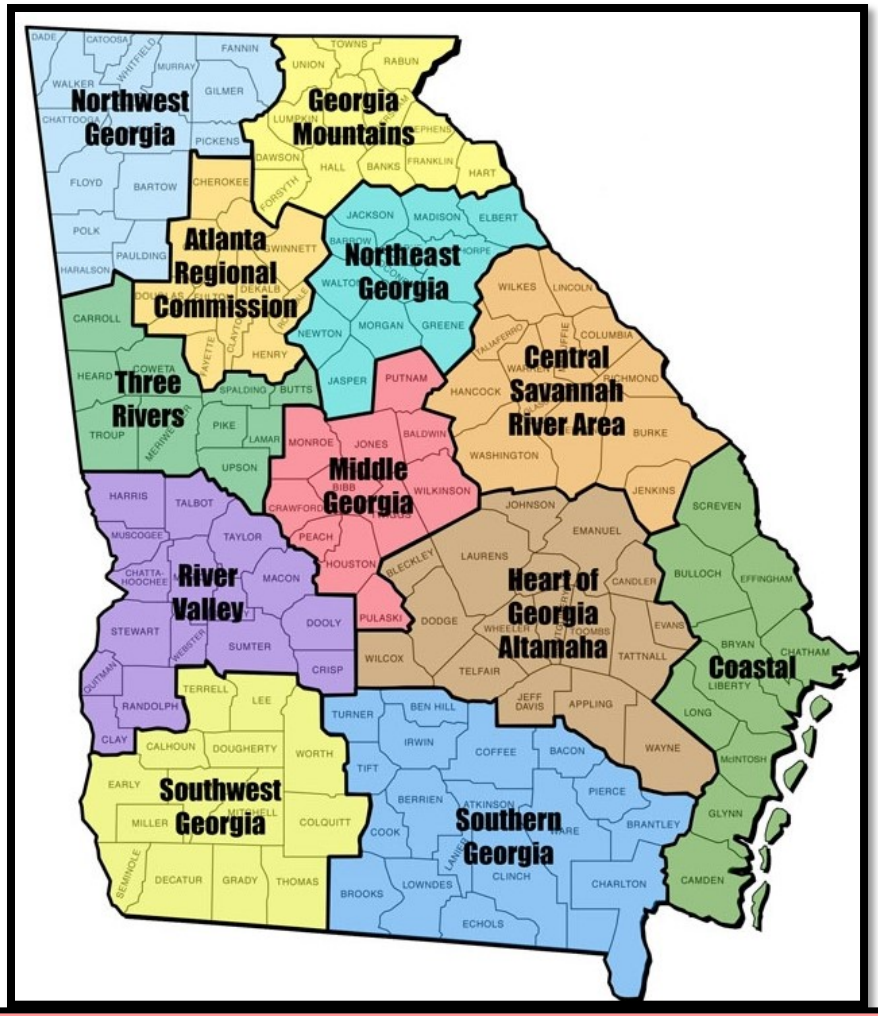


Moving Georgia Forward:

Road and Bridge Conditions, Traffic Safety, Travel Trends and Funding Needs in Georgia

NOVEMBER 2020

TRIP | A National Transportation Research Nonprofit

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.

Introduction

Accessibility and connectivity are critical factors in a region or state's quality of life and economic competitiveness. The growth and development of a region hinges on the ability of people and businesses to efficiently and safety access employment, customers, commerce, recreation, education and healthcare via multiple transportation modes. The quality of life of residents in Georgia and the pace of the state's economic growth are directly tied to the condition, efficiency, safety and resiliency of the state's transportation system. The necessity of a reliable transportation system in Georgia has been reinforced during the coronavirus pandemic, which has placed increased importance on the ability of a region's transportation network to support a reliable supply chain.

Providing a safe, efficient and well-maintained 21st century transportation system, which will require long-term, sustainable funding, is critical to supporting economic growth, improved safety and quality of life throughout the area. A lack of reliable and adequate transportation funding could jeopardize the condition, efficiency and connectivity of the region's transportation network and hamper economic growth.

TRIP's "Moving Georgia Forward" report examines travel and population trends, road and bridge conditions, traffic safety, congestion, and transportation funding needs in Georgia. This statewide report compiles data included in the 12 reports produced by TRIP for the following regions in Georgia: Atlanta, Central Savannah River Area, Coastal Georgia, Georgia Mountains, Heart of Georgia Altamaha, Middle Georgia, Northeast Georgia, Northwest Georgia, River Valley, Southern Georgia, Southwest Georgia and Three Rivers.

