Keeping Colorado Mobile

A National Transportation Research Nonprofit

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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 surface transportation issues. TRIP is sponsored by insurance companies, equipment manufacturers, distributors and suppliers; businesses involved in highway and transit engineering and construction; labor unions; and organizations concerned with efficient and safe surface transportation.

Executive Summary

Accessibility and connectivity are critical factors in a state's quality of life and economic competitiveness. The growth and development of a state or region hinges on efficient and safe access to employment, customers, commerce, recreation, education and healthcare via multiple transportation modes. The quality of life in Colorado -- one of the fastest growing states in the country -- and the pace of the state's economic growth are directly tied to the condition, efficiency, safety and resiliency of its transportation system.

An adequate and reliable source of transportation funding is critical to providing the system of roads, highways and bridges that can support commerce within Colorado and connect the state to markets around the globe, while providing the safe, smooth and efficient mobility that residents require.

TRIP's "Keeping Colorado Mobile" report examines the condition, use, safety and efficiency of Colorado's surface transportation system and the importance of reauthorization of the federal surface transportation program. Sources of information for this report include the Colorado Department of Transportation (CDOT), the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), the Bureau of Transportation Statistics (BTS), the U.S. Census Bureau, the Texas Transportation Institute (TTI), the American Road & Transportation Builders Association (ARTBA), the University of Minnesota Center for Transportation Studies, and the National Highway Traffic Safety Administration (NHTSA).

COLORADO'S TRANSPORTATION SYSTEM AND FUNDING

Investment in Colorado's roads, highways and bridges is funded by local, state and federal governments. A lack of sufficient funding at all levels will make it difficult to adequately maintain and improve the state's existing transportation system.

The ability of revenue from Colorado's motor fuel tax – a critical source of state transportation funds – to keep pace with the state's future transportation needs is likely to erode as a result of increasing vehicle fuel efficiency and the increasing use of electric vehicles. The average fuel efficiency of U.S. passenger vehicles increased from 20 miles per gallon in 2010 to 24.5 miles per gallon in 2020. Average fuel efficiency is expected to increase another 31 percent by 2030, to 32 miles per gallon, and increase 51 percent by 2040, to 37 miles per gallon. The share of electric vehicles of total passenger vehicle sales in the U.S. is expected to increase to five percent by 2023 and to 60 percent by 2040, by which time electric vehicles will represent approximately 30 percent of the passenger vehicle fleet.

The current federal transportation legislation, Fixing America's Surface Transportation Act (FAST Act), was set to expire on September 30, 2020. Congress extended it by one year to September 30, 2021. The FAST Act is a major source of funding for road, highway and bridge repairs in Colorado. Throughout the FAST-Act – fiscal years 2016 to 2021 – the program provided $3.4 billion to Colorado for road repairs and improvements, an average of $571 million per year. From 2014 to 2018, the federal government provided $1.19 for road improvements in Colorado for every $1.00 state motorists paid in federal highway user fees, including the federal state motor fuel tax.

From 2014 to 2018, federal funds provided for highway improvements were the equivalent of 65 percent of the amount of Colorado state capital outlays on road, highway and bridge projects, including construction, engineering and right-of-way acquisition.

TRAFFIC CONGESTION IN COLORADO

Congested roads, highways and bottlenecks choke commuting and commerce and cost Colorado drivers $3.5 billion each year in the form of lost time and wasted fuel. From 2000 to 2019, vehicle travel in Colorado increased by 31 percent, the ninth highest rate in the country. Due to the Covid-19 pandemic, vehicle travel in Colorado dropped by as much as 42 percent in April 2020 (as compared to vehicle travel during the same month the previous year) but rebounded to ten percent below the previous year's volume in November 2020. The chart below details the annual hours lost to congestion, congestion costs per driver and the average amount of fuel per driver wasted annually due to congestion in the state's largest urban areas.

Location	Hours Lost to Congestion	Annual Cost Per Driver	Gallons of Fuel Wasted Per Driver
Colorado Springs	44	$838	19
Denver	62	$1,242	26
Northern Colorado	22	$460	9
Mesa County	11	$230	4
Pueblo	20	$431	7

While traffic congestion is largely constrained to the state's urban areas, increasing congestion on Colorado's major urban highways and roads hampers the state's ability to support economic development and quality of life by reducing the reliability and efficiency of personal and commercial travel, including the transport of goods and services. Traffic congestion robs commuters of time and money and imposes increased costs on businesses, shippers and manufacturers, which are often passed along to consumers. Increased levels of congestion can also reduce the attractiveness of a location when a company is considering expansion or deciding where to locate a new facility. The chart below lists Colorado's 10 most congested highway segments based on measuring volume of traffic carried by a roadway compared to its capacity. A chart of the 25 most congested highway segments in Colorado is included in the report.

Rank	Route	Urban area	Segment	Length (Miles)	Avg. Daily Traffic
1	SH 470	Littleton, Lone Tree	From NW of SH 85, (Santa Fe Drive) to Yosemite St.	10.8	104,959
2	I-25	Denver	From N of SH 30 & SH 285 (Hampden Ave. to Speer Boulevard)	9.9	236,182
3	SH 83, (Parker Road)	Aurora	From S of Hampden Ave. to Cornell St. and Dartmouth Ave.	2.5	79,662
4	SH 88, (Arapahoe Road)	Greenwood Village, Aurora	W of I-25 to SH 83 (Parker Rd.)	4.5	65,656
5	I-25	Lone Tree, Denver	From N of Lincoln Ave. to SH 30 and 285 (Hampden Ave.)	8.6	242,249
6	I-70	West Vail, Vail	From W of Chaonix Rd. to Vail Rd.	4.6	45,000
7	SH 85, (Santa Fe Drive)	Littleton	From S of Blakeland Dr. to Mineral Ave.	2.3	43,455
8	SH 24, (Powers Blvd.)	Colorado Springs	From N of Fountain Blvd. to Platte Ave.	1.7	61,909
9	SH 85, (Santa Fe Drive)	Englewood, Denver	From N of SH 285 (Hampden Ave,) to I-25	4.0	93,128
10	SH 287, (Federal Blvd.)	Westminster	From S of SH 36 to 104TH Ave.	3.0	39,047

A 2018 report by the Center for Transportation Studies at the University of Minnesota found that of the approximately 1.7 million jobs accessible to residents of the Denver metro area within a one-hour drive, only 47 percent are accessible within 30 minutes. The report also found that the number of jobs accessible within 30 minutes during peak commuting times in the Denver area was reduced by 39 percent as a result of traffic congestion.

