



# 2035 Statewide Transportation Plan

## State Highways

### TECHNICAL REPORT

March 2008



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## INTRODUCTION

The presence of an extensive public State Highway system, low population densities in rural areas of the state and an historical dependence on automobiles contributes significantly to automobiles being the most prevalent form of transportation in Colorado. According to the *CDOT Statewide Resident Survey: Results of the 2006 Statewide Survey on Transportation Issues*, 78 percent of respondents typically travel alone in vehicles and 14 percent carpool.

Although this preference will likely continue in the future, public awareness of environmental issues, Colorado's unique physical constraints, extreme financial limitations and increasingly severe traffic congestion in urbanized areas all demand a more balanced approach to mobility in Colorado. Travel Demand Management efforts, transit, and bicycle and pedestrian modes provide alternatives to single occupancy vehicle highway travel. One example is the use of High Occupancy Vehicle (HOV) lanes, which give drivers incentive to rideshare, or carpool, by allowing them access to lanes restricted to buses and vehicles with two or more passengers. Another example is providing mass transit in combination with highway improvements in heavily traveled corridors. An example is the recently completed T-REX project in a highly congested area of Denver. This project includes a unique combination of an improved highway and a light rail system that allow people to travel more safely and efficiently. In the future, toll facilities will likely play a significant role in providing increased capacity to the state highway system.

Automobiles, trucks, buses and bicycles utilize Colorado's public roadways. Users of this system expect an efficient ease of access to facilities, good physical conditions of the surface, and safety. The Colorado Department of Transportation (CDOT) is responsible for maintaining and improving the state highway system, municipal and county governments are responsible for the local roadway system.

CDOT and its planning partners consider various alternatives throughout the planning process. These alternatives result in a variety of recommendations such as:

- ***Safety improvements*** (channeling intersections, adding or widening shoulders, and installing signs, guardrails, bus pullouts and sidewalks)
- ***Capacity improvements*** (new highway lanes, HOV/bus lanes, passing lanes, climbing lanes and bicycle lanes)
- ***Travel Demand Management strategies*** (carpooling, telecommuting and park-n-Rides)
- ***Intelligent Transportation Systems***, traffic operations and management strategies (traffic signal timing and incident management)
- ***Intermodal connections***
- ***System quality improvements*** (reconstruction and resurfacing)

Information provided in this technical report is from the 2006 Resident Survey, the 2006 *Colorado Transportation System Performance Report* and the *Strategic Plan for Improving Roadway Safety* (2006).

## POLICY GUIDANCE

The 2035 Plan provides a valuable policy framework and overarching vision for the state, while offering policy guidance to transportation providers, including the Colorado Department of Transportation, in developing and managing the state's transportation system. The 2035 Plan also provides the policy structure necessary to guide transportation investments based on Colorado's transportation mission, vision, goals and objectives.

The Colorado Transportation Commission adopted 2035 Planning Guidance, Policy Directive 13 on CDOT values and Policy Directive 14 on Investment Categories. The full text of the policies is included in the Transportation Commission Policies Technical Report of this 2035 Plan. The Transportation Commission planning policies guide a multi-modal transportation system. The policies emphasize:

- Continuing a high priority on preserving, maintaining, and enhancing the existing transportation system given declining revenues and increasing construction costs;
- Acknowledging that declining federal and state revenues restrict expansion of the State Highway System;
- Completing the 28 strategic projects and paying the debt service that made the acceleration of these projects possible;
- Recognizing the role of all modes of transportation in addressing mobility needs; and
- Working with planning partners to leverage limited financial resources to address transportation needs.

## OVERVIEW OF THE STATE HIGHWAY SYSTEM

In 2006, CDOT reported that Colorado has 9,161 centerline miles and 23,106 lane miles under the state's purview. In addition, there are approximately 73,900 centerline miles of roadway under the jurisdiction of counties and municipalities throughout the state. The State Highway system is the focus of this technical report.

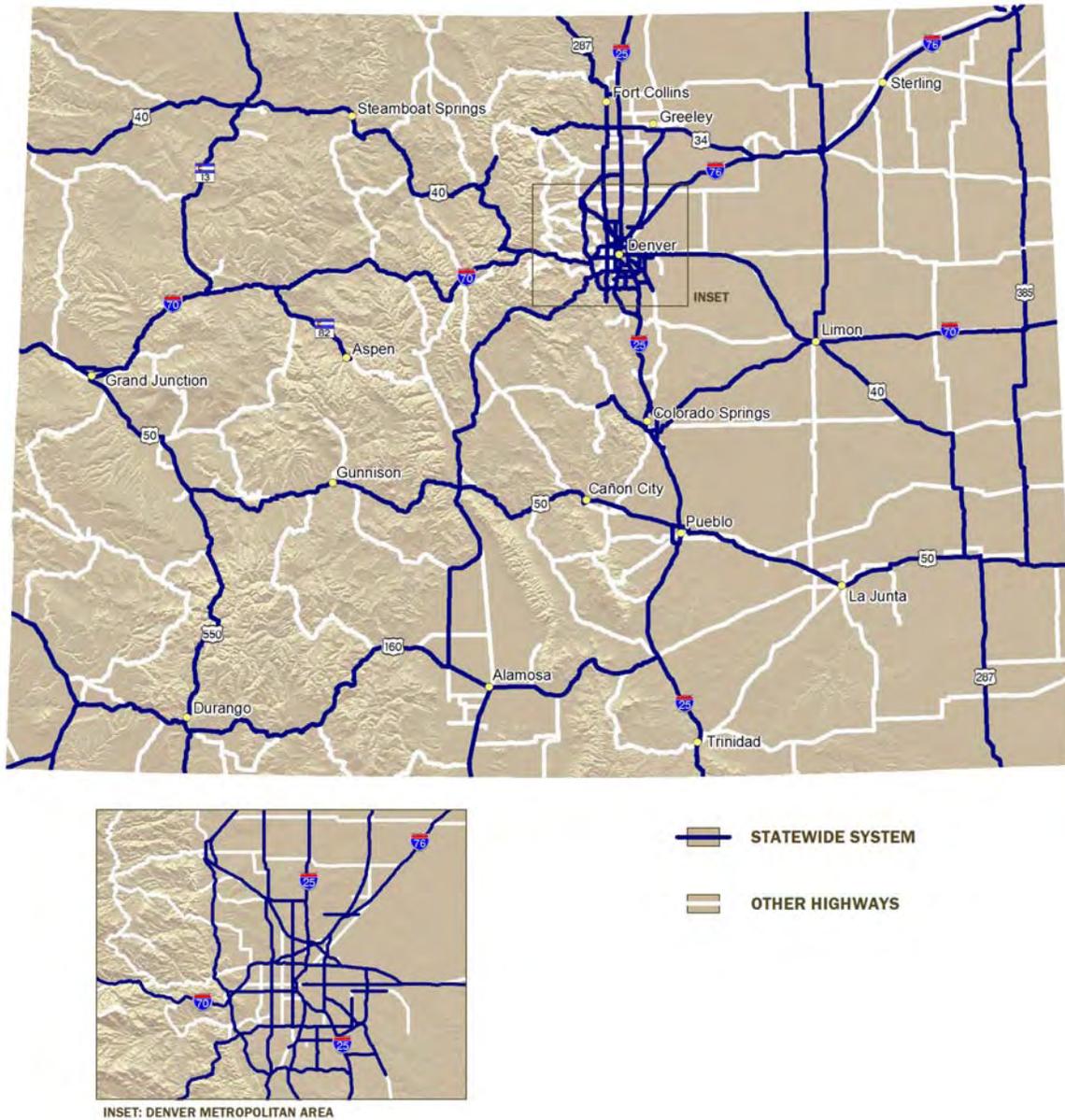
**Table 1. Colorado's Public Roadways (2005)**

	Roadway Centerline Miles	Roadway Lane Miles
State	9,161	23,106
County	58,810	136,287
Municipal	15,108	32,285
<b>Total</b>	<b>83,079</b>	<b>191,678</b>

Source: CDOT Dataset

The following map shows the statewide system and inter-regional system of corridors developed by the Transportation Commission in the Interstate Corridor Vision Guidance Resolution #TC1252 located in the Transportation Commission Policies Technical Report. The purpose of the statewide system is to provide an interconnected network of principal travel routes that serve major population centers, airports, public transportation, and other intermodal facilities. The statewide system consists primarily of Interstate Highways and the National Highway System (NHS).

Figure 1. Statewide and Inter-Regional Corridors



Following is a discussion of the current state of the state highway system. The discussion is organized into the investment categories adopted by the Transportation Commission. This discussion identifies the Strategic Project Investment Category as a separate category. In the body of the 2035 Plan this investment category has been integrated into the remaining investment categories since these strategic projects have a significant effect on those categories.

**Safety**

Delivering a safe transportation system to the traveling public is of prime importance to CDOT. The two program areas that the Safety category concentrates its efforts on are roadway characteristics and driver behavior programs.

The successes in this category have varied from year to year; nonetheless the trend has shown positive progress over the past twenty years. Of the six measures that are tracked, there has been a general trend of improvement in recent years. Although the total crash rate showed an upward trend for several years, the last three years have revealed a decline. Injury, fatal, alcohol, and seatbelt statistics show improvement during the fifteen years over which data has been collected. Customer's perception of the safety on Colorado's highways and interstate has risen slightly over the past three surveys.

## **System Quality**

The condition (quality) of the state highway infrastructure has been improving since 1998, but the future condition projections based on forecasted revenues are not promising.

The pavement condition, as measured by good and fair condition rating as a percentage of the total pavement condition, has risen from a low in 1998 of 44% good and fair condition to 63% good and fair condition at present. The Department's goal of 60% good and fair pavement condition has been met for the past three years. However, the projected pavement condition for 2026 deteriorates to 25% good and fair condition based on projected revenues.

Bridge condition has stayed relatively flat from 1995 (96.05% good/fair) to 2006 (94.81% good/fair). Again the projected bridge condition is expected to drop (to 63% good/fair condition) in 2035 based on projected funding.

The significant effort to maintain the transportation system has been successful from the beginning of the Maintenance Level of Service (MLOS) program in FY1999. There are nine maintenance program areas (MPA) monitored, such as snow & ice control, roadway surface, and traffic services. Six of the nine MPA met or exceeded the goal in FY2006. This demonstrates the commitment to provide high quality maintenance services to the transportation customer.

## **Mobility**

The movement of "people, goods and information" is included in CDOT's mission and vision statements and is a high priority of transportation system users as indicated by respondents of the 2006 and earlier Statewide Customer surveys. Because of the population growth in the already congested areas of the State and the vehicle miles traveled per individual continuing to rise, there is a respective growth in congestion. Mobility is a service provided by CDOT that is difficult and complicated to measure. Various mobility measures have been tracked since FY1999 with mixed results. Currently travel time in selected corridors, volume to capacity, and vehicle miles traveled are measured.

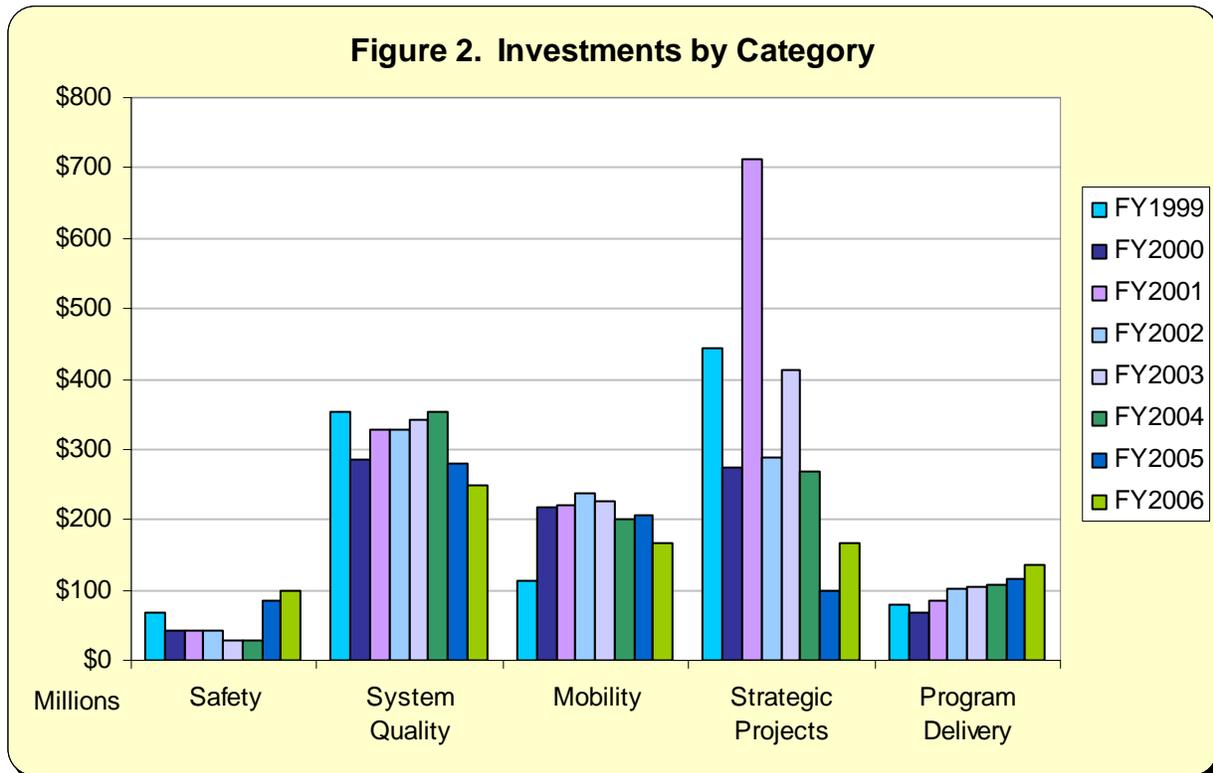
## **Strategic Projects**

Until the recent downturn in the Colorado economy affected available transportation revenues, this investment category had substantial progress in attaining the established goals. The Strategic Projects current status indicates that through 2006, 86% of the budgeted dollars have been expended or encumbered since the adoption of the Strategic Projects program.

## Investment Trends

The annual investments illustrated below and on the following page reflect the investment strategies of the Transportation Commission. The percentages have remained fairly constant in each of the categories except in the Strategic Projects category. CDOT's fiscal year 2006 transportation funding has been allocated into the five Investment Categories based on a number of factors including previous years performance results. This allocation process into the five investment categories using performance results to guide the decision process has been done for the past eight years. In the body of the 2035 Plan, the strategic projects have been integrated into the remaining four investment categories. The credibility of the performance data in the Safety, System Quality, and Strategic Projects Investment Categories has increased significantly over this same time period. Mobility performance results data remains in its infancy for utilization in the budgeting process.

Furthermore, the management systems that provide some of the data have been going through modifications and refinements throughout the same period adding to the need for prudence in data comparisons and analyses. Additionally, the relationship between investment and outcome is less direct in some programs than in others (e.g., Pavement investment related to Remaining Service Life (RSL) performance versus Safety Behavioral investments related to seatbelt usage performance).



