

The Interstate Highway System in Colorado:

Saving Lives, Time and Money

*A report on the condition, impact, use and future needs of
Colorado's Interstate Highway System*

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Founded in 1971, TRIP of Washington, DC is a nonprofit organization that researches, evaluates and distributes economic and technical data on highway transportation issues. TRIP is supported by insurance companies, equipment manufacturers, distributors and suppliers; businesses involved in highway engineering, construction and finance; labor unions; and organizations concerned with an efficient and safe highway transportation network.

Executive Summary

Fifty years ago the nation embarked on its greatest public works project, the construction of the Interstate Highway System. President Dwight D. Eisenhower provided strong support for the building of an Interstate Highway System that would improve traffic safety, reduce travel times and improve the nation's economic productivity.

Serving as the most critical transportation link in the state's economy, Colorado's Interstate highways have significantly improved the lives of the state's residents and visitors. In Colorado, and throughout the nation, the Interstate system allows for high levels of mobility by greatly reducing travel times and provides a significantly higher level of traffic safety than other routes.

But 50 years after President Eisenhower articulated a vision for the nation's 20th Century transportation system, Colorado and the nation again face a challenge in modernizing the system of aging, increasingly congested Interstate highways. If Coloradans are to continue to enjoy their current level of mobility on Interstate highways and bridges, the state will need to make a commitment to providing the public with a 21st Century highway system.

In this report, TRIP looks at the history and impact of Colorado's Interstate Highway System, its current use and condition and at the future needs of the state's most critical transportation system. Sources of data for this study include the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), the U.S. Census Bureau and the Colorado Department of Transportation (CDOT). The major findings of the report are:

The Dwight D. Eisenhower National System of Interstate and Defense Highways, which has been called the most ambitious public works project built since the Roman Empire, is the most critical link in the nation's and Colorado's transportation system.

- Colorado's Interstate system, which includes two percent of all roadway lane miles in the state, carries 24 percent of all vehicle travel in the state.
- Since Interstate construction began in 1956, vehicle miles of travel in Colorado have increased by 585 percent, from 6.7 billion to 45.9 billion miles driven annually.
- The number of vehicles in Colorado has increased by 161 percent since 1956, and the state's population has jumped by 191 percent – from 1.6 million to 4.6 million.

The state's Interstate Highway System saves the average Colorado resident \$2,804 per year in saved lives, saved time, reduced motor fuel consumption and reduced apparel, food, housing and transportation costs. The total annual statewide savings is \$12.9 billion.

- Improved traffic safety provided by the Interstate system saves the state \$633 million annually and the average state resident \$138 annually in reduced healthcare costs and costs associated with lost productivity.
- By reducing travel times, the Interstate system saves each Colorado resident 67 hours of travel time annually - 307 million hours statewide.
- The Interstate system saves Colorado residents \$4.9 billion annually in the value of saved time and fuel - \$1,072 per person (\$992 in time and \$80 in fuel).
- Colorado's Interstate system annually reduces statewide motor fuel consumption by 147 million gallons and saves the average person in the state \$80 per year in reduced fuel costs.
- Consumer costs have been significantly lowered by the Interstate Highway System. The cost of transporting goods has been reduced because the time it takes to make trips has been decreased. Increased access between locations has enabled access to cheaper land.
- TRIP estimates that consumer costs in Colorado for apparel, food, housing and transportation are reduced by \$7.3 billion annually, or \$1,594 per state resident, as a result of the Interstate Highway System.
- TRIP's estimates of reduced consumer costs are based on consumer expenditure estimates by the U.S. Department of Labor and estimates of the Interstate's impact on consumer costs collected in a survey of transportation economist.

Construction of the Interstate system in Colorado began in 1956 and was mostly completed by 1976, providing the state with 956 miles of Interstate highways, running the length of the state and connecting the state's major urban areas.

- The Federal-Aid Highway Act of 1956, signed into law by President Dwight Eisenhower on June 29, 1956, called for the construction of a 41,000 mile system of Interstate highways to be paid for by taxes on motorists, such as the federal motor fuel tax. The federal motor fuel tax was set at three cents-per-gallon in 1956 and is now 18.4 cents-per-gallon.

- Revenue collected from the 18.4 cents-per-gallon federal motor fuel tax and the 24.4 cents-per-gallon federal diesel fuel tax are the primary source of funding for the federal Highway Trust Fund, which distributes funds to state and local governments for highway and bridge repairs as well as other surface transportation improvements, including public transit, walking and bicycling facilities.
- The first Interstate route that was opened in Colorado was the Denver Valley Highway, which opened in 1958. Planning for this limited-access freeway through Denver, which eventually became the first segment of I-25 to be completed in Colorado, as well as the first interstate segment finished in the entire state, actually began in 1944.
- Ninety-seven percent of the length of Colorado's Interstate system was completed by 1976.
- The final piece of the Interstate in Colorado, a six-mile segment of I-176 connecting I-25 and I-70 in the Denver area, was finished in 1993. This vital link in Colorado's Interstate system was designed to carry 60,000 vehicles per day; it now carries more than 250,000 vehicles per day.
- Vehicle miles of travel on Colorado's Interstates have increased by 417 percent since 1966, from 2.1 billion miles driven annually to 10.8 billion miles driven annually.

Traffic congestion on Colorado's Interstate highways is increasing as travel growth significantly outpaces the addition of new lanes.

- Thirty-three percent of Colorado's 269 miles of urban Interstates are considered congested because they carry traffic levels that result in significant delays during peak travel hours.
- Between 1990 and 2004, vehicle travel on Colorado's Interstates increased by 56 percent, while lane miles on the system only increased by three percent.
- During the same time, the average annual amount of travel per Interstate-lane-mile in Colorado increased by 51 percent.

- The ten most congested sections of Interstate highways in Colorado are listed below. A full list of congested sections can be found in the text of the report.

Route	Urban Area	From	To	Length (Mi.)	Daily Travel	Lanes
I-225	Denver	I-225, north of State Highway 83, Parker Rd	I-225, south of I-70	5.8	103,700	4
I-25	Colorado Springs	I-25, west of the southern junction of State Highway 25, Colo. Springs Business Route, Nevada Ave	I-25, north of Bijou St. Interchange	2.1	84,900	4
I-70	Denver	I-70, southwest of State Highway 26 & State Highway 40	I-70, south of State Highway 6, 6th Ave	3.9	67,000	6
I-70	Denver	I-70, north of State Highway 58	I-70, west of Harlan St.	3.8	115,800	6
I-25	Colorado Springs	I-25, north of State Highway 38, Fillmore St. Interchange	I-25, south of State Highway 105, Monument	14.0	74,500	4
I-25	Denver	I-25, northwest of University Blvd	I-25, north of State Highway 128, 120th Ave. Interchange	18.5	189,900	8/6
I-25	Denver	I-25, north of State Highway 7 Interchange	I-25, south of State Highway 119 Interchange	3.0	67,400	4
I-70	Denver	I-70, east of State Highway 95, Sheridan Blvd.	I-70, east of Washington St.	4.0	120,200	6/4
I-25	Denver	I-25, north of State Highway 88, Arapahoe Rd. Interchange	I-25, north of Yale Ave. Interchange	5.4	179,200	6
I-25	Fort Collins	I-25, south of State Highway 392 Interchange	I-25, south of Prospect St. Interchange	2.3	50,100	4

Source: Colorado Department of Transportation

Colorado faces a significant challenge in rebuilding its aging Interstate highways system and providing additional lane capacity to meet growing travel demands. Traffic congestion is likely to get significantly worse in Colorado unless the state can fund needed congestion-relief projects.