ROAD CONDITIONS IN COLORADO

Statewide, 47 percent of Colorado's major roads are in poor or mediocre condition. Twenty-two percent of Colorado's major locally and state-maintained roads are in poor condition and 25 percent are in mediocre condition. Eighteen percent of Colorado's major roads are in fair condition and the remaining 34 percent are in good condition.

Driving on rough roads costs Colorado's drivers an average of $651 each annually, a total of $2.8 billion statewide. The chart below details pavement conditions on major urban roads in the state's largest urban areas and statewide, and the average annual additional Vehicle Operating Costs (VOC) per regional driver as a result of driving on rough roads.

Location	Poor	Mediocre	Fair	Good	VOC
Colorado Springs	30%	25%	18%	27%	$644
Denver	37%	26%	15%	22%	$732
Northern Colorado	22%	22%	19%	38%	$517
Mesa County	26%	26%	14%	34%	$583
Pueblo	35%	24%	19%	21%	$710
Colorado Statewide	**22%**	**25%**	**18%**	**34%**	**$651**

BRIDGE CONDITIONS IN COLORADO

Five percent of Colorado's bridges are rated in poor/structurally deficient condition. Bridges that are rated poor/structurally deficient have significant deterioration of the bridge deck, supports or other major components. Fifty-four percent of the state's bridges are rated in fair condition and the remaining 40 percent are in good condition. Most bridges are designed to last 50 years before major overhaul or replacement, although many newer bridges are being designed to last 75 years or longer. In Colorado, 33 percent of the state's bridges were built in 1969 or earlier. The chart below details bridge conditions statewide and in the state's largest urban areas.

Location	Poor/Structurally Deficient		Fair		Good		Total
	Number	Share	Number	Share	Number	Share	Bridges
Colorado Springs	27	4%	355	53%	283	43%	665
Denver	51	4%	668	50%	618	46%	1,337
Northern Colorado	66	6%	645	56%	445	38%	1,156
Mesa County	10	3%	174	56%	126	41%	310
Pueblo	19	7%	150	58%	89	34%	258
Colorado Statewide	**466**	**5%**	**4,769**	**54%**	**3,550**	**40%**	**8,785**

TRAFFIC SAFETY IN COLORADO

From 2015 to 2019, 3,030 people were killed in traffic crashes in Colorado. The state's 2019 traffic fatality rate of 1.09 fatalities for every 100 million miles traveled is below the national average of 1.11. The fatality rate on Colorado's non-interstate rural roads in 2019 was more than double that on all other roads in the state (1.83 per 100 million vehicle miles of travel vs. 0.90). Improving safety on Colorado's roadways can be achieved through further improvements in vehicle safety; improvements in driver, pedestrian, and bicyclist behavior; and, a variety of improvements in roadway safety features.

Traffic crashes in Colorado imposed a total of $6.5 billion in economic costs in 2019. TRIP estimates that roadway features were likely a contributing factor in approximately one-third of all fatal traffic crashes, resulting in $2.2 billion in economic costs in Colorado in 2019.

The chart below shows annual traffic fatalities in Colorado from 2015 to 2019.

Year	Statewide Fatalities
2015	546
2016	608
2017	648
2018	632
2019	596
TOTAL	**3,030**
AVERAGE	**606**

FREIGHT TRANSPORTATION AND THE IMPACT OF TRANSPORTATION INVESTMENT ON ECONOMIC GROWTH IN COLORADO

The health and future growth of Colorado's economy is riding on its surface transportation system. Each year, $305 billion in goods are shipped to and from sites in Colorado.

The amount of freight transported in Colorado and the rest of the U.S. is expected to increase significantly as a result of further economic growth, changing business and retail models, increasing international trade, and rapidly changing consumer expectations that place an emphasis on faster deliveries, often of smaller packages or payloads. The value of freight shipped to and from sites in Colorado, in inflation-adjusted dollars, is expected to increase 82 percent by 2045 and by 68 percent for goods shipped by trucks, placing an increased burden on the state's network of roads and bridges.

The following two charts show the highway segments in Colorado carrying the greatest number of large commercial trucks daily, and the highway segments where large commercial trucks make up the largest share of daily vehicle travel.

Rank	Route	Urban area	Segment	Avg. Daily Truck Travel	Length (Miles)
1	I-25	Thornton	From S. of SH 6 (6th Ave.) to SH 128 (120th Ave.)	10,301	15.1
2	I-25	Denver	From N of SH 470 to SH 285 (Hampden Ave.)	7,481	7.3
3	I-270	Denver	From SE of I-76 to I-70	6,862	5.8
4	I-70	Aurora	From W of SH 391 (Kipling St.) to SH 40 (Colfax Ave.)	6,802	19.2
5	I-25	Colorado Springs. Monument	From S of SH 24 (Cimarron St.) to SH 105 (2nd St.)	6,411	18.3
6	I-76	Arvada, Brighton	From SW of SH 95 (Sheridan Blvd.) to SH 2 (SABLE Blvd.)	5,758	12.5
7	I-225	Denver, Aurora	From NE of SH 83 (Parker Rd.) to I-70	5,462	8.5
8	I-70	Limon	From W of SH 24 Spur to SH 24 & SH 40	3,619	21.6
9	I-25	Fort Collins, Norfolk	From N of Mountain Vista Interchange to Weld Co Rd. 126	3,483	21.2
10	SH 85 (Sante Fe Dr.)	Littleton, Denver	From SW of SH 88 to I-25	2,638	7.0

Rank	Route	Urban area	Segment	Percent Large Truck Travel	Length (Miles)
1	SH 40	Wild Horse	From NW of SH 94 to CR 6	52%	20.2
2	SH 287	Campo, Springfield	From S of Road H to SH 160	52%	21.6
3	SH 287	Wiley	From N of SH 196 SPUR (7TH ST) to SH 96 E Jct. and CR 43	49%	22.2
4	SH 287	Lamar	From NE of CR F to Memorial Dr. S. Jct.	48%	21.8
5	SH 287	Springfield	From S of SH 116 & CR RR to CR F	48%	21.1
6	SH 40	Wild Horse, Kit Carson	From E of CR 9 to SH 59	42%	19.7
7	SH 40	Hugo	From 4TH ST., NW of 1ST AVE to CR 2W	35%	14.3
8	SH 36	Byers	From W of CR 254 (PRICE Rd.) to CR 269	34%	15.2
9	SH 385	Snyder, Stoneham	From S of CR EE to SH 14 W Jct.	33%	19.3
10	SH 96	Cope	From E of CR LL & CR 9 to NW of SH 59 W Jct.	30%	12.2

Accommodating the significant increase expected in the movement of freight by trucks in Colorado will be further challenged by the significant number of freight routes in the state that are constrained because they have inadequate load carrying capacity to accommodate large trucks.

