby Manthey, Performance Analyst, at toby.manthey@state.co.us.

