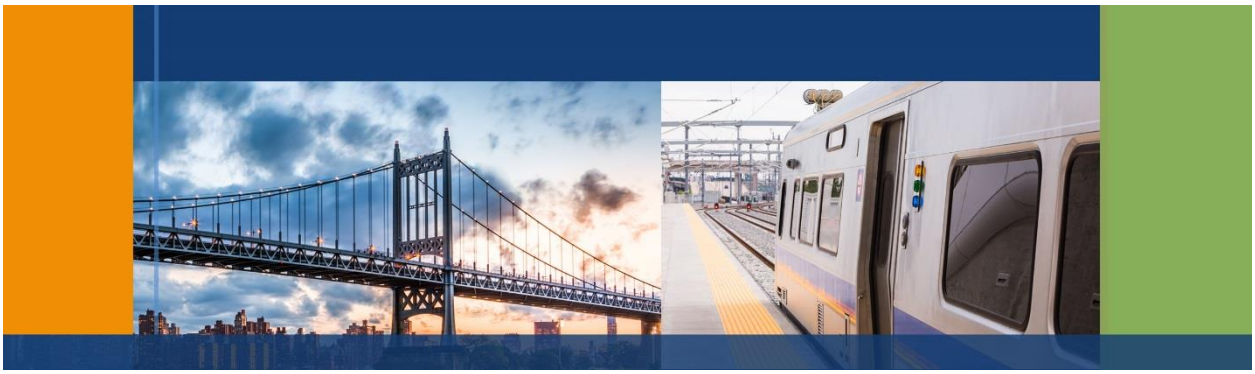


CHAPTER 11: Rural America

Rural America – Highways

Rural areas play significant roles in the U.S. economy and culture. A century ago, half the population of the United States lived in rural areas.[62] Many rural residents were farmers, and communities were built around a lifestyle of self-sufficiency. Although there were a few motorized vehicles on the road, people in rural areas mainly traveled by horse and wagon and goods were shipped long-distance via railroads.

Today, rural communities look much different. They depend on transportation to help support their economies by providing access to job opportunities, professional services, and goods and services not readily available in the local marketplace. Although the population of rural areas is much smaller than that of suburban and urban communities, rural areas constitute approximately 97 percent of land in the United States[63] and account for 71 percent[64] (by length) of our Nation's roads.

Rural transportation networks allow residents of rural areas to access employment, education, and goods and services and make it possible for visitors to enjoy rural tourism destinations that support many local businesses. Some of the transportation challenges facing rural America resemble those in more urban areas, including economic, spatial, physiological, and social barriers to accessing economic and social opportunities. However, given the limited availability of modal options in rural areas, the distances and terrain that affect the cost of infrastructure and operations, and the evolving economic environment in many rural areas, dependence on a more limited transportation network—primarily rural highways—can be significantly greater than in urban areas.

KEY TAKEAWAYS

- Rural areas make up 18 percent of the population, constitute approximately 97 percent of land in the United States, and account for 71 percent (by length) of our Nation's roads.
- Rural areas account for 90 percent of America's weight-limited bridges; 80 percent of all poor-condition bridges are in rural areas.
- The distance, terrain, and evolving economic environment in many rural areas affect the cost of infrastructure and operations, which limits the availability of modal options, constrains the transportation network, and promote dependence on personal vehicles for mobility.
- Rural counties provide most of the Nation's food and produced $139.6 billion in agricultural exports in 2018.
- In 2017, rural households devoted 20 percent of their total budget to transport, compared with 13 percent for urban households.
- Approximately two-thirds of rural Americans (63 percent) had a broadband internet connection at home in 2019, up from about a third (35 percent) in 2007.
- Rural households account for 24 percent of all passenger vehicle miles traveled (VMT), with an average annual household VMT of 24,465—about 50 percent higher than that of urban households.
- A total of 95.13 billion vehicle miles of freight movement occurred on rural roads in 2018, significantly more than the 89.04 billion miles in urban areas.

[62] The 1920 census marked the first time in which over 50 percent of the U.S. population was defined as urban. https://www.census.gov/history/www/programs/geography/urban_and_rural_areas.html
[63] https://www.census.gov/library/stories/2017/08/rural-america.html
[64] https://www.fhwa.dot.gov/policyinformation/statistics/2018/hm12.cfm

Understanding the Rural Landscape

Daily travel in the United States has undergone significant change over the past few years with the introduction of new travel modes, transportation services, and business models, along with technology-enabled travel tools and apps. Understanding the impacts and implications of these changes on travel demand is important for policy development and resource planning. Travel mode options, quality and availability of infrastructure such as sidewalks and bike lanes, and the proximity of essential services including the number of grocery stores, jobs, and healthcare within a certain distance from home all vary based on where one lives.

Rural areas are heterogeneous, in that some lie just beyond the urban fringe within or near large metropolitan areas, whereas others are remote communities with limited access to major cities. In fact, according to the U.S. Census Bureau's American Community Survey (ACS), more than half (54.4 percent) of people living in rural areas live within a metro area.[65]

The word "rural" recalls small towns, pastoral landscapes, tight-knit communities, open recreation, and an agricultural economy. Rural can be all these things. For example, a rural community may be agricultural and cover a vast geographic area with a small population, a small mining town with a main street, or a bustling coastal town with seasonal tourism to support the local economy. This diversity makes it complicated to define rural for purposes of policy. Consequently, the similarities and differences between rural communities are important in a transportation context.

Rural and urban designations are used frequently and in many different contexts and applications. Rural definitions vary considerably across Federal agencies. The U.S. Census Bureau defines rural as whatever is not defined as urban—that is, rural encompasses everything not defined as individual urban areas.[66]

The U.S. Census Bureau definition seeks to draw the boundary around an urban area's "footprint" to include its developed territory. The U.S. Census Bureau classifies two types of urban areas: urbanized areas and urban clusters. Urbanized areas are areas with 50,000 or more people. Urban clusters are areas with at least 2,500 but fewer than 50,000 people.[67] This definition essentially combines cities such as New York City and Los Angeles into the same category as Des Moines (IA), Albuquerque (NM), Great Falls (MT), Charleston (SC), and Portland (ME). The aggregation of the majority of Americans into such a broad "urban" category can mask density and land use distinctions that are important to transportation policy, planning, and research.

Fortunately, FHWA's National Household Travel Survey (NHTS) categorizes home locations using both the Census definitions and a density variable (density centile ranging from 0 to 99) that divides the urban-rural spectrum[68] into five categories: (3,4)

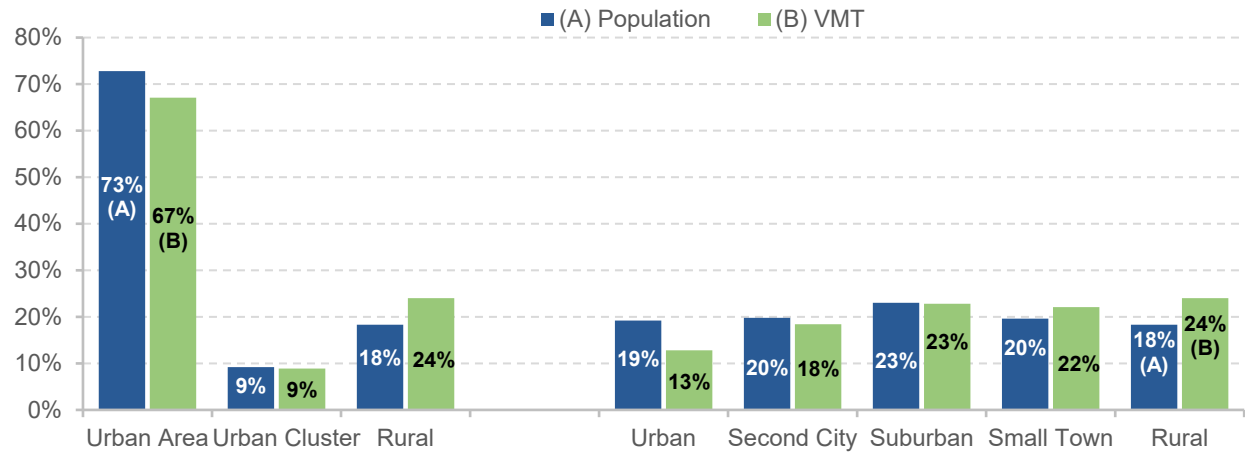
1. Urban (high-density downtown areas and classic high-density neighborhoods with a density centile score between 75 and 99).
2. Second City (medium-density areas that serve as population centers for surrounding communities; satellite cities with a density centile score between 40 and 90).
3. Suburban (medium-density areas, connected closely to urban areas or second cities for employment and entertainment opportunities with a density centile score between 40 and 90).
4. Small Town (small towns, villages, and low-density areas outside suburbs with a density centile between 20 and 40).

[65] https://gis-portal.data.census.gov/arcgis/apps/MapSeries/index.html?appid=7a41374f6b03456e9d138cb014711e01
[66] U.S. Census Bureau (2016). *Defining Rural at the U.S. Census Bureau. American Community Survey and Geography Brief*. https://www.census.gov/content/dam/Census/library/publications/2016/acs/acsgeo-1.pdf
[67] U.S. Census Bureau (2019). 2010 Census Urban and Rural Classification and Urban Area Criteria. https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2010-urban-rural.html. Accessed March 2, 2020.
[68] Federal Highway Administration National Household Travel Survey (2009–2017). Derived Variables Descriptions, p.20. https://nhts.ornl.gov/2009/pub/DerivedAddedVariables2009.pdf

5. Rural (low-density farming communities and other rural areas with a density centile between 0 and 20).

Exhibit 11-1 illustrates the differences in population and travel estimates of vehicle miles traveled (VMT) based on the expanded categories. On the left side of the figure are the population and travel estimates grouped according to the Census urban and rural categories. As expected, this grouping shows the majority of households living in urban areas. On the right side of the figure, the same data are summarized using the more detailed urban-rural categories.

Exhibit 11-1 ■ Comparison of Population and VMT Distribution across Urban-Rural Categories, 2017[69]



Source: National Household Travel Survey.

As shown in *Exhibit 11-1,* suburban, small town, and rural areas may be more alike than they are different. Using the NHTS definition for "urban," urban communities are home for approximately 19 percent of Americans. The VMT numbers are much higher in areas outside of large cities, suggesting that less dense areas are more vehicle-dependent.

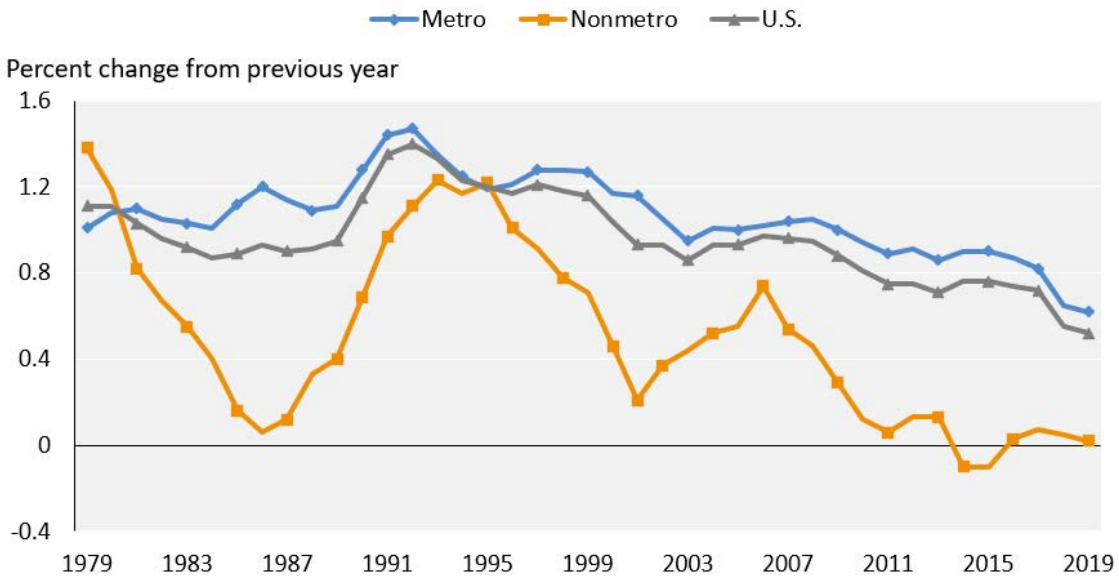
Population and Demographics

The size and density of a population often determine the availability and accessibility of transportation services; likewise, demographics of system users, such as age, income, and worker status, frequently determine transportation needs. The lower population density in rural areas can limit the number of transportation options available to rural residents because the level of demand does not match the level of investment needed. Rural communities have few high-density clusters, and accessing medical services, shopping, educational institutions, and work centers requires longer travel distances for rural households compared with those in urban areas.