- Travel on Colorado’s Interstate highways is expected to increase by 48 percent by the year 2026.
- Currently, 33 percent of Colorado’s urban Interstates are congested. By the year 2016, if the state’s urban Interstate highways are not widened, 59 percent of Colorado’s urban Interstate highways will be congested during peak periods.
- By 2026, 73 percent of Colorado’s urban Interstates will be congested during peak periods unless urban Interstate capacity is increased.

- Increasing urban traffic congestion may erode some of the logistics advantages that Colorado producers and distributors have over competitors as shipping costs increase while reliability decreases.

Travel on Colorado's Interstate highways is safer than travel on all other roadways in the state. Colorado's Interstates provide travelers with a network of highways with a variety of safety designs that greatly reduce the likelihood of serious accidents.

- Colorado's Interstate highways have saved approximately 5,000 lives in Colorado since 1956. This estimate is based on assuming that if there were no Interstate highways, traffic would be carried by other major roads in the state, which have higher traffic fatality rates.
- Colorado's Interstate system has saved an average of 50 lives per year over the last 10 years, based on the above criteria.
- Travel on Colorado's Interstate highways is significantly safer than travel on all other roadways. The fatality rate per 100 million vehicle miles of travel on Colorado's Interstate system in 2004 was 0.91, while it was 1.62 on non-Interstate routes in 2004 in Colorado.
- There were 99 traffic fatalities on Colorado's Interstate highways in 2004. Only 15 percent of the 665 traffic fatalities that occurred in Colorado in 2004 were on the Interstate system, even though it carried 24 percent of all travel in the state in 2004.
- The features that make Interstates safer than non-Interstate routes include: a separation from other roads and rail lines, a minimum of four-lanes, gentler curves and often paved shoulders, and median barriers and rumble strips to warn drivers when they are leaving the roadway.

Overall, pavement conditions on the Colorado Interstate system are below average, while Interstate bridge conditions are good.

- Seven percent of Colorado's Interstate pavements are in poor condition, while 18 percent are in mediocre condition. An additional 20 percent of the state's Interstate pavements are in fair condition and the remaining 56 percent are in good condition.
- Six percent of Colorado's Interstate bridges are rated structurally deficient and 16 percent are rated functionally obsolete.

- A bridge is structurally deficient if there is significant deterioration of the bridge deck, supports or other major components. Bridges that are functionally obsolete no longer meet current highway design standards, often because of narrow lanes, inadequate clearances or poor alignment.
- The following chart lists the 10 most heavily-traveled Interstate bridges that are structurally deficient:

Urban Area	Route Carried	Route or feature intersected	Daily Travel	Year Built	Lanes
Denver	State Highway 128/120th Ave.	I-25	64,746	1962	6
Denver	I-70 westbound	Sand Creek	61,088	1964	3
Denver	144th Ave.	I-25	68,693	1962	6
Denver	I-70 eastbound	Sand Creek	61,088	1960	4
Denver	104th Ave.	I-25	106,893	1962	9
Denver	State Highway 35	I-270	54,393	1968	4
Colorado Springs	Bijou Street	I-25	96,655	1959	4
Denver	I-25	Roadway, Railroad, South Platte River	206,267	1951	10
Denver	I-70 westbound	State Highway 391	62,540	1967	3
Denver	I-70	Tennyson Street	95,048	1966	6

Source: Colorado Department of Transportation

The Colorado Department of Transportation projects a \$69 billion shortfall in needed Interstate preservation and expansion funding through 2030.

- The department expects to receive \$28 billion from state and federal sources for Interstate needs over the next quarter-century. However, CDOT estimates that \$97 billion will be needed through 2030 to adequately address Interstate preservation, maintenance and capacity needs.
- The Colorado Department of Transportation has identified five sections of urban Interstates that need to be widened over the next 10 years to accommodate growing traffic:

Route	County	From	To	Length (Mi.)	Current Lanes	Proposed Lanes
I-25	Weld	State Highway 52	State Highway 66	7.8	4	6
I-25	Weld	State Highway 66	County Line	9.6	4	6
I-25	Larimer	County Line	State Highway 14	16.6	4	6
I - 70	Eagle	180	190	10	4	6
I-25 South	Douglas	174.000	180.600	7	4	6

Source: Colorado Department of Transportation

The Interstate system is the backbone of the Colorado economy and has played a critical role in improving business productivity in the state.

- Every year, \$93.2 billion in goods are shipped annually from sites in Colorado and another \$104.5 billion in goods are shipped annually to sites in Colorado, mostly by truck.
- Sixty-nine percent of the goods shipped annually from sites in Colorado are carried by trucks and another 16 percent are carried by courier services, which use trucks for part of the deliveries. Similarly, 74 percent of the goods shipped to sites in Colorado are carried by trucks and another 15 percent are carried by courier services, which use trucks for part of their deliveries.
- The Interstate system has led to significant increases in economic productivity. Improvements in the highway system have allowed businesses to adopt more efficient logistics practices, which reduce costs for producers and consumers.
- The initial construction of much of the Interstate system provided a tremendous boost to business productivity as a result of more efficient goods shipment. Economists have estimated that from the initial phase of Interstate construction in 1956 to 1970, the annual rate of return for every dollar of public investment in highway construction was 54 cents, which meant that investments recovered their costs in two years.
- The completion of the vast majority of the Interstate system by the 1980s and the deregulation of the U.S. trucking industry resulted in a significant improvement in the competitiveness of U.S. business. In fact, the cost of moving freight, as measured by U.S. business logistics costs, dropped from 16 percent of U.S. Gross Domestic Product (GDP) in 1980 to nine percent in 2002.
- Colorado's Interstate highways have reduced travel times both within the state and to locations outside of Colorado. The improved mobility provided by the Interstate system has given Colorado's residents greater choices about where they live, work, shop and spend their leisure time.

Several sections of Colorado's Interstate highways have several notable features or had a significant effect on travel patterns in the state. Some of these projects include:

- *Eisenhower-Johnson Memorial Tunnels:* These tunnels opened western Colorado to Interstate travel. Construction of the Eisenhower Tunnel

began in 1968 and was completed in 1973, and construction of the Johnson Tunnel began in 1972 and was completed in 1980.

- *Glenwood Canyon I-70 Final Link:* Construction of one of the final segments of the Interstate system began in 1980 and was completed in 1992. The final link of I-70 through Glenwood Canyon has been hailed as an engineering marvel because of the care taken to incorporate the interstate improvements into the fragile canyon environment while leaving as much of the flora and fauna intact as possible.

Introduction

The Dwight D. Eisenhower National System of Interstate and Defense Highways has been called the most ambitious public works project built since the age of the Roman Empire and is literally the backbone of America's economy.

Initially conceived in 1939, significant construction of the Interstate Highway System did not start until 1956 when Congress approved the financing of today's Interstate system, largely through collection of the federal motor fuel tax and other taxes on highway users.

Running the length of the state and connecting major urban areas, Colorado's Interstate Highway System is the most critical element of the state's transportation system. Fifty years after construction of the Interstate Highway System began, this network of highways has become the most important set of corridors linking Coloradans to people and businesses within the state and throughout the nation.

Today, the Interstate continues to provide Colorado with economic growth, improved traffic safety and convenient access, while playing a vital role in the nation's defense.

In this report, TRIP looks at the history and impact of Colorado's Interstate Highway System, its current use and condition and at the future needs of the state's most critical transportation system. Just as 50 years ago, when our leaders made critical decisions on the future of the nation's highway system, Colorado's political leaders now face the challenge of insuring that the safety and reliability of the state's Interstate system are maintained by investing adequately in needed repairs and improvements to meet the needs of the 21st Century.