**Figure 3. Investments and Percentages by Year**

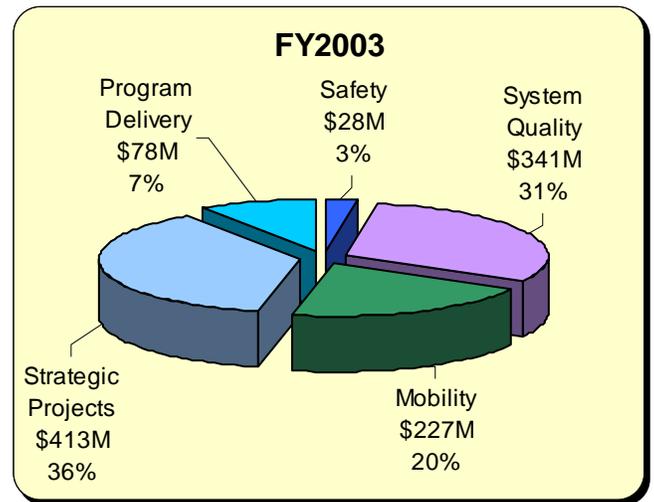
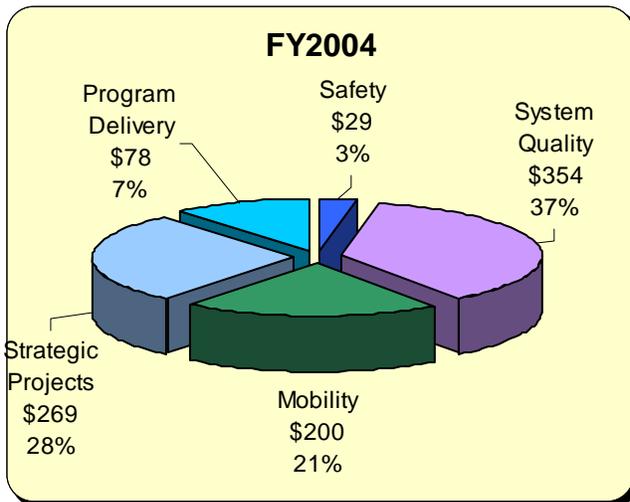
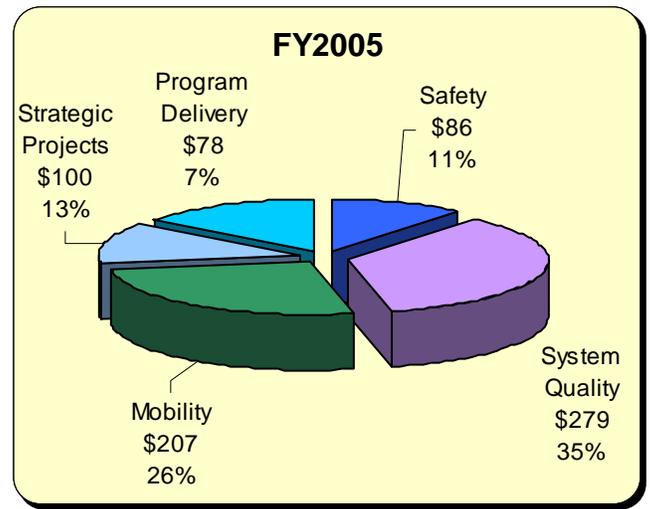
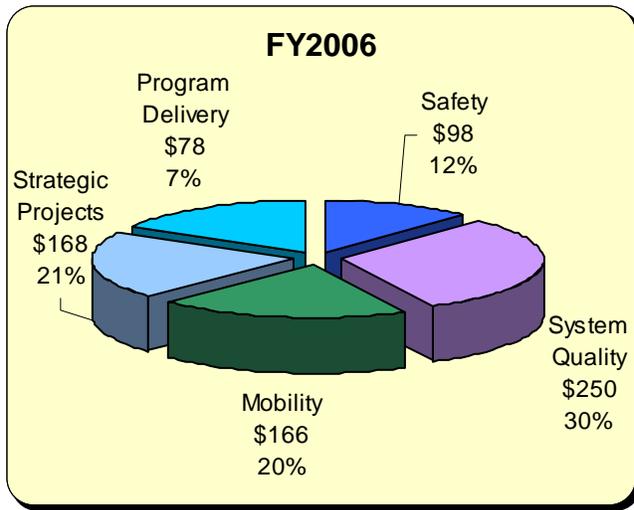
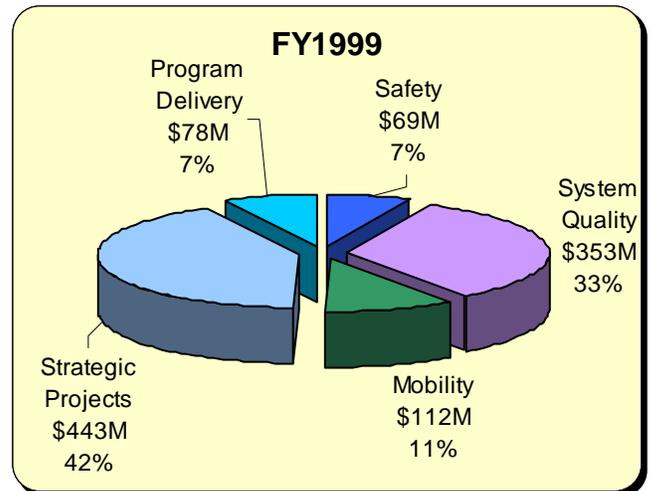
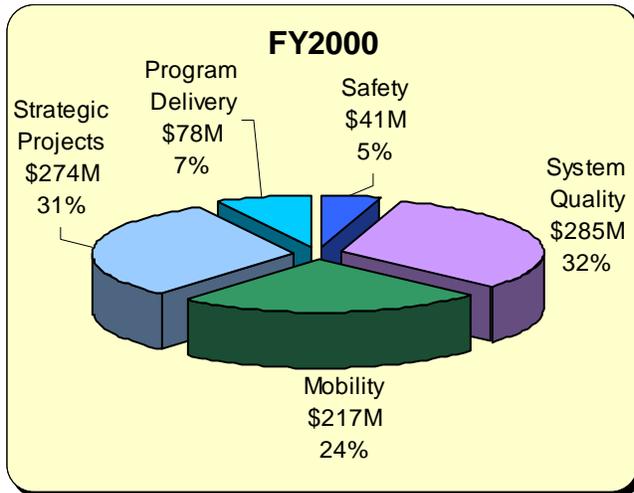
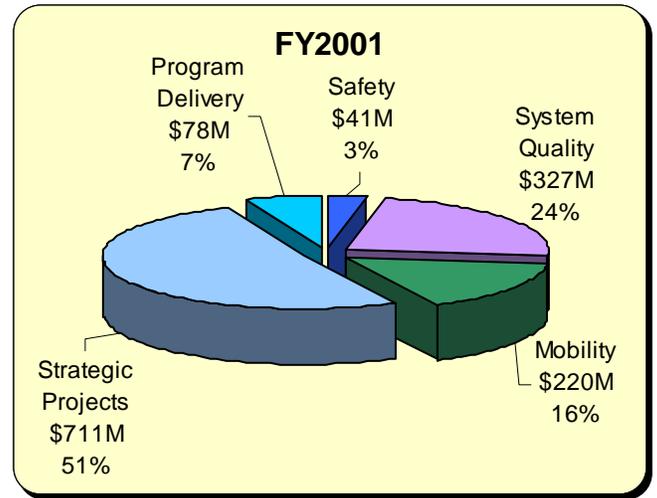
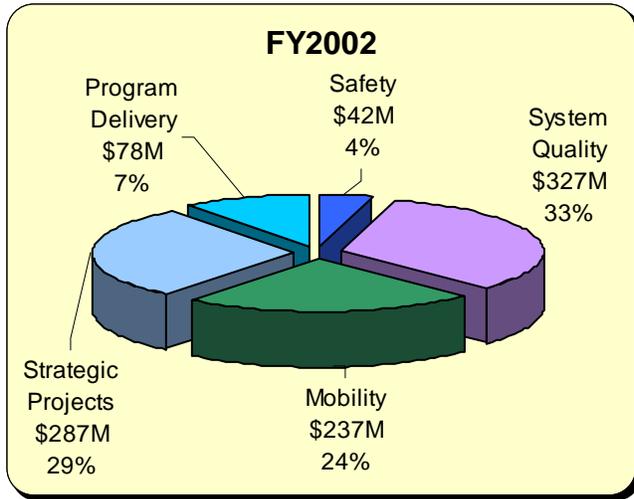


Figure 3. Investments and Percentages by Year (Continued)



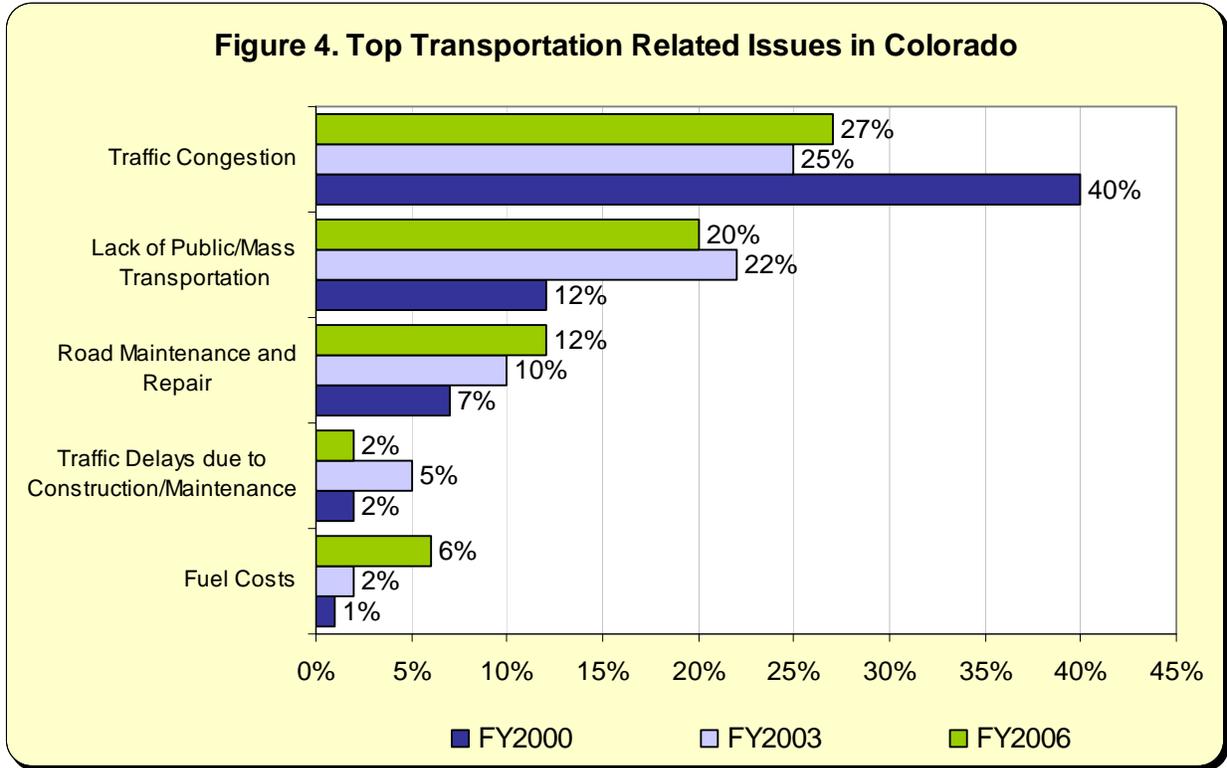
Analyzing the numerous performance indicators each fiscal year can give an indication of the state of the system and the associated relational change from year to year. However, care must be taken not to conclude that there was more or less of an emphasis or result in any of the investment categories based only on one or two performance indicators. An indication of this is displayed in the FY2001 graph. The expenditures increased dramatically in Strategic Projects in fiscal year 2001. This does not necessarily demonstrate that the completion of the high priority Strategic Projects was the emphasis over the other investment categories. It may only be an indication that there was a funding source increase for fiscal year 2001. Also, illustrated in the FY2001 and FY2002 graphs is the System Quality budget percentage increase by 9% from FY2001 to FY2002 but only a 0.2 % increase in dollar amount. Therefore a full analysis must be completed on the total budget dollars available, current expenditures, the need in each category, previous years' expenditures, customer expectations and current performance indicators to form an entire picture of results associated to investments in the transportation system.

## Customer Perception

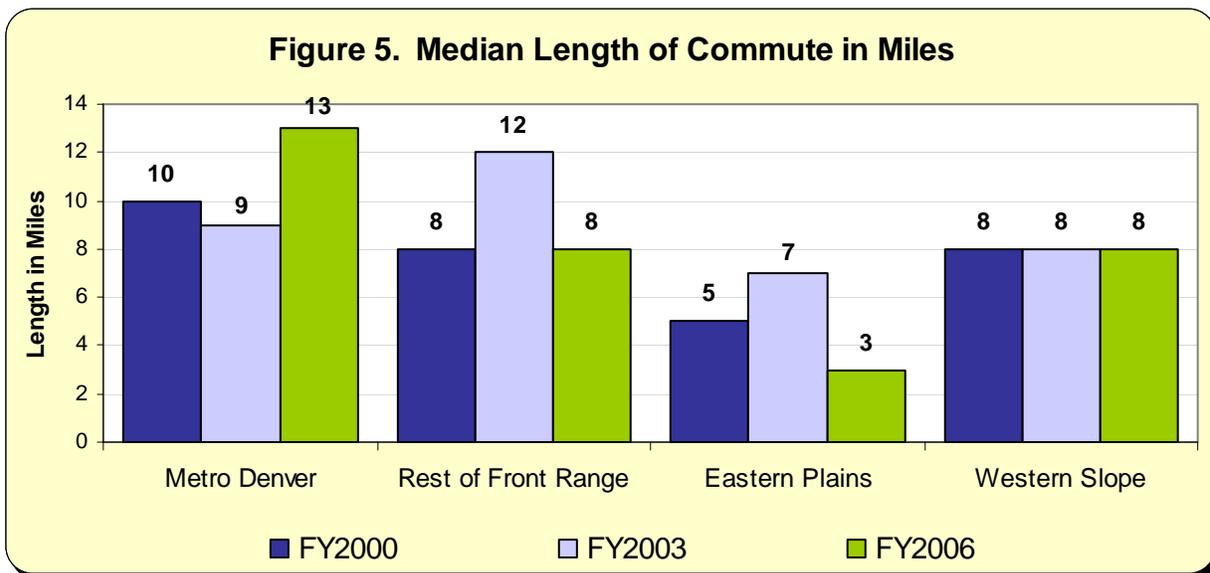
Vitally important to CDOT is the continued input from customers and the desire and commitment to meet their needs. One instrument to obtain input is the *CDOT Statewide Resident Survey: Results of the 2006 Statewide Survey on Transportation Issues in Colorado*. The first survey was conducted in 1994 with a follow-up surveys in 2000 and 2003, and the most recent version was completed in April of 2006. CDOT's objective is to conduct a statewide survey on a recurring basis to obtain valuable customer perception data to supplement other data to guide transportation investments.

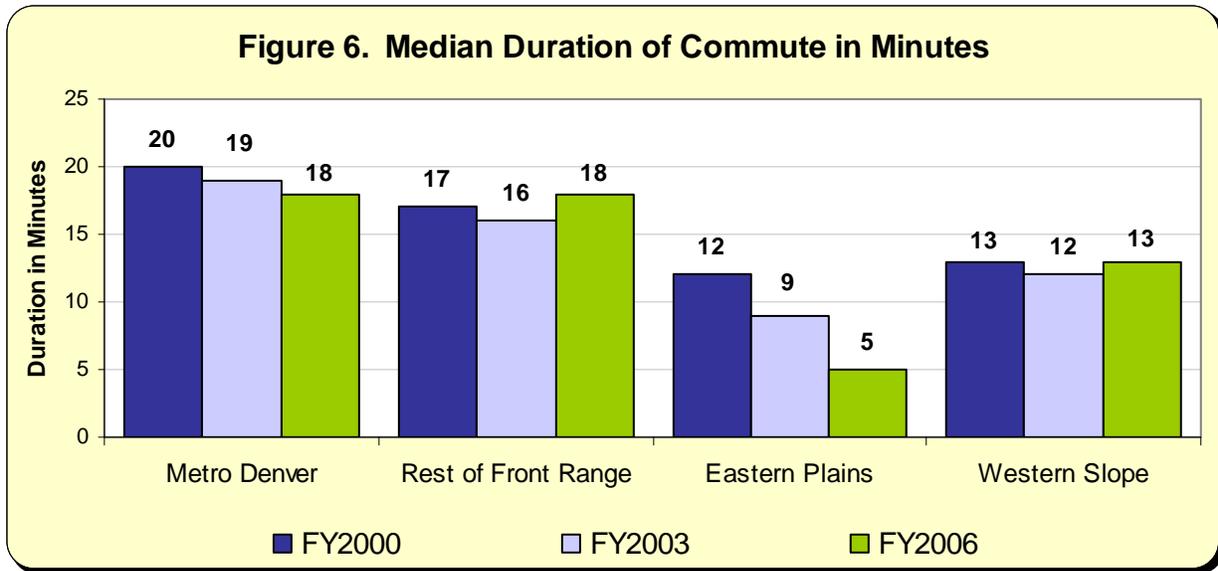
In the 2000 survey, the respondents ranked transportation as the second most important problem facing Colorado with growth/sprawl being number one on their list. Noteworthy is that transportation dropped to a tie along with growth/sprawl for fourth in the 2003 Survey behind water issues, the economy, and taxes/government spending respectively. The top five most frequently mentioned problems in 2006 were: education (14% of respondents), economy/unemployment (8%), taxes/government spending (8%), growth/urban sprawl (8%), and transportation issues/maintenance (7%).

Twenty-seven percent of the 2006 survey respondents said that traffic congestion was the top transportation issue in Colorado, which is down from 40% in the 2000 survey. The responses over time show that lack of public transportation is becoming more of a concern to residents than it was in 2000.

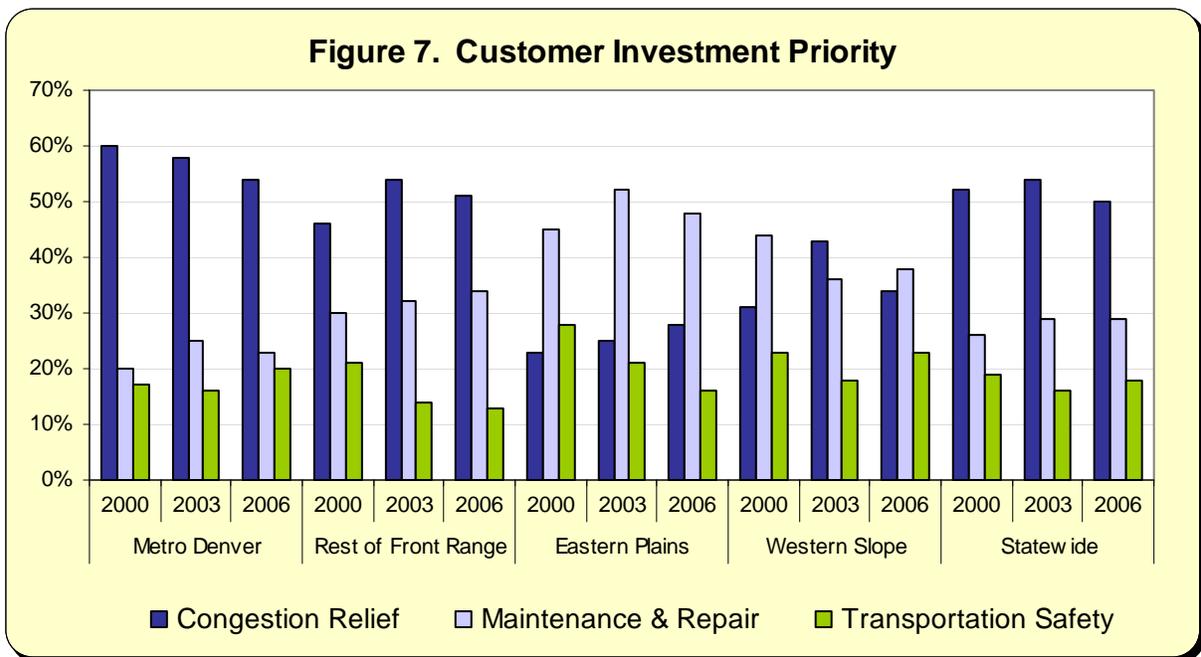


The 2006 survey reports that statewide, the median (50<sup>th</sup> percentile) reported commute length was eight miles, and the median commute duration was 18 minutes. The median commute has fluctuated throughout the years, but generally Metro Denver commuters drive the farthest, and Eastern Plains commuters live closest to work. The duration of the commute was longer for those in Metro Denver than in other areas. Respondents in the rest of the Front Range had shorter distances to work than Metro Denver commuters, but their commutes took just as long. Western Slope and the Eastern Plains commuters experience the quickest commutes.





The past three customer surveys typify the priority investment areas preferred by the general public. When compared with “providing travel options and relief from congestion”, “maintenance and repair of the transportation system”, and “transportation safety”, that respectively are analogous to the Mobility, System Quality, and Safety Investment Categories, the statewide public’s preference is investment in congestion relief (Mobility). Safety, in the minds of the transportation user by geographical area, continues to be the lowest priority according to the results of the 2006 survey.



Also quantified in the statewide survey conducted in early 2006 is the customer perception of CDOT performance. This information is provided statewide and by four different geographical areas (Metropolitan Denver, Rest of Front Range, Eastern Plains, and Western Slope) as it was in the previous surveys. In addition to geographical areas, the 2003 customer survey data was also provided by the six Engineering Regions and the 15 Transportation Planning Regions (TPR). The survey data is a valuable tool for utilization in the statewide planning process that is currently underway, as well as other uses.

The results from the 2006 Statewide Customer Survey scored CDOT’s overall performance at “B-”. This is the same grade as 2003.