Rural (nonmetro) population growth has consistently been below that of metropolitan areas over the past four decades (see *Exhibit 11-2*). The nonmetro population in the United States actually declined each year from 2011 to 2017, and was essentially stagnant in the two years following.

[69] Federal Highway Administration (2017). 2017 National Household Travel Survey. http://nhts.ornl.gov

Exhibit 11-2 ■ U.S. Metropolitan and Nonmetropolitan Population Change by Decade, 1979–2019



Note: Metro status changed for some counties in 1980, 1990, 2000, and 2010.
Source: USDA, Economic Research Service.[70]

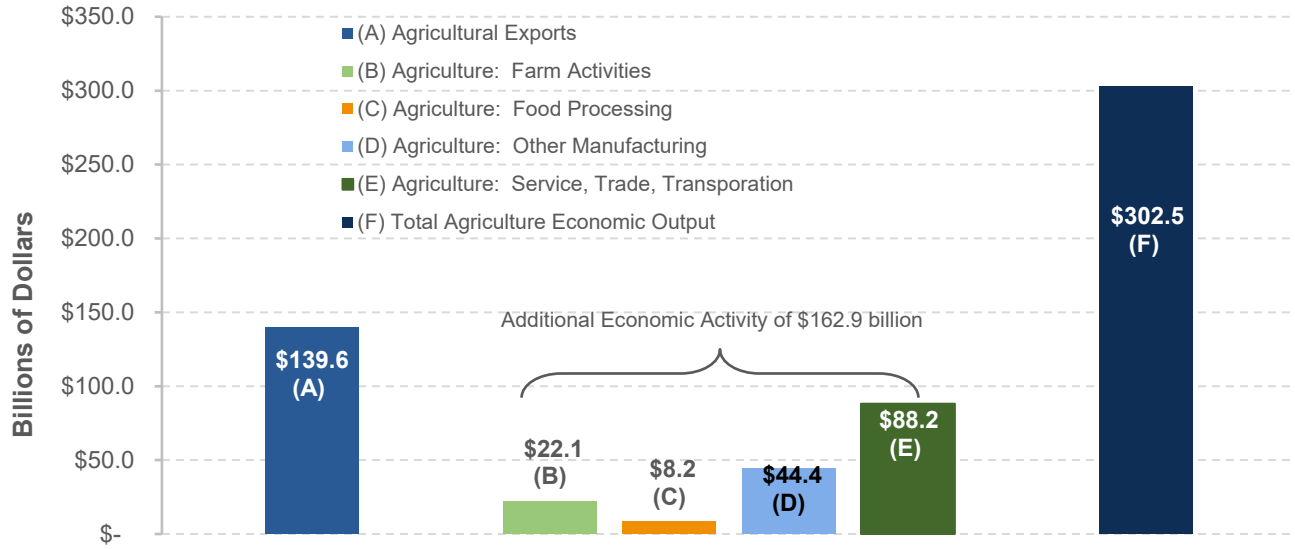
Rural Industries

Service industries account for the largest share of jobs and earnings in both rural and urban areas. However, rural areas are more dependent on industries such as farming, forestry, fishing, and mining, which account for more than 11 percent of rural earnings but only 2 percent of urban earnings. The manufacturing sector accounts for nearly 15 percent of earnings in rural areas and just over 9 percent in urban areas.[71]

The goods produced by rural industries provide products to consumers around the world. Today, 95 percent of the world's consumers are located outside of the United States. Rural areas, in many respects, are feeding the world and the growth in agricultural exports continues to have a positive impact on economic activity in the United States. According to the U.S. Department of Agriculture (USDA), rural areas produced $139.6 billion in agricultural exports in 2018.[72] As shown in *Exhibit 11-3*, USDA estimates that an additional $169.2 billion in economic activity, such as food processing, manufacturing, and transportation, was generated by these agricultural exports in 2018.[73] As consumers around the world continue to demand high-quality U.S. agricultural products, reliable roadway connections to intermodal hubs become increasingly important for rural areas.

[70] https://www.ers.usda.gov/topics/rural-economy-population/population-migration/
[71] https://www.ers.usda.gov/webdocs/publications/80894/eib162_forprinting.pdf?v=0
[72] https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=98298
[73] https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=98298

Exhibit 11-3 ■ Additional Economic Activity Generated by Agricultural Exports, 2018

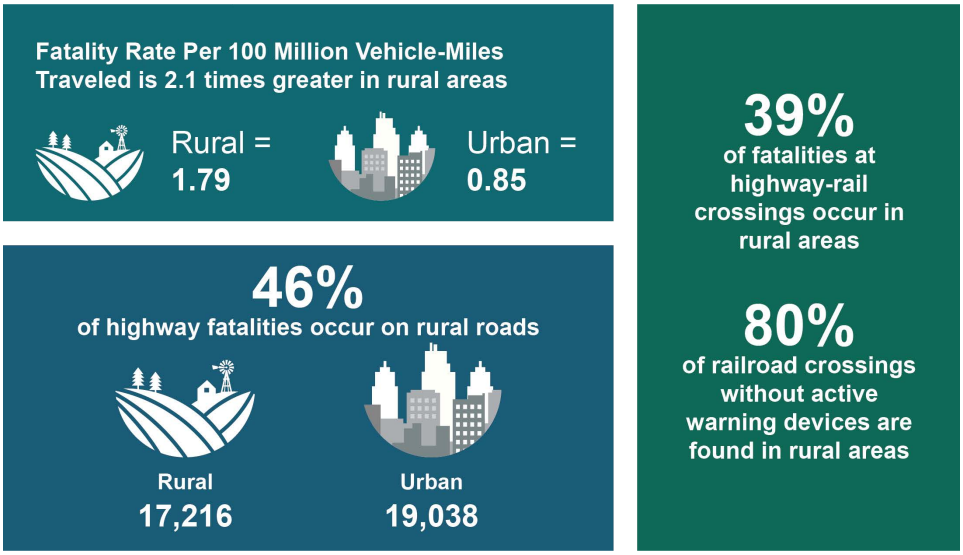


Source: USDA, Economic Research Service Agricultural Trade Multiplier, March 2020.

Rural America contributes more than just agricultural production. Access to transportation and destinations is essential to rural areas to support connections to jobs, to facilitate the movement of goods and people, to access opportunities for healthcare and education, and to provide links to other social services. Transportation sustains existing businesses and continues to be a critical factor in a company's decision to locate new business operations. For communities that depend on tourism and natural areas to help support their economy, transportation is the key link between visitors and destinations that can generate billions in tourism expenditures annually.

Rural transportation's role in the U.S. economy is demonstrated by the amount of transportation infrastructure located in rural areas: 69 percent of the Nation's lane miles are in rural areas, and two-thirds of rail freight originates in rural areas. This significant rural contribution provides economic gains throughout America, but also disproportionately affects these smaller communities and community infrastructure. For example, 90 percent of the Nation's bridges that are posted for weight limits are in rural areas, heavily affecting freight traffic routes. Rural America's traffic fatalities are disproportionately high, totaling 46 percent of fatalities in 2018 (see *Exhibit 11-4*).

Exhibit 11-4 ■ Rural Safety Statistics



Source: Bureau of Transportation Statistics, 2020.

Through the Rural Opportunities to Use Transportation for Economic Success (ROUTES) initiative, DOT will assist rural communities in accessing federal transportation grant programs. It will provide user-friendly information to these communities to assist them in applying for discretionary grants, and will improve sharing of rural data and analysis to achieve national transportation infrastructure goals.[74]

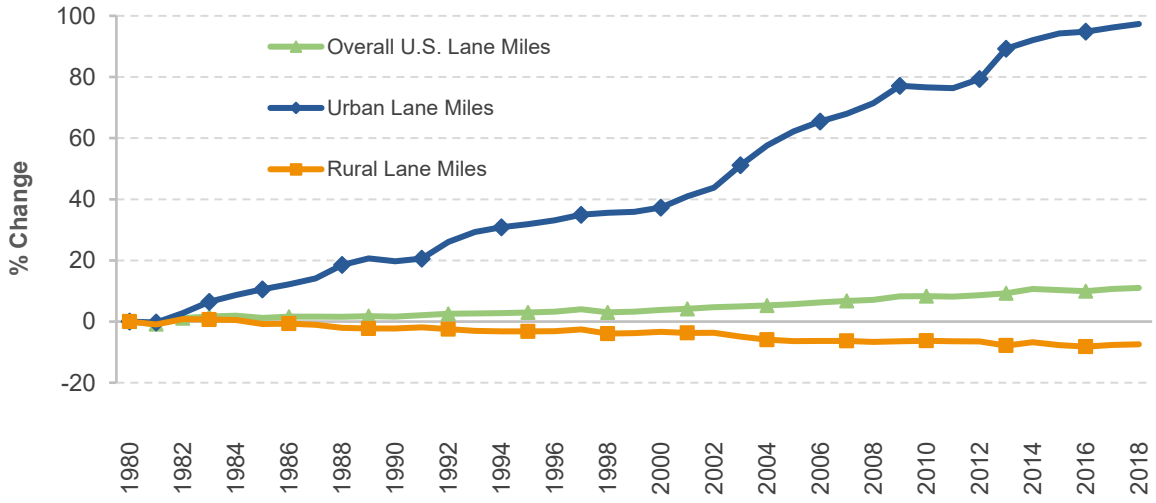
Modal Availability and Use

Transportation plays an important role in the overall economic health of communities, providing access to jobs, education, goods, and essential services. The type and number of transportation options vary by geography, primarily due to population size and density. Many transportation service models, such as bikeshare, commuter buses, and on-demand transportation, are costly to operate in less-dense areas and are less viable for the longer trips required to reach destinations in those areas.

The vast road network in the United States provides an accessible transportation option for rural, suburban, and urban areas alike. The majority of the U.S. rural road system was developed in the 1950s and was designed to meet the transportation needs of that time. With changes in population and industry, transportation demands have also changed. However, the basic infrastructure of the rural road system has not.

For example, as shown in *Exhibit 11-5*, total lane miles in the United States have grown by only about 10 percent since 1980. Much of this growth has been in urban areas, which have seen a 95-percent increase since 1980 compared with the decline in rural lane miles over the same period. Since lane miles are a fixed asset, this decline is likely related to changes in classification (from rural to urban) as well as to changes in infrastructure.

Exhibit 11-5 ■ Percentage Change in Lane Miles by Geography from 1980–2018



Source: Federal Highway Administration. (2020). Highway Statistics 2018: Public road lane miles by functional system, 1980–2018: Table HM-260.