According to a report by the American Road & Transportation Builders Association, the design, construction and maintenance of transportation infrastructure in Colorado supports approximately 77,000 full-time jobs across all sectors of the economy. These workers earn $3.4 billion annually. Approximately 1.1 full-time jobs in Colorado in key industries like tourism, retail sales, agriculture and manufacturing are completely dependent on the state's transportation network.

Sources of information for this report include the Federal Highway Administration (FHWA), the Colorado Department of Transportation (CDOT), the American Association of State Highway and Transportation Official (AASHTO), the American Road and Transportation Builders Association (ARTBA), the Bureau of Transportation Statistics (BTS), the U. S. Census Bureau, the Center for Transportation Studies, the Texas Transportation Institute (TTI), the University of Minnesota Center for Transportation Studies, and the National Highway Traffic Safety Administration (NHTSA). All data used in the report are the most recent available.

Introduction

Colorado's surface transportation system provides a vital link for the state's residents, visitors and businesses, providing daily access to homes, jobs, shopping, natural resources and recreation. Supporting quality of life and a robust economy in Colorado requires that the state provide an efficient, safe and well-maintained transportation system that allows for a high level of accessibility, connectivity and safety.

Colorado relies on a diverse economy including tourism, finance, retail, government services, manufacturing, agriculture and education. A safe, well-maintained and reliable network of roads and bridges is critical to each of these sectors and for the economic health of the state and the nation.

Adequate investment in Colorado's transportation network will help enhance economic development opportunities, improve business productivity, and make it easier and more reliable for the public to get to and from destinations including work, home, school, shopping and social events.

Population, Travel and Economic Trends in Colorado

Colorado residents and businesses require a high level of personal and commercial mobility. Population increases and economic growth in the state have resulted in an increase in vehicle miles of travel (VMT) and an increased demand for mobility and connectivity. To foster quality of life and spur continued economic growth it will be critical that Colorado provide an efficient, safe and modern transportation system that can accommodate future growth in population, tourism, business, recreation and vehicle travel.

Colorado's population has grown steadily, reaching approximately 5.8 million residents in 2019, a 34 percent increase since 2000 and the seventh highest rate of growth in the country during this period.[1] Colorado had approximately 4.2 million licensed drivers in 2019.[2]

From 2000 to 2019, Colorado's gross domestic product (GDP), a measure of the state's economic output, increased by 52 percent when adjusted for inflation.[3] U.S. GDP, adjusted for inflation, increased 45 percent during this period.[4]

From 2000 to 2019, annual VMT in Colorado increased by 31 percent, the ninth highest rate in the nation, from approximately 42 billion miles traveled annually to approximately 55 billion miles traveled annually.[5] Due to the Covid-19 pandemic, vehicle travel in Colorado dropped by as much as 42 percent in April 2020 (as compared to vehicle travel during the same month the previous year) but rebounded to ten percent below the previous year's volume in November 2020.[6]

Road Conditions in Colorado

The life cycle of Colorado's roads is greatly affected by state and local governments' ability to perform timely maintenance and upgrades to ensure that road and highway surfaces last as long as possible.

The pavement data in this report, which is for all arterial and collector roads and highways, is provided by the Federal Highway Administration (FHWA), based on data submitted annually by CDOT on the condition of major state and locally maintained roads and highways. Pavement data for Interstate highways and other principal arterials is collected for all system mileage, whereas pavement data for minor arterial and all collector roads and highways is based on sampling portions of roadways as prescribed by FHWA to ensure the data collected is adequate to provide an accurate assessment of pavement conditions on these roads and highways.

Twenty-two percent of Colorado's major locally and state-maintained roads and highways have pavements rated in poor condition and 25 percent are in mediocre condition.[7] Eighteen percent of Colorado's major roads are rated in fair condition and the remaining 34 percent are rated in good condition.[8]

Thirty-eight percent of Colorado's major locally and state-maintained urban roads and highways have pavements rated in poor condition and 27 percent are in mediocre condition.[9] Fourteen percent of Colorado's major urban roads are rated in fair condition and the remaining 22 percent are rated in good condition.[10] The chart below details pavement conditions on major roads in the state's largest urban areas and statewide.[11]

Fifteen percent of Colorado's major locally and state-maintained rural roads and highways have pavements rated in poor condition and 24 percent are in mediocre condition.[12] Twenty percent of Colorado's major rural roads are rated in fair condition and the remaining 40 percent are rated in good condition.[13]

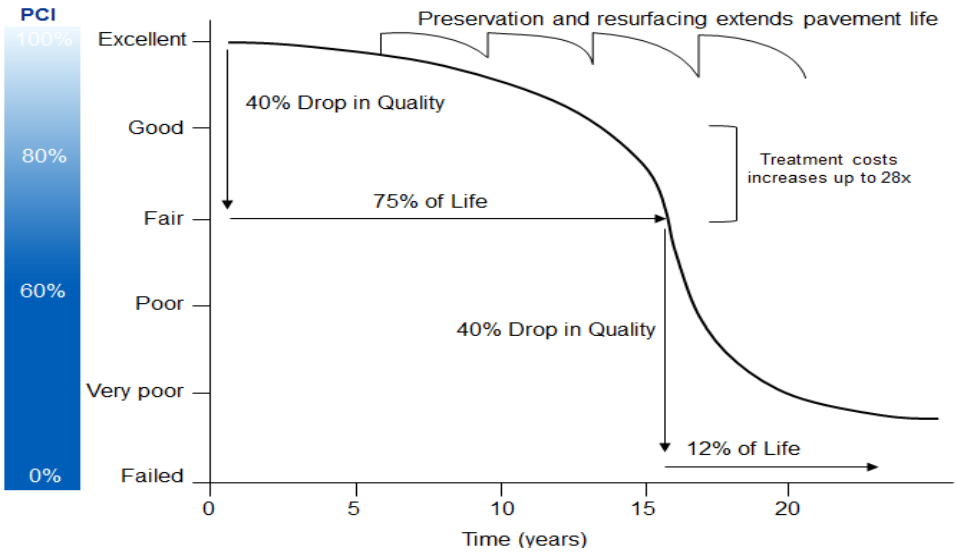
Chart 3. Pavement conditions on major roads in Colorado's largest urban areas and statewide.

Location	Poor	Mediocre	Fair	Good
Colorado Springs	30%	25%	18%	27%
Denver	37%	26%	15%	22%
Northern Colorado	22%	22%	19%	38%
Mesa County	26%	26%	14%	34%
Pueblo	35%	24%	19%	21%
Colorado Statewide	**22%**	**25%**	**18%**	**34%**

Source: TRIP analysis of Federal Highway Administration data.