**Figure 8. Customers Overall Rating of CDOT Services**



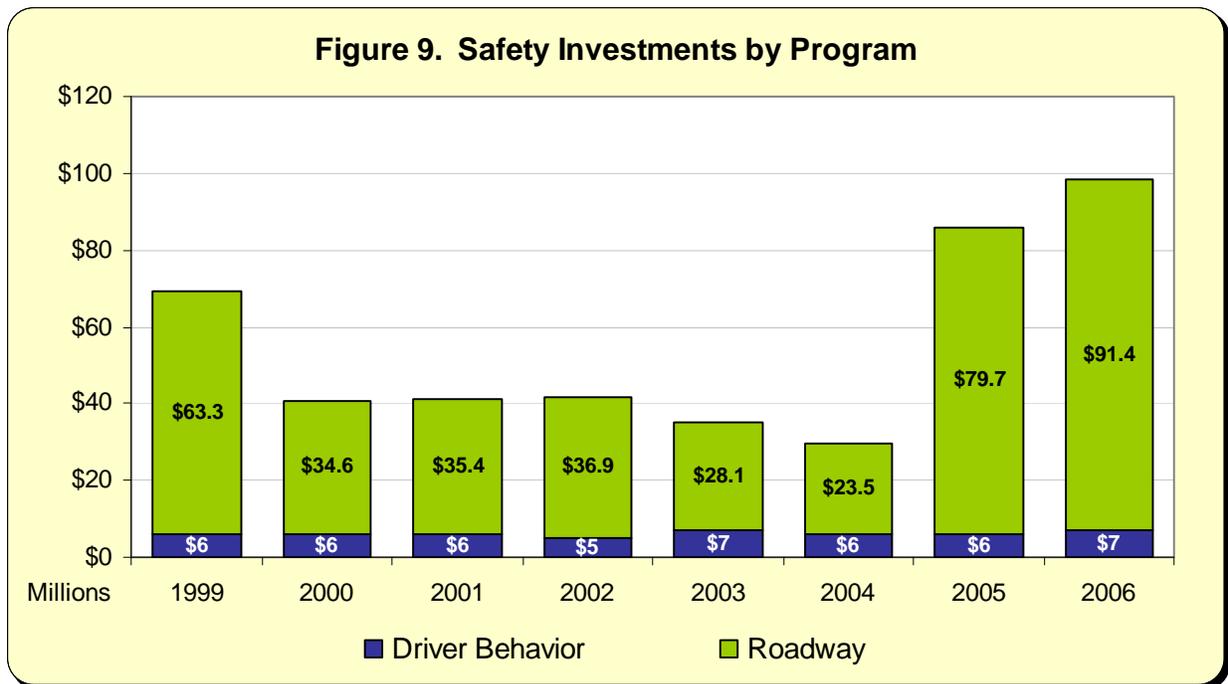
## SAFETY INVESTMENT CATEGORY

*“Services, programs and projects that reduce fatalities, injuries and property damage for all users of the system.”*

The Safety Investment Category is funded in two key program areas: Roadway Safety Characteristics and Driving Behaviors. Roadway Characteristics performance is measured by: Total Crash Rates, Injury Rates, and Fatality Rates. Driving Behaviors performance is measured by tracking: Alcohol Related Fatality Rates and Seatbelt Usage. In the development stage are the performance indicators for the objective “Emphasize applicable safety features consistent with population growth.” To measure the performance for this objective, elements of safety “Before & After” treatments as well as “Evaluation of Cost Effectiveness of Safety Improvement Strategies” are being tracked. Data have yet to be solidified enough to assess the impact on the Department’s safety performance.

### CDOT’s Investment in Safety

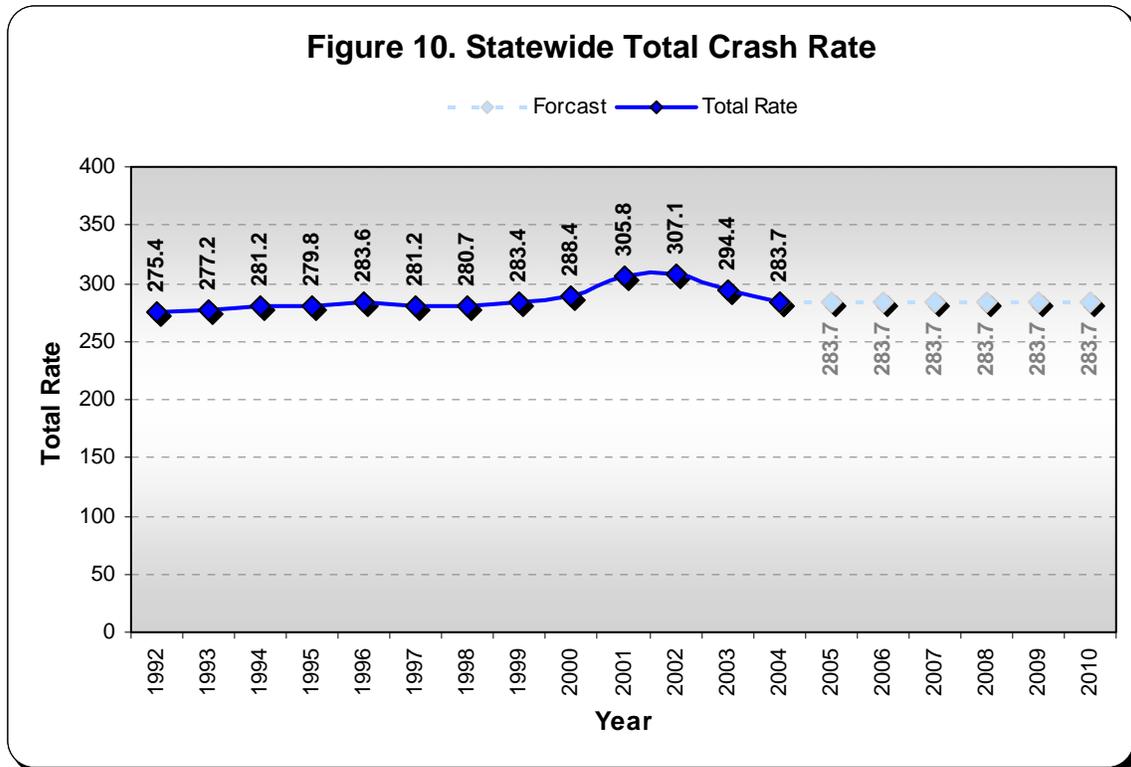
Based on the actual funding for FY 2006 in the Colorado Integrated Safety Plan, CDOT budgeted approximately nearly \$98 million (12% of the total budget) to Safety related programs and projects. The significant increase in funding for safety in 2005 and 2006 resulted from a shift of roadway striping funds from System Quality to the Safety investment category.



## Current Condition

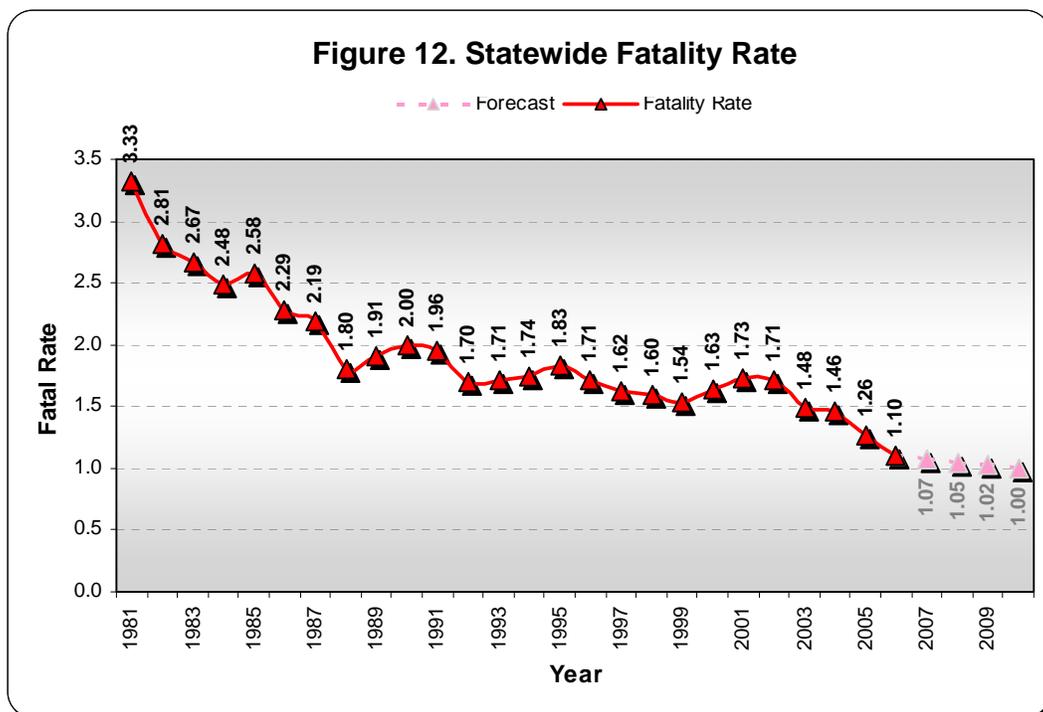
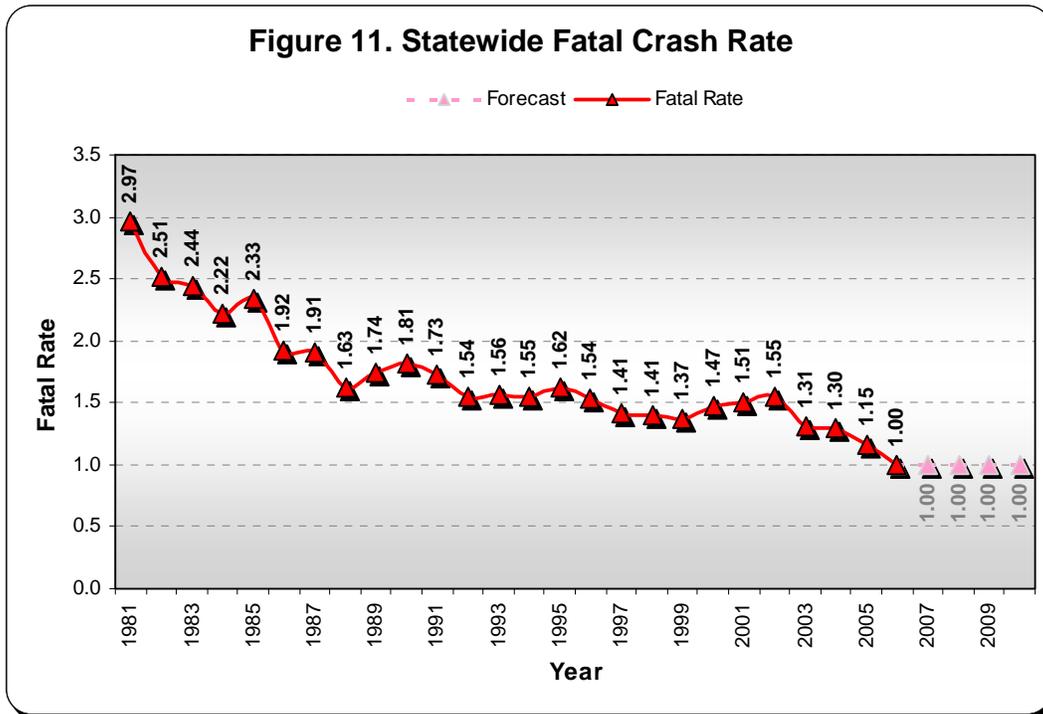
### Total Crash Rate

After the substantial decrease in the total crash rate from 1990 through 1992, the rate had been slowly but steadily rising to a point higher than the 300 crashes per 100 million vehicle miles of travel (MVMT) in 2001 and 2002. However, in 2003 and 2004, the rate has made a dramatic downward movement. The total crash rate is forecasted to remain at 283.7 crashes per 100 MVMT, which is in agreement with CDOT’s safety goals.



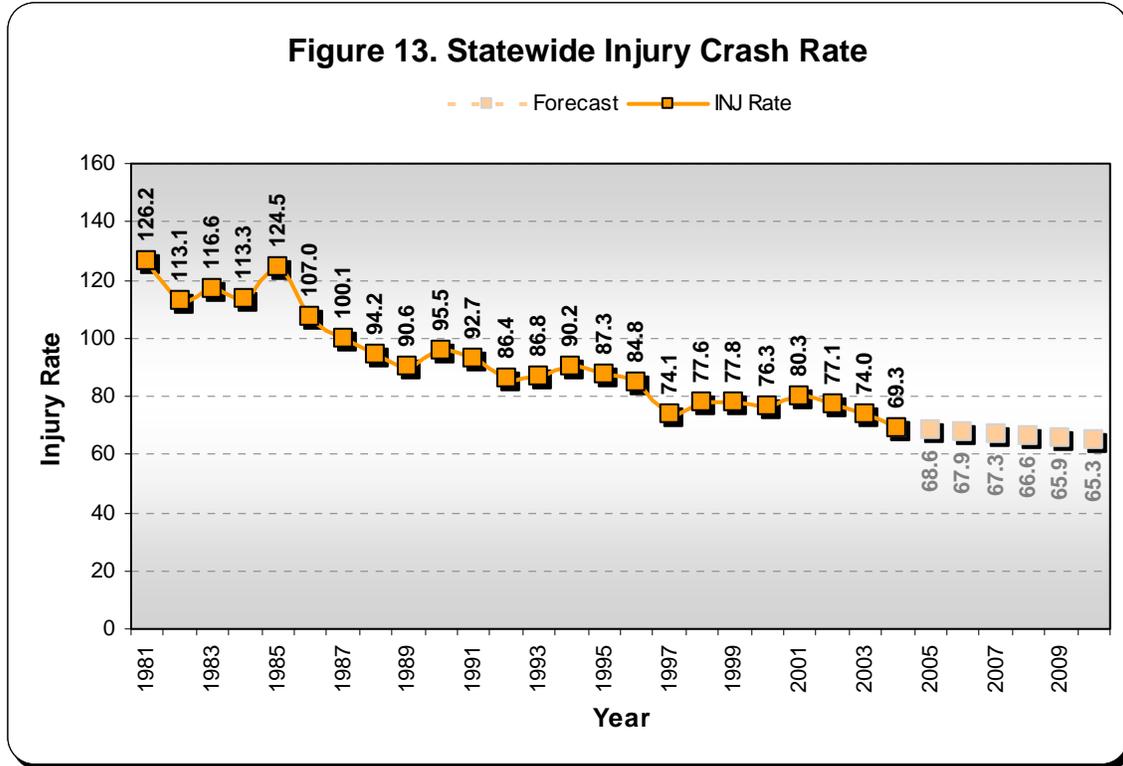
### Fatal Crash Rate

The fatal crash rate has been varying from year to year with an overall downward trend with the goal to reduce the statewide fatal crash rate to 1.00 per 100 MVMT by 2008. Similar to the total crash rate, the fatal crash rate started to climb in 2000, but made a major reversal in 2003 and continued to decrease to 1.00 in 2006. The number of fatalities has followed a similar pattern.



### Injury Crash Rate

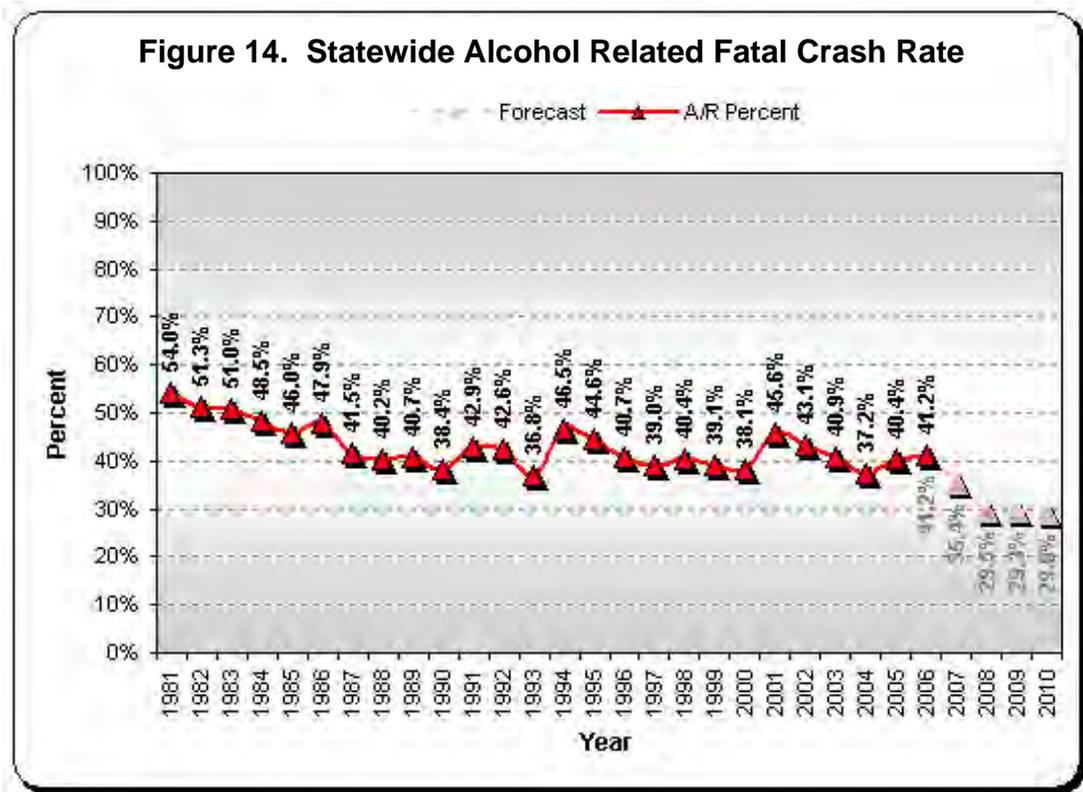
The 2004 statewide injury crash rate of 69.3 per 100 MVMT has improved since the 1981 high of 126.2. The rate increased to slightly over 80 in 2001 from a low of 74.1 in 1997 before heading in a downward trend to an all time low in 2004.



While monitoring total crashes helps determine the magnitude of problems in the safety category, differentiating the types of crashes between those that are roadway characteristics versus driver behavioral (seat belt usage and alcohol related fatal) can help determine the specific problem area. Upon that determination, the investment focus of the Department can be established. The monitoring and investments in these programs are aimed at decreasing the number of these types of crashes with the ultimate goal to minimize the associated economic and social impacts.

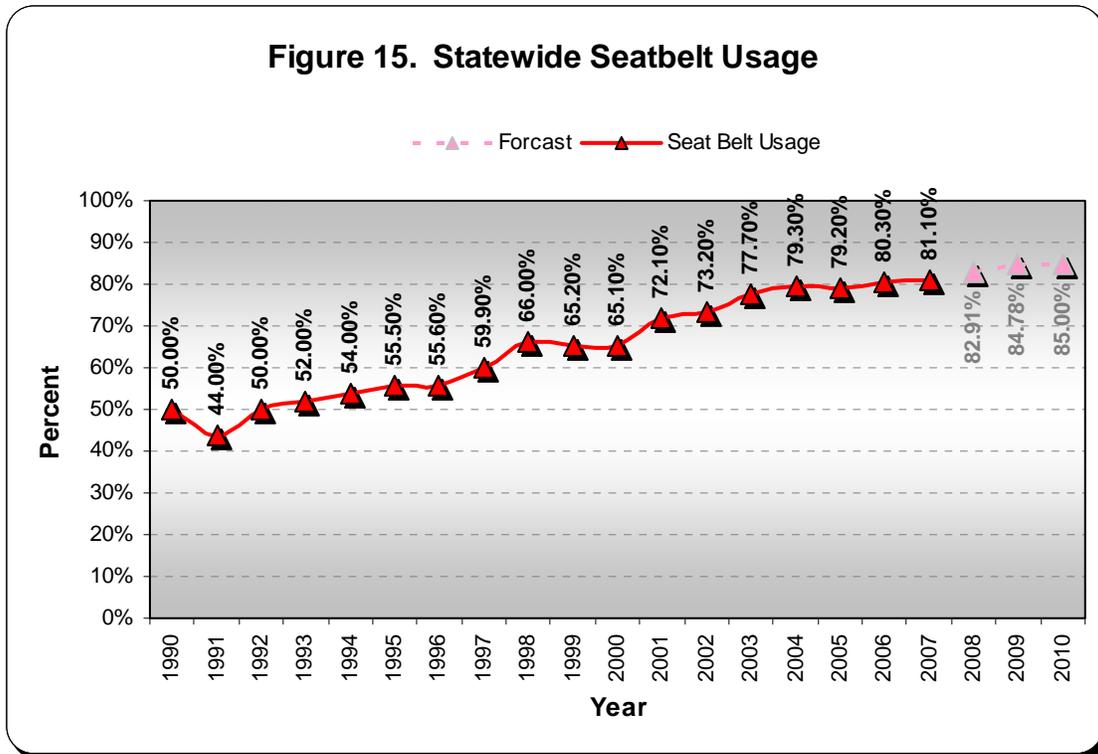
### Alcohol-Related Fatal Crashes

The number of alcohol-related fatal crashes as a percentage of all fatal crashes has increased from 37.3% in 2004 to 41.2% in 2006. However, these percentages are lower than the most recent high point of 45.6%, which occurred in 2001. The number of alcohol-related fatal crashes as a percentage of all fatal crashes is projected to decrease in 2008 to 29.5% and to 29.0% by 2010. These projections are in line with CDOT’s goals.