Vehicle Ownership

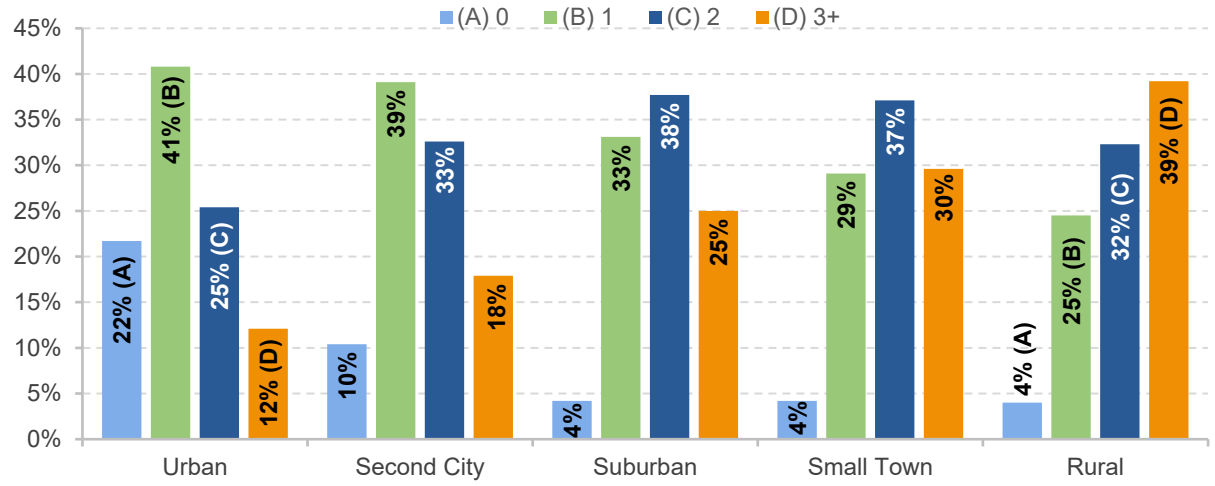
Vehicle ownership is often a major indicator of household mobility. As the number of household vehicles increases, the number of household person trips also increases. Zero-vehicle households have fewer annual person trips across all geographies. Households living in high-density areas, such as urban and small cities, typically have fewer vehicles compared with households in less-dense

[74] More information on the ROUTES Initiative can be found at https://www.transportation.gov/rural.

suburbs, small towns, and rural communities. The difference is likely due to the larger variety of mobility options, including walking and biking, available in high-density areas.

As shown in *Exhibit 11-6*, just under 22 percent of urban households have no vehicles compared with 4 percent of rural households. In fact, 39 percent of rural households have three or more vehicles.

Exhibit 11-6 ■ Percentage of 0, 1, 2, and 3+ Vehicle Households by Geography, 2017



Source: National Household Travel Survey.

Broadband Access

Throughout the United States, transportation provides access to jobs, education, goods and services, and social and civic activities. In rural areas, access to high-speed broadband internet provides much of the same or similar level of access without requiring long-distance travel. Small, remote, and rural communities are an important component of the Nation's identity, economy, and global competitiveness, but many of these communities are unable to take full advantage of services and resources offered through advances in communications, networking, and technology.

To a large extent, broadband is seen today as basic infrastructure. The National Broadband Plan, issued in 2010 by the U.S. Federal Communications Commission (FCC), states: "Like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness, and a better way of life."[75] The FCC has reframed the National Broadband Plan to serve the goal of Universal Service, the principle that all Americans should have access to communications services.[76]

KentuckyWired

Access to broadband is further challenged by lack of infrastructure, a growing national trend that links the ability to expand broadband access to leveraging assets such as highway rights-of-way.

States continue to respond to this challenge with coordinated and innovative solutions such as those being implemented in Kentucky, which will be the first State to build an open-access fiber optic cable network in every county—focusing initially on improving access in rural areas. The 3,200-mile KentuckyWired network will be State-constructed and partially leased to private companies. The fiber optic network will serve as a "middle mile," or backbone, that connects to local internet service providers (ISPs), similar in concept to an Interstate highway with exit ramps.

[75] https://www.fcc.gov/general/national-broadband-plan
[76] Federal Communications Commission (2009). Connecting America: The National Broadband Plan. https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf

The network will be open access, allowing local public or private ISPs, cities, partnerships, or other groups to connect to the network and extend services to local communities, universities, State government buildings, and community and technical colleges. Improved cellphone coverage is also anticipated as part of the initiative. Approximately 85 percent of the network will be aerial and 15 percent underground. Information and updates on the project's development can be found at https://kentuckywired.ky.gov/Pages/index.aspx.

The digital divide is getting smaller, with the number of Americans lacking a connection of at least 25 Mbps/3 Mbps (the Commission's current benchmark) dropping from 26.1 million Americans at the end of 2016 to 21.3 million Americans at the end of 2017. According to the FCC, the majority of those gaining internet access, approximately 4.3 million, were located in rural areas.[77] Similarly, Pew Research estimates that approximately two-thirds of rural Americans (63 percent) had a broadband internet connection at home in 2019, up from about a third (35 percent) in 2007.[78]

The lack of infrastructure, especially for communication and networking, is a central issue in underconnected rural communities. Rural communities are in desperate need of increased access to broadband networks, as high-speed internet has become the backbone of the 21st century economy. The Bureau of Economic Analysis estimates that the digital economy is growing by roughly 10 percent per year, nearly three times as fast as the overall economy.[79] Without adequate broadband services, rural residents are unable to participate in one of the fastest growing sectors of the United States' GDP.

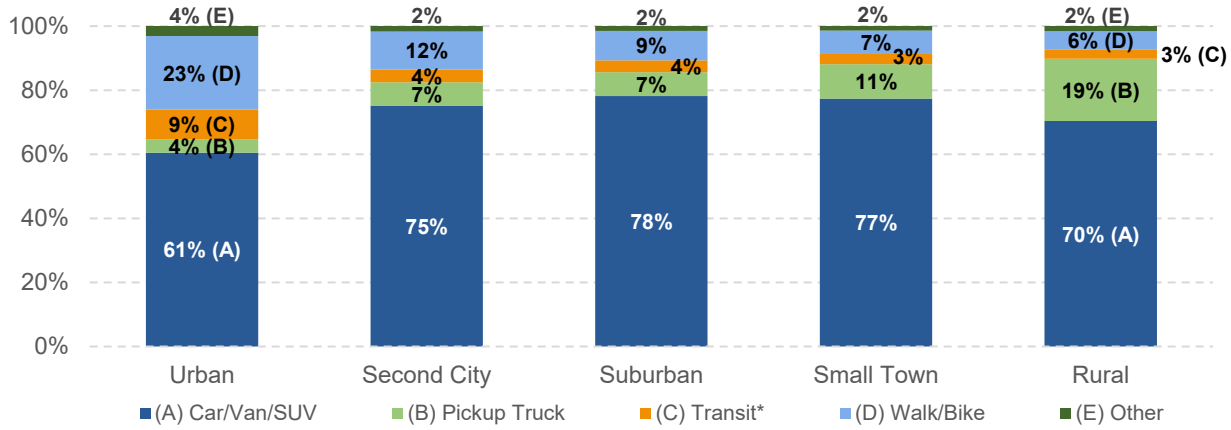
Other factors affecting broadband use in rural areas include the older average age of the population, higher poverty rates, and lower education levels. Reclassification of faster growing nonmetro counties to metro status during 2001–15 also increased the rural-urban gap because reclassified counties show higher rates of broadband use than counties that remain nonmetro.[80]

Travel Behavior in Rural Communities

Travel patterns for urban and rural households have historically been distinctly different. Urban households are more likely to use public transit, rideshare, bikeshare, and pedestrian facilities. Rural households typically require longer vehicle trips to reach their desired destinations and have limited access to public transit facilities. According to the 2017 NHTS, 24 percent of all passenger VMT occurs by rural households, with an average annual household VMT of 24,465, about 50 percent higher than that of urban households. Although 19 percent of the Nation's population lives in rural areas, 46 percent of highway fatalities occur on rural roads. This is an important issue for urban, suburban, and rural communities as 44 percent of rural VMT is from urban residents traveling to destinations outside their home metro areas.[81]

[77] https://docs.fcc.gov/public/attachments/FCC-19-44A1.pdf
[78] https://www.pewresearch.org/fact-tank/2019/05/31/digital-gap-between-rural-and-nonrural-america-persists/
[79] https://www.bea.gov/system/files/2019-04/digital-economy-report-update-april-2019_1.pdf
[80] https://www.ers.usda.gov/webdocs/publications/85740/eib182_brochure%20format.pdf?v=0
[81] U.S. Department of Transportation (2020). ROUTES Fact Sheet. https://www.transportation.gov/sites/dot.gov/files/docs/mission/office-policy/rural/353086/routes-fact-sheet-web.pdf

Exhibit 11-7 ■ Mode of Travel by Geography, Person Trips, 2017



Source: National Household Travel Survey.

The personal vehicle is central to the transportation landscape in rural communities. Just under 90 percent of passenger trips in rural areas occur in automobiles, including pickup trucks, compared with 65 percent of trips in the largest urban areas (see *Exhibit 11-7*). Public transit is limited in rural communities: Less than 3 percent of rural households use public transit compared with 9.4 percent of urban households. Public transit includes buses, subway, commuter rail, paratransit, and fixed route services.

Mobility refers to the ease of person and freight movements such as travel time and distance. *Accessibility* is the ability of people and businesses to reach desired goods, services, and activities. Distances are longer in rural areas; however, mobility is often better overall due to low levels of congestion and other travel time barriers. However, low-density rural areas are particularly accessibility challenged due to limited transportation options. Transportation networks are developed to provide the opportunity for goods and people to reach desired destinations. In general, accessibility in a given area can be improved primarily by increasing the supply of transportation. Improved access can result from infrastructure improvements or from expanding existing transportation services, such as providing more frequent intercity buses or by increasing the number of available modes.

The availability of transit is limited in rural communities because providing transportation to a dispersed population is very expensive. In rural areas where a transit option is available, service is often infrequent and inconvenient. This is one reason why rural residents are more car-dependent than their urban counterparts. Residents who cannot drive often have very few alternative options for transportation. About 40 percent of rural residents live in an area with no public transit options at all.[82] Most others have only very limited access to transit. Walking or biking is often a poor option due to a lack of infrastructure and long trip distances. Mobility issues in rural counties are further complicated by a high percentage of older residents. The average age in the United States is generally increasing, and this trend is amplified in rural counties.

New transportation options such as shared mobility and the emergence of connected and automated vehicles, particularly in urban/suburban settings, may provide additional transportation options for rural communities. For example, the deployment of highly automated transit vehicles (SAE levels 4 and 5) could significantly improve the provision of transit and paratransit services to rural areas through labor cost savings and more door-to-door service. It is likely that demographics, geography, and access to technology will pose unique opportunities and risks for additional transportation alternatives in rural communities.

[82] Twadell, H. and Emerine, D. (2007). *Best Practices to Enhance the Transportation-Land Use Connection in the Rural United States*. NCHRP Report 582. Transportation Research Board, Washington, DC, p. 12

Freight Movement in Rural Areas

The transportation system is critical to the efficient movement of people and goods in urban and rural areas. The Fixing America's Surface Transportation (FAST) Act brought focus to both types of populations in its efforts to advance national policy on freight and goods movement. A detailed discussion of freight is included in the Highway Freight Transportation Conditions and Performance Report, first produced with the 23rd edition of the Conditions and Performance report, with an update included in Part III of this edition. Specific issues related to rural freight transportation are described in the following sections.

The FAST Act established a new National Highway Freight Program to improve the efficient movement of freight on the National Highway Freight Network (NHFN; see *Exhibit 11-8*) and supported several goals, one of which was to improve the safety, security, efficiency, and resilience of freight transportation in rural and urban areas. To support rural freight needs, the NHFN includes designation and inclusion of Critical Rural Freight Corridors (CRFC) in its set of four subsystems of roadways. The NHFN is composed of 57,800 miles, including 4,400 miles classified as Critical Rural Freight Corridors.

