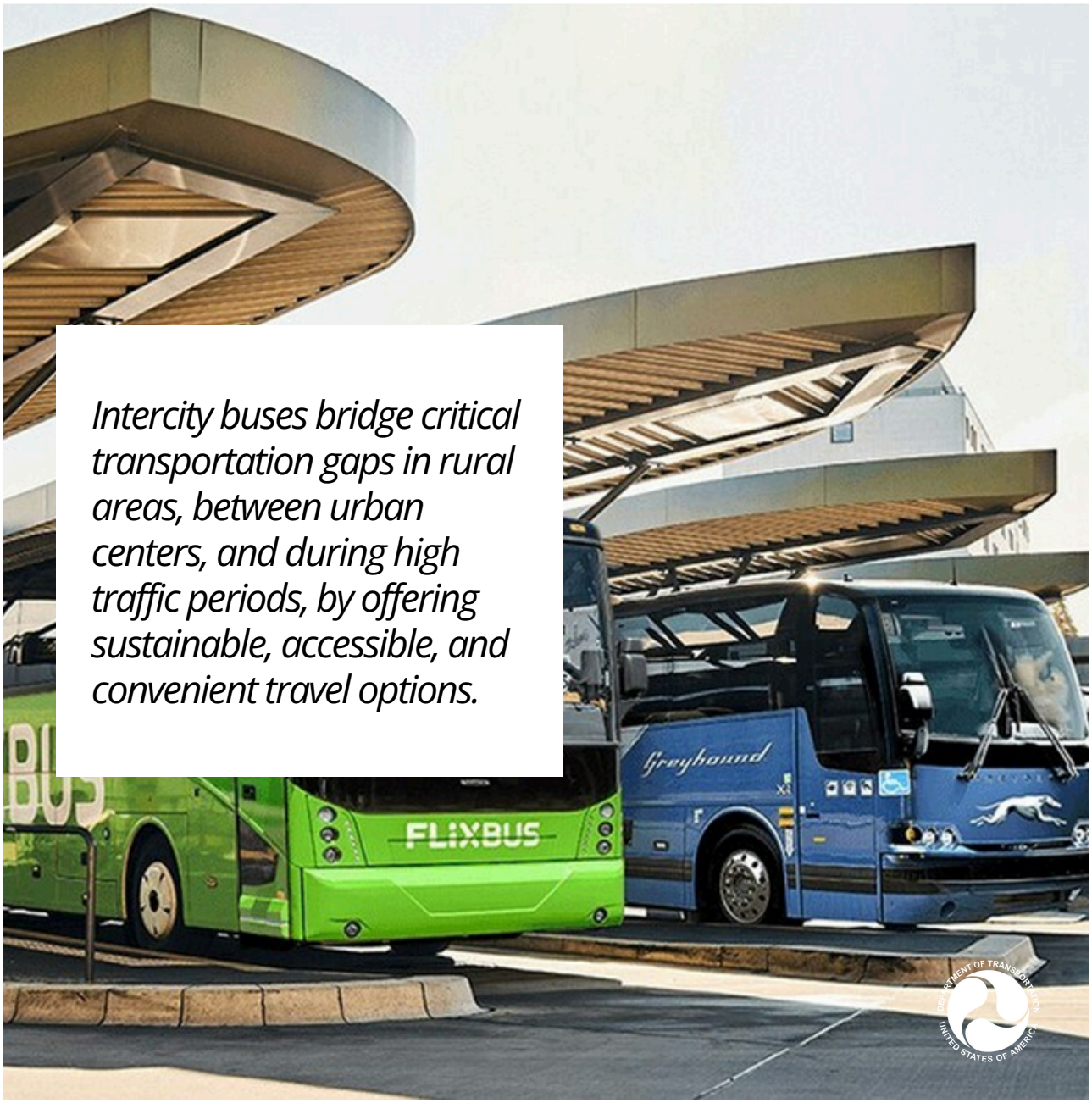
U.S. Department of Transportation, Climate Change Center
Decarbonization Strategies Playbook

INTERCITY BUSES



Intercity buses bridge critical transportation gaps in rural areas, between urban centers, and during high traffic periods, by offering sustainable, accessible, and convenient travel options.

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OVERVIEW

Best Suited for:
Long term & short term
Urban, suburban & rural

Intercity buses, also known as motorcoaches, are a key component of the transportation system, **providing sustainable and convenient travel options** for a diverse range of journeys. From connecting urban metropolises, to bridging service gaps in rural communities, intercity service plays a multifaceted role in enhancing mobility and connectivity. The intercity bus network is extensive, with over 1,800 carriers operating nearly 28,000 motorcoaches in the United States alone. The **intercity network has seen significant growth over the last two decades**, with scheduled trips reaching nearly 5,000 every weekday – a 35% increase since 2006. This translates to an **annual ridership of 62 million passengers**, which can be compared to the 31 million passengers served by Amtrak and the 650 million served by commercial airlines each year.