### Seat Belt Usage

Seat belts are the most effective means of reducing fatalities and serious injuries. In 2004, it is estimated that safety belts saved 15,434 lives nation-wide and billions of dollars in medical care, lost productivity, and other injury-related costs.<sup>1</sup> CDOT funds education and enforcement activities that aim to increase safety belt usage. As a result, seat belt usage in Colorado has increased substantially from 50% in 1990 to 80.3% in 2006. The 2008 and 2010 goals of 82.9% and 85%, respectively, are slightly higher than what is expected if past trends continue. Current efforts should be continued or enhanced in order to achieve these goals.



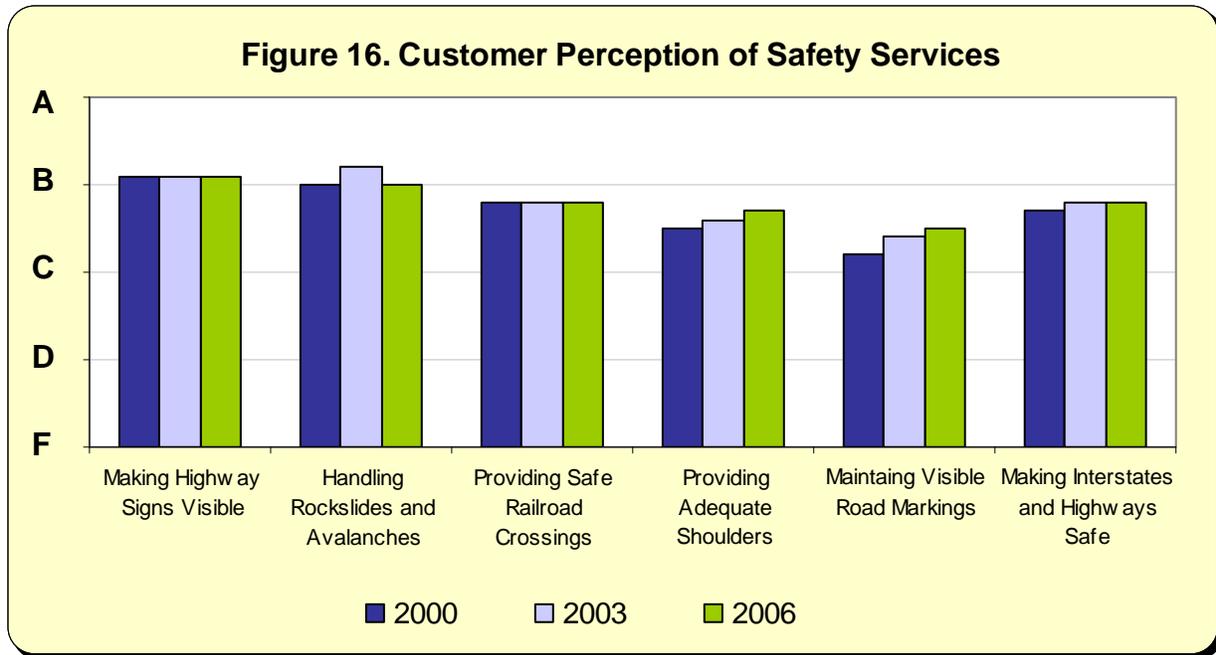
### Customer Perception of Safety

#### CDOT Safety Services

Customers rated CDOT’s service of “making highways and interstates safe” an above average grade of B minus on a scale of A through F. The customer perception of Safety on the state highway system has remained the same in 2003 and 2006, but has risen slightly from previous years’ surveys.

There are no specific safety areas that demonstrated a customer perception grade below C. Comparing 2006 to 2003 survey results, most ratings were very close. The biggest drop in satisfaction was from a 3.2 rating to a 3.0 rating for handling avalanches and rockslides, but it should be noted that the survey was done soon after a rockslide closed Highway 6 and Interstate 70.

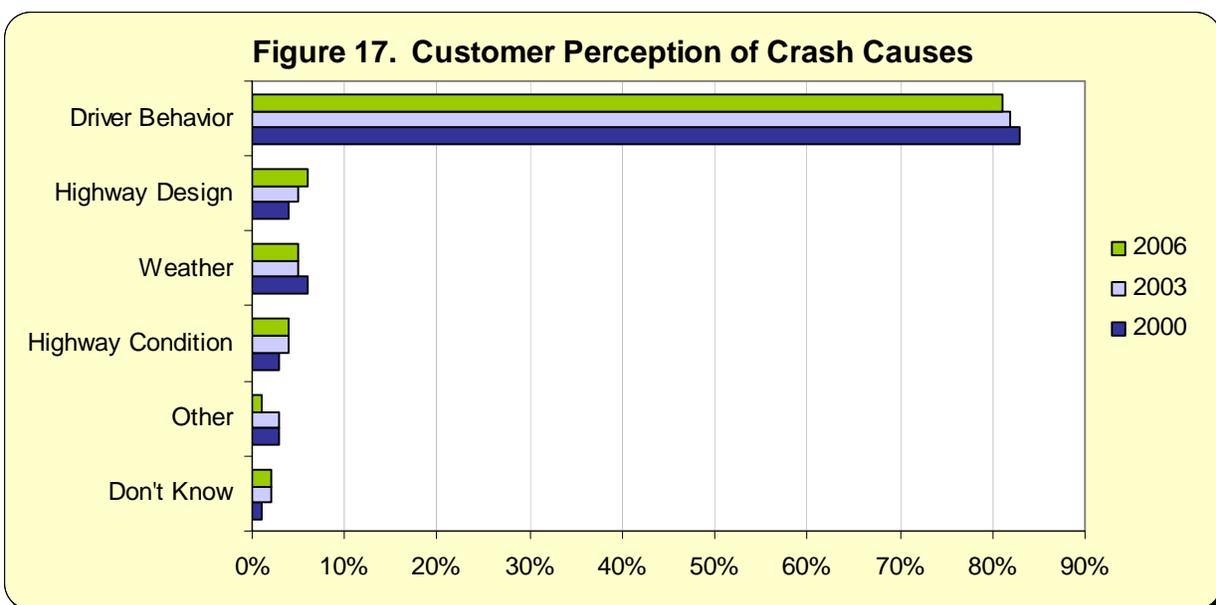
<sup>1</sup> Traffic Safety Facts, NHTSA’s National Center for Statistics and Analysis, 2004



**Crash Causes**

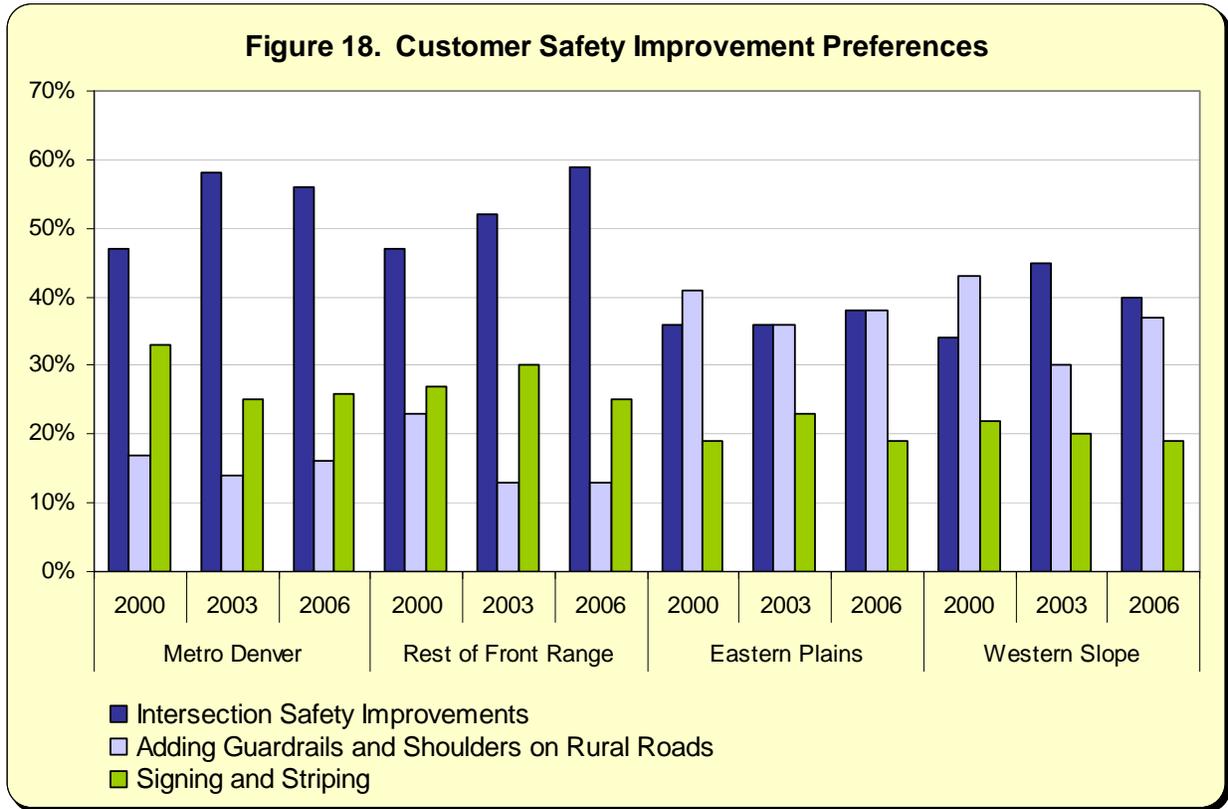
When asked what is perceived to be the most common cause of traffic crashes, the respondents have consistently indicated “driver behavior”. However, contrary to this perception on causes of crashes, they also continue to prefer resource expenditures on improving the roadways (58% in 2006) rather than on public safety campaigns (driver behavior programs) to improve traffic safety.

This may be understandable given that seventy-nine percent of the participants (in 2006) also indicated that “driver behavior” campaigns have no effect on their driving behavior, thus giving tacit disapproval to investments in this area.



### Roadway Safety Improvement Preferences

With roadway improvements the preferred investment solution to crashes, the tradeoffs in the roadway improvements program area were posed to respondents. The Metro Denver and the Rest of the Front Range respondents clearly prefer intersection safety improvements. In 2006, the Western Slope and Eastern Plains respondents' highest priority was fairly evenly divided between intersection safety improvements and adding guardrails and shoulders on rural roads.



## SYSTEM QUALITY INVESTMENT CATEGORY

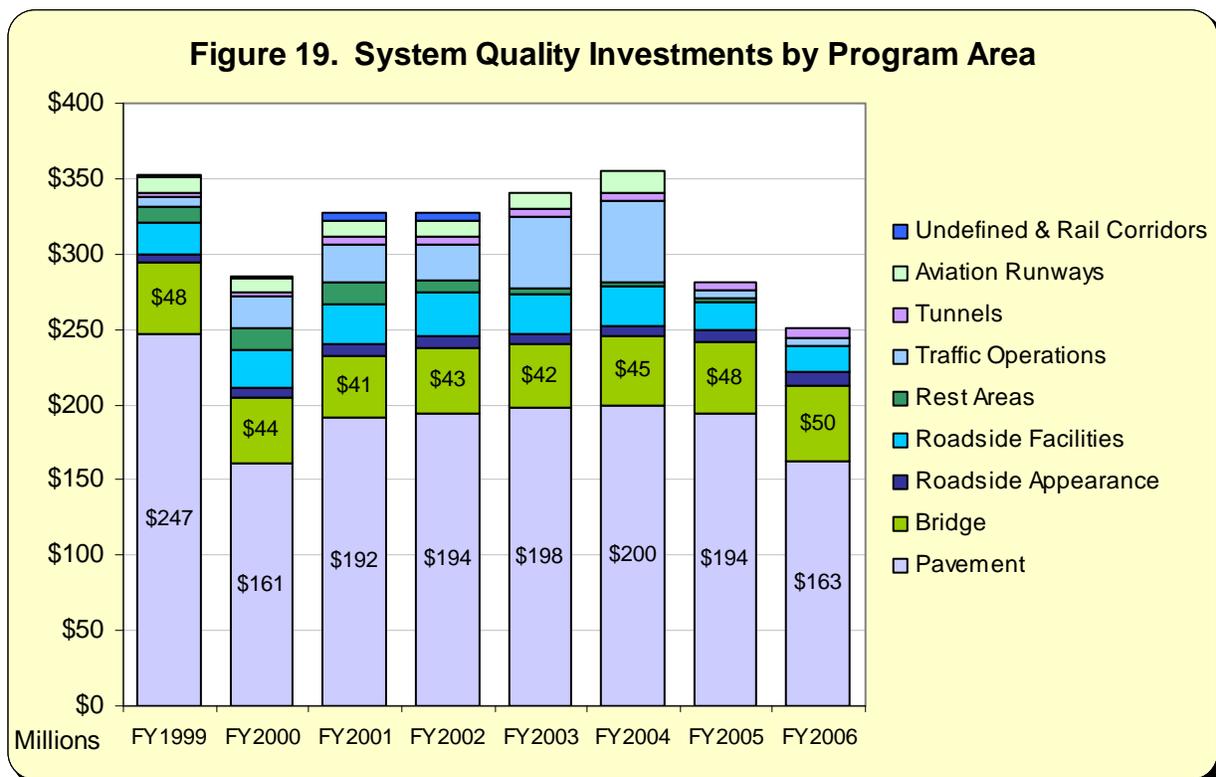
*“Activities, programs and projects that maintain the function and aesthetics of the existing transportation infrastructure.”*

This investment category is responsible for the quality of the transportation infrastructure. Investment decisions in this category impact the surface quality and remaining service life of roadways and structures. The investment Program Areas are: Pavement, Bridge, Roadside Facilities, Traffic Operations, Rest Areas, Roadside Appearance and Other Modes.

### CDOT’s Investment in System Quality

Based on the fiscal year 2006 budget, CDOT allocated approximately \$250 million, which is approximately 31% of the total budget, to System Quality programs, services and projects.

The system quality budget is allocated to nine program areas as shown below. The pavement program includes the surface treatment program, roadway surface (within Maintenance Level of Service), and gaming funds. Over the past eight years, the pavement program has accounted for 56 to 70% of the total System Quality budget. The bridge project, which includes both bridge and structures (within Maintenance Level of Service) funds, has accounted for between 12 and 20% of the total System Quality budget over the eight year period.



## Current Condition

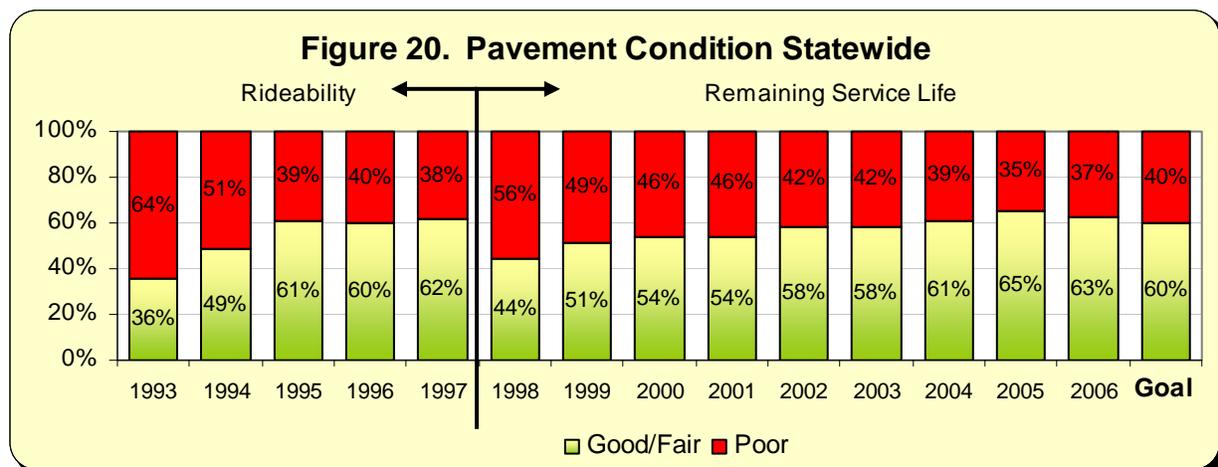
### Surface Condition

Colorado’s state highway pavement condition rating trend is reflected in the following set of four graphs. Consistent with CDOT’s investment strategy direction, the output of the Pavement Management System is focused on Remaining Service Life (RSL).