Exhibit 11-8 ■ Map of the National Highway Freight Network (NHFN), 2015

Source: FHWA Office of Infrastructure[83]

Trucks move 70 percent of freight in the United States by value. In addition, 42 percent of all truck VMT is on Interstates,[84] and 60 percent of Interstates are in rural areas. Freight tonnage is projected to increase by an average of 1.4 percent per year through 2045, and trucks are projected to carry the largest share of the additional freight traffic.[85] Nearly half of all truck VMT occurs on our Nation's rural

[83] https://ops.fhwa.dot.gov/freight/infrastructure/nfn/maps/nhfn_map.htm
[84] https://www.fhwa.dot.gov/policyinformation/statistics/2018/
[85] U.S. Department of Transportation (2018). Freight Facts & Figures 2017, Table 2-1. https://www.fhwa.dot.gov/policyinformation/statistics/2018/vm1.cfm#foot3

roads. In 2018, 95.13 billion VMT for goods movement was made by combination trucks on rural roads, significantly more than the 89.04 billion VMT by combination trucks in urban areas.[86]

The condition and maintenance of rural infrastructure affect the safety and efficiency of freight movements. Rural Interstates have the best ride quality of all roadways, with 82.8 percent of VMT in 2016 occurring on pavements with good ride quality. Within rural areas, roads designed for low capacity generally had higher shares of pavements with poor ride quality than did roadways designed for high capacity such as Interstates and freeways. Low- to moderate-capacity roads used to connect local traffic to freeways/expressways (Rural Major Collectors) had the highest share of VMT (18.7 percent) on pavements with poor ride quality in 2016.

Similarly, most of the Nation's bridges (72.2 percent) are in rural areas, over a third (33.1 percent) of which are on local roadways. The percentage of bridges rated as poor (by deck area) was generally lower in rural areas; however, the highest share of bridge deck area rated in poor condition (8.9 percent) in 2016 was located on local rural roads. Ninety percent of posted (limited weight) bridges are in rural areas, and heavy trucks cannot cross posted bridges. To find a safe bridge, heavy trucks hauling in rural areas must traverse three times the distance compared with metro areas.[87] Refer to Chapter 1 for an overview of the different roadway functional classifications and Chapter 6 for a detailed description of our Nation's roadway conditions.

Last-mile Delivery and Intermodal Connectors

Last-mile logistics refers to the final step of the delivery process from a distribution center or facility to the end user. Although the name implies it is the final mile of delivery, actual last-mile delivery can range from a few blocks to 50 or 100 miles.[88] For rural areas, the cost and efficiency of last-mile delivery from an e-commerce perspective is not usually an issue of congestion but one of economy of scale. A courier service may have deliveries at 10-mile intervals—far greater than in urban freight operations. This operation environment can affect the ability of a courier service to provide the same level of service (speed, frequency of operations, cost) to a rural customer that it would to an urban one.

Although the majority of freight logistics policy today seems to be trending toward solving the last-mile issues in urban settings, both the first and last mile are important to rural industries and producers. The first mile is critical because this is where farmers have the greatest logistical challenges prior to goods entering a State-operated highway system. Road quality and design, bridge load postings, safety issues, and weather are just a few of the challenges in both first- and last-mile delivery. For these participants in the freight system, the last mile is also important for obtaining goods and supplies critical to generating production outputs.

Modal exchange points, and access to these intermodal connectors—which are located primarily in rural settings—are also important to rural mobility. Intermodal connectors are key to many rural industries that rely on export to global markets, such as transferring agricultural product from truck to barge for movement to a coastal port for export. First-mile, last-mile, and modal exchange/transfer points are areas that could be greatly improved by emerging technologies such as blockchain, the Internet of Things (IoT), and possibly automation.

[86] U.S. Department of Transportation (2018). Freight Facts & Figures 2017, Table 2-1. https://www.fhwa.dot.gov/policyinformation/statistics/2018/vm1.cfm#foot3
[87] US Department of Transportation (2020). ROUTES Initiative. https://www.transportation.gov/rural#:~:text=Rural%20Opportunities%20to%20Use%20Transportation%20for%20Economic%20Success%20(ROUTES)%20is,disparities%20in%20rural%20transportation%20infrastructure.
[88] Cerasis (Undated). What Is Last Mile Logistics & Why Are More Shippers Looking at This Transportation Function? https://cerasis.com/last-mile/

Truck Parking

As discussed in Part III of this report, one of the major challenges to the safe movement of freight is the availability of adequate truck parking. Truck parking is vital to long-haul freight movement by trucks. Long-duration trips, many of which span rural areas of the country, require truck drivers to stop for service breaks and rest periods that can last for hours. Truck drivers rely on truck parking at commercial truck stops and parking at highway safety rest areas.

There is a nationwide shortage of truck parking, which is relevant to long-haul drivers and their ability to meet timeframes along their routes. Nationwide, 66 percent of truck parking is located in rural areas and 11 percent is located in small urban areas of less than 50,000 in population. The remaining 23 percent of truck parking is located in urbanized areas with populations above 50,000. The greater availability of land and the cheaper land prices in rural areas create an advantage for developing truck parking facilities at rural rest areas and truck stops. Nevertheless, parking needs and shortages in urban areas can impact delivery of goods from rural areas.

Another aspect of truck parking that is important in rural areas, such as in the western mountain States, is the provision of parking for trucks during road closures caused by winter storms or other extreme events.

Congestion and Performance

Although rural areas typically do not experience the levels of congestion or delays found in urban areas, nonrecurring delays in rural areas can be caused by weather, work zones, crashes, and other disruptions. System reliability is especially important to freight in any area, and major incidents or extreme weather events in rural areas can have significant impacts on freight movement across the Nation. For rural areas that lack a redundant transportation network, blizzards, flooding, landslides, wildfires, and other extreme events can cause major delays and alternate routes may require long, costly detours.

Rural industries such as agriculture, mining, lumber, and oil and natural gas production can generate significant truck traffic, heavier-than-typical loads, and movement of other equipment on rural roadways that may not be designed for this increased demand. In regions with natural resource production, roadways can be adversely affected by high truck volumes moving equipment and resources, slow overall traffic speeds, and traffic safety issues. These movements have a detrimental impact on the operations and quality of life in small communities lacking alternate truck routes.

Conclusion

As transportation, travel behavior, and the movement of goods are intricately tied to land use, a standard definition of "rural" for transportation applications is important for understanding system performance, user needs, and costs and benefits of investments across different geographies. With more refined categories within the urban-rural spectrum, the diversity of our Nation's communities is revealed with areas ranging from high-density urban cores (19 percent of the population) to suburban communities (23 percent) to low-density rural areas (18 percent of the population).

Although the population of rural areas is much smaller than that of suburban and urban communities, rural areas constitute approximately 97 percent of land in the United States and account for 71 percent (by length) of our Nation's roads. Rural transportation networks allow residents of rural areas to access employment, education, and goods and services, and make it possible for visitors to enjoy rural tourism destinations that support many local businesses.

Rural transportation systems are critical for the movement of goods across the United States and for rural communities' participation and contribution to the National economy. With limited transportation options, rural households are especially reliant on vehicles for travel as evidenced by the large proportion of VMT on rural roads. Rural households account for 24 percent of all

passenger vehicle miles traveled (VMT), with an average annual household VMT of 24,465—about 50 percent higher than that of urban households. Although rural areas are typically free of the congestion, pollution, and travel time delays that plague large cities, just under 90 percent of passenger trips in rural areas occur in automobiles, including pickup trucks, compared with 65 percent of trips in the largest urban areas. This is important as it represents the modal limitations that affect accessibility, mobility, and affordability in rural communities. Safety is also a concern, with 46 percent of the Nation's highway fatalities occurring on rural roads.

Although rural economies support a wide and changing range of jobs from advanced manufacturing to recreational tourism, rural employment has not bounced back from the 2008–2009 recession. However, the economy in rural counties is diverse and not necessarily dependent only on farming or manufacturing, with the largest segment of the workforce in rural counties employed in professional, managerial, or technical occupations. This is all more the reason that rural communities are in desperate need of increased access to broadband networks, such as high-speed internet. The Bureau of Economic Analysis estimates that the digital economy is growing by roughly 10 percent per year, and without adequate broadband services rural residents are unable to participate in one of the fastest growing sectors of the United States' GDP.

The economic health of rural areas, and of the Nation as a whole, relies on the efficient movement of goods through the road network. A total of 95.13 billion vehicle miles of freight movement occurred on rural roads in 2018, significantly more than the 89.04 billion miles in urban areas. Rural industries such as agriculture, mining, lumber, and oil and natural gas production can generate significant truck traffic.

Federal programs, policy, and spending play significant roles in determining which communities thrive and which ones wane. Travel mode options, the quality and availability of infrastructure such as sidewalks and bike lanes, and the proximity of essential services all vary based on where one lives. Transportation networks are developed so that goods and people can reach desired destinations. Improved transportation service can result from infrastructure improvements or from expanding transportation services, such as providing additional modal options or non-transportation alternatives for people and businesses in rural communities. An awareness of these factors, in the context of existing transportation needs and services, allows stakeholders and providers to account for the interrelationship of urban and rural transportation systems and improve transportation services nationwide.

Rural America – Transit

This C&P Report defines "rural" based on the distinctions made in the Federal Transit Administration (FTA) formula grants programs. In these programs, an apportionment is made to States and territories for areas outside of urbanized areas with 50,000 or less in population. For simplicity, FTA refers to these areas as "rural areas." In practice, however, these rural areas also include a number of areas designated by the Census Bureau as urban areas with populations between 5,000 and 50,000. The Census Bureau defines these areas as "urban clusters."

Rural public transportation systems play a critical role in serving the mobility needs of rural communities. Some form of transit exists in the majority of rural communities, providing essential mobility to employment, medical services, schools, places of worship, and social and recreational destinations.

Although the majority of rural transit riders come from transportation-disadvantaged populations, rural transit systems in some areas provide service to discretionary transportation consumers as well.

Non-residents who travel to National Parks, ski resorts, and other recreational destinations in summer and winter months account for a significant share of rural transit demand. Supply in these areas is high during recreation seasons and low during the rest of the year. These recreational destinations are served by a small number of bus systems that operate nearby. For instance, within a 50-mile radius from all ski resorts in Colorado, 13 bus systems reported more than 15 million trips, 20 percent of the National total of 74.2 million bus rural trips in 2018.

KEY TAKEAWAYS

- In 2018, 1,301 rural systems and Tribes reported to the National Transit Database, representing roughly 1,600 separate modal services.
- Rural systems belong to one of two groups: systems located in clusters, and systems located in rural-designated census areas.
- Since 2008, rural ridership has increased by 46 percent, from 83.5 million trips in 2008 to 121.8 million in 2018, of which 74.2 million were bus trips.
- Bus and demand response serve distinct markets: bus demand is largely driven by recreational activities and tourism by non-residents during summer and winter months.
- The demand response market is of residents who are transit-dependent and have disabilities.
- The most common providers of rural service include city/county government or private nonprofit corporations.
- Demand response is the most common mode in operation in rural areas. In 2018, 1,140 systems out of 1,301 offered demand-response service, of which 772 were single-mode.
- Georgia and Kansas are the States with the largest number of rural systems.

Thus, rural transit serves two basic markets: transportation-disadvantaged populations and tourism. The former market is spread throughout the country; the latter is highly concentrated around attractions.

Rural transit riders have been found to share a number of common characteristics with rural populations. Compared with urban communities, rural communities include a greater share of elderly residents 65 years or older (17.5 percent vs. 13.8 percent) and persons with disabilities (15.3 percent vs. 12.0 percent).[89] Given the dispersed activities and longer distances traveled in rural areas, access to transit is challenging and the automobile is the predominant mode of travel. As a result, rural transit includes more demand-responsive services that provide point-to-point service in smaller vehicles than are typically found in urban areas.

[89] Based on data from the 2014 American Community Survey.