Sources of information for this report include a survey of county governments by TRIP, the Federal Highway Administration (FHWA), the Georgia Department of Transportation (GDOT), 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) and the National Highway Traffic Safety Administration (NHTSA). All data used in the report are the most recent available.

Population, Travel and Economic Trends in Georgia

To foster quality of life and spur continued economic growth throughout Georgia, it will be critical that the state provide an efficient, safe and modern transportation system that can accommodate future growth in population, tourism, business, recreation and vehicle travel.

Statewide, Georgia's population grew to approximately 10.5 million residents in 2018, an eight percent increase since 2010.[1] From 2014 to 2018, annual VMT in Georgia increased by 18 percent, to approximately 131 billion miles traveled annually.[2] Due to the Covid-19 pandemic, vehicle travel in Georgia dropped by as much as 38 percent in April 2020 (as compared to vehicle travel during the same month the previous year), but rebounded to 12 percent below the previous year's volume in August 2020.[3]

Pavement Conditions in Georgia

The life cycle of Georgia'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.

Based on results of a TRIP survey of Georgia counties conducted in late 2019 and early 2020, TRIP has calculated the share of county-maintained roads in Georgia in poor, fair and good condition. Survey responses from Georgia counties indicate that 22 percent of county-maintained roads are in poor condition, 33 percent are in fair condition, and 44 percent are in good condition.[4]

The chart below details the share of county-maintained miles of roadways in good, fair and poor condition in each of Georgia's 12 regions and statewide.

Chart 1. Share of county-maintained roads in good, fair or poor condition.

Condition of County-Maintained Pavement			
Region	**Good**	**Fair**	**Poor**
Atlanta	50%	26%	24%
Central Savannah River	36%	40%	25%
Coastal Georgia	33%	36%	31%
Georgia Mountains	57%	32%	12%
Heart of Georgia Altamaha	36%	40%	24%
Middle Georgia	33%	42%	25%
Northeast Georgia	50%	34%	17%
Northwest Georgia	36%	35%	29%
River Valley	37%	38%	26%
Southern Georgia	36%	40%	24%
Southwest Georgia	46%	30%	24%
Three Rivers	49%	30%	22%
STATEWIDE	**44%**	**33%**	**22%**

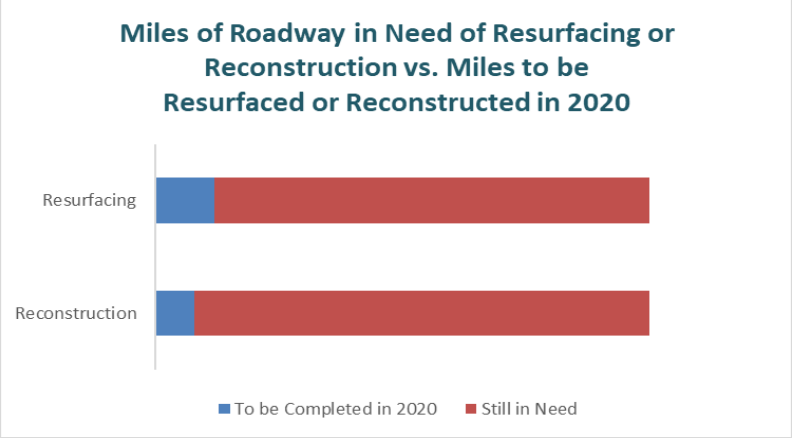
Source: TRIP survey of Georgia counties, conducted December 2019 - February 2020.

Roads rated in poor condition may show signs of deterioration, including rutting, cracks and potholes. In some cases, poor roads can be resurfaced but often are too deteriorated and must be reconstructed. Roads rated in fair condition may show signs of significant wear and may also have some

visible pavement distress. Most pavements in fair condition can be repaired by resurfacing, but some may need more extensive reconstruction to return them to good condition.

TRIP's survey of county governments in Georgia found that, of the miles of county-maintained roadway in need of resurfacing, current budgets will only allow for resurfacing of 12 percent of those miles in 2020.[5] And, of the miles of county-maintained roadway in Georgia in need of reconstruction, only eight percent will be able to be reconstructed in 2020 under current funding conditions.[6]

Chart 2. Share of county-maintained roads in need of resurfacing or reconstruction in Georgia vs. share of roads that are expected to be resurfaced or reconstructed in 2020.