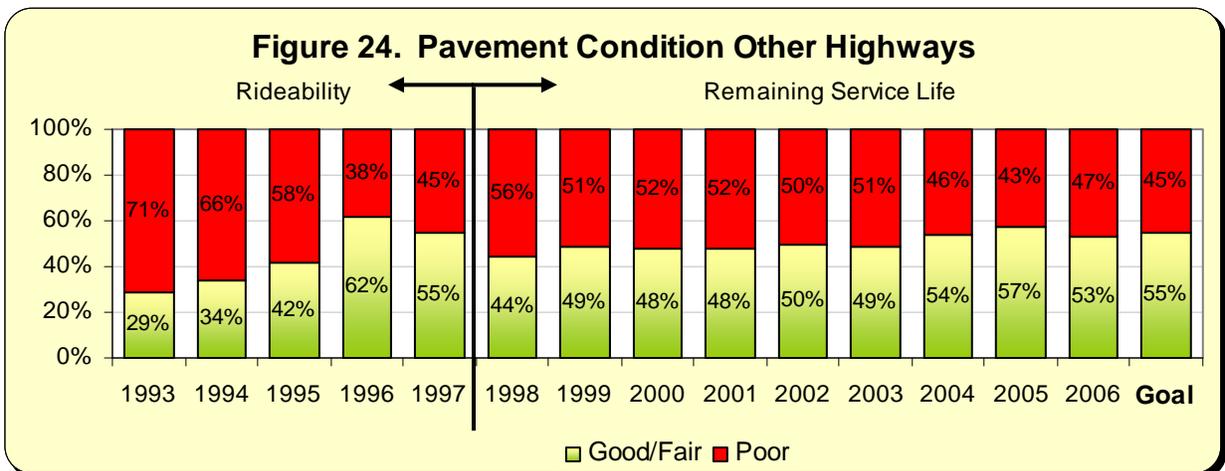
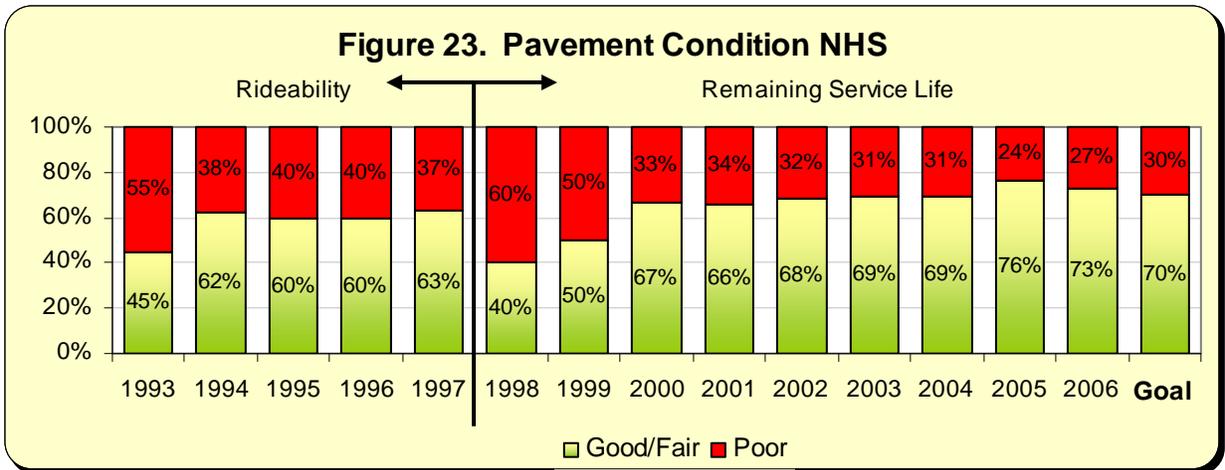
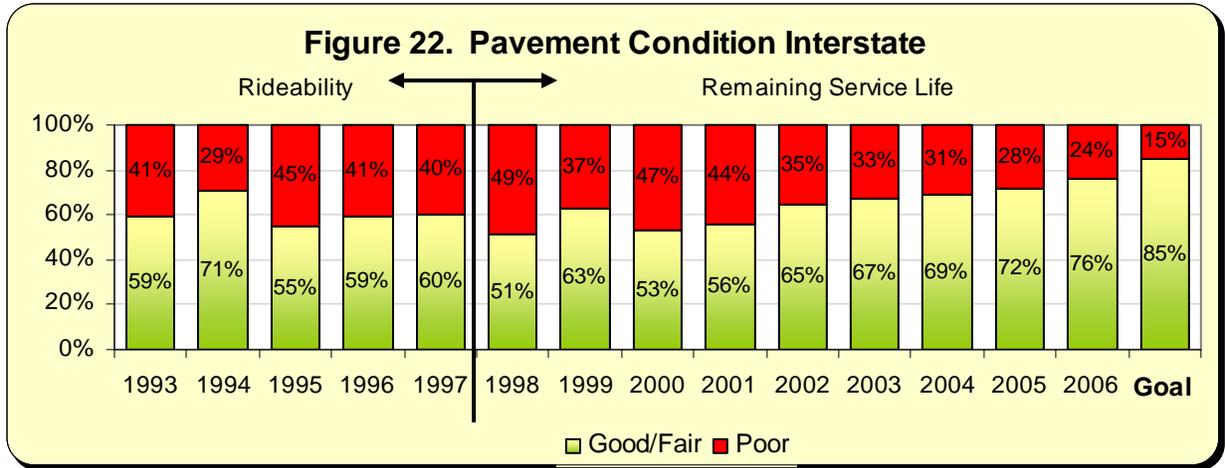
The graphs illustrate a substantial change in pavement condition between years 1997 and 1998, which is due to the different methodology to measure pavement condition at the juncture of these years. Instead of a ride-ability index pavement condition rating based on elements of surface smoothness and aesthetics used in 1997 and prior years, the pavement condition is rated for the length of remaining service life condition from 1998 and thereafter. Thus the data for 1997 and prior years are not comparable to 1998 and subsequent years. This change of evaluation redistributes the investment away from the obvious visible needs of the surface and more towards sustaining and maintaining the remaining value of the roadway.

The pavement condition goal is to attain a 60 percent Good/Fair remaining service life on highways statewide overall. A good surface condition rating means there is a remaining service life of 11 years; a fair rating indicates a remaining service life of 6-10 years; and a poor evaluation represents a remaining service life of less than six years. This target is further separated into three classifications: interstates, NHS (National Highway System non-interstate), and other state highways. The goals for these are 85 percent on interstate highways (956 miles), 70 percent on NHS highways (2,473 miles), and 55 percent on all other state highways (5,719 miles).

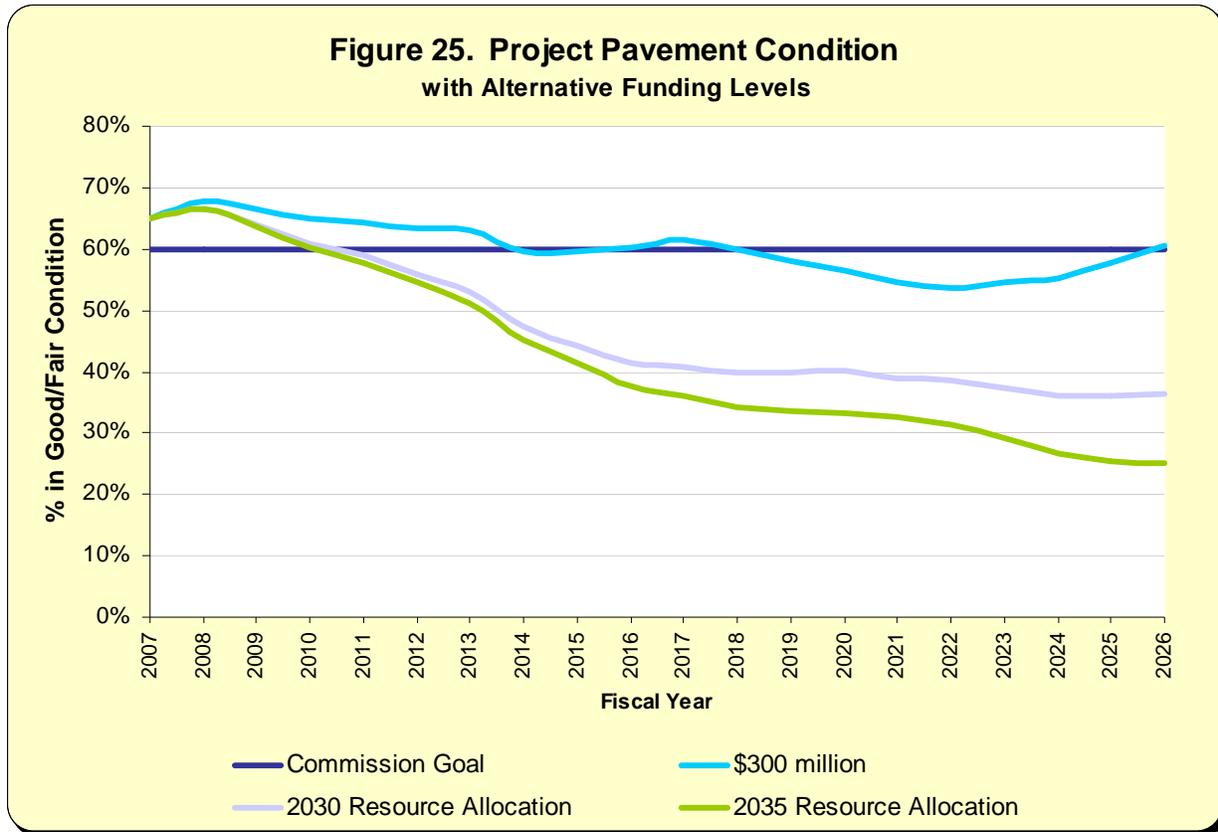
As shown by the statewide graph, the overall pavement condition has improved by 19% on state highways from 44% to 63% in 1998 and 2006, respectively. In 2007, the state highway system surface condition was rated about 59 percent good or fair. A map of the 2006 statewide pavement condition is provided on the next page. The Interstate highway pavement condition has improved for the sixth year in a row; however the overall pavement condition on the interstate system remains below the goal of 85% good/fair. The NHS system has seen significant improvement from 1998 to 2006 (a 23% improvement) and has been above the 70% good/fair goal for the last two years. The “Other State Highways” system has improved by 9% between 1998 and 2006, but remains slightly below the 55% good/fair goal.







Monitoring the pavement condition during the next several years will be critical because of projections. The following pavement condition projection graph indicates that a substantial annual<sup>2</sup> investment increase over present investment (\$151M) will be necessary to maintain the overall statewide Good/Fair pavement condition at or above the Transportation Commission’s goal of 60% Good/Fair.



<sup>2</sup> Assumes 4.0% inflation in costs and k factor = 0.2  
 95% of the budget is utilized for resurfacing and reconstruction projects.  
 5% of the total budget is utilized for preventive maintenance

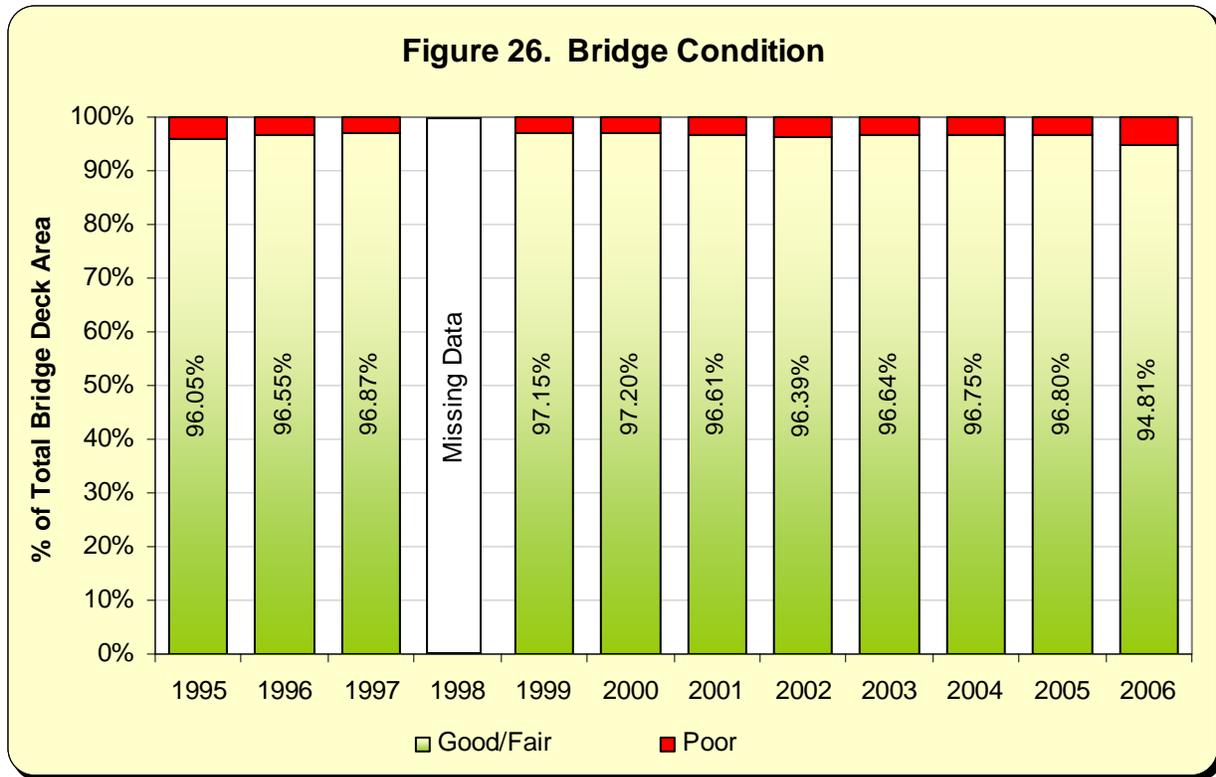
## Major Bridges

The Colorado Transportation Commission's goal is to maintain or improve the current percentage of bridges in good or fair condition. Currently there are: 116 bridges in poor condition (5.25 percent of total bridge deck area); 379 bridges in fair condition (8.19 percent of total bridge deck area), and 3,280 bridges in good condition (86.56 percent of total bridge deck area). Bridges in poor condition do not meet all safety and geometry standards and require reactive maintenance to ensure their safe service. For the purpose of determining bridge-funding needs it is assumed that bridges in poor condition have exceeded their economically viable service life and require replacement. Bridges in fair condition marginally satisfy safety and geometry standards and require preventative maintenance or rehabilitation. Bridges in good condition typically adequately meet all safety and geometry standards and typically only require preventative maintenance.

CDOT utilizes PONTIS (a bridge management model) and the National Bridge Inventory (NBI) to monitor the condition of approximately 3,775 major bridges under its jurisdiction. The condition is monitored by regularly scheduled inspections which typically occur on a two year frequency. The NBI is used to determine a condition rating of the bridge elements deck, superstructure, and substructure. The bridge element condition ratings are combined with other factors (such as, average daily traffic, load carrying capacity, and geometric adequacy) to determine a sufficiency rating and a status for each major bridge. Status ratings include structurally deficient, functionally obsolete, not deficient, or not applicable. The major bridges are then classified as poor, fair or good using the Sufficiency Rating and the Status. Poor bridges have a sufficiency rating less than 50 and a status of structurally deficient or functionally obsolete. Fair bridges have a sufficiency rating between 50 and 80 and status of structurally deficient or functionally obsolete. Good bridges are all remaining major bridges that do not meet the criteria for poor or fair.

Based on an average 75 year service life for bridges and only using bridge program funds to address bridge needs the 95 percent of bridge deck are in good and fair condition is expected to change to approximately 60 percent good and fair over the next 28 years. The 60 percent is a rough estimate and should only be used to determine required annual funding levels over the next 28 years.

The on-system bridge condition chart is based on the total deck area of bridges on the state highway system. In 2006 the good/fair rated bridges decreased slightly from the 2005 conditions. The major portion of this decline is due to the condition of the I-70 viaduct east of I-25 changing from fair to poor condition. The proposed objective for the bridge program is to eliminate the bridges in poor condition.



- Good = Structural Sufficiency Rating > 80 or NO
- Fair = Structural Sufficiency Rating ≥ 50 but ≤ 80 and SD or FO
- Poor = Structural Sufficiency Rating < 50 and SD or FO

*SD = Structurally Deficient    FO = Functionally Obsolete    NO = Not Structurally Deficient or Functionally Obsolete*

To be categorized as poor, a bridge must have a sufficiency rating of less than fifty, and be either structurally deficient or functionally obsolete. The sufficiency rating is a numerical rating for bridges that takes into account structural adequacy and functionality and is based on a 100 point scale where 100 is a perfect rating. A bridge is structurally deficient when the structural condition or capacity of the bridge is less than fully adequate. A bridge is functionally obsolete when its size or geometric clearances are less than fully adequate. The criteria for determining the sufficiency rating, structural deficiency, and functional obsolescence is established by the Federal Highway Administration and used by all state Department of Transportations.

In more detail, 20 different factors, or component ratings, of the bridge are used to calculate the sufficiency rating. Fifty-five percent of the sufficiency rating is based on four structural adequacy and safety factors which include the condition of the structural members as well as their load carrying capacity. Thirty percent of the sufficiency rating is based on 13 serviceability and functional obsolescence factors including width of the bridge, waterway adequacy, and geometric clearances. Fifteen percent of the sufficiency rating is based on three essentiality for public use factors: detour length, average daily traffic, and defense highway designation.

Structurally deficient means there are elements of the bridge that need to be monitored and may also need maintenance, rehabilitation, or replacement. Monitoring is accomplished through the

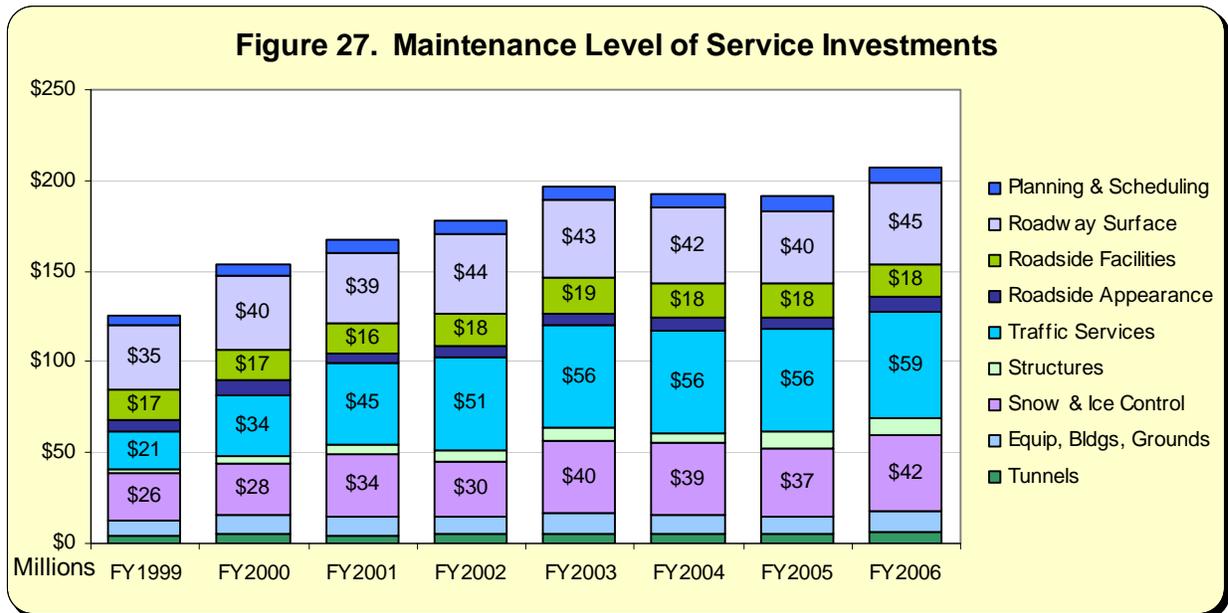
bridge inspection program and, as needed, by maintenance patrols. Structurally deficient bridges may have load restrictions to ensure their safe use. The condition of different parts of a bridge are rated on a scale of 0 to 9, with 9 being "excellent" and zero being "failed". If the bridge deck, the superstructure (the support immediately beneath the deck), or the substructure (the bridge foundation and supporting piers and abutments) are rated in condition four or less, then the bridge is categorized as structurally deficient.

As stated above, a bridge is functionally obsolete when its size or geometric clearances are less than fully adequate. Bridges that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demands are categorized as functionally obsolete. Bridges used for water crossings that have inadequate hydraulic openings and are occasionally flooded are also categorized as functionally obsolete.