The 2017 National Household Travel Survey (NHTS) found that the share of private vehicles users (automobiles, SUVs, vans, and trucks) in urbanized areas and urban clusters was 80 percent and 90 percent respectively. The rural market segments in urban clusters had a relatively larger share of trucks compared with urbanized areas. The same survey revealed that the market share of public transportation (bus, and rail modes) for all trip purposes was 3 percent in urbanized areas and 0.2 percent in urban clusters in 2017. The survey also revealed that within public transportation markets, 20 percent of users in all urban clusters combined were below the poverty level; 10 percent were below the poverty level in urbanized areas,

According to the 2014–2018 American Community Survey (ACS) five-year estimates, the market share of private vehicles for work-related trips was 80 percent in urbanized areas and 90 percent in clusters, which include a relatively higher share of trucks and SUVs.

This chapter compiles information from the National Transit Database (NTD), the ACS, the NHTS, and the General Transit Feeds Specification (GTFS). Rural transit systems include transit providers receiving Section 5311 Non-Urbanized Area Formula Program funding. A number of rural transit providers also receive funding under the Section 5310, Transportation for Elderly Persons and Persons with Disabilities Program. However, nationwide data for 5310 services are not available, as providers are not required to report such data to the NTD. Therefore, rural transit providers not funded by the 5311 program but receiving funding from Section 5310 are not included in the data tables compiled in this section.

What is a Rural Area?

The U.S. Census Bureau defines a rural area as any area that is not urban. Urban areas are *"… densely settled core of census tracts and/or census blocks that meet minimum population density requirements*." To qualify as urban, the core must have a minimum population of 2,500 people.

The census divides urban areas into two tiers: urban clusters and urbanized areas. Clusters are urban areas with populations greater than 2,500 and less than 50,000. Urbanized areas are urban areas with population over 50,000.

Areas with population of less than 2,500 people are defined as census-designated rural areas.

For FTA, both urban clusters and census-designated rural areas are treated as rural for apportionment purposes. There were 1,301 rural systems in the United States in 2018, of which 1,167 were general transit systems and 134 were run by Indian Tribes.

This chapter splits rural systems into two groups: systems located in urban clusters, and systems in nonurban (rural) areas. The existence of a rural system in a cluster does not mean that all service is provided within its boundaries. Systems can serve adjacent rural areas and other secondary clusters. However, all NTD data are attributed to the clusters where systems are located.

- Type A systems: Systems in urban clusters (2,500–50,000 people)
- Type B systems: Systems in areas with less than 2,500 people

Not all rural transit systems were found to be Type A or B systems because the addresses of these systems are either inaccurate or too incomplete to be properly geocoded. There were 101 systems in this category in 2018, most of which were Tribal systems.

Excluding intercity bus providers, 1,301 rural systems reported to the NTD in 2018:

- 718 were geocoded by their headquarters location 693 urban clusters. These are Type A systems.
- 395 systems were geocoded by their headquarters location as not within the boundaries of any cluster. These are Type B systems.
- 134 Tribes were not included for lack of identifiable locations.
- 54 non-Tribal systems could not be geocoded due to inaccurate or incomplete addresses.

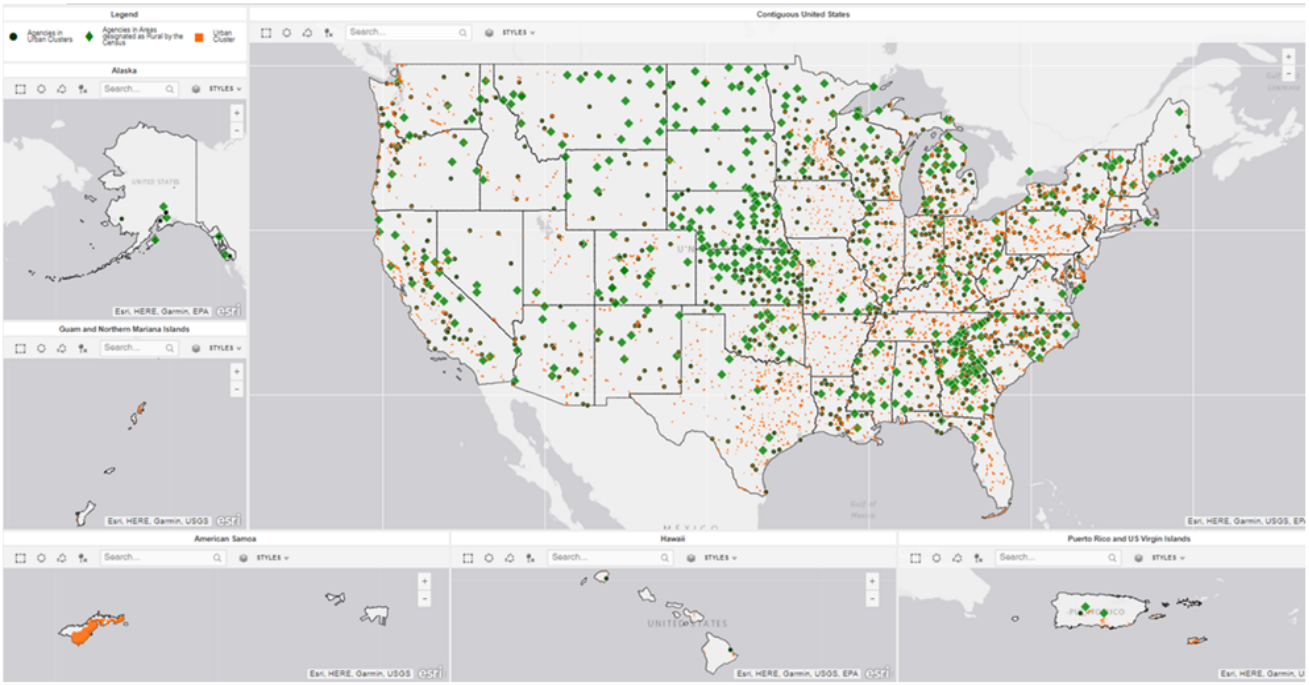
All systems, including Tribal systems and non-Tribal systems that are not geocoded, are included in all NTD aggregate analyses in this chapter.

Splitting systems into Type A and Type B allows normalized demographic analysis of Type A systems side by side with systems in urbanized areas, especially those with populations of less than 100,000 people, as discussed later in this chapter.

Exhibit 11-9 shows the geographic distribution of rural transit systems in the United States as of 2018. The map shows 1,136 systems, including Type A (indicated in dark green) and Type B (indicated in light green). The map does not show the locations of Tribal systems.

The distribution of rural systems is sparse and nonuniform. Some States have very few rural systems, whereas others—such as Kansas and Georgia—have large clusters of systems.

Exhibit 11-9 ■ Rural Transit Systems of the United States, 2018



Source: 2010 U.S. Census map overlaid by data generated from the National Transit Database.

System Infrastructure

Rural transit service in the United States is provided by 1,301 rural transit systems representing 55 percent of the transit systems in the country. Rural transit systems operate in every State. In 2018, 127 million transit trips were taken in rural areas, accounting for 1.3 percent of the total transit trips in the United States. The other 99 percent of trips were taken on urban transit systems. *Exhibit 11-10* shows the breakdown of systems, unlinked trips, and population between urban and rural areas.

Exhibit 11-10 ■ Urban and Rural Transit Systems, 2018

Geography	Systems	Percent of Systems	Unlinked Trips (millions)	Percent of Trips	Population (millions)	Percent of Population
Urban	1,052	45%	9,732	99%	261	81%
Rural	1,301	55%	127	1.3%	61	19%
Total	**2,329**		**9,859**		**321**	

Source: National Transit Database and American Community Survey.

Exhibit 11-11 shows that more than 70 percent of rural systems are either units of a city, county, or local government, or have been established as private nonprofit corporations; very few are independent public systems.

Exhibit 11-11 ■ Organization Types, 2018

Organization Type	Number	Percent
City, County or Local Government Unit or Department of Transportation	623	48%
Private Nonprofit Corporation	303	23%
Independent Public Agency or Authority of Transit Service	173	13%
Tribe	134	10%
Area Agency on Aging	39	3%
MPO, COG, or Other Planning Agency	16	1%
Other	13	1%
Total	**1,301**	

Note: Other represents private for-profit corporation, State government unit or department of transportation, other publicly owned or privately chartered corporation, private provider reporting on behalf of public entity, and subsidiary unit of a transit system, reporting separately. MPO is metropolitan planning organization; COG is council of governments.

Source: National Transit Database 2018.

As noted earlier, recreational activities account for a significant share of the total fixed-route supply and demand. Service is highly concentrated around ski resorts and National Parks. The 100 largest rural transit systems by ridership account for more than half of total ridership by all such systems. The more than 1,200 remaining systems account for less than half of total ridership on these systems.

Most of these large rural transit systems fall into one of four categories: recreational destinations, university towns, large-area providers, and other providers. A number of the largest rural transit systems are in university towns, including the local transit systems for the communities around Appalachian State University in North Carolina, Mississippi State University, Ohio University, Oklahoma State University, the University of Mississippi, the University of Wyoming, and Washington State University. Not all transit systems that service colleges and universities are included in the NTD.

Some States have established large area providers for rural public transportation. For example, Iowa has divided its 99 counties into 12 regions, each served by a regionwide provider. In Missouri, Oats Transit is a single provider that provides service across 87 counties. With nearly 1.6 million trips provided in 2018, it was the eighth-largest primarily rural transit system.

Finally, some rural transit systems have relatively large ridership due to unusual circumstances. For example, the Eastern Upper Peninsula Transportation Authority is the exclusive provider of ferry transportation for residents to three islands in eastern Michigan.

Finance

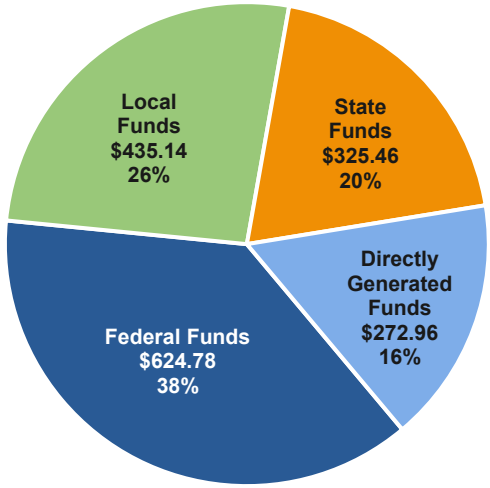
Chapter 2 presented an in-depth discussion of transit finance. This section discusses a few specific characteristics of rural transit finance.

As discussed in Chapter 2, transit funding comes from public funds allocated by Federal, State, and local governments, as well as from system-generated revenues. Total transit funding in 2018 was $1,658.3 million in 2018 dollars, of which $1,385 million was from public funds and $273 million was from directly generated funds, including fares, contract revenues, fare assistance funds, and other contributions such as donations, advertisement revenues, parking revenues, and concessions.

As shown in *Exhibit 11-12*, Federal sources contributed 38 percent of the funding for rural transit, with State and local sources combined contributing 46 percent. Directly generated funds accounted for the remaining 16 percent.

Other Federal funds accounted for 5 percent of rural transit operations funding. These other Federal funds include the FTA Enhanced Mobility of Seniors and Individuals with Disabilities Formula Program (5310), capital assistance applied to operating expenses, Tribal funds, and other Federal funds.

Exhibit 11-12 ■ Rural Sources of Funds, 2018

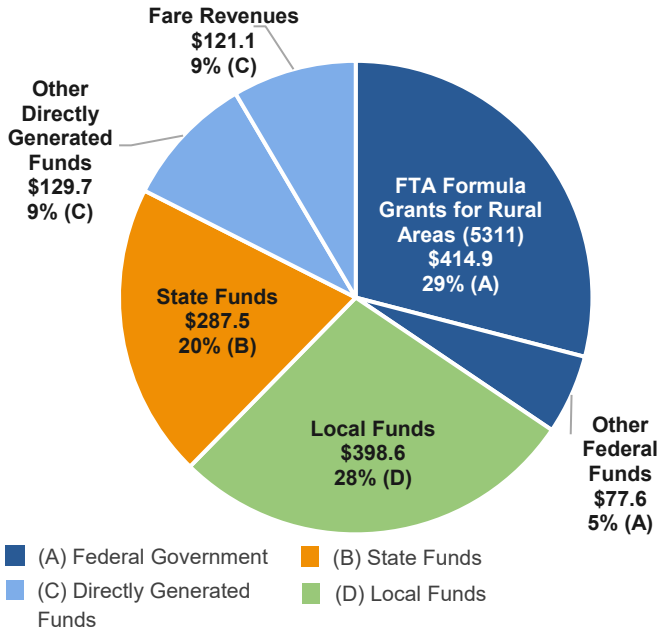


Source: National Transit Database, 2018.