Source: TRIP survey of Georgia counties, conducted December 2019 - February 2020.

Of the miles of county-maintained roads in need of resurfacing or reconstruction in 2020, the chart below details the share that are expected to be resurfaced or reconstructed in 2020 in each of Georgia's 12 regions and statewide, based on current funding.

Chart 3. Share of county-maintained roads in need of resurfacing or reconstruction that are expected to be addressed in 2020 based on current funding.

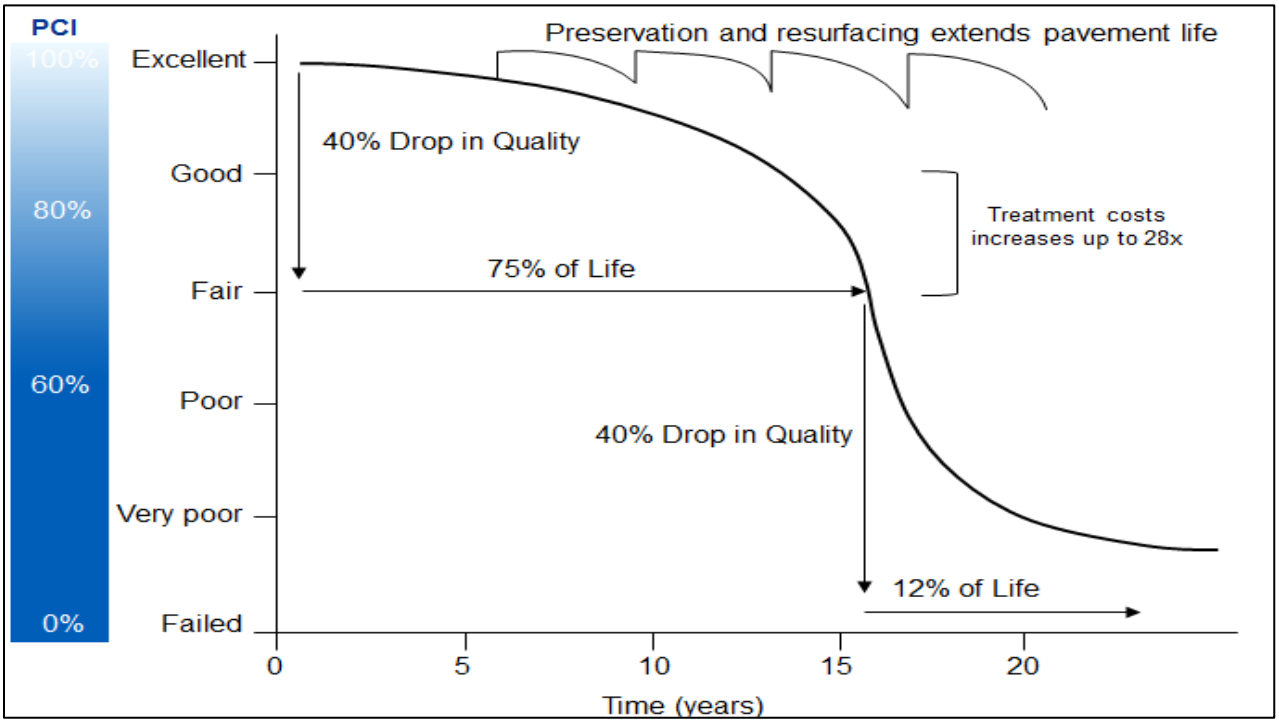
Region	Resurfacing	Reconstruction
Atlanta	14%	10%
Central Savannah River	14%	10%
Coastal Georgia	8%	7%
Georgia Mountains	21%	8%
Heart of Georgia Altamaha	13%	3%
Middle Georgia	7%	4%
Northeast Georgia	16%	7%
Northwest Georgia	15%	10%
River Valley	7%	15%
Southern Georgia	13%	7%
Southwest Georgia	13%	11%
Three Rivers	8%	7%
STATEWIDE	**12%**	**8%**

Source: TRIP survey of Georgia counties, conducted December 2019 - February 2020.

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.[7] 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.