Development of the U.S. Interstate System

In 1919, Lieutenant Dwight D. Eisenhower participated in the U.S. Army's first transcontinental motor convoy, from Washington, DC, to San Francisco. During the 62 days it took to cross the country, the convoy experienced numerous difficulties, including

roads that were muddy, narrow or otherwise inadequate and bridges that often could not support the vehicles in the convoy.

A generation later, General Eisenhower saw first hand how an efficient, effective highway transportation system benefited a nation, when he noted that the German Autobahn network, opened in 1935, provided a significant military advantage to Germany.

The United States began looking at the feasibility of constructing a series of interregional highways in the late 1930s. In 1938 Congress directed the then Bureau of Public Roads (BPR) to prepare a study on the possibility of building a national system of toll highways. The resulting 1939 BPR report concluded that it would be impossible to finance a national system of highways strictly through charging tolls, but did recommend that the U.S. build a system of approximately 26,700 miles of transcontinental highways. The BPR report also called for many of the design elements found on modern Interstate highways, including limited access, which separates highway traffic from other traffic and from trains. The report also suggested that the nation's highways should connect with the center of large cities, should include beltways around large urban areas and should bypass small towns.

Further attempts to develop a national highway system were interrupted by World War II. But as the Allies gained the upper hand in the war, Congress started to turn its attention to post-war challenges, including consideration of a modern highway system to support the nation's growing economy and improve safety and mobility. The Federal-Aid Highway Act of 1944 authorized the BPR to designate a system of approximately 40,000 miles of Interstate highways, which proved very similar to the routes approved

ultimately as the national Interstate system. But the 1944 highway bill did not specify any additional funds for construction of the highways, other than the small amount of funds currently made available by the federal government for highway construction.

The 1944 Highway Act identified the need for a national system of interconnected highways, but left out a key piece of the puzzle – how to fund a uniformly-designed national highway system, which would have significant differences in construction costs and traffic volume, depending on location. Even without significant federal funding available, cities and states began to move forward on their own, with some additional highway networks being built or planned in current Interstate corridors, under various financing mechanisms. These early highway projects included toll highways such as the Pennsylvania Turnpike and the New York Thruway and early urban highways including the Los Angeles Freeway System and the Detroit Expressway System.

But for most motorists and businesses, the inadequate roadway system of the late 1940s and early 1950s contributed to growing human and economic losses, as cars and trucks jostled for position on the nation's inadequate, narrow and winding roads and streets.

In 1954 President Eisenhower appointed a committee to draft a proposal to fund a national system of Interstate Highways. Eisenhower noted that the nation's obsolete highway system penalized Americans through increased traffic deaths, the waste of time caused by traffic delays, the increased cost of freight movement and the inability of the nation's highways to meet the mobility demands that would be caused by a regional catastrophe or national defense emergency.

The initial plan prepared for President Eisenhower called for funding a national Interstate system through bond financing, but Congress dismissed the use of bond revenue as the primary source of Interstate highway financing. In 1956, Congress overwhelmingly approved the construction of a national Interstate Highway System when the financing was changed to a pay-as-you-go format that would collect a series of user fees -- most notably a 3 cent-per-gallon tax on motor fuel -- into a national Highway Trust Fund.

The Federal-Aid Highway Act of 1956 called for the construction of a 41,000-mile Interstate Highway System, which was to be completed by 1970 at a cost of approximately \$27 billion. The design of the system was very similar to the initial 1944 plan, which called for connecting large urban areas, including routing highways into central cities, largely at the request of mayors and other local politicians who feared that their communities would be left behind without modern highway access. The Interstate system was designated to incorporate approximately 2,000 miles of existing highways, including the Pennsylvania Turnpike and the New York Thruway. The highways were to be built to high design standards that would reduce traffic deaths and increase the amount and speed of traffic that could be carried. These design standards included: full access control to limit entrance and exit to on and off ramps, a minimum of four lanes, medians to separate oncoming lanes and moderate curves.

The Construction of the Interstate System in Colorado

Following the signing of the Federal-Aid Highway Act of 1956 by President Eisenhower on June 29, 1956, Colorado moved quickly to orient its highway program

toward the enormous task of planning and constructing the state's eventual 956-mile Interstate system.

The first Interstate route that was opened in Colorado was the Denver Valley Highway, which opened in 1958. Planning for this limited-access freeway through Denver, which eventually became the first segment of I-25 to be completed in Colorado, actually began in 1944.¹

By 1966, more than half (59 percent) of the lane miles of Colorado's current Interstate system had been built, and nearly three-quarters (74 percent) of the system's length in center-lane miles had been constructed.²

By 1976, 91 percent of the lane miles of the state's Interstates had been built, while 97 percent of its length had been completed.³

Center lane miles are the actual miles of Interstate routes and lane miles are the total number of lanes multiplied by the length. Thus a 10-mile segment of four-lane highway equals 10 center-lane miles and 40 lane miles.

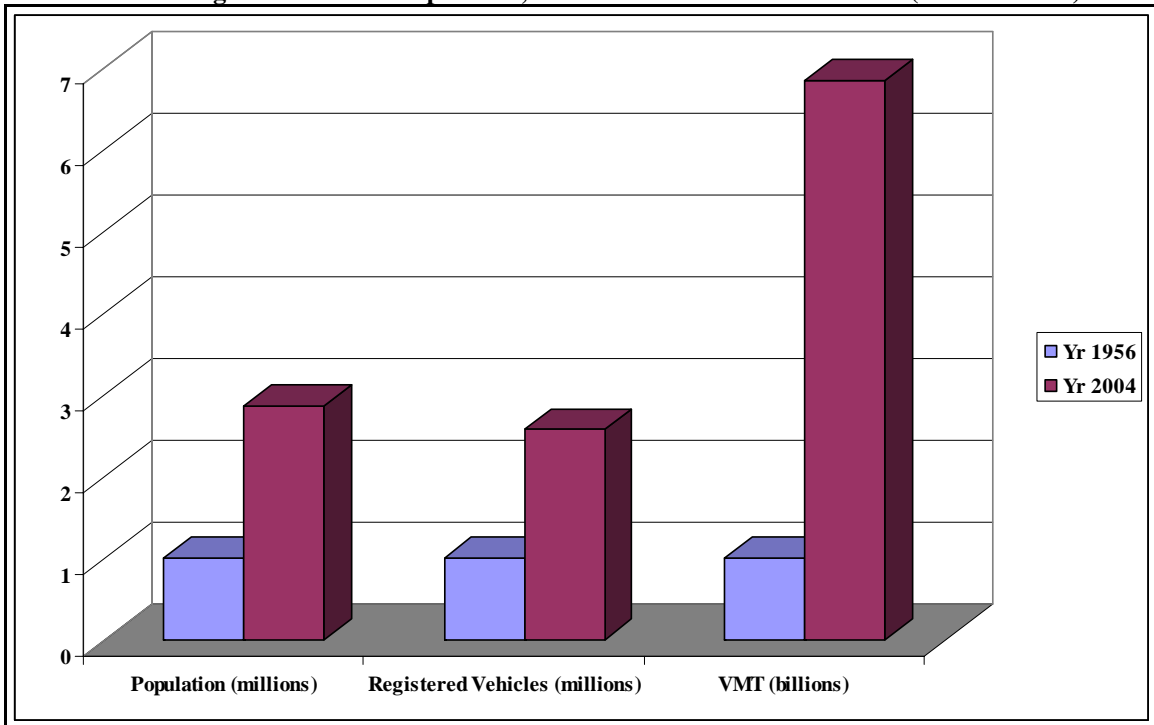
The final piece of the Interstate in Colorado, a six-mile segment of I-176 connecting I-25 and I-70 in the Denver area was finished in 1993. This "vital link" in Colorado's Interstate system was designed to carry 60,000 vehicles per day; it now carries more than 250,000 vehicles per day.⁴