According to Chapter 2, the total contribution of public funds to transit in the United States in 2018 was 72 percent. Rural transit relies more on public funds, and less on system-generated revenue, compared with urban transit. In 2018, public funds accounted for 84 percent of all rural transit funds. *Exhibit 11-13* breaks down the sources of rural operating funding. In 2018, public funds of $1.4 billion were spent on rural transit operations. Of this amount, Federal funding provided $492.5 million or 33 percent of total funding. State and local funding totaled $686.0 million, accounting for 48 percent of all funding for rural transit operations.

Exhibit 11-14 shows capital funding sources for rural transit in 2018. Capital funding in 2018 was $229.0 million, of which Federal sources accounted for 66 percent and State and local funds accounted for 32 percent. The share of Federal 5311 funds alone accounted for 31 percent, and the FTA bus and bus facilities program accounted for 21 percent. Other Federal funds include FTA Capital Program funds (5309), funds received from other DOT grant programs, FTA Enhanced Mobility of Seniors and Individuals with Disabilities Formula Program funds (5310), and funds from other programs.

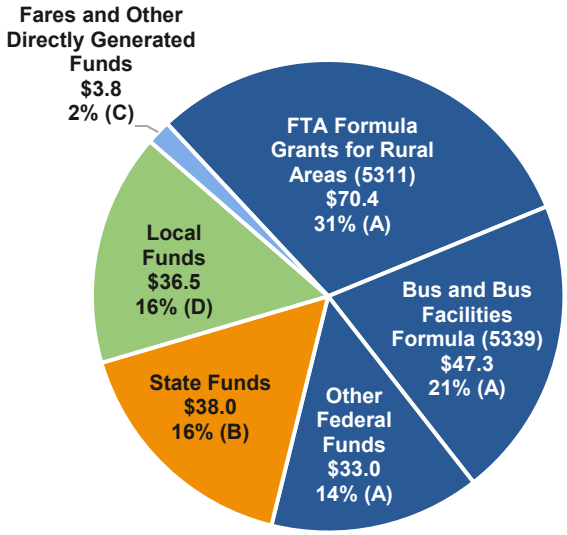
Exhibit 11-13 ■ Rural Operating Funding Sources, 2018



Note: Other Federal funds include FTA Capital Program funds (5309), funds received from other DOT grant programs, FTA Enhanced Mobility of Seniors and Individuals with Disabilities Formula Program funds (5310), and funds from other programs.

Source: National Transit Database, 2018.

Exhibit 11-14 ■ Rural Capital Funding Sources, 2018

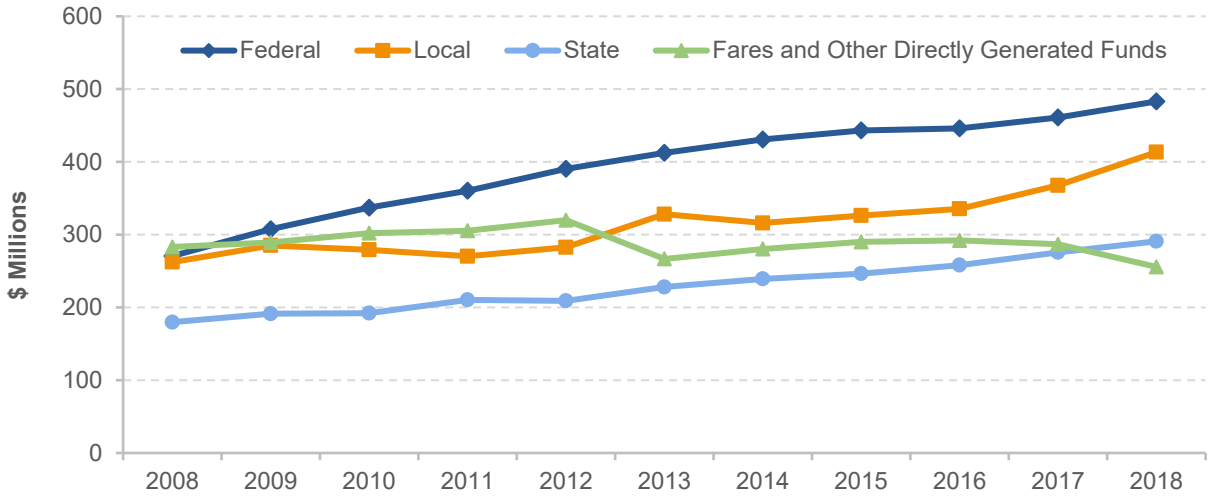


Note: Other Federal Funds include FTA Capital Program funds (5309), funds received from other DOT grant programs, FTA Enhanced Mobility of Seniors and Individuals with Disabilities Formula Program funds (5301), and funds from other programs.

Source: National Transit Database. 2018.

As shown in *Exhibit 11-15*, funds from all public sources increased by an average of more than 4 percent per year. System-generated funds decreased by an average of 1 percent. Combined, the overall average annual increase was 3.4 percent per year.

Exhibit 11-15 ■ Rural Transit Sources of Operating Funding, 2008–2018

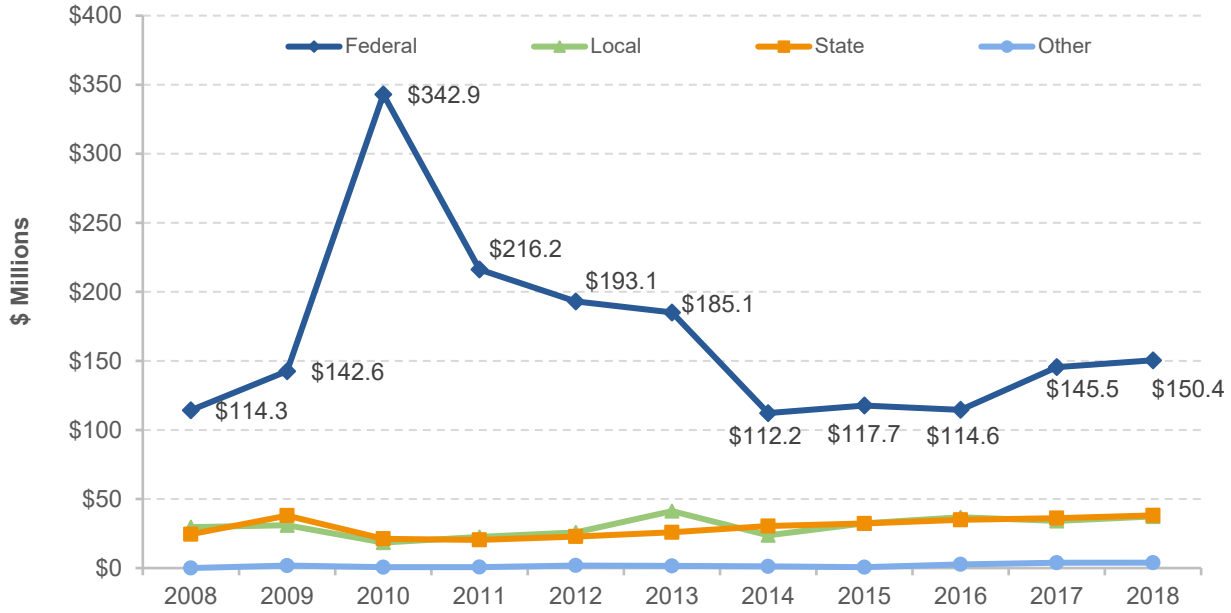


Source: National Transit Database, 2018.

Exhibit 11-16 shows that capital funding sources peaked in 2010, due to the Recovery Act, and decreased until 2014. State and local funding accounted for 32 percent on average.

For more information on the impact of the Recovery Act on transit finance, see the discussion on Federal funding in Chapter 2.

Exhibit 11-16 ■ Rural Transit Sources of Capital Funding, 2008–2018



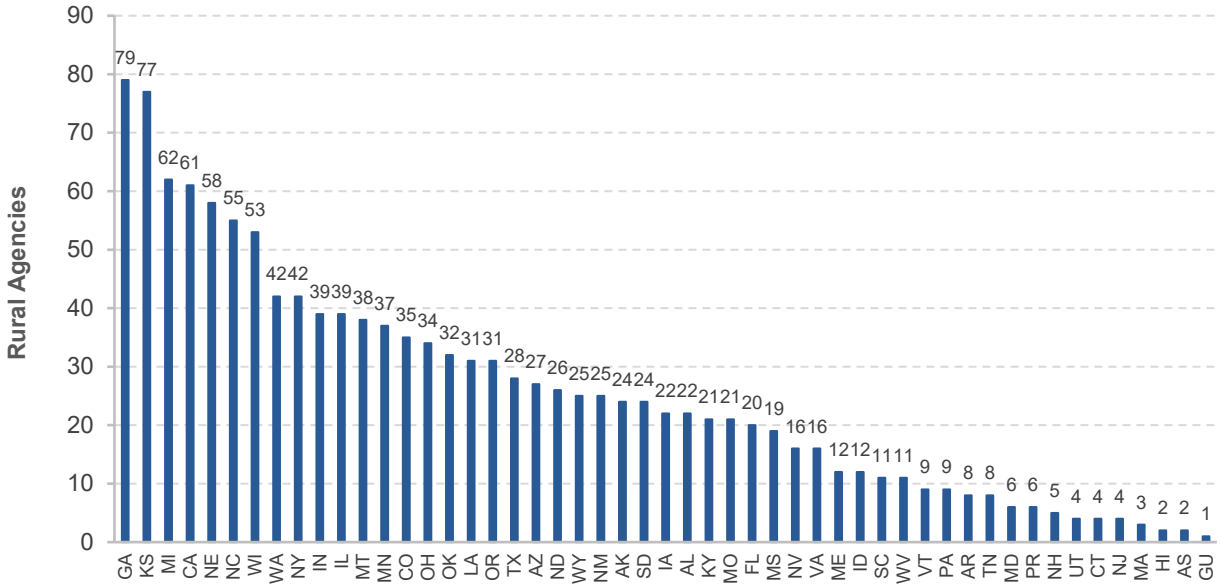
Source: National Transit Database, 2018.

Aggregate Data by State

Exhibit 11-17 shows States ranked by number of rural systems. Georgia and Kansas are the top two States in this regard, with 79 and 77 systems respectively. They are followed by Michigan, California, Nebraska, North Carolina, and Wisconsin, which each have 50–60 systems, followed by 30 States with 10–40 systems (ranging from 42 in Washington to 11 in West Virginia), and 14 States/territories with fewer than 10 systems each. As noted previously, the total number of systems in a State is partly a local decision. Some States have decided to establish large multi-county providers of rural public transportation that guarantee service coverage to all residents. Other States have largely left the development of rural transit services to individual municipal and county governments.

Thus, although the NTD does not currently explicitly collect service coverage information on a systematic basis, it is nevertheless self-evident that certain States with more rural transit systems almost certainly have more gaps in rural service coverage than do some States that ensure universal coverage through the establishment of regional rural transit providers. On the other hand, in some cases, localized municipal transit providers can provide higher-quality and more-frequent service coverage to the public than might otherwise be provided by a large regional provider. For example, a large regional provider may not provide service coverage seven days per week; instead, it may only serve certain communities on certain days.