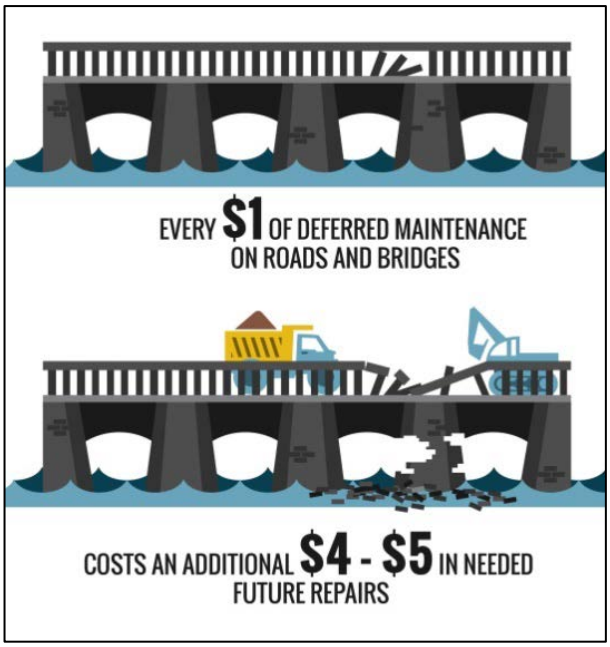
TRIP's survey of Georgia counties indicates that, statewide, the amount of money anticipated to be spent in 2020 on roads, highways and bridges is only 52 percent of the total amount that needs to be spent to make significant progress towards achieving a state of good repair for roads, highways and bridges.

Chart 3. Pavement Condition Cycle Time with Treatment and Cost



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

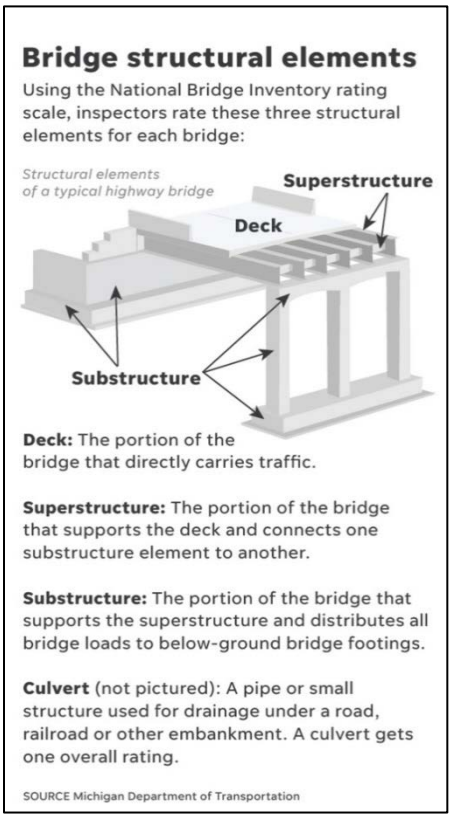
Long-term repair costs increase significantly when road and bridge maintenance is deferred, as road and bridge deterioration accelerates later in the service life of a transportation facility and requires more costly repairs. A report on maintaining pavements found that every $1 of deferred maintenance on roads and bridges costs an additional $4 to $5 in needed future repairs.[8]



Bridge Conditions in Georgia

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

Ten percent (1,551 of 14,799) of Georgia's locally and state-maintained bridges are rated as deficient.[9] This includes all bridges that are 20 feet or more in length. Each day, 5.1 million vehicles travel over deficient bridges in Georgia.[10]



A bridge is deemed deficient if it meets at least one of the following criteria: The physical condition of a bridge deck, superstructure or substructure is rated a four or below on a scale of one to nine, indicating significant deterioration of a major component of the bridge; A bridge is restricted to carrying only lighter-weight vehicles; A bridge has a carrying capacity of 18 tons or less, which restricts it from carrying larger commercial vehicles.

Bridges that are 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. Bridges that have a carrying capacity below 18 tons largely are unable to carry large commercial vehicles, which can harm a region's economic competitiveness by restricting access for commercial goods.

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.

The chart below ranks the five most deficient bridges (carrying a minimum of 500 vehicles per day) in each Georgia region based on the number of categories where the bridge ranked "deficient" (P = physical condition of deck, superstructure or substructure based on a rating of four or below for its deck, substructure or superstructure; C = the carrying capacity of the bridge is 18 tons or less; R = the bridge is restricted to only carrying lighter-weight vehicles), and average daily traffic (ADT).