Trends in Interstate Travel and Capacity

Since the beginning of the Interstate era 50 years ago, Colorado has seen enormous increases in population, the number of motor vehicles and the amount of vehicle travel. From 1956 to 2004 (the latest year for which data is available), the state's

population has increased by 191 percent, from approximately 1.6 million residents to 4.6 million, the number of motor vehicles increased by 161 percent from approximately 775,000 to 2 million, and vehicle travel in Colorado has jumped dramatically, increasing by 585 percent, from 6.7 billion miles driven annually to 45.9 billion miles driven annually.⁵

Chart 1. Percentage since 1956 in Population, Vehicles and Travel in Colorado (1 = 1956 level)



Source: TRIP analysis of Federal Highway Administration and U.S. Census Bureau data

Traffic Congestion on Colorado’s Interstates

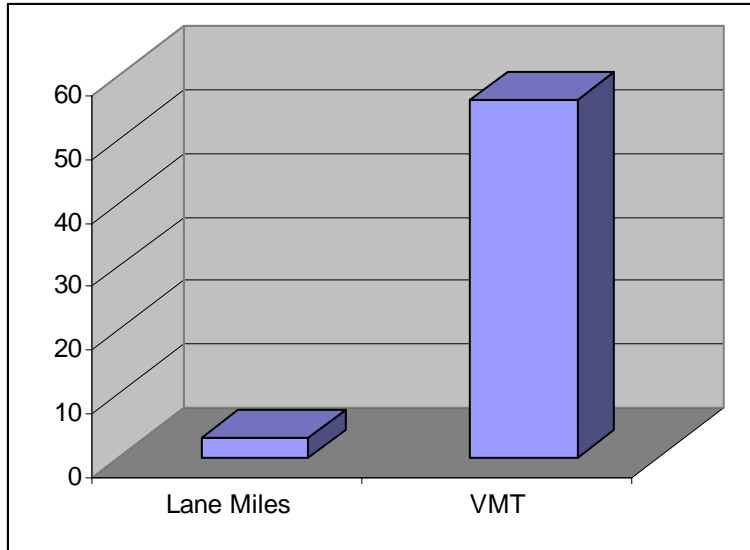
The Interstate Highway System was initially designed largely to provide transportation between the nation’s urban areas and to support national defense. But as

Interstate highways were ultimately built around and through many cities, they became the nation's most critical transportation corridors both between and within urban areas.

The Interstate Highway System remains the most critical component of Colorado's transportation system. While Interstate highways account for only two percent of all lane miles of roads in the state, they carry 24 percent of all travel in the state.⁶

Travel on Colorado's Interstate highways continues to grow at a significant rate, although there has been very little expansion of the system in recent years. From 1990 to 2004, vehicle travel on the state's Interstates increased by 56 percent from 7 billion miles driven annually to 10.9 billion miles driven annually.⁷ Yet, during the same time, total lane miles on Colorado's Interstate system increased by only three percent, from 3,951 lane miles to 4,066 lane miles. As a result of this significant increase in travel on the state's Interstates, with very little increase in Interstate lane mileage, these highways are now carrying significantly more traffic than in the past. In fact, the average annual amount of travel per Interstate lane mile in Colorado increased by 51 percent from 1990 to 2004.

Chart 2. Interstate Vehicle Miles of Travel (VMT) and Lane Mileage Increase in Colorado, 1990-2004.



Source: TRIP analysis of Federal Highway Administration data

This increase in traffic on Colorado’s Interstate highways has resulted in a significant rise in traffic congestion levels. Thirty-three percent – 90 of 269 total miles - of Colorado’s urban Interstates are considered congested because they carry traffic levels that result in significant delays during peak travel hours.⁸ The Federal Highway Administration considers any Interstate highway that carries more than 80 percent of its design capacity to be congested, because at this level of traffic, drivers experience significant delays in traffic flow. When Interstate traffic reaches 95 percent of the highways’ design capacity they are rated as being severely congested, because vehicles are likely to experience stop and go traffic and any incident can be expected to cause a serious breakdown of traffic flow.

The most heavily congested sections of urban Interstates in Colorado were identified by comparing current traffic volumes with overall design capacity (volume/service ratio). The state’s most congested section of Interstate highway is a 5.8

mile section of I-225 in Denver, from north of State Highway 83 to south of I-70. The following chart indicates the Interstate highway segments in Colorado that experience the greatest levels of traffic congestion.

Chart 3: The Most Heavily Congested Sections of Urban Colorado Interstates

Route	Urban Area	From	To	Length (Mi.)	Daily Travel	Lanes	Volume Service Flow Ratio
I-225	Denver	I-225, north of State Highway 83, Parker Rd	I-225, south of I-70	5.8	103,700	4	1.09
I-25	Colorado Springs	I-25, west of the southern junction of State Highway 25, Colo. Springs Business Route, Nevada Ave	I-25, north of Bijou St. Interchange	2.1	84,900	4	1.04
I-70	Denver	I-70, southwest of State Highway 26 & State Highway 40	I-70, south of State Highway 6, 6th Ave	3.9	67,000	6	1.04
I-70	Denver	I-70, north of State Highway 58	I-70, west of Harlan St.	3.8	115,800	6	0.98
I-25	Colorado Springs	I-25, north of State Highway 38, Fillmore St. Interchange	I-25, south of State Highway 105, Monument	14.0	74,500	4	0.96
I-25	Denver	I-25, northwest of University Blvd	I-25, north of State Highway 128, 120th Ave. Interchange	18.5	189,900	8/6	0.96
I-25	Denver	I-25, north of State Highway 7 Interchange	I-25, south of State Highway 119 Interchange	3.0	67,400	4	0.95
I-70	Denver	I-70, east of State Highway 95, Sheridan Blvd.	I-70, east of Washington St.	4.0	120,200	6/4	0.93
I-25	Denver	I-25, north of State Highway 88, Arapahoe Rd. Interchange	I-25, north of Yale Ave. Interchange	5.4	179,200	6	0.92
I-25	Fort Collins	I-25, south of State Highway 392 Interchange	I-25, south of Prospect St. Interchange	2.3	50,100	4	0.92
I-70	Denver	I-70, east of State Highway 265, Brighton Blvd.	I-70, west of State Highway 35, Quebec St.	2.6	124,600	6	0.91
I-270	Denver	I-270, southeast of I-76	I-270, northwest of I-70	5.3	73,900	4	0.90
I-25	Fort Collins	I-25, south of State Highway 34 Interchange	I-25, north of State Highway 34 Interchange	2.0	60,600	4	0.86

Source: Colorado Department of Transportation

Freight Shipment by Large Trucks on Colorado's Interstate Highways

Every year, \$93.2 billion in goods are shipped from sites in Colorado and another \$104.5 billion in goods are shipped to sites in Colorado, mostly by trucks.⁹ In fact, 69 percent of the goods shipped annually from sites in Colorado are carried by trucks and another 16 percent are carried by courier services, which use trucks for part of their deliveries. Similarly, 74 percent of the goods shipped to sites in Colorado are carried by trucks and another 15 percent are carried by courier services, which use trucks for part of their deliveries.¹⁰

The state's Interstate system is the most critical set of highways for goods shipment. Large commercial truck travel accounted for eight percent of all vehicle travel in Colorado in 2004.¹¹