Intercity buses offer several advantages to travelers, including competitive pricing, flexible schedules, and a viable alternative for those seeking to reduce their environmental impact. On a per-passenger basis, particularly for journeys between 200 and 500 miles, **bus travel boasts a significantly lower carbon footprint compared to single-occupancy vehicles and air travel**. For example, travelling from St. Louis to Chicago (approximately 300 miles) by motorcoach results in over five times fewer CO2 emissions compared with driving a single-occupancy vehicle.

Intercity buses play a particularly crucial role in ensuring transportation equity. **In 2018, 79% of rural residents had access to intercity bus services, a nearly 10% increase from 2006**. Targeted investments in stations and stops, growing from 1,718 in 2006 to 2,632 in 2018, have helped to strengthen the network and grow ridership. These services connect rural residents to major urban centers, offering connections to essential services and economic opportunities. Looking ahead, State and local efforts to improve user experience and accessibility – such as comprehensive trip planners and connected statewide networks – can further bolster the appeal of intercity bus services and ensure they remain a sustainable mode of transportation for diverse populations.

Intercity buses cater to a diverse range of travel needs. Different use cases may include:

Urban to Urban Areas

Express routes linking major cities provide convenient and sustainable travel for commuters and leisure travelers in high-demand corridors.

Rural to Urban Areas

Intercity buses linking small towns in rural regions to larger urban hubs and activity centers provide vital transportation links for residents in areas with limited transit options. Operating at lower frequencies, typically offering a single roundtrip per day, these services ensure rural communities remain connected to essential services.

Rural Feeder Service

This specialized service utilizes small vehicles, offering demand-responsive rather than fixed-schedule transportation to connect rural areas with rail or air passenger services where feasible. By providing flexible and tailored transportation solutions, rural feeder services enhance connectivity and accessibility for residents in remote regions.

Special Events & Seasonal Services

Intercity buses can offer dedicated routes for special events and seasonal activities, catering to increased demand during specific times of the year.

Bustang in Colorado provides special event routes:

- *Snowstang, offering weekend service from Denver to ski resorts during the winter.*
- *Bustang to Broncos for professional football games in Denver.*

Student Tourism

Intercity buses serve as a convenient mode of transportation for students traveling between educational institutions and urban centers.

Routes like the Ram's route, which provides weekend service between Colorado State University in Fort Collins and Denver, offer students affordable and accessible travel options.

GHG REDUCTION POTENTIAL

GHG EMISSIONS PER PASSENGER-MILE: COMPARISON OF DIFFERENT STUDIES

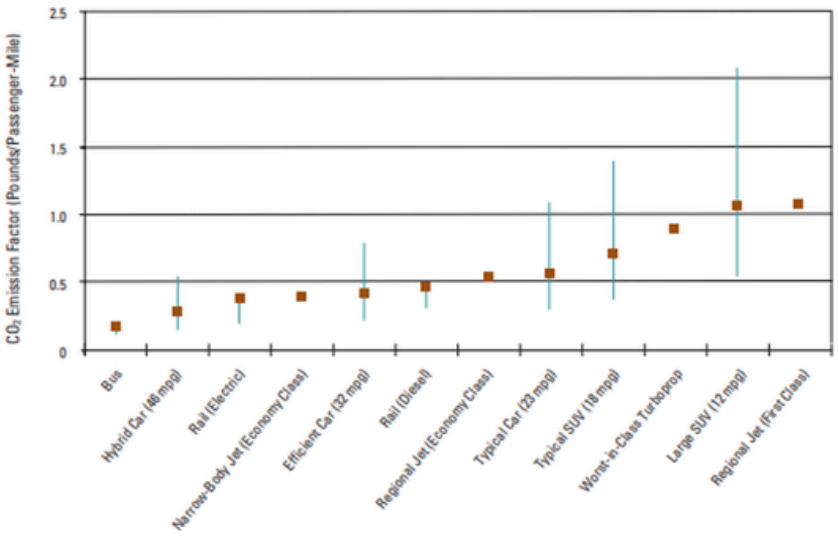
Several studies have assessed the carbon footprint of intercity bus travel, with a slight range in estimates across studies due to varying methodologies.

In 2019, CO2 emissions from intercity buses (including charter buses and tour buses, which are sometimes referred to as motorcoaches) **averaged 0.15 pounds per passenger-mile** (CBO 2022).