Chart 4. Most deficient bridges in Georgia by region.

Deficiency Noted	Rank	County	Facility Carried	Feature Intersected	Location	Year Built	ADT	Deck	Super-structure	Sub-structure
ATLANTA										
PCR	1	Fulton	HOWELL MILL ROAD	PEACHTREE CREEK	IN N ATLANTA	1948	27915	6	3	3
PCR	2	Fulton	MARIETTA ROAD	CSX RR YARD (TILFORD)	IN N W ATLANTA	1971	2910	4	4	5
PCR	3	Clayton	BROWN ROAD	SWAMP CREEK	1 MI SW OF JONESBORO	1958	2895	7	6	4
CR	4	Clayton	UPPER RIVERDALE RD	FLINT RIVER	0.5 MI E OF RIVERDALE	1962	45390	7	7	7
CR	5	DeKalb	N. DRUID HILLS RD.	NS RAILROAD	2.8 MI N OF DECATUR	1963	45390	6	5	6
CENTRAL SAVANNAH RIVER										
PCR	1	Richmond	5TH STREET	SAVANNAH RIVER	AT THE SC S L	1931	3615	5	4	4
PCR	2	Wilkes	STONEY ROAD	LITTLE KETTLE CREEK	6 MI SW OF WASHINGTON	1967	735	7	7	4
CR	3	Richmond	BERCKMAN ROAD	RAES CREEK	12.9 MI NE OF HEPHIZIBAH	1950	15705	6	7	5
CR	4	Wilkes	SR 17	BROAD RIVER	7.5 MI N OF TIGNALL	1971	2265	5	6	5
CR	5	Burke	SR 23	BRIER CREEK OVERFLOW	2.5 MI N OF SARDIS	1962	1770	7	7	5
COASTAL GEORGIA										
PCR	1	Bulloch	AKINS POND ROAD	MILL CREEK	4.9 MI NW OF STATESBORO	1965	900	6	6	4
PR	2	McIntosh	US 17 SR 25	DARIEN RIVER	IN CITY LIMIT OF DARIEN	1944	9045	6	4	4
CR	3	Bulloch	CYPRESS LAKE ROAD	DRY BRANCH	5 MI SW OF STATESBORO	1970	3840	6	6	6
CR	4	Bulloch	NEVILS-DAISY ROAD	LOTTS CREEK	8.2 MI SE OF REGISTER	1960	1380	6	7	6
CR	5	Bulloch	OLD SR 46	ASH BRANCH	11.6 MI SE OF BROOKLET	1956	1080	6	7	5
GEORGIA MOUNTAINS										
PCR	1	Rabun	W.76 LOOP ROAD	TIMPSON CREEK	4.6 MI W OF CLAYTON	1928	900	4	4	4
PCR	2	Banks	WRIGHTS MILL ROAD	HUDSON RIVER	7.3 MI SE OF HOMER	1960	735	4	5	6
PCR	3	Lumpkin	DICKS CREEK RD.	DICKS CREEK	10.1 MI NE OF DAHLONEGA	1936	735	7	4	7
PCR	4	Rabun	CAT GAP ROAD	TALLULAH RIVER	7.1 MI NW OF TIGER	1948	735	6	5	2
PCR	5	Union	FISHER FIELD	NOTTELY RIVER	8.5 MI SE OF BLAIRSVILLE	1980	735	5	4	4
HEART OF GEORGIA ALTAMAHA										
PCR	1	Laurens	NORTH P'TREE ROAD	BREWTON CREEK	.4 MI N OF BREWTON	1950	735	6	6	3
PCR	2	Laurens	ROCK SPRINGS ROAD	FLAT CREEK	12 MI SE OF DUBLIN	1957	735	6	6	4
PCR	3	Laurens	LOWERY FIREHOUSE RD	OKEEWALKEE CREEK	19.6 MI S OF DUBLIN	1950	735	5	6	2
PCR	4	Laurens	LORD DEXTER ROAD	BUCKHORN BRANCH	4.6 MI S OF DUDLEY	1950	735	5	6	4
PCR	5	Laurens	CR 348	ROCKY CREEK	4.6 MI S OF DUDLEY	1950	735	6	5	2