Exhibit 11-17 ■ Rural Systems by State/Territories, 2018

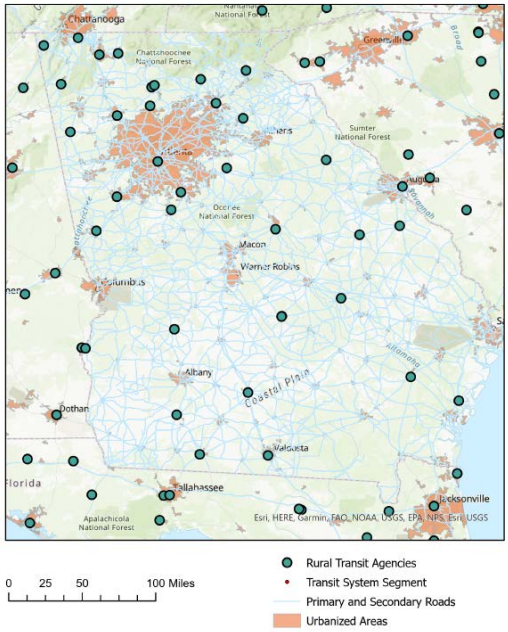


Source: National Transit Database.

The ranking by total area served within a State is not the same as the ranking by number of systems.

Exhibits 11-18 and *11-19* show the distribution of systems in Georgia and Kansas, the States with the largest number of systems. The geographic distribution of systems in Georgia is concentrated around the Atlanta urbanized area, becoming sparser in the southern part of the State.

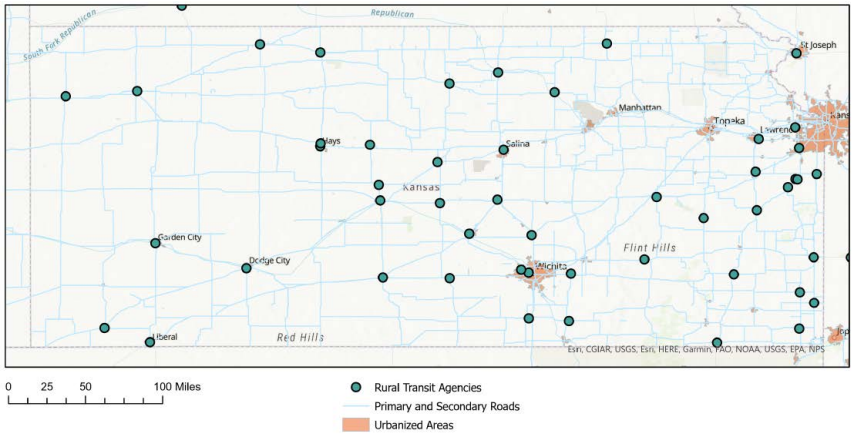
Exhibit 11-18 ■ Rural Systems in Georgia



Sources: National Transit Database; U.S. Census.

Systems in Kansas are more evenly distributed throughout the State than in Georgia. The urban clusters in Kansas are generally very small in area, and are barely visible at this scale. Westward, systems become sparser, especially in the Southwest.

Exhibit 11-19 ■ Rural Systems in Kansas

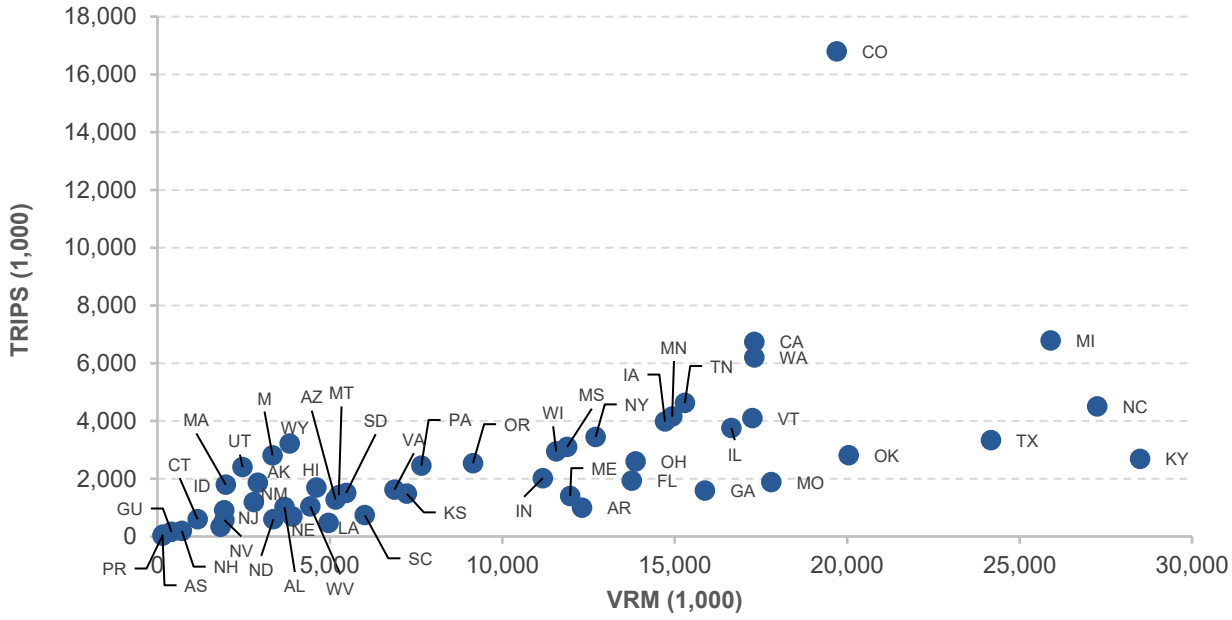


Sources: National Transit Database; U.S. Census.

Exhibit 11-20 shows aggregate service supply and demand by State, measured by vehicle revenue miles and unlinked passenger trips respectively. Colorado stands out as a State with by far the highest demand—more than twice that of Washington, California, and Michigan, the States with highest demand after Colorado.

Although comparisons between States should be avoided because supply and demand characteristics are constrained by geography, demographics, land use, and other local factors, the data suggest that service areas increase with demand. Population densities decrease and trip lengths increase, resulting in supply growth at rates higher than those for demand. Another key factor was the growth in demand-response service, which has typically low capacity.

Exhibit 11-20 ■ Supply (Vehicle Revenue Miles) and Demand (Trips) By State, 2018



Source: National Transit Database.

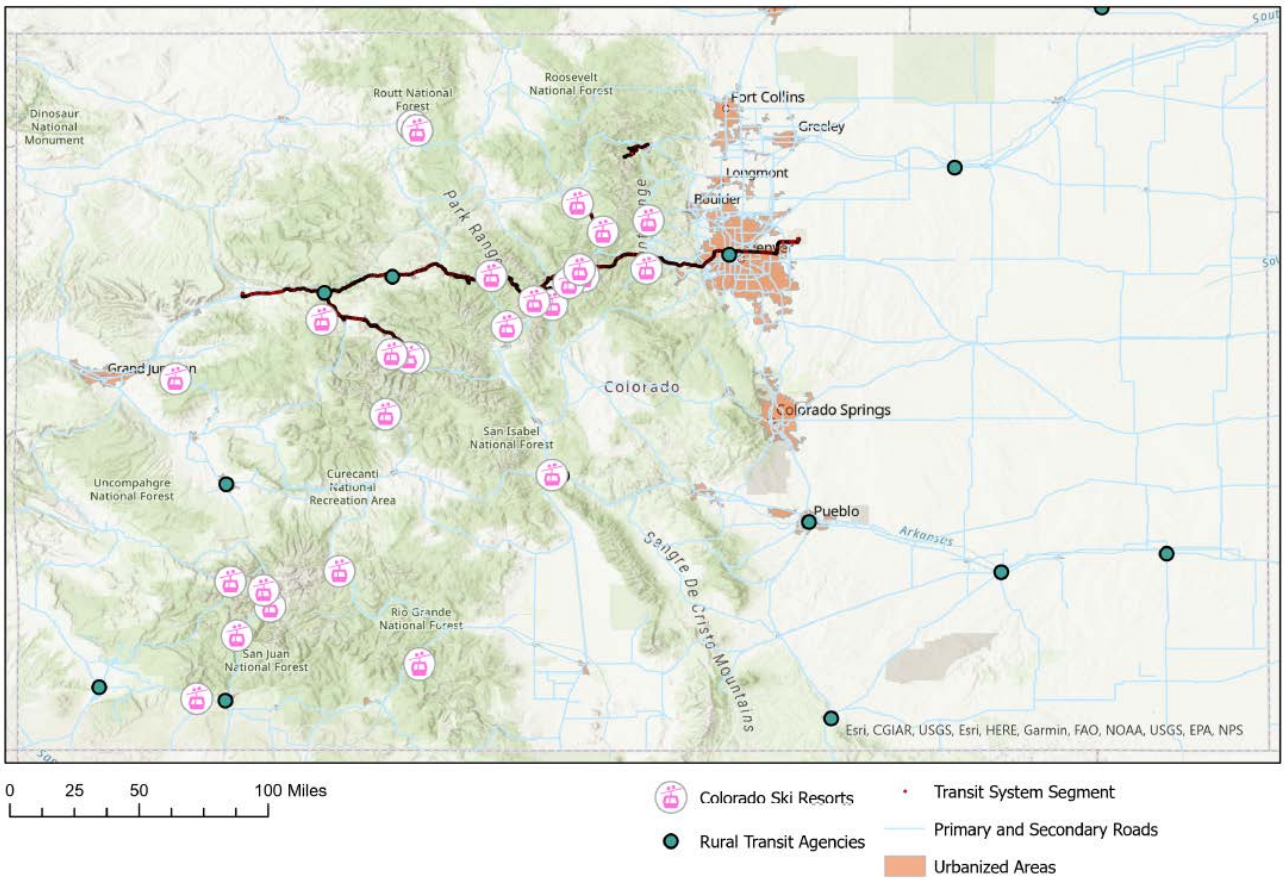
Transit Supply and Demand in Colorado

As *Exhibit 11-20* shows, Colorado is the single most transit-intense state in in rural America, and accounts for more than 20 percent of all rural transit demand in the country. Demand is intense in the winter months, during the ski season. Seven ski resorts and nine bus systems cluster in the southwestern portion of the State, but the majority of resorts are located along the East-West corridor from Denver to Roaring Fork.

Exhibit 11-21 shows the locations of all bus systems and ski resorts in the State. Unsurprisingly, most systems cluster within a short radius (on average less than 50 miles) from resorts. Combined, demand for these systems accounted for 15.3 million (91 percent) of the total 16.8 million trips in the rural areas of the State in 2018. The main corridor depicted in the map extends 150 miles westward, from Denver to Roaring Fork, in the intersection with the Aspen transit system. Most of the service supplied in this corridor is provided by four systems operating contiguously throughout its entire range.

The Town of Mountain Village, shown in the map in the southwestern part of the State, operates the only rural tramway system reported to the NTD. It has high demand, and carried 3 million people in 2018, 27 percent of all transit trips in rural Colorado. Bus ridership was 12.3 million, or 73 percent of trips.

Exhibit 11-21 ■ Transit Systems Routes in Colorado During Ski Season



Source: General Transit Feeds Specification; U.S. Census; National Transit Database.

Modes and Performance

As shown in *Exhibit 11-22,* rural transit service takes many forms, including demand response, fixed-route bus (including buses with route deviation), commuter bus, vanpools, ferryboats, a bus rapid transit system, and an aerial tramway. Demand response is provided by 1,127 systems, or 87 percent of the 1,301 systems that reported to the NTD in 2018. Conventional fixed-route bus and route deviation comes in second, with 35 percent of systems. Note that systems generally operate more than one mode, therefore the sum of individual modes does not indicate the total number of systems.

Exhibit 11-22 ■ Number of Rural Systems by Mode, 2018

Mode	Abbreviation	Number of Systems
Demand Response and Taxi	DR	1,127
Conventional Fixed-Route Bus and Route Deviation	MB	460
Commuter Bus	CB	66
Vanpools	VP	19
Ferryboat	FB	10
Tramway	TR	1
Bus Rapid Transit	RB	1
Total	**ALL**	**1,301**

Note: The total number of systems (1,301) does not equal the sum of individual modes, as many systems operate more than one mode.
Source: National Transit Database.