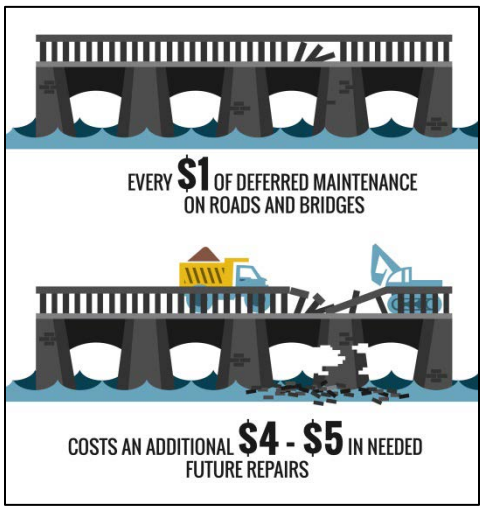
Pavement failure is caused by a combination of traffic, moisture and climate. Moisture often works its way into road surfaces and the materials that form the road's foundation. Road surfaces at intersections are more prone to deterioration because the slow-moving or standing loads occurring at these 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.[14] As roads and highways continue to age, they will reach a point of deterioration where routine paving and maintenance will not be adequate to keep pavement surfaces in good condition and costly reconstruction of the roadway and its underlying surfaces will become necessary.

Chart 5. Pavement Condition Cycle Time with Treatment and Cost



Source: North Carolina Department of Transportation (2016). 2016 Maintenance Operations and Performance Analysis Report

Long-term repair costs increase significantly when road and bridge maintenance is deferred, as road and bridge deterioration accelerates later in the service life of a transportation facility and requires more costly repairs. A report on maintaining pavements found that every $1 of deferred maintenance on roads and bridges costs an additional $4 to $5 in needed future repairs.[15]



The Cost to Motorists of Rough Roads in Colorado

TRIP has calculated the additional cost to motorists of driving on roads in poor, mediocre or fair condition. When roads are in poor, mediocre or fair condition – which may include potholes, rutting or rough surfaces – the cost to operate and maintain a vehicle increases. These additional vehicle operating costs (VOC) include accelerated vehicle depreciation, additional vehicle repair costs, increased fuel consumption and increased tire wear. TRIP estimates that additional VOC borne by Colorado motorists as a result of deteriorated road conditions is $2.8 billion annually, an average of $651 per driver statewide.[16] The chart below shows additional VOC per motorist in the state's largest urban areas and statewide.

Chart 6. Vehicle operating costs per motorist as a result of driving on deteriorated roads.

Location	VOC
Colorado Springs	$644
Denver	$732
Northern Colorado	$517
Mesa County	$583
Pueblo	$710
Colorado Statewide	**$651**

Source: TRIP estimates.

Additional vehicle operating costs have been calculated in the Highway Development and Management Model (HDM), which is recognized by the U.S. Department of Transportation and more than 100 other countries as the definitive analysis of the impact of road conditions on vehicle operating costs. The HDM report is based on numerous studies that have measured the impact of various factors, including road conditions, on vehicle operating costs.[17] The HDM study found that road deterioration increases ownership, repair, fuel and tire costs. The report found that deteriorated roads accelerate the pace of depreciation of vehicles and the need for repairs because the stress on the vehicle increases in proportion to the level of roughness of the pavement surface. Similarly, tire wear and fuel consumption increase as roads deteriorate

since there is less efficient transfer of power to the drive train and additional friction between the road and the tires.

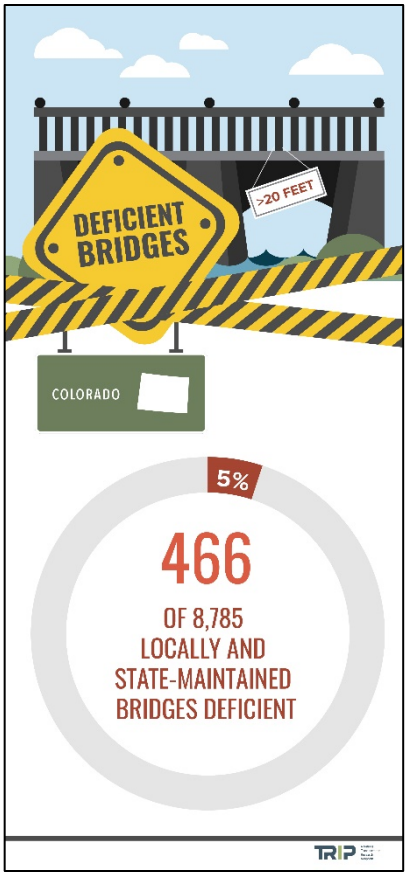
TRIP's additional VOC estimate is based on taking the average number of miles driven annually by a motorist, calculating current VOC on AAA's driving cost estimates and then using the HDM model to estimate the additional VOC paid by drivers as a result of substandard roads.[18] Additional research on the impact of road conditions on fuel consumption by the Texas Transportation Institute (TTI) is also factored into TRIP's vehicle operating cost methodology.

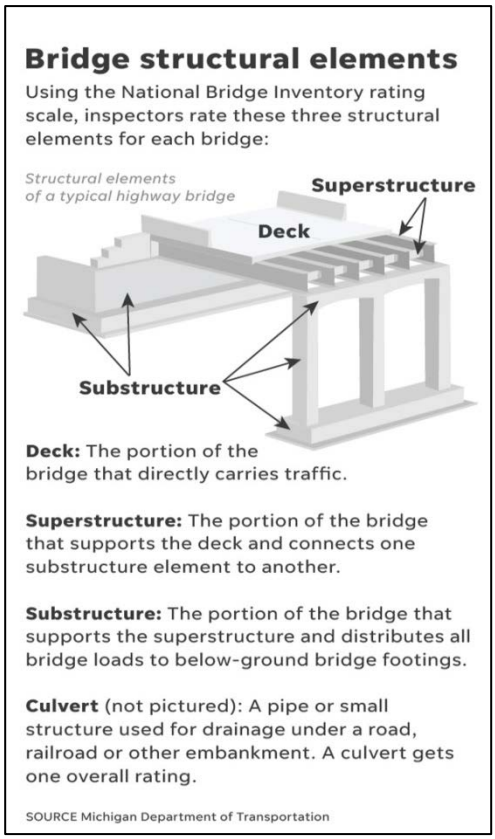
Bridge Conditions in Colorado

Colorado's bridges form key links in the state's highway system, providing communities and individuals access to employment, schools, shopping and medical facilities, and facilitating commerce and access for emergency vehicles.