MIDDLE GEORGIA										
PCR	1	Bibb	JEFFERSONVILLE RD.	WALNUT CREEK	IN NE MACON	1929	14955	5	4	6
PCR	2	Bibb	TUCKER ROAD	ROCKY CREEK	1 MI W OF MACON CTY LMTS	1935	13845	5	7	2
PCR	3	Baldwin	BARROWS FERRY RD	TOBLER CREEK	2 MI NE OF MILLEDGEVILLE	1960	1644	6	6	2
PCR	4	Peach	TAYLOR'S MILL RD	MOSSY CREEK	3 MI N OF FORT VALLEY	1970	1050	N	N	N
PCR	5	Jones	HOWARD ROBERTS RD	WALNUT CREEK	4.7 MI W OF GRAY	1961	735	7	6	3
NORTHEAST GEORGIA										
PCR	1	Barrow	PATRICK MILL ROAD	APALACHEE RIVER	3.6 MI S OF CARL	1956	735	5	3	4
CR	2	Clarke	NORTH AVENUE	NORTH OCONEE RIVER	UNDER RR TRUSSEL BRIDGE	1974	19,950	7	7	7
CR	3	Newton	BROWN BRIDGE ROAD	YELLOW RIVER	2.5 MI W OF COVINGTON	1961	14,220	6	6	6
CR	4	Newton	BROWN BRIDGE ROAD	SNAPPING SHOALS CREEK	4.5 MI W OF PORTERDALE	1963	10,410	6	7	7
CR	5	Clarke	EAST BROAD STREET	NORTH OCONEE RIVER	0.5 MI E OF ATHENS SQ	1971	7,590	7	7	7
NORTHWEST GEORGIA										
PCR	1	Bartow	SUGAR VALLEY ROAD	NANCY CREEK	IN NW CARTERSVILLE	1942	9480	4	5	6
PCR	2	Whitfield	GORDON STREET	NS RAILROAD (719083G)	IN DALTON	1937	6915	5	4	6
PCR	3	Polk	COLLEGE STREET	CSX RAILROAD	IN SOUTH CEDARTOWN	1918	5175	3	3	3
PCR	4	Floyd	WALNUT AVENUE	NS RAILROAD(719109G)	IN ROME	1974	4815	4	6	5
PCR	5	Fannin	MADOLA ROAD	FIGHTINGTOWN CREEK	4.5 MI SW OF MCCAYSVILLE	1956	2340	7	7	4
RIVER VALLEY										
PCR	1	Quitman	FLORENCE STREET	CHATTAHOOCHEE RIV TRIB	GEORGETOWN CITY LIMITS	1977	1440	7	7	4
PCR	2	Quitman	FLORENCE STREET	CHATTAHOOCHEE RIV TRIB	GEORGETOWN CITY LIMITS	1963	1440	7	7	3
PCR	3	Randolph	CR 27	PUMPKIN CREEK	7 MI NW OF CUTHBERT	1983	1215	5	5	3
PCR	4	Marion	HARBUCK POND RD	HARDAGE FORD CREEK	5 MI NE OF BUENA VISTA	1960	900	7	7	2
PCR	5	Harris	BETHLEHEM CH. RD	BETHLEHEM CREEK	4.5 MI WSW OF SHILOH	1955	735	5	6	2
SOUTHERN GEORGIA										
PCR	1	Tift	SCOOTERVILLE ROAD	LITTLE CREEK	APP 6 MI NW OF OMEGA	1939	1965	5	5	4
PCR	2	Lowndes	OLD QUITMAN ROAD	CSX RAILROAD	APP 6 MI W OF VALDOSTA	1928	735	4	5	5
PCR	3	Atkinson	COGDELL ROAD	LITTLE RED BLUFF CREEK	APP 1.5 MI SE PEARSON	1954	735	6	6	3
PCR	4	Brooks	OLD MADISON ROAD	PISCOLA CREEK	3.5 MI SE OF QUITMAN	1920	735	5	5	4
PCR	5	Clinch	CR 202 WITHERS ROAD	SUWANNOOCHEE CREEK TRIB	APP 8 MI S OF DUPONT	1957	735	7	7	4
SOUTHWEST GEORGIA										
CR	1	Colquitt	ELLENTON-OMEGA RD	WARRIOR CREEK	APP 6 MI N OF ELLENTON	1939	1,935	6	6	6
CR	2	Mitchell	OLD HIGHWAY 3	FLINT RIVER TRIB	CITY LIMITS BACONTON GA	1921	1,230	6	6	6
CR	3	Mitchell	OLD HIGHWAY 3	FLINT RIVER TRIB	2 MI S DOUGHERTY CO LN	1921	1,230	7	7	6
CR	4	Lee	PINEWOOD ROAD	KINCHAFOONEE CREEK	APP 5 MI NW OF LEESBURG	1965	1,125	7	6	6
CR	5	Colquitt	MOULTRIE LENOX RD	LITTLE RIVER	9 MI E OF NORMAN PARK	1964	1,110	7	7	6
THREE RIVERS										
PCR	1	Upson	HANNAHS MILL ROAD	POTATO CREEK	NW EDGE OF THOMASTON	1966	3,405	6	6	4
PCR	2	Spalding	HOLLONVILLE ROAD	LINE CREEK TRIB	12 MI W OF GRIFFIN	1953	2,670	6	6	4
PCR	3	Spalding	VAUGHN ROAD	SHOAL CREEK	6 MI W OF GRIFFIN	1956	2,670	7	7	4
PCR	4	Spalding	JORDAN HILL ROAD	TROUBLESOME CRK TRIB	5 MI N OF GRIFFIN	1958	2,370	6	6	4
PCR	5	Coweta	MT CARMER ROAD	THOMAS CREEK	8.3 MI W OF NEWNAN	1950	735	5	6	4