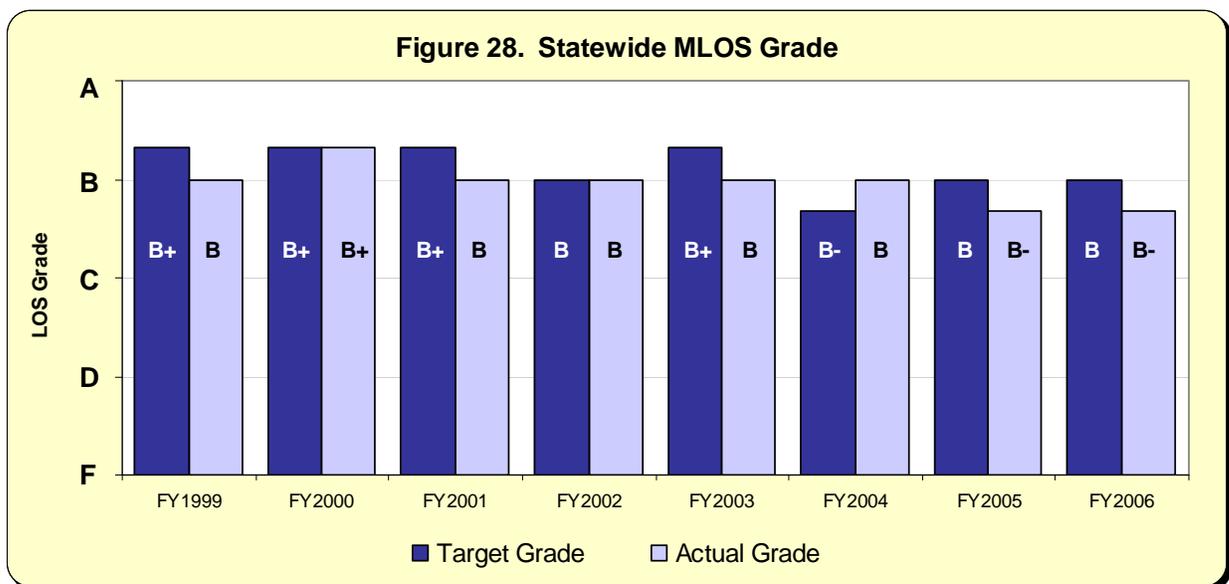
For planning CDOT considers the bridges in poor condition as those that have exhausted their remaining economically viable service life and should be replaced or receive major rehabilitation. Bridges in good condition adequately meet all safety and geometry standards and typically only require preventive maintenance. A bridge in good condition could have a low sufficiency rating due to poor ratings in some of the 20 factors not related to public safety. For example, having an extremely long detour (if the bridge were closed) could result in a low sufficiency rating. Currently, the average total project cost for replacement or major rehabilitation is assumed to be \$390 per square foot of bridge deck area. The exception to this is the I-70 Viaduct near the Denver Coliseum.

### **Maintenance Levels of Service (MLOS)**

Within CDOT, there are three tiers of performance accountability ranging from the investment level, to core service level and finally to the tools & service level. The activities encompassing the Maintenance Levels of Service (MLOS) represent performance accountability at the tools & service level that are rolled up to the investment level within the maintenance program. The following performance measures and levels of service have been incorporated within a process of annual maintenance program development based upon performance management principles. The delivery of maintenance services encompasses about 70 individual activities organized within nine Maintenance Program Areas (MPAs). They are as follows: Planning & Training; Roadway Surfacing; Roadside Facilities; Roadside Appearance; Traffic Services; Structures; Snow & Ice Control; Equipment, Buildings & Grounds; and Tunnels.



Each of the nine program areas is assessed for the service level achieved against their expenditures. Each assessment is then converted into a grading scale of A through F. The concept of gauging performance within the Maintenance Level of Service programs areas has been in operation for eight years. As a result, it's not surprising that the current service levels remain relatively constant and near the targets from 1999 through 2006. CDOT has met or exceeded the Statewide Maintenance Level of Service (MLOS) targets in three of the past eight years of the program.

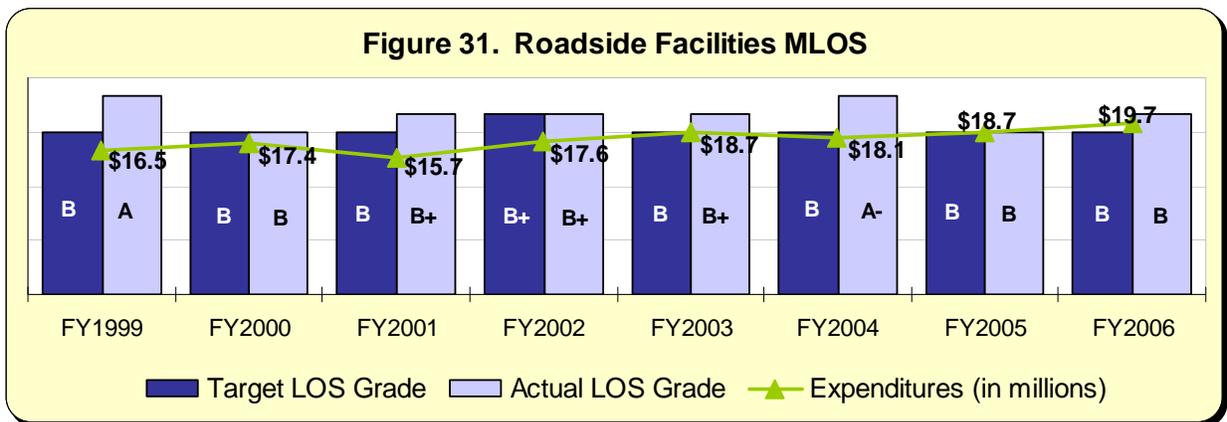
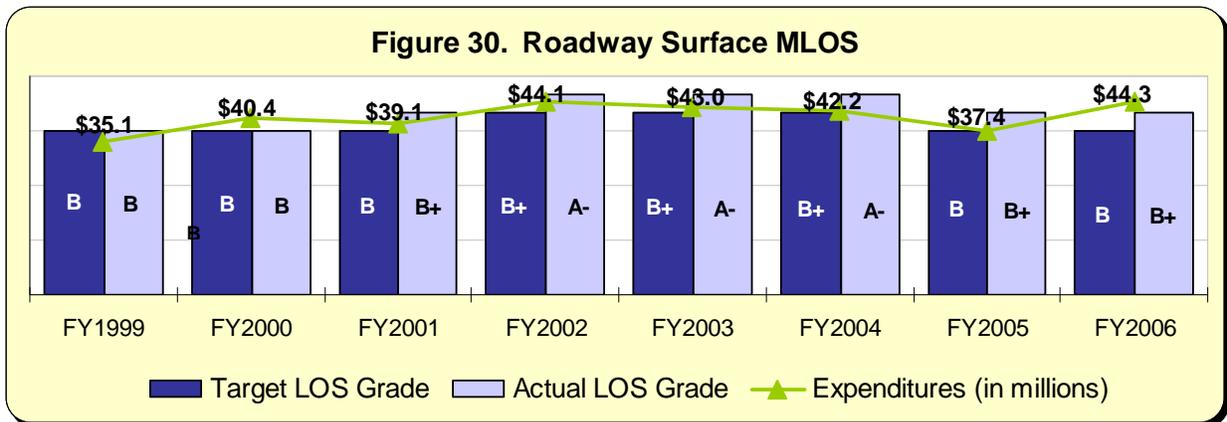
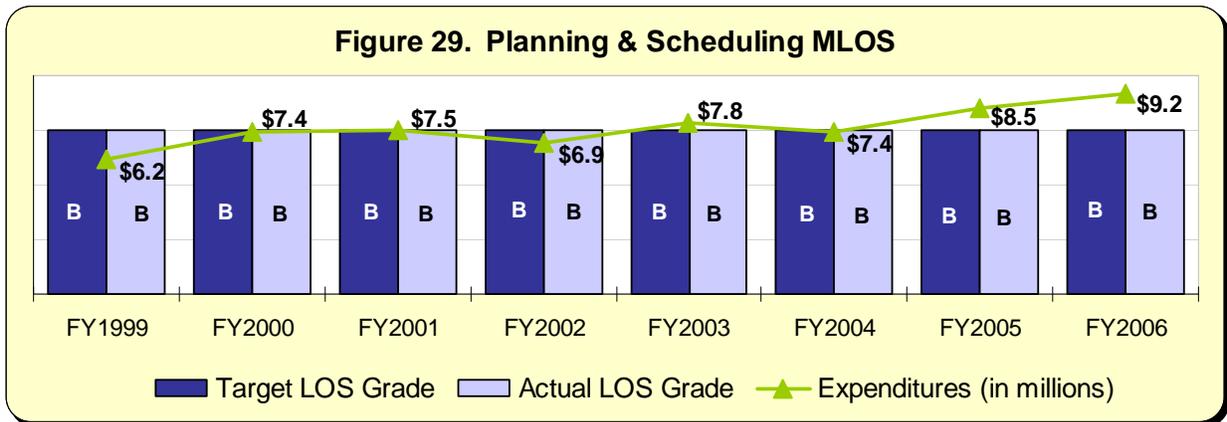


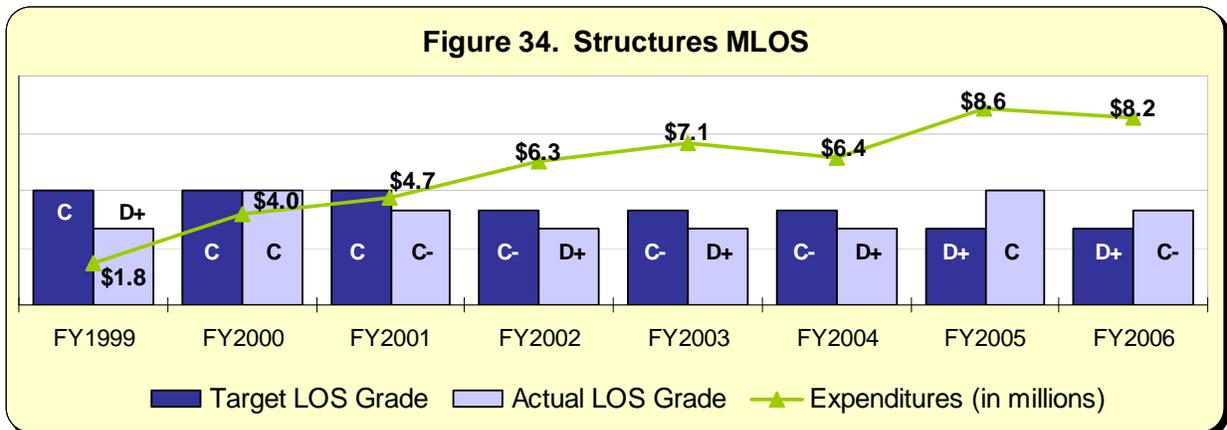
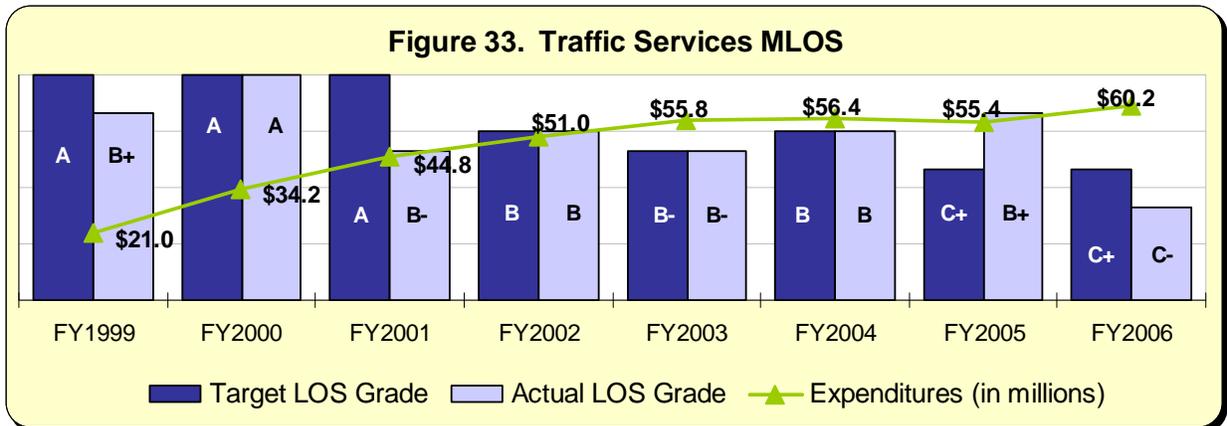
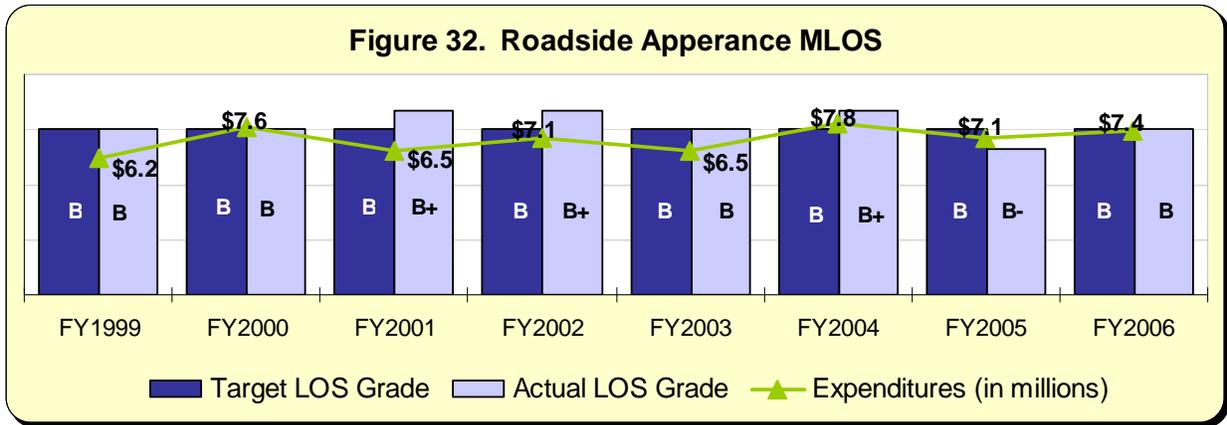
The table below lists all nine maintenance program areas with the projected targets and actual results for each. Four of the nine maintenance program areas exceeded and two met the targeted performance for 2006.

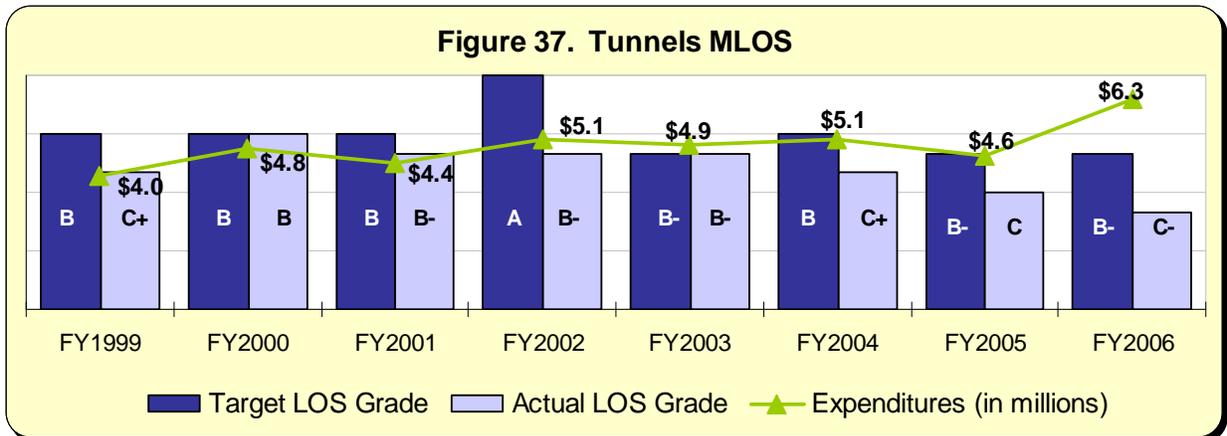
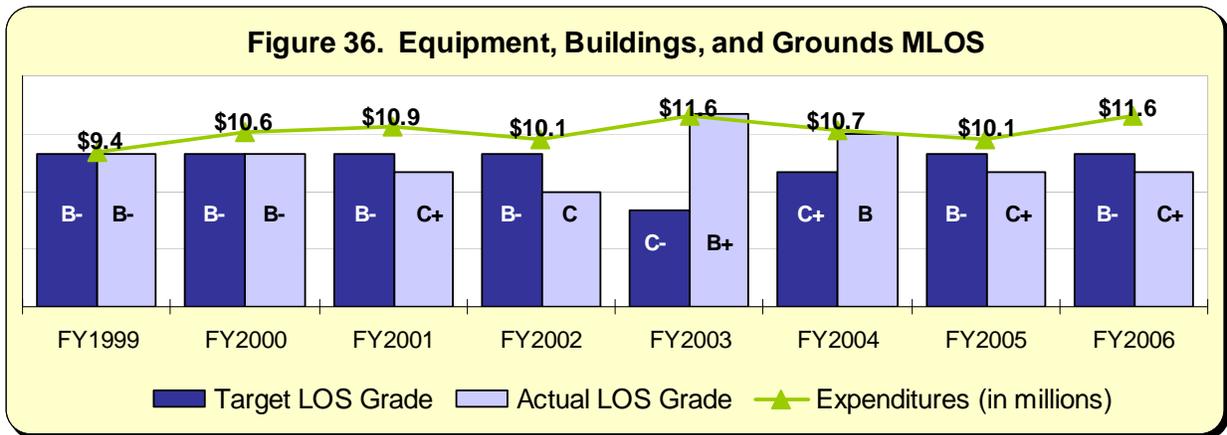
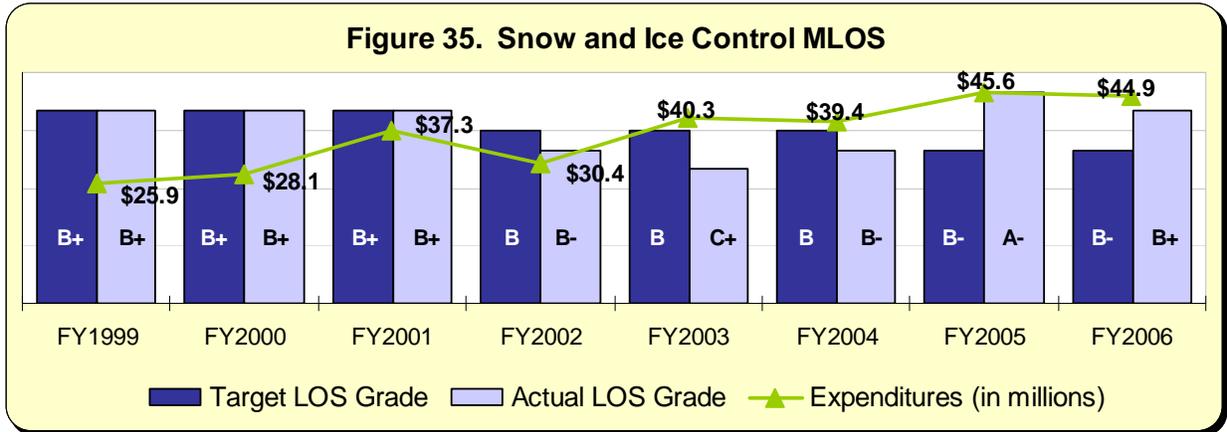
**Table 2. Maintenance Condition Survey (FY2006)**

Maintenance Program Area	Target MLOS	Actual MLOS	Achievement
Planning and Scheduling	B	B	Target Met
Roadway Surface	B	B+	Target Exceeded
Roadside Facilities	B	B+	Target Exceeded
Roadside Appearance	B	B	Target Met
Traffic Services	C+	C-	Target Not Met
Structures	D+	C	Target Exceeded
Snow & Ice Control	B-	B+	Target Exceeded
Equipment, Buildings & Grounds	B-	C-	Target Not Met
Tunnels	B-	C-	Target Not Met
<b>Statewide Total</b>	<b>B</b>	<b>B-</b>	<b>Target Not Met</b>

The following graphs illustrate eight years of investments (in millions of dollars), the levels of service targets, and the levels of service outcomes on an annual basis in the maintenance program areas. Generally, maintenance has provided expected results from resources invested.