Five percent (466 of 8,785) of Colorado's locally and state-maintained bridges are rated in poor/structurally deficient condition.[19] This includes all bridges that are 20 feet or more in length. A bridge is deemed poor/structurally deficient if there is significant deterioration of the bridge deck, supports or other major components.

Bridges that are poor/structurally deficient may be posted for lower weight limits or closed if their condition warrants such action. Deteriorated bridges can have a significant impact on daily life. Restrictions on vehicle weight may cause many vehicles – especially emergency vehicles, commercial trucks, school buses and farm equipment – to use alternate routes to avoid posted bridges. Redirected trips also lengthen travel time, waste fuel and reduce the efficiency of the local economy.





Fifty-four percent of Colorado's locally and state-maintained bridges have been rated in fair condition.[20] A fair rating indicates that a bridge's structural elements are sound but minor deterioration has occurred to the bridge's deck, substructure or superstructure. The remaining 40 percent of the state's bridges are rated in good condition.[21]

The chart below shows the condition of bridges statewide and in Colorado's largest urban areas.

Chart 7. Bridge conditions statewide and in Colorado's largest urban areas.

Location	Poor/Structurally Deficient		Fair		Good		Total Bridges
	Number	Share	Number	Share	Number	Share	
Colorado Springs	27	4%	355	53%	283	43%	665
Denver	51	4%	668	50%	618	46%	1,337
Northern Colorado	66	6%	645	56%	445	38%	1,156
Mesa County	10	3%	174	56%	126	41%	310
Pueblo	19	7%	150	58%	89	34%	258
Colorado Statewide	**466**	**5%**	**4,769**	**54%**	**3,550**	**40%**	**8,785**

Source: TRIP analysis of Federal Highway Administration National Bridge Inventory (2020).

Most bridges are designed to last 50 years before major overhaul or replacement, although many newer bridges are being designed to last 75 years or longer. In Colorado, 33 percent of the state's bridges were built in 1969 or earlier.[22] The service life of bridges can be extended by performing routine maintenance such as resurfacing decks, painting surfaces, ensuring that a facility has good drainage and replacing deteriorating components. But most bridges will eventually require more costly reconstruction or major rehabilitation to remain operable.

Traffic Safety in Colorado

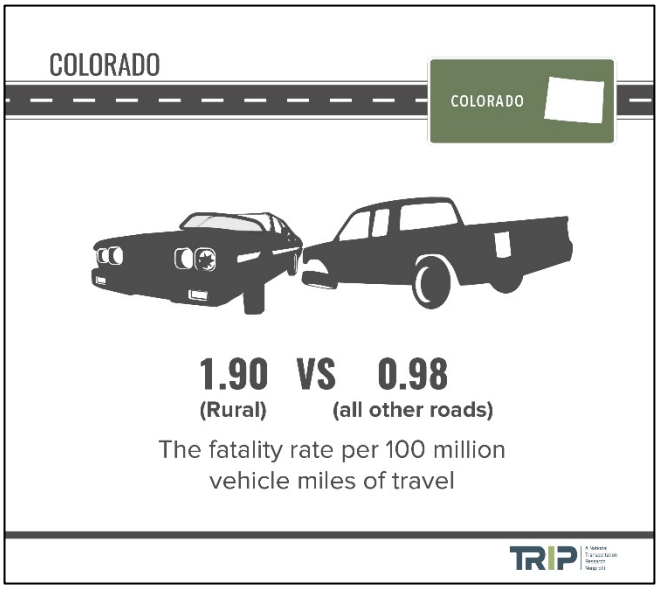
A total of 3,030 people were killed in Colorado traffic crashes from 2015 to 2019, an average of 606 fatalities per year.

Chart 8. Regional and statewide traffic fatalities 2015 – 2019.

Year	Statewide Fatalities
2015	546
2016	608
2017	648
2018	632
2019	596
TOTAL	**3,030**
AVERAGE	**606**

Source: National Highway Traffic Safety Administration.

Three major factors are associated with fatal vehicle crashes: driver behavior, vehicle characteristics and roadway features. It is estimated that roadway features are likely a contributing factor in approximately one-third of fatal traffic crashes. Roadway features that impact safety include the number of lanes, lane widths, lighting, lane markings, rumble strips, shoulders, guard rails, other shielding devices, median barriers and intersection design.



Colorado's overall traffic fatality rate of 1.09 fatalities per 100 million vehicle miles of travel in 2019 is below the national average of 1.11.[23] The fatality rate on Colorado's non-interstate rural roads is more than double that on all other roads in the state (1.83 fatalities per 100 million vehicle miles of travel vs. 0.90).[24]

Traffic crashes in Colorado imposed a total of $6.5 billion in economic costs in 2019.[25] TRIP estimates that roadway features were likely a contributing factor in approximately one-third of all fatal traffic crashes, resulting in $2.2 billion in economic costs in Colorado in 2019.[26] According to a 2015 National Highway Traffic Safety Administration (NHTSA) report, the economic costs of traffic crashes includes work and household productivity losses, property damage, medical costs, rehabilitation costs, legal and court costs, congestion costs and emergency services.[27]

Improving safety on Colorado's roadways can be achieved through further improvements in vehicle safety; improvements in driver, pedestrian, and bicyclist behavior; and, a variety of improvements in roadway safety features. The severity of serious traffic crashes could be reduced through roadway improvements, where appropriate, such as converting intersections to roundabouts; removing or shielding roadside objects; the addition of left-turn lanes at intersections; the signalization of intersections; adding or improving median barriers; improved lighting; adding centerline or shoulder rumble strips; providing appropriate pedestrian and bicycle facilities, including sidewalks and bicycle lanes; providing wider lanes, wider and paved shoulders; upgrading roads from two lanes to four lanes; providing better road and lane markings; and updating rail crossings.

The U.S. has a $146 billion backlog in needed roadway safety improvements, according to a 2017 report from the AAA Foundation for Traffic Safety. The report found implementing these cost-effective and needed roadway safety improvements on U.S. roadways would save approximately 63,700 lives and reduce the number of serious injuries as a result of traffic crashes by approximately 350,000 over 20 years.

Traffic Congestion in Colorado

While traffic congestion is largely constrained to the state's urban areas, increasing congestion on Colorado's major highways and roads hampers the state's ability to support economic development and quality of life by reducing the reliability and efficiency of personal and commercial travel, including the transport of goods and services. Traffic congestion robs commuters of time and money and imposes increased costs on businesses, shippers and manufacturers, which are often passed along to consumers. Increased levels of congestion can also reduce the attractiveness of a location when a company is considering expansion or deciding where to locate a new facility.