Source: List of deficient bridges provided by Georgia Department of Transportation. Rankings calculated by TRIP.

Georgia Traffic Safety

A total of 7,192 people were killed in traffic crashes in Georgia from 2014 to 2018, an average of 1,438 fatalities per year.[11] Georgia had a traffic fatality rate 1.14 fatalities per 100 million vehicle miles of travel in 2018, near the national average of 1.13.[12]

Chart 5. Traffic Fatalities in Georgia, 2014 – 2018.

Year	Fatalities
2014	1,164
2015	1,430
2016	1,554
2017	1,540
2018	1,504
Average	**1,438**
Total	**7,129**

Source: TRIP analysis of National Highway Traffic Safety Administration data.

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.

Improving safety on Georgia'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.

Importance of Transportation System to Georgia's Economy

Reliable highway access is critical to Georgia's economic development. At a time when a significant increase in freight deliveries are forecast for Georgia, the quality of its transportation system will have a significant impact on Georgia's ability to attract economic development.

The amount of freight transported in Georgia 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, $843 billion in goods are shipped to and from sites in Georgia, mostly by trucks.[13] Seventy-six percent of freight delivered to or from sites in Georgia are shipped by truck and another 14 percent are shipped by multiple modes, including trucking.[14] The value of freight shipped to and from sites in Georgia, in inflation-adjusted dollars, is expected to increase 115 percent by 2045 and by 89 percent for goods shipped by trucks.[15] But, the ability of the Georgia's freight transportation system to efficiently and safely accommodate the growing demand for freight movement could be hampered by deficient roads and bridges, including bridges that are not able to carry large commercial vehicles.

The need to improve the state'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 Georgia 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 110,000 full-time jobs across all sectors of the state economy, earning these workers approximately $3.9 billion annually.[16] These jobs include approximately 55,000 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 55,000 full-time jobs in Georgia.[17] Transportation construction in Georgia contributes an estimated $703 million annually in state and local income, corporate and unemployment insurance taxes and the federal payroll tax.[18]

Approximately 1.9 million full-time jobs in Georgia 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.

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.[19]

Conclusion

As Georgia looks to support further economic and population growth, 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.

A robust and reliable transportation system that is maintained in good condition, can accommodate large commercial vehicles, and is reliable and safe, is vital to the quality of life of Georgia residents, the success and growth of businesses and the positive experience of its visitors.

# # #

ENDNOTES

[1] U.S. Census Bureau (2018).
[2] U.S. Department of Transportation - Federal Highway Administration: Highway Statistics 2000 and 2018.
[3] Federal Highway Administration – Traffic Volume Trends.
[4] TRIP survey of Georgia counties, December 2019-February 2020.
[5] Ibid.
[6] Ibid.
[7] Selecting a Preventative Maintenance Treatment for Flexible Pavements. R. Hicks, J. Moulthrop. Transportation Research Board. 1999. Figure 1.
[8] Pavement Maintenance, by David P. Orr, PE Senior Engineer, Cornell Local Roads Program, March 2006.
[9] Georgia Department of Transportation.
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