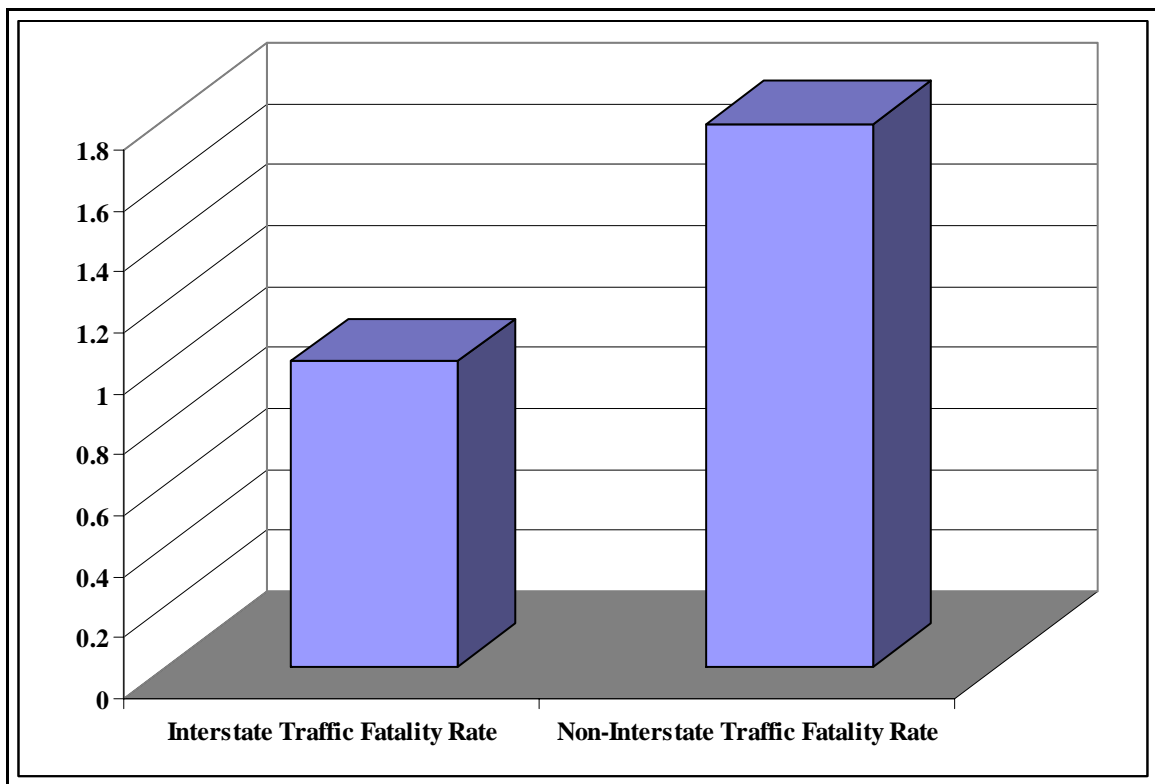
Traffic Safety on Colorado's Interstate Highways

Perhaps the most significant benefit of the Interstate system is that it has greatly improved traffic safety in Colorado, and throughout the U.S., by providing travelers with a network of highways with a variety of safety designs that greatly reduce the likelihood of serious accidents.

The safety features that are required on Interstates include a separation from other roads, streets and rail lines, access limited to on and off ramps, a minimum of four lanes to prevent the need to enter oncoming lanes for passing, and gentler curves. Most Interstate highways have paved shoulders, and many have median barriers to avoid cross over accidents and rumble strips to warn drivers if they are leaving the roadway.

The result of the high level of safety design standards on the Interstate is that travel on Colorado's Interstate highways is significantly safer than travel on all other roads and highways in the state. The traffic fatality rate per 100 million vehicle miles of travel on Colorado's Interstate highways was 0.91 in 2004, the latest year for which data is available. The fatality rate per 100 million vehicle miles of travel in 2004 on Colorado's non-Interstate routes was 1.62.¹²

Chart 4. Fatality rate per 100 Million Vehicle Miles of Travel for Colorado's Interstate and Non-Interstate roadways, 2004 (Interstate Fatality Rate=1)



Source: TRIP analysis of FHWA data

Colorado's Interstate Highway System, which carried 24 percent of the state's travel in 2004, accounted for only 15 percent of the state's fatalities as a result of its superior traffic safety features. There were 99 traffic fatalities on Colorado's Interstate

highways in 2004 – 15 percent of the 665 traffic fatalities that occurred in Colorado in 2004.¹³

Pavement Conditions of Colorado Interstate System

The lifecycle of highway pavements is greatly affected by a transportation agency's ability to perform timely maintenance and upgrades to ensure that surfaces remain smooth as long as possible. The pavement condition of a state's major roads are evaluated and classified as being in poor, mediocre, fair or good condition. A desirable goal for state and local organizations that are responsible for road maintenance is to keep 75 percent of major roads in good condition.

In 2004 (the latest year for which data is available), seven percent of Colorado's Interstate pavements were rated in poor condition and 18 percent were rated in mediocre condition.¹⁴ Roads rated in mediocre condition show signs of significant wear and may also have some visible pavement distress. Most pavements in mediocre condition can be repaired by resurfacing, but some may need more extensive reconstruction to return them to good condition. Twenty percent of Colorado's Interstate pavements are rated in fair condition and the remaining 56 percent of Interstate pavements are rated in good condition.¹⁵

Pavement deterioration is caused by a combination of traffic, moisture and climate. Moisture often works its way into road surfaces and the materials that form the road's foundation. Road surfaces at intersections are even more prone to deterioration because the slow-moving or standing loads occurring at these sites subject the pavement to higher levels of stress. It is critical that roads are fixed before they require major

repairs because reconstructing roads costs approximately four times more than resurfacing them.¹⁶

Bridge Conditions of Colorado’s Interstate Highways

Of the 1,097 bridges on Colorado’s Interstate highways, six percent are rated as structurally deficient and 16 percent are rated as functionally obsolete.¹⁷

Bridges that are rated structurally deficient show significant signs of deterioration as a result of use and exposure. The FHWA defines a structurally deficient bridge as one that requires immediate rehabilitation to remain open, is restricted to carrying lighter-weight vehicles or is closed. Bridges that are rated as functionally obsolete do not meet current design standards, which may result in reduced traffic safety, compared to a bridge meeting current standards. Functionally obsolete bridges are defined by the FHWA as those that have deck geometry, load carrying capacity, clearance or approach roadway alignment that no longer meet the criteria for the system of which the bridge is a part.

The average lifespan of an older bridge is 50 years. Older bridges often need significant repairs or rehabilitation or may need to be replaced to continue to provide adequate service. The average age of Colorado’s Interstate bridges is 15 years.¹⁸

Chart 5. The most heavily-traveled Interstate bridges in Colorado which are structurally deficient:¹⁹

Urban Area	Route Carried	Route or feature intersected	Daily Travel	Year Built	Lanes
Denver	State Highway 128/ 120th Ave.	I-25	64,746	1962	6
Denver	I-70 westbound	Sand Creek		1964	3

			61,088		
Denver	144th Ave.	I-25	68,693	1962	6
Denver	I-70 eastbound	Sand Creek	61,088	1960	4
Denver	104th Ave.	I-25	106,893	1962	9
Denver	State Highway 35	I-270	54,393	1968	4
Colorado Springs	Bijou Street	I-25	96,655	1959	4
Denver	I-25	Roadway, Railroad, South Platte River	206,267	1951	10
Denver	I-70 westbound	State Highway 391	62,540	1967	3
Denver	I-70	Tennyson Street	95,048	1966	6
Denver	I-70 westbound	State Highway 35	61,088	1964	3
Denver	I-70 eastbound	State Highway 35	61,088	1964	3
Denver	I-70 westbound	Up River	55,993	1964	4
Denver	I-70 eastbound	Up River	55,993	1960	4
Denver	I-70 eastbound	State Highway 391	62,540	1967	3
Denver	I-70	Harlan Street	81,028	1967	6
Denver	Happy Canyon Road	I-25	63,826	1965	4
Denver	Tabor Street	I-70	105,223	1967	6
Denver	County Road 107	I-25	59,354	1964	4

Source: Colorado Department of Transportation

Unique Features of Colorado's Interstates

The construction of the U.S. Interstate system was the nation's largest public works project, spanning the nation with a system of highways able to carry large numbers

of vehicles at highway speeds. But the system is really a collection of numerous individual segments that presented states with a number of engineering and planning challenges.