Based on a 2019 report on urban mobility by the Texas Transportation Institute that analyzes urban traffic congestion levels and provides estimates on the amount of time and the value of lost time and wasted fuel as a result of traffic congestion, TRIP has estimated in the following chart the average number of hours lost annually for each driver, the per-driver cost of lost time and wasted fuel due to congestion and the average amount of fuel per driver wasted annually due to congestion in each of Colorado's largest urban areas.

Chart 9. 2019 Annual hours and fuel lost to congestion and congestion costs per driver.

Location	Hours Lost to Congestion	Annual Cost Per Driver	Gallons of Fuel Wasted Per Driver
Colorado Springs	44	$838	19
Denver	62	$1,242	26
Northern Colorado	22	$460	9
Mesa County	11	$230	4
Pueblo	20	$431	7

Source: TRIP estimate based on Texas Transportation Institute Analysis.

Based on the TTI report, TRIP estimates that the total cost of traffic congestion in Colorado in 2019 in terms of lost time and wasted fuel is $3.5 billion annually.[28] The chart below lists Colorado's worst traffic bottlenecks.

The chart below lists Colorado's 25 most congested highway segments based on measuring volume of traffic compared to its capacity.[29]

Chart 10. Colorado's Most Congested Highway Segments.

Rank	Route	Urban area	Segment	Length (Miles)	Avg. Daily Traffic
1	SH 470	Littleton, Lone Tree	From NW of SH 85, (Santa Fe Drive) to Yosemite St.	10.8	104,959
2	I-25	Denver	From N of SH 30 & SH 285 (Hampden Ave. to Speer Boulevard)	9.9	236,182
3	SH 83, (Parker Road)	Aurora	From S of Hampden Ave. to Cornell St. and Dartmouth Ave.	2.5	79,662
4	SH 88, (Arapahoe Road)	Greenwood Village, Aurora	W of I-25 to SH 83 (Parker Rd.)	4.5	65,656
5	I-25	Lone Tree, Denver	From N of Lincoln Ave. to SH 30 and 285 (Hampden Ave.)	8.6	242,249
6	I-70	West Vail, Vail	From W of Chaonix Rd. to Vail Rd.	4.6	45,000
7	SH 85, (Santa Fe Drive)	Littleton	From S of Blakeland Dr. to Mineral Ave.	2.3	43,455
8	SH 24, (Powers Blvd.)	Colorado Springs	From N of Fountain Blvd. to Platte Ave.	1.7	61,909
9	SH 85, (Santa Fe Drive)	Englewood, Denver	From N of SH 285 (Hampden Ave,) to I-25	4.0	93,128
10	SH 287, (Federal Blvd.)	Westminster	From S of SH 36 to 104TH Ave.	3.0	39,047
11	I-25	Colorado Springs	From SH 24 (Cimarron St. to Briargate Parkway)	10.4	137,191
12	SH 121, (Wadsworth Blvd.)	Lakewood, Arvada	From N of SH 285 (Hampden Ave.) to 58TH Ave. and Ralston Rd.	10.4	50,231
13	SH 121, (Wadsworth Bypass)	Arvada, Broomfield	From S of 64TH Ave. to SH 287	8.1	45,110
14	I-25	Thornton	From NE of Speer Blvd. to SH 34 (Thornton Parkway)	8.4	229,971
15	SH 88, (Belleview Ave.)	Littleton, Greenwood Village	From E of SH 85 (Santa Fe Dr.) to I-25	5.7	35,556
16	I-70	Denver	From E of 287, (Federal Blvd.) to I-225	9.1	160,463
17	SH 391, (Kipling Street)	Wheatridge	From N of 32nd Ave. to I-70.	1.6	42,112
18	SH 16, (Mesa Ridge Parkway)	Fountain	From E of Carson Blvd. to Powers Blvd.	2.0	33,351
19	I-70	Aurora	From W of I-225 to Colfax Ave.	5.2	137,105
20	SH 36	Broomfield, Denver	From SE of Flatiron Circle to I-25	10.9	122,334
21	SH 40, (Colfax Ave.)	Denver	From W of 7TH St. and Osage St. to Broadway	1.6	52,966
22	I-76	Commerce City	From SW of SH 95 (Sheridan Blvd.) to SH 224 (74TH Ave.)	8.1	89,344
23	SH 34, (Eisenhower Blvd.)	Loveland, Greeley	from E OF Boise Ave to SH 257	9.4	51,592
24	SH 285	Broadway, Englewood	From E of SH 3912 (Kipling Parkway) to SH 75 (Broadway).	6.6	69,674
25	SH 83, (Parker Road)	Parker	From N of Hilltop Rd. and Twewnty Mile Rd. to E-470	2.4	52,216

Source: Colorado Department of Transportation.

Traffic congestion significantly reduces access to jobs and employees. In a 2018 report, the Center for Transportation Studies at the University of Minnesota analyzed accessibility to jobs in private vehicles in the largest 50 urban areas in the U.S. The report found that of the approximately 1.7 million jobs accessible to residents of the Denver metro area within a one-hour drive, only 47 percent are accessible within 30 minutes.[30]

The Center for Transportation Studies report also looked at the impact of traffic congestion on reducing accessibility to employment by comparing travel times during peak hours versus non-peak hours. The report found that the number of jobs accessible within 30 minutes during peak commuting times in the Denver area was reduced by 39 percent as a result of traffic congestion.[31]

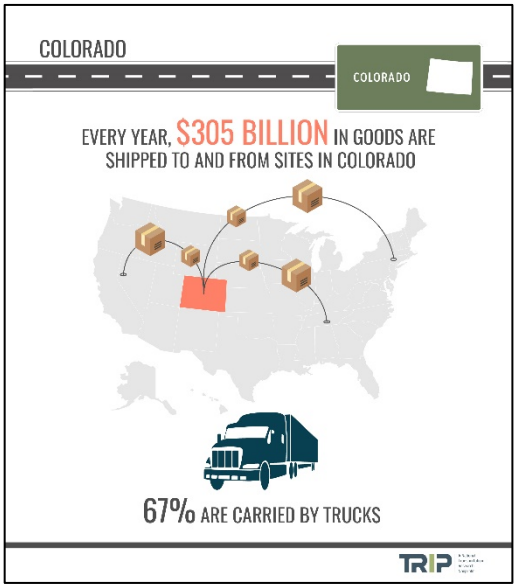
Freight Transportation and the Impact of Transportation Investment in Colorado

Today's culture of business demands that an area have well-maintained and efficient roads, highways and bridges if it is to remain economically competitive. Global communications and the impact of free trade in North America and elsewhere have resulted in a significant increase in freight movement, making the quality of a region's transportation system a key component in a business's ability to compete locally, nationally and internationally.