Exhibit 11-23 presents aggregate statistics for the two most common modes, demand response (shown as DR in the table) and fixed-route bus (shown as MB in the table).

Exhibit 11-23 ■ Rural Supply and Demand for Bus and Demand Response, 2015–2018

Mode Aggregate Supply and Demand	2015		2018		Variation 2018/2015	
	DR	MB	DR	MB	DR	MB
Values						
Unlinked Trips (Millions)	47.4	69.1	47.2	74.2	-0.4%	7.4%
Revenue Hours (Millions)	18.5	5.8	20.4	7.0	10.3%	20.7%
Revenue Miles (Millions)	321	105.9	353.7	128.8	10.2%	21.6%
Vehicles Operated in Maximum Service	13,890	3,255	14,836	3,602	6.8%	10.7%
Fare Revenues (Millions of 2018 $) (*)	$51.0	$49.6	$50.3	$44.9	-1.4%	-9.5%
Operating Expenses (Millions of 2018 $)	$802.8	$433.0	$887.8	$530.3	10.6%	22.5%
Performance Indicators						
Trips per Mile (Service Effectiveness)	0.15	0.65	0.13	0.58	-11.0%	-11.4%
Cost per Mile (Cost Efficiency)	$2.50	$4.09	$2.50	$4.10	0.4%	0.7%
Cost per Trip (Cost-Effectiveness)	$16.93	$6.27	$18.80	$7.10	11.1%	14.0%
Fare per Trip	$1.08	$0.72	$1.07	$0.60	-1.4%	-16.0%
Subsidy per Trip	$15.86	$5.55	$17.74	$6.54	11.9%	17.9%
Farebox Recovery Ratio	6.4%	11.4%	5.7%	8.5%	-11.5%	-25.7%

Notes: *Including fare subsidies in 2018 but not in 2015.
Source: National Transit Database, 2008.

Demand response is the most common mode and was reported by 1,127 rural systems. It includes conventional demand response and taxis, of which 772 systems were DR-only systems. There were 527 bus systems in 2018, including conventional bus, commuter bus, and bus rapid transit.

Exhibit 11-23 shows aggregate supply and demand data by mode for 2015 and 2018. Only fixed-route bus and demand response are included. The 2015–2018 timeframe was chosen because the collection of financial data by mode was introduced in the NTD starting in 2014. Cost-effectiveness is defined as the ratio of operating cost per trip, and cost efficiency as operating cost per revenue mile or hour.

Bus

As shown in *Exhibit 11-23*, bus revenue miles and hours increased by more 20 percent between 2015 and 2018, and ridership increased by 7.5 percent. These increases were driven mostly by an increase in the demand for recreational attractions. Main attractions are National Parks and beaches in the summer, and ski resorts in the winter months. This market is highly concentrated around these destinations and accounts for over 50 percent of the National rural market.

Operating expenses increased at approximately the same rate as that reported for revenue miles and hours. Therefore, whereas cost per revenue mile and hour did not change significantly, cost per trip increased by more than 14 percent, from $6.20 in 2015 to $7.10 in 2018.

The increase in ridership was not followed by a proportional increase in fares. On the contrary, whereas ridership increased by 7.5 percent, fare revenues in 2018 decreased by 9.5 percent from those in 2015. The fares per trip decreased by 16 percent and the subsidy per trip increased by 18 percent.

Demand Response

The demand response market supplies service to low-income and transit-dependent populations, including people with disabilities. More than 770 systems offer demand response service only. Demand response is less cost-effective than bus but is more cost-efficient. This is because demand response operates smaller vehicles that are cheaper to operate but ultimately provide less service per vehicle. The cost per trip for demand response is usually greater than that for bus. *Exhibit 11-23* shows that cost per trip for demand response in 2018 was $19 per trip, compared with $7 per trip for bus. The cost per revenue mile for demand response in 2018 was $2.50, 40 percent less than the cost per mile for bus of $4.10.

Demand-response ridership remained roughly unchanged between 2015 and 2018. Revenue miles, revenue hours, and operating expenses on the other hand increased by slightly more than 10 percent, and fare revenues increased by over 30 percent, well above the increase in operating expenses. However, the impact of the increased recovery ratio is negligible because fares are much lower than operating expenses. A 10-percent increase in operating cost results in only a slightly less than 10 percent (9.7 percent) increase in subsidy per passenger.

Demand Response Supply-Demand Relationships

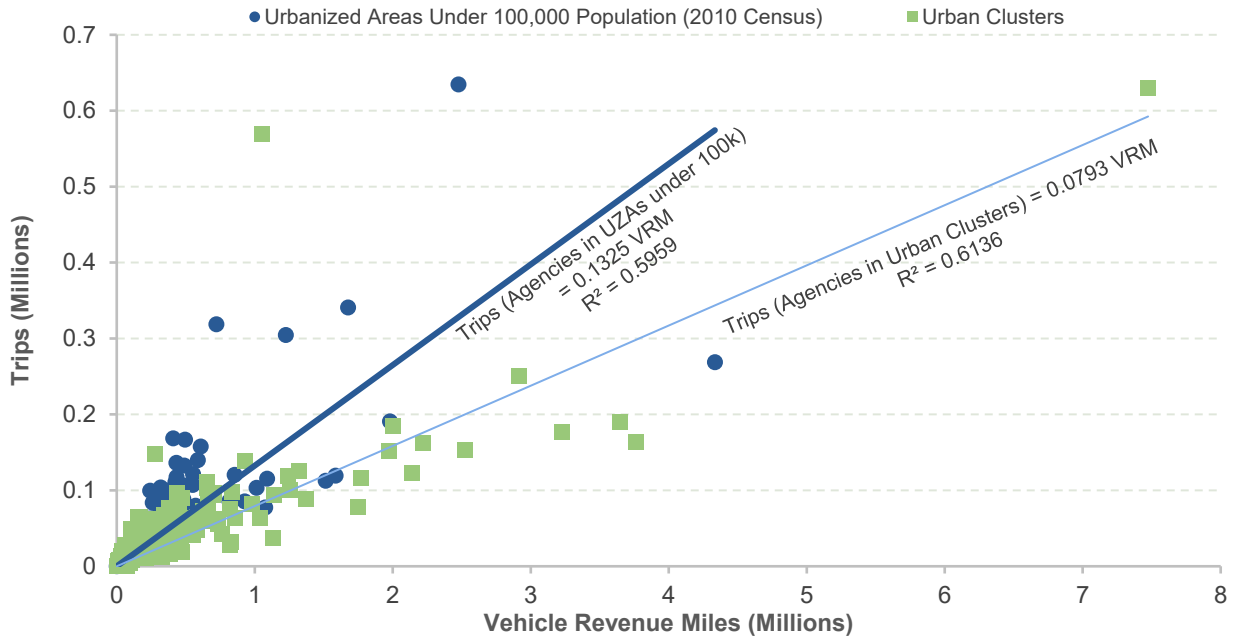
Exhibit 11-24 shows the shapes of two simple regression models of trips vs. revenue miles for demand response. The models represent two tiers: urbanized areas (UZAs) with populations greater than 50,000 and less than 100,000, and urban clusters. Demand response is the most common mode operated in urban clusters.

As discussed in the introduction to this chapter, these are Type A systems. There were 718 systems in 683 clusters in 2018. The ones that operated demand response were included in the models and are shown in the chart.

The models show that the service effectiveness (trips per mile) of systems in UZAs under 100,000 is better than in the cluster tier. The slopes of the UZAs under 100,000 and urban cluster tiers are 0.13 ± 0.013 and 0.08 ± 0.01 respectively. Thus, the two tiers do not overlap and the difference is statistically significant (95 percent confidence). Although not shown in the chart, this conclusion can be extended to the UZAs under 200,000 population tier.

The fact that these two tiers are separated by a population threshold does not necessarily imply that population alone is an explanatory factor. Candidate factors include population density, market share of public transportation and demand response, share of population eligible for demand service, and other factors. The analysis of these factors is beyond the scope of this chapter. As far as effectiveness is concerned, however, these two tiers are quite distinct.

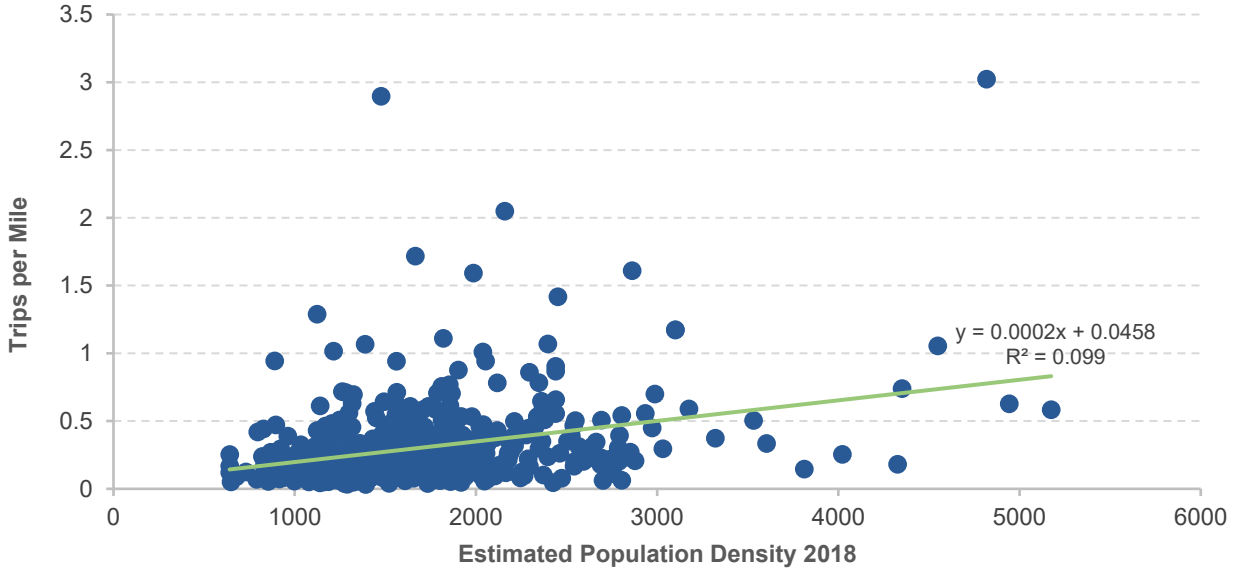
Exhibit 11-24 ■ Demand Response Supply and Demand by Tier, 2018



Source: National Transit Database; U.S. Census.

Exhibit 11-25 explores the relationship between service effectiveness and population density of rural systems located in urban clusters. The hypothesis is that the denser the area, the more effective is service supply. The exhibit suggests that a slightly positive relationship may exist over a wide density range of 1,000–5,000 people per square mile.

Exhibit 11-25 ■ Trips per Mile vs. Population Density of Clusters Served by Transit, 2018



Source: National Transit Database; U.S. Census.

Rural Fleet Inventory

Exhibit 11-26 shows the composition of rural fleets by mode and vehicle types. Cutaways and minivans are the most common vehicle types for demand-response service, with a fleet of more than 13,000 vehicles nationally. Cutaways also account for a large share of the fixed-guideway bus mode, and account for more than 50 percent of all rural vehicles.

These modes have smaller capacities than buses, but provide enough capacity to meet the demand of a mode with low ridership and low capacity utilization.

Exhibit 11-26 ■ Rural Fleet Composition by Mode and Vehicle Type, 2018

Mode	Bus	Cutaway	Minivan	Van	Other	Total
Demand Response	884	9,275	3,738	2,398	513	**16,808**
Bus	1,856	2,076	28	88	124	**4,172**
Vanpools			127	215	9	**351**
Total	**2,740**	**11,351**	**3,893**	**2,701**	**646**	**21,331**

Note: Does not include fleet with no recorded year of manufacture.

Source: National Transit Database 2018.