The following Colorado Interstate projects are of particular note both for the significant challenges they represented and the noteworthy benefits that the completion of these projects provided to motorists in the state.²⁰

Eisenhower-Johnson Memorial Tunnels

These tunnels through the Rockies opened western Colorado to Interstate travel. Construction of the Eisenhower Tunnel began in 1968 and was completed in 1973, and construction of the Johnson Tunnel began in 1972 and was completed in 1980. To alleviate the distance and rigors of travel over U.S. Highway 6 at Loveland Pass, the Colorado Department of Highways developed plans for two two-lane tunnels beneath the Continental Divide three miles from Loveland Pass at an elevation of 11,000 feet.

The Eisenhower Tunnel Bore, today's westbound bore, was the first tunnel completed. It was planned for three years but actually required five years to complete due to unanticipated hazards and the harsh climate. The tunnel bore was 50 feet high and 45 feet wide. The Eisenhower Memorial Tunnel was dedicated on March 8, 1973. Federal funds accounted for about 92 percent of the \$108 million cost. At the height of construction, more than 1,140 persons were employed in three shifts, 24 hours a day, six days a week.

The Edwin C. Johnson Memorial Tunnel, named for the Colorado legislator, lieutenant governor, governor, and U.S. Senator, required more than 800 workers.

Approximately 500 of those workers were employed in actual drilling operations. Work began at both the east and west sides; the first hole connecting the two was blasted on August 17, 1978.

Glenwood Canyon I-70 Final Link

Construction of one of the final segments of the Interstate system began in 1980 and was completed in 1992. The final link of I-70 through Glenwood Canyon has been hailed as an engineering marvel because of the care taken to incorporate the Interstate improvements into the fragile canyon environment while leaving as much of the flora and fauna intact as possible.

A road had existed through spectacular Glenwood Canyon, with its cliffs towering a maximum of 2,000 feet above the Colorado River, from pioneer times. Photos of teams and wagons negotiating a rough trail through the canyon date from the 1880s. The Taylor State Road was completed between Denver and Grand Junction in 1902. It was the first improved vehicle road through Glenwood Canyon.

As many as 500 highway workers were employed in the canyon each day. The public driving through the area marveled at the new retaining walls, 40 viaducts and bridges, some of which were constructed using unique and spectacular slip-form gantry imported from France. At traffic stops that sometimes approached 30 minutes or more, drivers had a chance to get out of their vehicles and watch first-hand the construction activities going on around them.

Construction of three tunnels, 15 miles of retaining walls, and numerous other structures, comprised a challenging but very rewarding project. The Glenwood Canyon

project required 30 million points of structural steel, 30 million pounds of reinforcing steel, and 400,000 cubic yards of concrete weighing 1.62 billion pounds.

The result of the Glenwood Canyon I-70 Final Link is much more than just a transportation facility. State-of-the-art rest areas at No Name, Grizzly Creek, Hanging Lake, and Bair Ranch provide opportunities for rest, education about the canyon and the project, and direct access to recreational pursuits such as river rafting and bicycling, jogging and walking along the canyon's recreation path.

Interstate Benefits for Individuals in Colorado

The construction of Colorado's Interstate Highway System has had a profound impact on the state's development, impacting the quality of life of the state's residents and visitors in numerous ways including safety, expanded lifestyle choices and an enhanced economic standard of living.

TRIP has calculated the annual financial benefit per person and statewide in Colorado, based on the value of improved traffic safety, reduced travel time, reduced fuel use and reduced consumer costs.

Safety:

By carrying significant volumes of traffic on roadways with higher safety standards and lower traffic fatality rates, the Interstate saves numerous lives annually. In fact, TRIP estimates that Interstate highways in Colorado save an average of 100 lives

per year.²¹ Since 1956, TRIP estimates that Interstate highways have saved approximately 5,000 lives in Colorado.²² This estimate is based on a comparison of the annual fatality rate on Colorado's Interstate highways compared to the fatality rate each year on other major roads in the state. Interstate safety benefits were estimated by calculating the additional fatalities that would have occurred in each year if the travel that occurred on Colorado's Interstate highways had instead been carried by other major roads in the state, many of which often lack many of the safety features found on Interstate highways and have a significantly higher traffic fatality rate.

TRIP estimates that the improved highway safety provided by Colorado's Interstates saves the state \$633 million annually in reduced economic costs as a result of the reduction in fatal or serious traffic accidents, saving \$138 per person annually.²³

TRIP's estimate is based on research by the National Highway Traffic Safety Administration (NHTSA), which annually estimates the economic costs of fatal and serious traffic accidents in the U.S. The NHTSA estimates are strictly of the economic consequences of serious and fatal traffic crashes, such as lost productivity and increased healthcare costs.

Time and motor fuel:

Because it features limited access, no stoplights and often more direct routes between major urban areas, the Interstate system has saved travelers time by reducing travel times and making travel more efficient. By reducing travel times, the Interstate Highway System has also increased the choices people have of where to live, work, shop and travel for recreation.

TRIP has estimated the additional time that Colorado residents would spend traveling if the state did not have its network of Interstate highways. These estimates are based on assuming that if there were no Interstate highways in Colorado that this traffic would be carried by other major roads in the state, such as other urban freeways and urban and rural arterial roads and highways. Shifting the state's Interstate traffic onto other routes would increase traffic congestion on these other routes and also slow travel times, by shifting travel from faster-moving Interstate highways onto slower-moving roads and highways. TRIP applied traffic speed calculations developed by the Texas Transportation Institute, which annually estimates traffic congestion levels throughout the U.S., to estimate the traffic speeds that would result on other major roads in the state if they had to carry the traffic in Colorado currently being carried by the state's Interstate system.

TRIP found that without Interstate highways, Colorado residents would spend an additional 307 million hours annually traveling in vehicles, or 67 hours per person annually.²⁴ TRIP also found that without Interstate highways, Colorado motorists would use an additional 147 million gallons of motor fuel annually. The total value of the time and motor fuel that is saved annually in Colorado by the Interstate Highway System is \$1,072 per person (\$992 in time and \$80 in fuel).²⁵

Reduced Consumer Costs:

The Interstate system has had a significant impact on consumer costs by reducing the time it takes to complete trips, thereby reducing the cost of transporting goods. It has also reduced costs by increasing access between locations, which has increased access to

cheaper land and increased consumer choices for everything from housing and jobs to recreation and shopping.

To calculate the economic impact of the Interstate Highway System on individual consumers in Colorado, TRIP has gathered data on average consumer expenditures in the state and has estimated the impact of the Interstate Highway System on these costs. Based on data from the U.S. Department of Labor and the Bureau of Economic Analysis, TRIP has calculated the average expenditure per capita in each state on apparel, food, housing and transportation.²⁶ TRIP then surveyed the nation's leading transportation economists for their estimates of the percentage reduction in consumer expenditures, as a result of the Interstate system, for apparel, food, housing and transportation. TRIP used the average estimated impact in each category to calculate the average amount saved by Colorado consumers annually in each category.