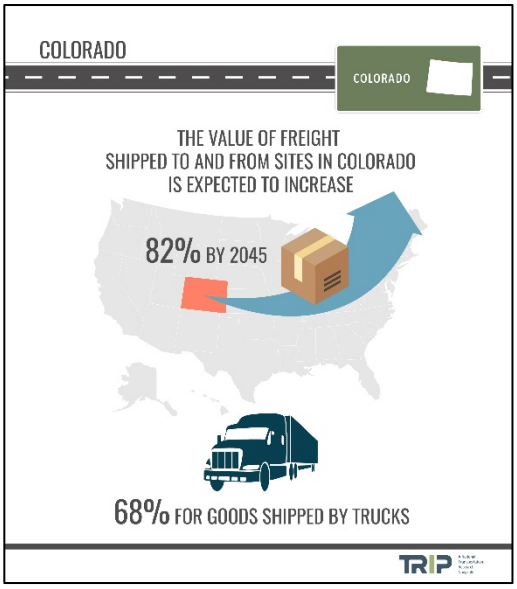
Businesses have responded to improved communications and the need to cut costs with a variety of innovations including just-in-time delivery, increased small package delivery, demand-side inventory management and e-commerce. The result of these changes has been a significant improvement in logistics efficiency as firms move from a push-style distribution system, which relies on large-scale warehousing of materials, to a pull-style distribution system, which relies on smaller, more strategic movement of goods. These improvements have made mobile inventories the norm, resulting in the nation's trucks literally becoming rolling warehouses.

Highways are vitally important to continued economic development in Colorado. As the economy expands, creating more jobs and increasing consumer confidence, the demand for consumer and business products grows. In turn, manufacturers ship greater quantities of goods to market to meet this demand, a process that adds to truck traffic on the state's highways and major arterial roads.

The amount of freight transported in Colorado and the rest of the U.S. is expected to increase significantly as a result of further economic growth, changing business and retail models, increasing international trade, and rapidly changing consumer expectations that place an emphasis on faster deliveries, often of smaller packages or payloads.



Every year, $305 billion in goods are shipped to and from sites in Colorado.[32] The value of freight shipped to and from sites in Colorado, in inflation-adjusted dollars, is expected to increase 82 percent by 2045 and by 68 percent for goods shipped by trucks.[33]



Accommodating the significant increase in the movement of freight by trucks in Colorado will be further challenged by the significant number of freight routes in Colorado that are constrained because they have inadequate load carrying capacity to accommodate large trucks. The following chart indicates the highway segments in Colorado carrying the greatest number of large commercial trucks daily.

Chart 11. Colorado Highway Segments Carrying the Largest Number of Large Commercial Trucks Daily

Rank	Route	Urban area	Segment	Avg. Daily Truck Travel	Length (Miles)
1	I-25	Thornton	From S. of SH 6 (6th Ave.) to SH 128 (120th Ave.)	10,301	15.1
2	I-25	Denver	From N of SH 470 to SH 285 (Hampden Ave.)	7,481	7.3
3	I-270	Denver	From SE of I-76 to I-70	6,862	5.8
4	I-70	Aurora	From W of SH 391 (Kipling St.) to SH 40 (Colfax Ave.)	6,802	19.2
5	I-25	Colorado Springs. Monument	From S of SH 24 (Cimarron St.) to SH 105 (2nd St.)	6,411	18.3
6	I-76	Arvada, Brighton	From SW of SH 95 (Sheridan Blvd.) to SH 2 (SABLE Blvd.)	5,758	12.5
7	I-225	Denver, Aurora	From NE of SH 83 (Parker Rd.) to I-70	5,462	8.5
8	I-70	Limon	From W of SH 24 Spur to SH 24 & SH 40	3,619	21.6
9	I-25	Fort Collins, Norfolk	From N of Mountain Vista Interchange to Weld Co Rd. 126	3,483	21.2
10	SH 85 (Sante Fe Dr.)	Littleton, Denver	From SW of SH 88 to I-25	2,638	7.0

Source: Colorado Department of Transportation

The following chart indicates the highway segments in Colorado where large commercial trucks make up the largest share of daily traffic.

Chart 12. Colorado Highway Segments Carrying the Largest Daily Traffic Share of Large Commercial Trucks

Rank	Route	Urban area	Segment	Percent Large Truck Travel	Length (Miles)
1	SH 40	Wild Horse	From NW of SH 94 to CR 6	52%	20.2
2	SH 287	Campo, Springfield	From S of Road H to SH 160	52%	21.6
3	SH 287	Wiley	From N of SH 196 SPUR (7TH ST) to SH 96 E Jct. and CR 43	49%	22.2
4	SH 287	Lamar	From NE of CR F to Memorial Dr. S. Jct.	48%	21.8
5	SH 287	Springfield	From S of SH 116 & CR RR to CR F	48%	21.1
6	SH 40	Wild Horse, Kit Carson	From E of CR 9 to SH 59	42%	19.7
7	SH 40	Hugo	From 4TH ST., NW of 1ST AVE to CR 2W	35%	14.3
8	SH 36	Byers	From W of CR 254 (PRICE Rd.) to CR 269	34%	15.2
9	SH 385	Snyder, Stoneham	From S of CR EE to SH 14 W Jct.	33%	19.3
10	SH 96	Cope	From E of CR LL & CR 9 to NW of SH 59 W Jct.	30%	12.2

Source: Colorado Department of Transportation

The ability of Colorado and the nation's freight transportation system to accommodate the growing demand for freight movement efficiently and safely could be hampered by inadequate transportation capacity, a lack of adequate safety features on some transportation facilities, institutional barriers to enhancing the nation's freight facilities, a lack of adequate funding for needed improvements to the freight network, and a shortage of drivers.

The need to improve the U.S. freight network is occurring at a time when the nation's freight delivery system is being transformed by advances in vehicle autonomy, manufacturing, warehousing and supply chain automation, increasing e-commerce, and the growing logistic networks being developed by Amazon and other retail organizations in response to the demand for a faster and more responsive delivery and logistics cycle.