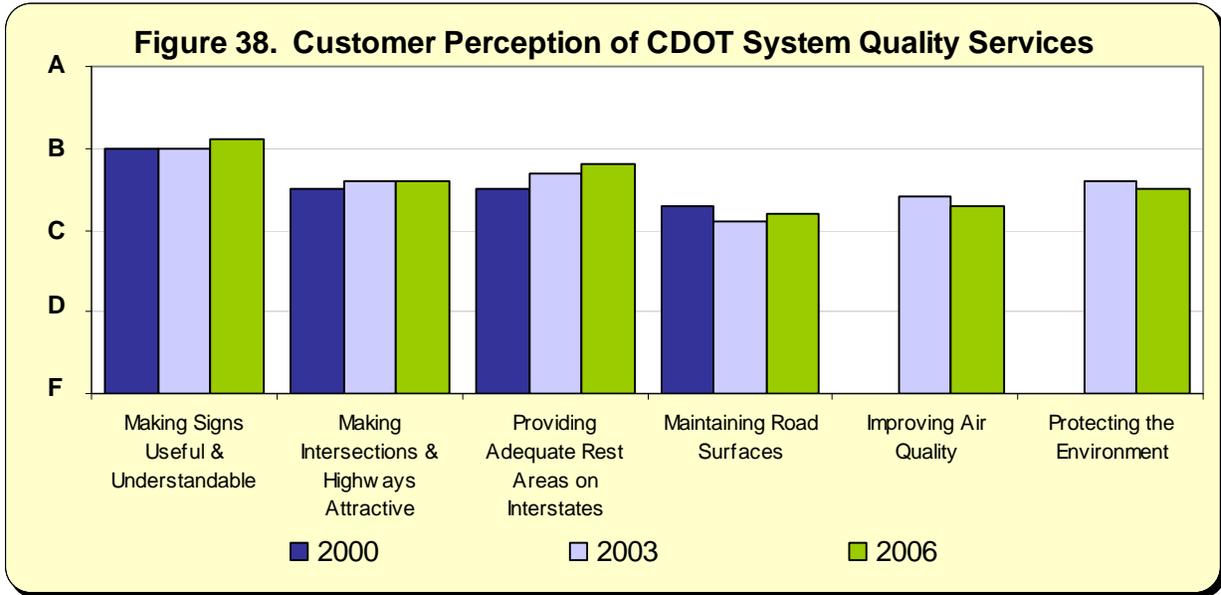






### Customer Perception of System Quality

Ratings shared by the customer related to specific aspects of services provided by CDOT included under the system quality category ranged from the “B” level for ‘making highway signs useful and understandable’ down to the “C+” level for ‘maintaining road surfaces.’ These measures over time will help CDOT understand if its investments are providing value and benefit in meeting the Department’s goals as well as meeting customer expectations.



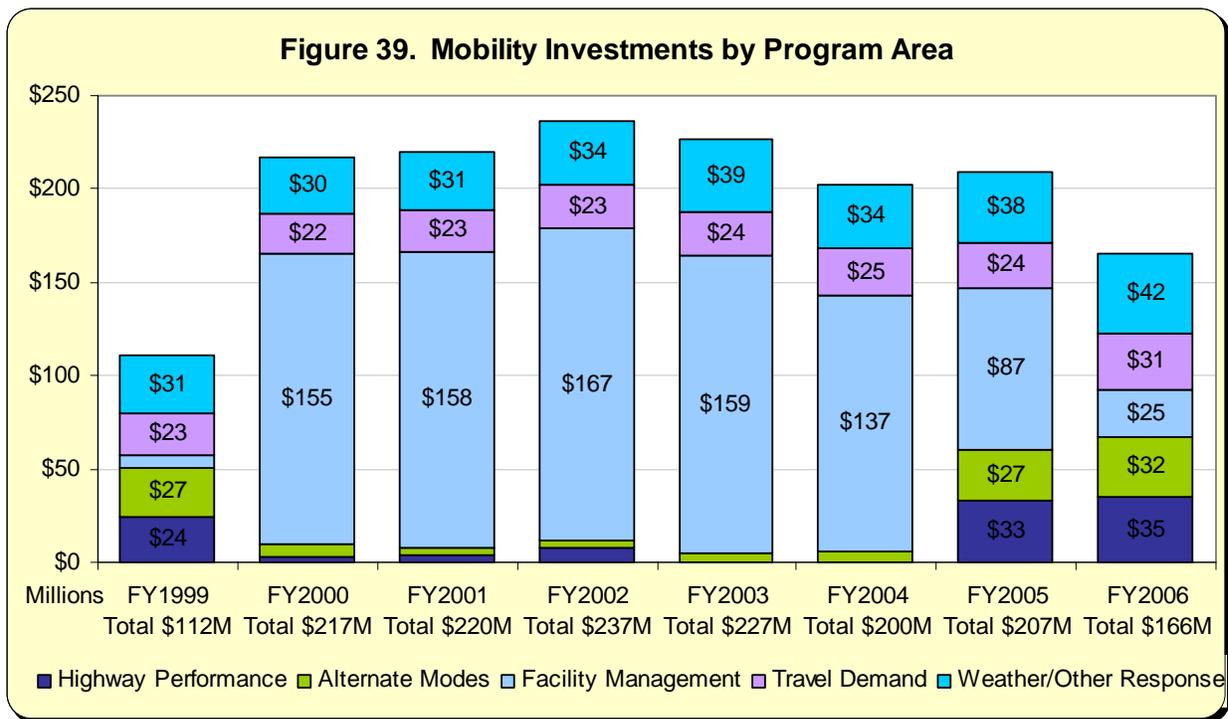
## MOBILITY INVESTMENT CATEGORY

*“Programs, services and projects that provide for the movement of people, goods, and information.”*

The Mobility Investment Category is a comprehensive category that complements other investment categories. The Mobility Investment Category Strategy encompasses investments made in accessibility to the transportation system, transportation options, connectivity, travel time variability and overall infrastructure management.

### CDOT’s Investment in Mobility

In fiscal year 2006, CDOT allocated approximately \$166 million, which is 20.3% of the total budget, to Mobility related areas including: Highway Performance, Weather/Other Response, Travel Demand, Facility (System) Management, and Alternate Modes.



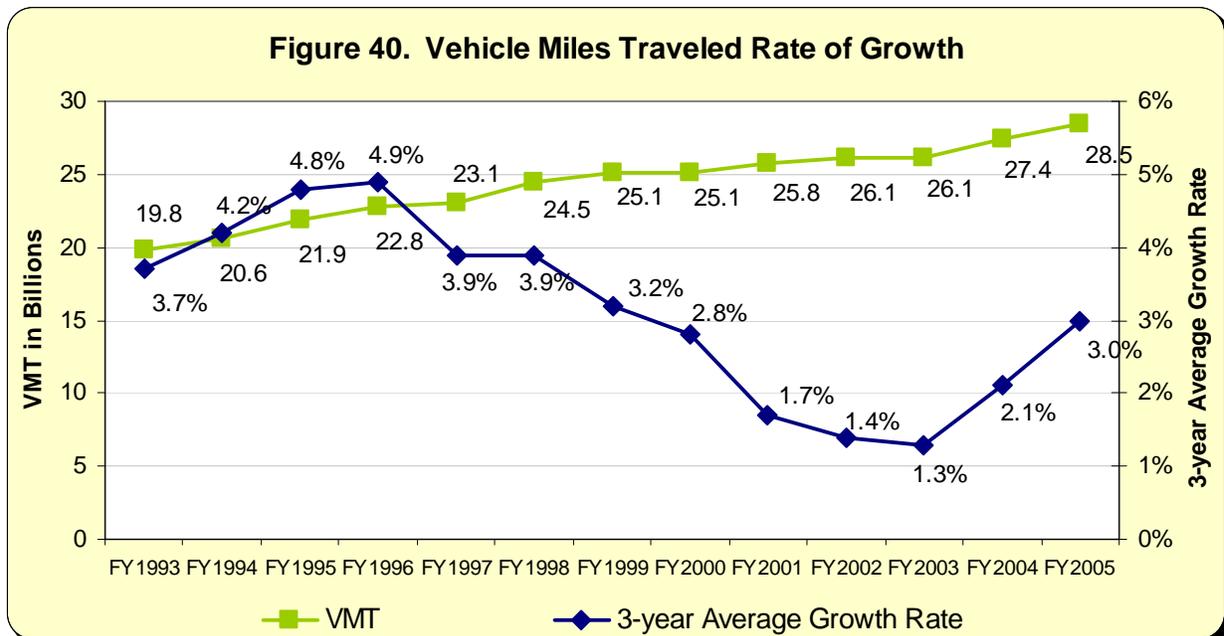
### Current Condition

The measure of performance for Mobility is an area that has been evolving since the beginning of the investment strategies program. There are numerous suggested measures that have been proposed, not only in Colorado, but also in many other states, to measure Mobility with little concurrence on best practices. Mobility means many different things to many different transportation users. The effort to illustrate mobility performance statewide led to CDOT being committed in the near term to measure mobility by the growth in vehicle miles traveled (VMT), and volume to capacity (V/C) ratios. Customer perception of mobility is an important tool to balance the priorities of mobility reliability, accessibility, variability, availability, and connectivity.

The emphasis on Travel Rate Index (TRI) to provide mobility data statewide is limited by the enormous data requirements of TRI. Consideration of TRI and/or Travel Time Index (TTI) may continue in specific corridors in the future.

### Vehicle Miles Traveled

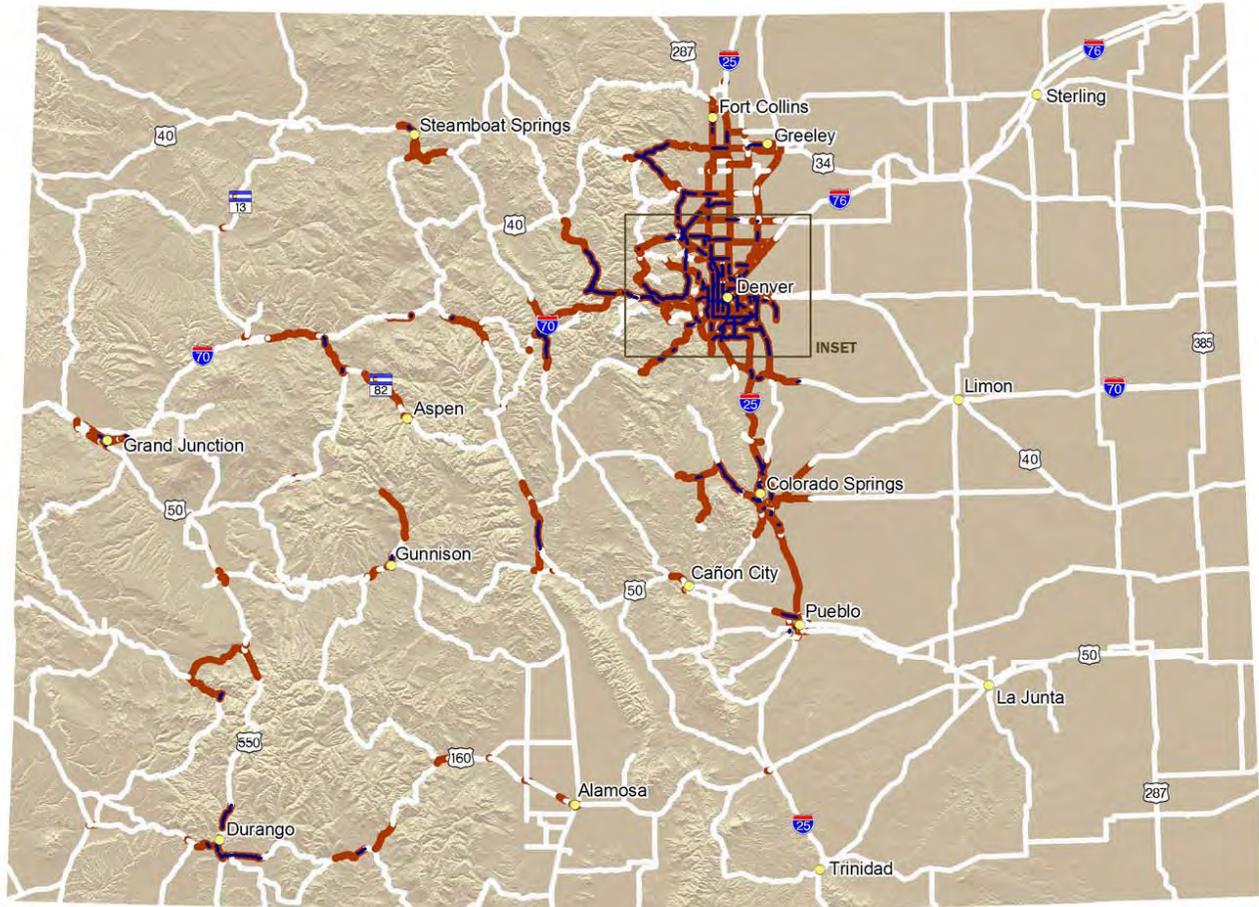
The total number of vehicle miles traveled on the state highway system is continuing to increase. Vehicles miles traveled increased 3.97% from 27.4 billion in 2004 to 28.5 billion in 2005. The 3-year average growth rate is used to measure relative increase in VMT over time. From 1996 through 2003, the 3-year average growth rate showed a downward trend; that is, the increase in VMT was slowing down. However, in recent years, the 3-year average growth rate has shown an upward trend; the rate of growth in VMT on the state highway system is once again increasing.



## Volume to Capacity

CDOT conducts an annual analysis of highways to identify congested roadway segments. Congested roadway segments are defined as those having a volume to capacity (V/C) ratio of 0.85 or greater based on average daily traffic volumes. The map on the next page shows the roadway segments that are currently congested (V/C >0.85) and those that are expected to be congested by 2035. Additionally, the percent of congested lane-miles on the state highway system in each of CDOT's six engineering regions is provided. It should be no surprise that the chart and map reveal that the majority of the congestion resides along the Front Range where the majority of Colorado's population resides. The congestion data, tracked over a period of time, on the highway system gives valuable data for trends to develop strategies for mitigation of congestion. Today there are about 520 miles of congested state highways on which traffic volumes exceed 85 percent of the roadway capacity. Congested highway miles are projected to more than triple by 2035. Overall, eight percent of the state highway lane miles are currently congested.

Figure 41. 2006 and 2035 Congested State Highways



INSET: DENVER METROPOLITAN AREA

STATE HIGHWAYS



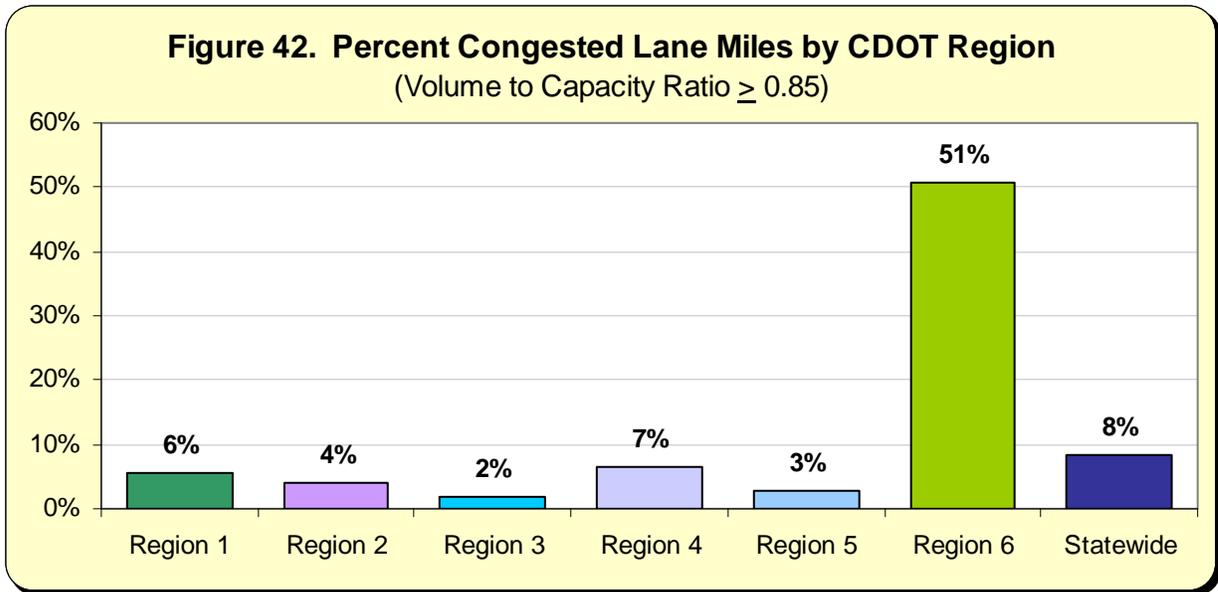
CONGESTED STATE HIGHWAYS



2006 2035

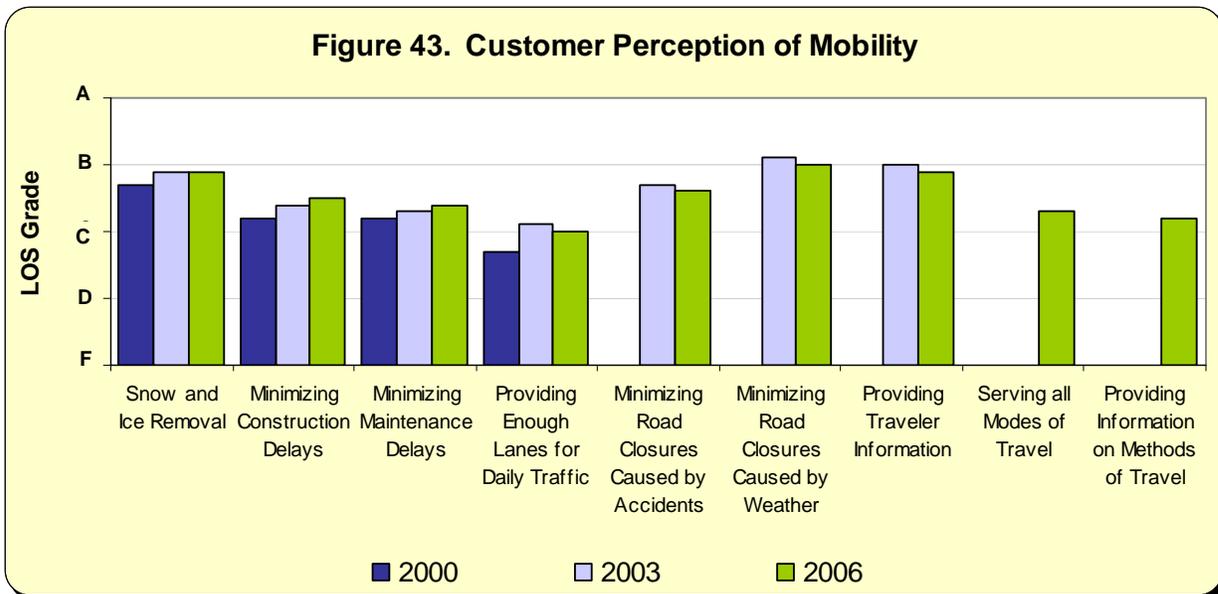
Congestion is defined as volume that exceeds 85% of roadway capacity

Source: [www.dot.state.co.us/App\\_DTD\\_DataAccessed/Index.cfm](http://www.dot.state.co.us/App_DTD_DataAccessed/Index.cfm)



### Customer Perception of Mobility

According to the 2006 Statewide Resident Survey, congestion remains the highest transportation related priority issue in Metro Denver, the Rest of the Front Range, and the Western Slope, while it was the second most frequently given response in the Eastern Plains. This high concern is also reflected in the mobility related areas, as shown in the graph below. Ratings for “conducting road construction work in ways that keep traffic delays to a minimum” and “conducting road maintenance work in ways that keep traffic delays to a minimum” improved slightly from 2000 to 2006. These measures over time will help CDOT understand if their investments are providing value and benefit in meeting the Department’s Mobility goals as well as meeting customer expectations.