Apparel and food costs are impacted by reduced logistics costs. Transportation costs, which include the cost of a vehicle, vehicle repairs and maintenance, and the cost of fuel, are similarly impacted by reduced logistics costs. The impact of the Interstate system on housing costs includes its impact on the cost of materials that are used in constructing homes as well as the impact that the Interstate system has had on lowering land prices by increasing consumer access to cheaper land, thus lowering housing costs.

TRIP estimates that the average Colorado resident saves \$2,804 per year as a result of the Interstate Highway System. The following chart indicates the annual saving per Colorado resident for apparel, food, housing and transportation costs as a result of the Interstate Highway System. The total annual statewide savings in Colorado in reduced consumer costs as a result of the Interstate Highway System is estimated to be

\$12.9 billion.

Chart 3. Annual, per person savings in Colorado, as a result of the Interstate Highway System.

	ANNUAL SAVINGS
Apparel	\$58
Food	\$202
Housing	\$852
Transportation	\$482
TOTAL	\$1,594

Source: TRIP

The Interstate Highway System provides tremendous benefits every year to the people of Colorado. The total annual benefit per person in Colorado of the Interstate system is \$2,804 as a result of saved lives, time fuel and consumer expenses. The total statewide benefit in Colorado of the Interstate Highway System is \$12.9 billion. The following chart shows the combined annual benefit of the Interstate system per person and statewide in Colorado.

Chart 4. Total Annual Interstate Benefit Per Person and statewide in Colorado

	Per Person	Statewide (millions)
Safety	\$138	\$632
Time and Fuel	\$1,072	\$4,932
Reduced Consumer Costs	\$1,594	\$7,334
TOTAL	\$2,804	\$12,898

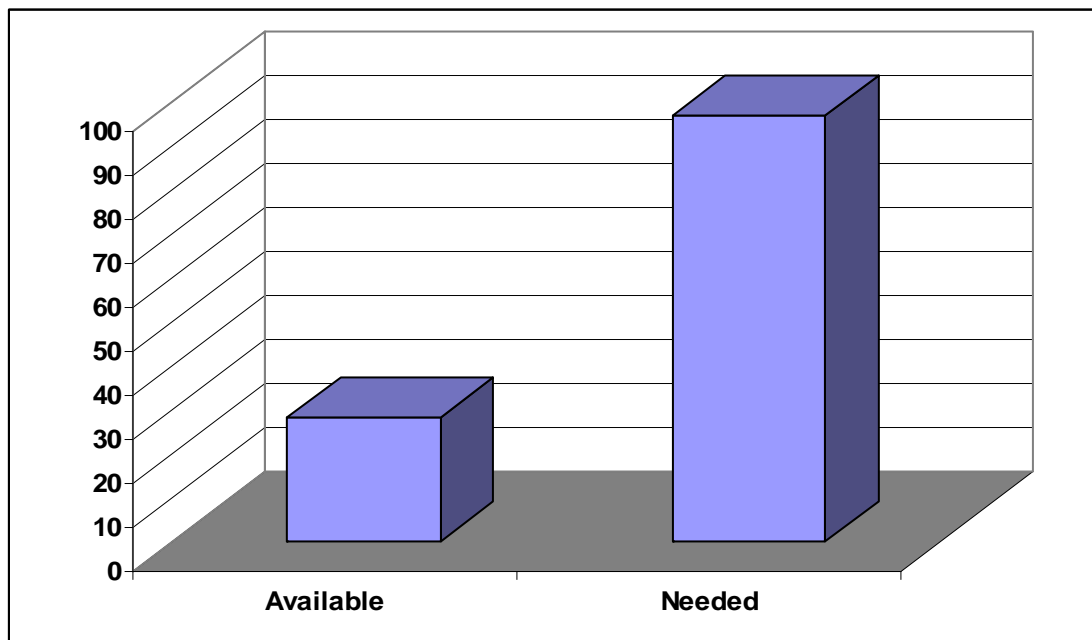
Source: TRIP

Meeting Colorado's Future Interstate Travel Needs

Colorado faces a significant challenge in maintaining and rebuilding its aging Interstate Highway System and providing additional lane capacity to meet growing travel demand. Travel on Colorado's Interstate highways is expected to increase by 48 percent by the year 2026.²⁷

The Colorado Department of Transportation projects a \$69 billion shortfall in needed Interstate preservation and expansion funding through 2030. The department expects to receive \$28 billion from state and federal sources for Interstate needs over the next quarter-century, but estimates that the cost of preserving and expanding the system to accommodate future travel through 2030 will cost \$97 billion.²⁸

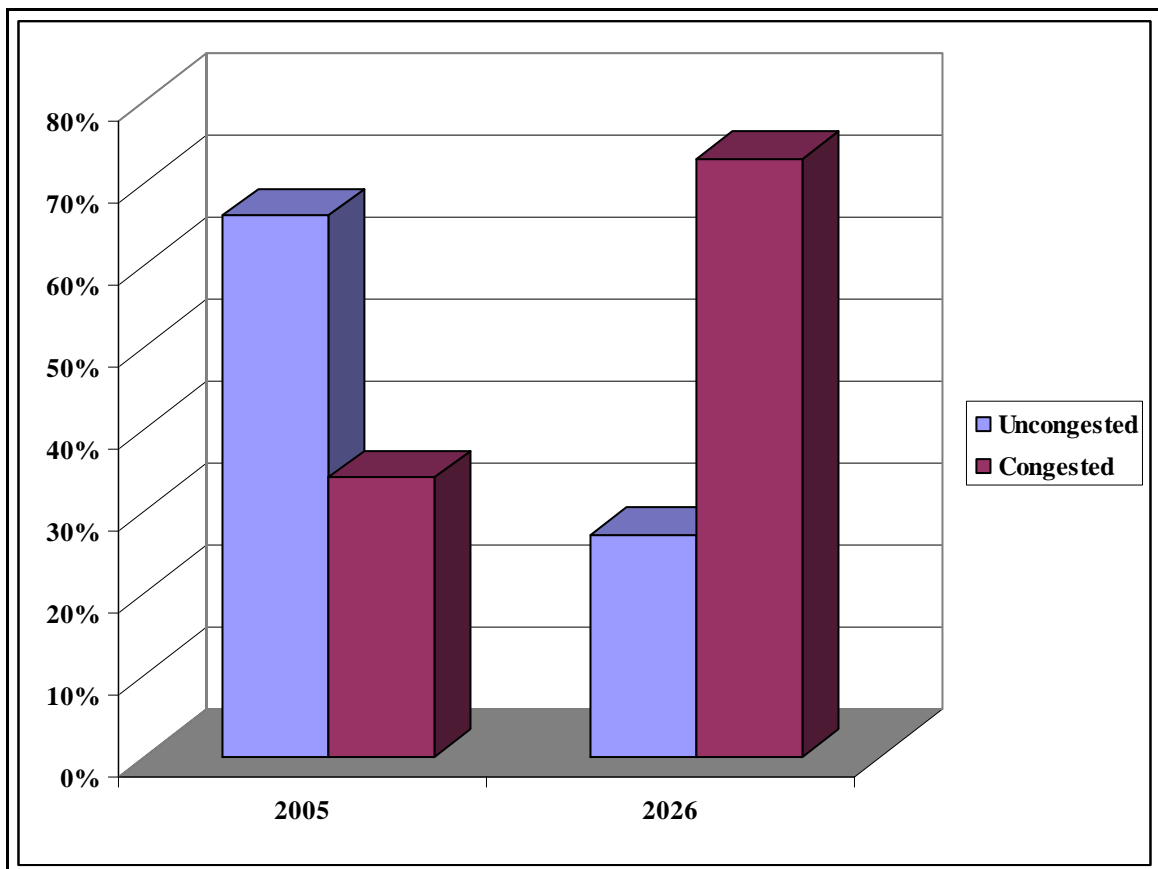
Chart 6. Available and Needed Interstate Preservation and Expansion Funding in Colorado 2006-2030