Investments in transportation improvements in Colorado play a critical role in the state's economy. A report by the American Road & Transportation Builders Association found that the design, construction and maintenance of transportation infrastructure supports the equivalent of approximately 77,000 full-time jobs across all sectors of the state economy, earning these workers approximately $3.4 billion annually.[34] These jobs include approximately 38,500 full-time jobs directly involved in transportation infrastructure construction and related activities. Spending by employees and companies in the transportation design and construction industry supports an additional 38,800 full-time jobs in Colorado.[35] Transportation construction

in Colorado contributes an estimated $620 million annually in state and local income, corporate and unemployment insurance taxes and the federal payroll tax.[36]

Approximately 1.1 million full-time jobs in Colorado in key industries like tourism, retail sales, agriculture and manufacturing are dependent on the quality, safety and reliability of the state's transportation infrastructure network. These workers earn approximately $45 billion in wages and contribute an estimated $8.2 billion in state and local income, corporate and unemployment insurance taxes and the federal payroll tax.[37]

Local, regional and state economic performance is improved when a region's surface transportation system is expanded or repaired. This improvement comes as a result of the initial job creation and increased employment created over the long-term because of improved access, reduced transport costs and improved safety.

Increasingly, companies are looking at the quality of a region's transportation system when deciding where to re-locate or expand. Regions with congested or poorly maintained roads may see businesses relocate to areas with a smoother, more efficient and more modern transportation system. Highway accessibility was ranked the number one site selection factor in a 2020 survey of corporate executives by Area Development Magazine.[38]

Improving Transportation Safety, Resiliency and Efficiency

Recognizing that extreme weather, sea level change, and changes in environmental conditions may threaten the condition and longevity of the nation's transportation infrastructure, transportation agencies have begun to assess vulnerabilities and consider the resilience of their transportation assets during the transportation planning process. Transportation agencies across the country have begun to incorporate resilience in asset management plans, addressing resilience in project development and design and optimizing operations and maintenance practices.[39]

Based on the importance of maximizing the level and safety of mobility provided by its transportation system, transportation agencies are adopting Transportation Systems Management and Operations (TSMO) practices and incorporating improved resiliency into their transportation network. While a TSMO program does not eliminate the need for capacity expansions along some routes, it helps enhance the mobility of an existing corridor as much as possible.

A TSMO program adopts an integrated set of strategies to improve traffic flow and safety on a portion of a roadway, including work zone management, traffic incident management, freight management, traveler information, traffic signal coordination, ramp management, transit management and improved bicycle and pedestrian crossings.[40] The benefits of TSMO can include reduced traffic congestion, reduced fuel consumption and reduced emissions.

Transportation Funding in Colorado

Investment in Colorado's roads, highways and bridges is funded by local, state and federal governments. A lack of sufficient funding at all levels will make it difficult to adequately maintain and improve the state's existing transportation system.

Revenue from Colorado's motor fuel tax – a critical source of state transportation funding -- is likely to erode as a result of increasing vehicle fuel efficiency and the increasing use of electric vehicles. The average fuel efficiency of U.S. passenger vehicles increased from 20 miles per gallon in 2010 to 24.5 miles

per gallon in 2020. Average fuel efficiency is expected to increase another 31 percent by 2030, to 32 miles per gallon, and increase 51 percent by 2040, to 37 miles per gallon.[41] The share of electric vehicles of total passenger vehicle sales in the U.S. is expected to increase to five percent by 2023 and 60 percent by 2040, by which time electric vehicles will represent approximately 30 percent of the passenger vehicle fleet.[42]

Most federal funds for highway and transit improvements in Colorado are provided by federal highway user fees, largely an 18.4 cents-per-gallon tax on gasoline and a 24.4 cents-per-gallon tax on diesel fuel (additional revenue is generated by fees on the sale of large trucks, a highway use tax levied on vehicles in excess of 55,000 pounds and a tax on the sale of large truck tires).

Since 2008, revenue into the federal Highway Trust Fund has been inadequate to support legislatively set funding levels so Congress has transferred approximately $53 billion in general funds and an additional $2 billion from a related trust fund into the federal Highway Trust Fund.[43]

Signed into law in December 2015, the five-year Fixing America's Surface Transportation Act (FAST Act) was scheduled to expire on September 30, 2020. Congress extended the legislation for one year to September 30, 2021. The FAST Act provides modest increases in federal highway and transit spending. The bill also provides states with greater funding certainty and streamlines the federal project approval process. But the FAST Act does not provide adequate funding to meet the nation's need for highway and transit improvements and does not include a long-term and sustainable funding source.

The FAST-Act is a major source of funding for road, highway and bridge repairs in Colorado. Throughout the six years of the FAST-Act – fiscal years 2016 to 2021 – the program provided $3.4 billion to Colorado for road repairs and improvements, an average of $571 million per year.[44] From 2014 to 2018, the federal government provided $1.19 for road improvements in Colorado for every $1.00 state motorists paid in federal highway user fees, including the federal state motor fuel tax.[45]

Federal funds are a critical source of highway investment in Colorado and represent a significant share of funds used by the state for major road, highway and bridge repairs and improvements. From 2014 to 2018, federal funds provided for highway improvements were the equivalent of 65 percent of the amount of Colorado state capital outlays on road, highway and bridge projects, including construction, engineering and right-of-way acquisition.[46]

Colorado federal-aid eligible roads, bridges and highways include the most critical routes in the state, including the Interstate Highway System, major highways and important rural and urban routes. Federal-aid eligible roadways in Colorado account for 23 percent of state lane-miles and carry 89 percent of all vehicle miles of travel in the state.[47] Fifty-seven percent of Colorado's bridges by count, and 82 percent of bridges measured by deck area are eligible for Federal aid.[48]

According to the Status of the Nation's Highways, Bridges, and Transit, 23rd Edition, submitted to Congress by the United States Department of Transportation (USDOT) in 2019, the nation faces a $786 billion backlog in needed repairs and improvements to the nation's roads, highways and bridges.[49] This backlog includes $435 billion for highway rehabilitation; $125 billion for bridge rehabilitation; $120 billion for system expansion and $106 billion for system enhancement.[50] The USDOT report found that the nation's current $105 billion investment in roads, highways and bridges by all levels of government should be increased by 29 percent to $136 billion annually to improve the conditions of roads, highways and bridges, relieve traffic congestion and improve traffic safety.[51]

Conclusion

As Colorado strives to continue and expand its economic growth and enhance quality of life for its residents, it will be critical that the state is able to provide a well-maintained, safe and efficient 21st century network of roads, highways, bridges and transit that can accommodate the mobility demands of a modern society.

It is critical that Colorado accommodate the significant growth that continues to be attracted to the state due to its high quality of life by boosting transportation funding to ensure that Colorado moves forward with a robust and reliable transportation plan capable of improving mobility and accessibility, which is vital to the state's residents, businesses and visitors.

# # #

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