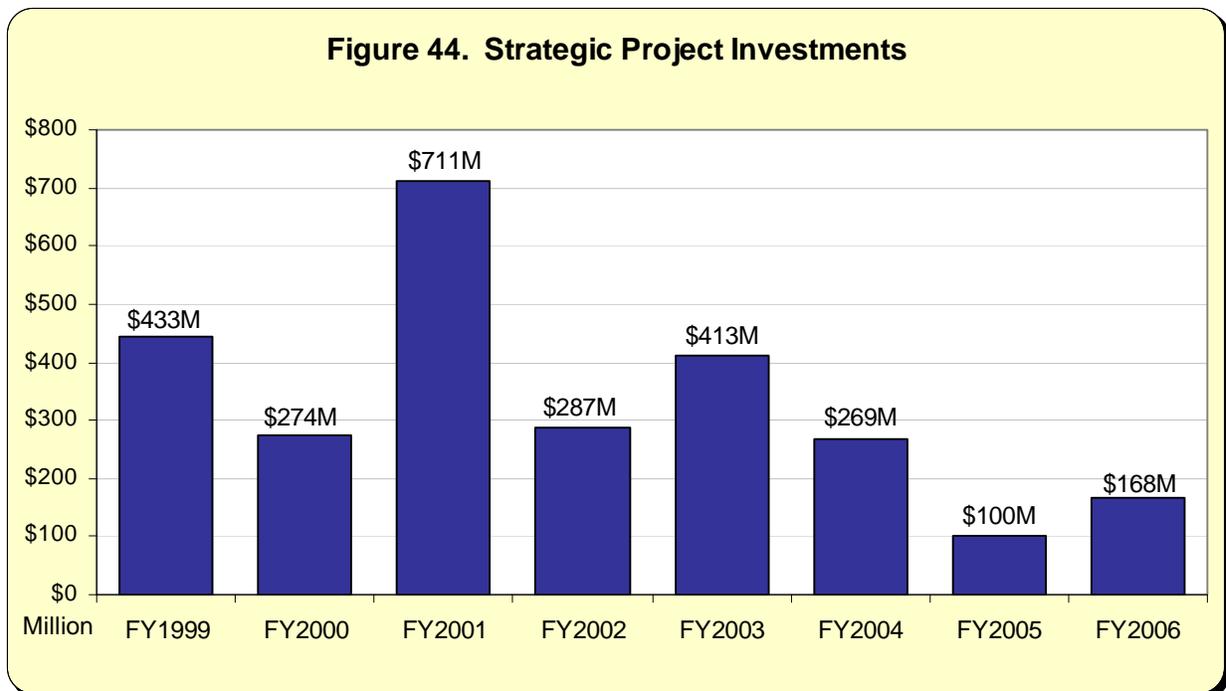
## STRATEGIC PROJECTS INVESTMENT CATEGORY

*“The 28 high-priority state-wide projects that have been committed for accelerated funding.”*

The Strategic Projects Investment Category was established to accelerate the funding and development of high priority transportation projects throughout the state. A base of 28 specific projects is maintained within this investment category. The elements that qualify a project for high priority status are based on the overall visibility, cost and return on investment of the project in addressing on-going needs of safety, mobility, and reconstruction. These projects are large in scope and consist of multiple phases to complete.

### CDOT’S Investment in Strategic Projects

As approved by the Transportation Commission, the total 1999 projected un-inflated cost to build the 28 strategic projects was \$4.65 billion dollars. The current 2005 cumulative programmed dollars are \$2.983 billion dollars. For fiscal year 2006, CDOT allocated approximately \$168 million dollars to continue towards the completion of these Projects.

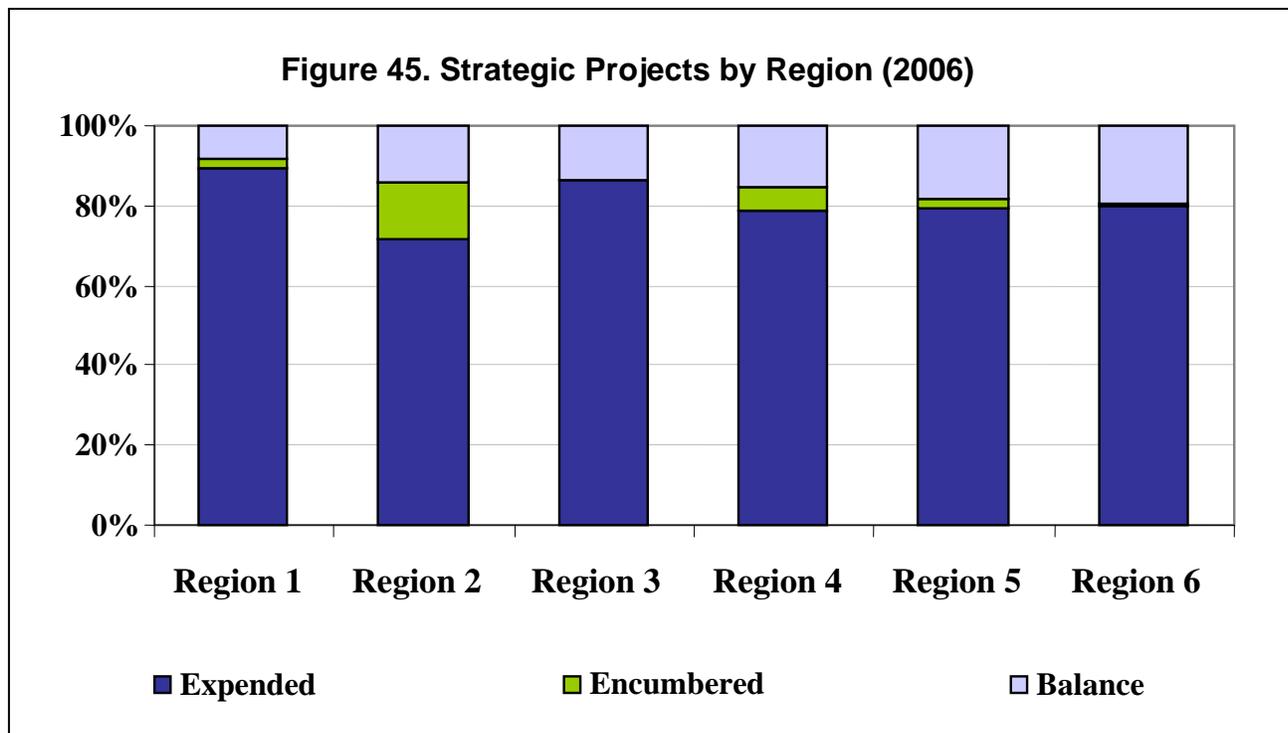


### Current Condition

Of the 28 Strategic Projects, the Regions have monitored the project dollar expenditures and encumbrances since the inception of the program to expedite the delivery of the projects. The continuing challenge is to encumber or expend 100% of funds within a specified timeframe on planned projects. The difficulty of this measure is the environment in which projects are managed. Project delays can and do occur outside of the direct control of CDOT project managers. Despite this somewhat difficult situation and challenge, the performance data should ultimately provide the necessary information to improve the encumbrance and expenditure of funds that will result in project completions.

The Strategic Projects current status indicates that through 2006, 86% of the budgeted dollars have been expended or encumbered since the adoption of the Strategic Projects program. To date, all of the TRANs bonds have been issued and programmed for projects.

Seventeen of the original 28 projects have been completed or fully funded. Though completion of the remaining projects identified in the Strategic Project program is dependent on the future of the Senate Bill 1 funds allocated by the legislature on an annual basis, current revenue forecasts indicate the remaining eleven projects should be completed by 2017.



## COLORADO TOLLING ENTERPRISE BOARD

In August 2002, the Colorado Transportation Commission created a Colorado Tolling Enterprise Board (CTE) to finance, construct, operate, and maintain toll highways in Colorado.

The CTE and CDOT conducted a preliminary evaluation of the existing and planned statewide transportation system and identified more than 75 potential candidate corridors. Through an extensive screening process, the number was reduced to approximately 40 candidate corridors. An extensive screening criterion was developed to use in the analysis.

CDOT entered into predevelopment agreements with private sector companies regarding the creation of toll facilities. The potential introduction of toll facilities, specifically express toll lanes, on I-70 from I-25 east to Pena Boulevard, and C-470 from I-70 to I-25 is options that will be evaluated as part of environmental studies that are currently being conducted on the corridors. Both predevelopment agreements are the result of unsolicited proposals presented to CDOT.

The Tolling Enterprise is also consulting with local entities regarding the completion of the missing link between I-70 and US 36 that would connect C-470 to the Northwest Parkway. This is commonly referred to as the Northwest Corridor, and efforts are underway to identify whether a toll facility is warranted. CTE is also working with CDOT to identify candidate toll facilities and to incorporate such toll facilities into the applicable Regional Transportation Plan and the Statewide Transportation Plan.

In 2003, the CTE began a statewide tolling system traffic and revenue feasibility analysis on twelve corridors. This study was the first step to evaluating and identifying potential toll projects based on financial feasibility. The study determined that nine corridors were deemed feasible to which tolling revenues could cover the cost the build only the tolled portion of the project, but also other major transportation improvements that will remain free of tolls. The potential corridors include:

- **I-25 north:** construction of two new reversible express toll lanes from US 36 to 120th Ave. connecting to four new express toll lanes extending to SH 66.
- **I-70 east:** construction of four new express toll lanes from Colorado Boulevard to Chambers.
- **US 36:** construction of four new express toll lanes from I-25 to McCaslin and two new express toll lanes to Cherryvale.
- **I-225:** construction of four new express toll lanes from I-70 to Parker Road.
- **I-270:** construction of four new express toll lanes from I-25 to I-70.
- **C-470:** construction of four new express toll lanes from I-70 to I-25.
- **Northwest Corridor:** new toll road construction in the northwest segment of the city.

- **I-70 mountain corridor:** tolling at the Eisenhower Tunnel and Twin Tunnels and construction of one new additional tolled two-lane tunnel at each location.
- **Powers Boulevard in El Paso County:** construction of new tolled connections to I-25 from existing Powers Boulevard on the north and south end of the roadway. The middle section of Powers would remain toll free pending its upgrade to a limited-access freeway.

While the analysis shows the above-listed corridors should be considered as potential toll projects, it does not mean that these projects will be constructed. Necessary environmental studies to determine a locally preferred alternative must be completed and even then, that alternative may not result in tolling as a way to fund the improvement. Should toll lanes emerge as an alternative, the corridor would then undergo a much more detailed financial analysis and bond market screening to determine if the project has enough financial viability and stability to secure investors.

## STATE HIGHWAY SYSTEM INVESTMENT NEEDS

In order to strategically plan for the future of the statewide transportation system in Colorado, several funding scenarios have been evaluated to determine the effects of varying funding levels on the performance of the transportation system.

The base scenario, **Forecast Revenue**, represents the level of funding currently estimated to be available by CDOT's resource allocation program plus local and modal revenue projections through 2035. It is estimated that \$28 billion will be available for state highway programs, and an additional \$95 billion will be available for transit, other modes and local roads, totaling \$123 billion from all sources by 2035.

With this scenario, conditions on the state transportation system will deteriorate. The average driver on the state's congested routes will experience an increase in daily delay from 22 minutes today to nearly 70 minutes in 2035. Today's approximately 60 percent good/fair rating for roadway surfaces on the state highway system will fall to 25 percent; local roads will also deteriorate. It is also estimated many major bridges statewide will require load restrictions, increased maintenance or other special management measures to ensure safe conditions. Efforts to reduce traffic fatalities and crashes will be diminished, and less than two-thirds of the estimated demand for public transit in the state will be met. These results will have a negative effect on our quality of life.

The **Sustain Current Performance Scenario** represents the funding needed to sustain the transportation system at current performance levels. The level of investment necessary to achieve today's level of performance is estimated at \$176 billion, or \$53 billion beyond currently forecast revenues through 2035. It will cost \$64 billion - \$36 billion beyond forecast revenues - to sustain the state highway system, including maintenance and operation costs beyond improvements to widen the state highway system. If the funding becomes available to sustain the system at current performance levels, the system would not reflect any improvement over today's conditions. Instead, with an additional \$53 billion beyond the current revenue forecast through 2035, the maintenance level of service would be sustained at a "B" grade, congestion delay sustained at 22 minutes, pavement and bridge condition sustained at today's levels, fatality rates reduced, as well as sustaining service levels for aviation, transit and local roads.

The **Accomplish Vision Scenario** reflects the additional investment level necessary to achieve the transportation vision strategies developed through the corridor visioning public process. To accomplish the vision would require a total of more than \$249 billion, more than double the currently forecast revenues through 2035. If additional funds were available to accomplish the vision, the investment would result in significantly better performance on the network than is experienced today, even with the growth anticipated in the state. The vision would provide Colorado with significant mobility and safety benefits such as a 21st Century inter-regional public transportation, state-of-the-art traveler information systems, seamless point-to-point travel over a multimodal system, and inter-modal freight transportation. Vision improvements and modal choices would enhance transportation activities defined by CDOT's management systems. Regional priorities in vision plans include activities such as adding shoulders and passing lanes, making interchange and intersection improvements, widening highways, implementing intercity

public transportation and high speed rail. In addition to these quantifiable results, the additional vision investment would make great strides in other benefits such as economic development and improved quality of life.

Clearly, with greater investment in the transportation system, the performance measures on the system will improve. The estimated effects on system performance for each of the scenarios are depicted on the following chart and are described in the subsequent sections.

### **Forecast Revenue Scenario**

Under this funding scenario, conditions on the state transportation system will deteriorate. The average driver on the state's congested routes will experience an increase in daily delay from 22 minutes today to nearly 70 minutes. Today's approximately 60 percent good/fair rating for roadway surfaces on the state highway system will fall to 25 percent, and local roads will also deteriorate. The level of maintenance on the state highway system will grade an "F". It is also estimated that 36 percent of all bridges statewide will require load restrictions, increased maintenance or other special management measures to ensure safe conditions for people and goods. Efforts to reduce traffic fatalities and crashes will be diminished. Less than one half of the estimated demand for public transit in the state will be met.

In addition to these quantifiable effects, other results will have an effect on the quality of life in the state. Residents will incur higher vehicle operating and maintenance costs, businesses will also experience higher costs, the movement of goods will incur higher costs which will be passed on to the consumer, less personal time will be available because of increased commuting time, and it will be more difficult to access our state's beloved recreational areas.

### **Sustain Current Performance Scenario**

By definition, this scenario will provide sufficient funding to maintain the level of performance for the key performance measures at the same levels as experienced today. This represents a significant improvement over the levels of performance which would otherwise be projected, but it does not reflect any improvement over today's conditions.

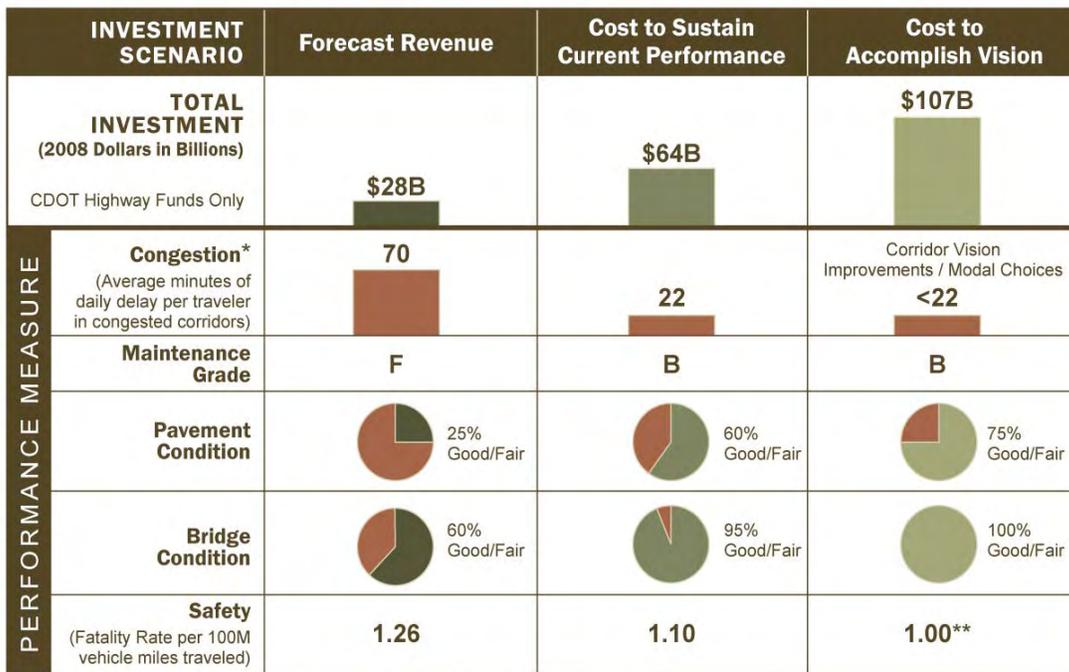
### **Accomplish Vision Scenario**

This scenario will provide a level of funding that will not only achieve the levels of performance experienced today but that will also reflect significant improvement on a number of performance measures. Pavement conditions on the state highway system will improve to 75 percent in the good/fair rating, and all bridges will be up to standards. Local roads will likewise improve. Safety improvements will result in a reduction of the fatality crash rate. The aviation system will be enhanced, and the transit system will be able to meet 90 percent of the projected demand.

Figure 46. Estimated 2035 State Highway System Performance Outcomes



**Estimated 2035 State Highway System Performance Outcomes**



\*Congestion is one component of the mobility investment category  
 \*\*Fatality Rate may decrease with the passage of a primary seat belt law

**Estimated 2035 Local Roadway, Transit / Rail and Aviation System Performance Outcomes**



Dollar amounts may not add due to rounding.