Source: TRIP analysis of Colorado Department of Transportation data

Traffic congestion, which currently afflicts 33 percent of the state’s urban Interstate highways, is expected to worsen substantially on Colorado’s urban Interstate highways, unless additional lanes are added to these routes. By the year 2016, if the state’s urban Interstate highways are not widened, 59 percent of Colorado’s urban Interstates are expected to be congested during peak period; by 2026, the share of urban Interstates that are congested in Colorado is expected to increase to 73 percent if additional lanes are not added to the state’s Interstate system.²⁹

Chart 7. Urban Interstate Congestion in 2005 in Colorado and Expected Congestion in 2026 Unless Additional Lane Capacity is Added



Source: TRIP analysis of Colorado Department of Transportation data

The Colorado Department of Transportation has identified five sections of urban Interstates that need to be widened over the next 10 years to accommodate growing traffic.

Chart 9. Interstate widening projects that are needed by 2016

Route	County	From	To	Length (Mi.)	Current Lanes	Proposed Lanes
I-25	Weld	State Highway 52	State Highway 66	7.8	4	6
I-25	Weld	State Highway 66	County Line	9.6	4	6
I-25	Larimer	County Line	State Highway 14	16.6	4	6
I -70	Eagle	180	190	10	4	6
I-25 South	Douglas	174.000	180.600	7	4	6

Source: Colorado Department of Transportation

Colorado also needs to begin rebuilding many aging segments of highways and bridges on its Interstate system that are in need of significant reconstruction rather than routine maintenance or repaving. The Colorado Department of Transportation provided the following list of Interstate sections that are in need of reconstruction by 2016.³⁰

Chart 10. Colorado Interstate sections in need of reconstruction by 2016.

Route	County	From	To	Length (Mi.)
I-25	Weld	State Highway 66	County Line	9.6
I-25	Larimer	County Line	State Highway 14	16.6
I-76	Weld	Lochbuie	Hudson	6.4
I-76	Weld	Keensburg	East of Roggen	9.6
I-76	Morgan	Ft. Morgan	Brush	16.0
I-76	Sedgwick	Sedgwick	Stateline	19.1
I-70	Mesa	0	65	65.0
I - 70	Eagle	143	190	47.0
I-270	Adams	216.35	218.53	2.2
I-70 Viaduct	Denver	275.03	276.57	1.5

I-70/ Quebec interchange	Denver	274	285.73	11.7
I-70 @ State Highway 58, Phase I, II, III	Jefferson	265.34	265.73	0.4
I-25, Logan to 6th Ave. (Phase I)	Denver	206.619	209.212	2.6
I-225 Corridor: Colfax interchange	Arapahoe	9.4	10.8	1.4
I-225 Corridor: Yale and Alameda interchanges	Arapahoe	3.95	8.95	5.0
I-70 @ Havana, Yosemite	Denver	280.567	280.671	0.1
I-25 South	Douglas	174.000	180.600	6.6
I-70 West	Summit Clear Creek Jefferson	190.000	258.722	68.7
I-70 East	Elbert, Lincoln, Kit Carson	285.000	449.500	164.5

Source: Colorado Department of Transportation

Conclusion

Fifty years after construction of the Interstate Highway System began, Colorado, and all of the U.S., continue to reap tremendous benefits from the nation's most critical transportation network. Colorado's Interstate system has saved approximately 5,000 lives since its inception in 1956 and today it continues to save Coloradans time while playing a critical role in supporting economic growth and enhancing the lifestyle choices of Coloradans.

The safe, reliable and timely mobility provided by the state's Interstate highways has improved the efficiency of Colorado's businesses and is integral to the functioning of the state's economy.

Prior to the approval to the funding of the Interstate system, President Eisenhower noted that inadequate highways resulted in lost time due to traffic delays, reduced economic productivity and reduced traffic safety.

Today, similar challenges are faced in Colorado, with growing traffic congestion, increasing car and truck travel and aging road surfaces and bridges that will soon need significant repairs and rehabilitation.

As Coloradans look back on the many benefits that the Interstate Highway System has provided the state, they must also look ahead to meeting the challenge of providing a 21st Century Interstate Highway System that will continue to enhance the quality of life in the future.

Endnotes

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- ¹ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ² Ibid.
- ³ Ibid.
- ⁴ Ibid.
- ⁵ U.S. Census Bureau data, Federal Highway Administration data. See charts MV-1 and VM-2. Additional historical data from Highway Statistics Summary to 1995.
- ⁶ TRIP analysis of Highway Statistics, 2004, Federal Highway Administration. Data is from charts VM-2 and HM-20.
- ⁷ TRIP analysis of 1990 and 2004 Federal Highway Administration data. See chart VM-2 in Highway Statistics 1990 and Highway Statistics 2004.
- ⁸ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ⁹ Bureau of Transportation Statistics, U.S. Department of Transportation. 2002 Commodity Flow Survey, State Summaries.
- ¹⁰ Ibid.
- ¹¹ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ¹² TRIP analysis of 2004 Federal Highway Administration data, Highway Statistics.
- ¹³ Ibid.
- ¹⁴ TRIP analysis of 2004 Federal Highway Administration data. See charts HM-63 and HM-64 in Highway Statistics 2004.
- ¹⁵ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ¹⁶ Selecting a Preventative Maintenance Treatment for Flexible Pavements. R. Hicks, J. Moulthrop. Transportation Research Board. 1999. Figure 1.
- ¹⁷ TRIP analysis of 2004 Federal Highway Administration data, Highway Statistics.
- ¹⁸ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ¹⁹ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ²⁰ Ibid.
- ²¹ Estimate is based on TRIP's analysis of FHWA data for 1997 through 2004. TRIP estimated safety benefits for 2005 and 2006, based on travel and traffic safety data for the 2000 to 2004 period. TRIP assumed that in the absence of Interstate highways, travel would occur on other federal-aid highways. The number of lives saved was based on calculating fatalities for Interstate travel, if it had occurred on other federal-aid routes in Colorado.
- ²² TRIP calculation is based on TRIP analysis of 1997 to 2004 data. Estimates of lives saved by the Interstate system from 1956 to 1996 are based on analysis by Wendell Cox and Jean Love in the 1996 publication "The Best Investment a Nation Ever Made."
- ²³ TRIP analysis of National Highway Traffic Safety Administration and Federal Highway Administration data.
- ²⁴ TRIP analysis of 2004 Federal Highway data, using speed factors from the 2005 Urban Mobility Report, which is published by the Texas Transportation Institute.
- ²⁵ The value of time used for these estimates was \$14.85 per hour, based on the value used by the Texas Transportation Institute in their annual report on urban traffic congestion. The value used to calculate fuel savings is \$2.50 per gallon.
- ²⁶ The U.S. Department of Labor estimates consumer costs per capita for U.S. regions. TRIP then calculated this data for each state by using state income per capita data to estimate cost differences between states.
- ²⁷ Colorado Department of Transportation, 2005. Response to TRIP survey.
- ²⁸ Ibid.
- ²⁹ Ibid.
- ³⁰ Ibid.