- Rail transit averaged 0.17 pounds per passenger-mile.
- Personal vehicles averaged 0.47 pounds per passenger-mile.
- Transit buses averaged 0.95 pounds per passenger-mile, largely because they often operated at only a fraction of their capacity. *(Emissions per passenger-mile decline as the number of occupants increases.)*

The Union of Concerned Scientists, in a 2008 study, estimated intercity bus emissions to be **0.17 pounds per passenger-mile** (Union of Concerned Scientists, 2008). *Note, this includes upstream emissions.*

Figure 22. Carbon Footprints, by Vehicle



Notes: Dots represent average emission factors for each vehicle. The vertical lines for cars and SUVs represent single-occupant emissions (high end), two occupants (dot), and four occupants (low end). Vertical lines below other vehicles represent emissions at 80 percent occupancy.

Carbon Footprints, by Vehicle (Union of Concerned Scientists).

A study funded by the American Bus Association Foundation found that the average contribution of intercity buses to CO2 emissions as 36.7 grams per passenger-mile (**0.081 lbs. per passenger-mile**), the lowest of any mode and well under intercity passenger rail at 141.7 grams per passenger-mile (M.J. Bradley & Associates 2019).

Table 1.1 Energy Use and CO_2 Emissions, by Mode

MODE	Pass-mi/Gal**			Btu/pass-mi			CO2 g/pass-mi		
	low	AVG	high	low	AVG	high	low	AVG	high
Motorcoach	230.9	**280.1**	318.3	433.5	**492.7**	597.7	32.3	**36.7**	44.5
Car - Avg Trip	33.6	**38.2**	83.2	1,658.5	**3,614.6**	4,106.9	123.5	**269.1**	305.7
Car - 1 Person	25.4	**28.9**	62.9	2,192.3	**4,777.8**	5,428.6	163.2	**355.7**	404.1
Car Pool - 2 Person	50.8	**57.8**	125.9	1,096.2	**2,388.9**	2,714.3	81.6	**177.8**	202.1
TNC - Avg	24.2	**27.4**	59.8	2,307.7	**5,029.3**	5,714.3	171.8	**374.4**	425.4
Van Pool	43.3	**107.1**	162.5	849.3	**1,289.0**	3,259.9	63.2	**95.9**	242.6
Heavy Rail	63.0	**190.8**	250.7	551.5	**723.4**	2,366.9	97.1	**127.3**	416.6
Intercity Rail (AMTRAK)	75.8	**89.8**	155.9	885.2	**1,536.2**	1,820.9	155.8	**141.7**	135.6
Commuter Rail	50.8	**97.0**	204.4	700.7	**1,422.3**	2,730.1	113.2	**167.2**	271.7
Domestic Air Travel		**56.6**			**2,437.9**			**181.5**	
Light Rail	37.9	**110.2**	183.1	753.6	**1,251.9**	3,640.2	132.7	**220.4**	640.7
Trolley Bus	58.1	**90.9**	104.3	1,319.6	**1,517.4**	2,411.7	232.3	**267.1**	424.5
Transit Bus	11.2	**33.7**	57.5	2,395.7	**4,091.8**	11,763.4	177.7	**283.2**	860.2
Ferry Boat	3.8	**11.9**	24.0	5,810.4	**11,616.6**	47,269.1	432.6	**863.8**	3,519.0
Demand Response	2.3	**9.0**	24.3	5,677.7	**15,280.7**	59,515.5	422.6	**1,100.8**	3,867.3

**Passenger miles per Diesel Equivalent gallon

* Miles per Diesel Equivalent gallon (based on energy content)

Energy Use and CO2 Emissions, by mode (M.J. Bradley & Associates 2019).

Texas Transportation Institute estimated that motorcoaches emit 53 grams of CO2 per passenger-mile (**0.12 lbs. per passenger mile**) compared to the second most efficient mode of travel, vanpool which emits 106 grams of CO2 per passenger-mile, and ferryboat, the 2nd less efficient mode of travel, emitting 1,392 grams of CO2 per passenger-mile (TTI 2023).

CO2 EMISSIONS FOR REAL-WORLD INTERCITY PASSENGER TRIPS

Boarding a motorcoach can significantly reduce carbon emissions compared to driving, even in a hybrid car. A 2008 report found that generally, a couple boarding a motor coach can cut their carbon nearly in half compared with driving even a hybrid car. And if they take the motor coach rather than flying, they will cut their emissions by 55 to 75 percent, depending on the distance they travel (Union of Concerned Scientists, 2008).

A study comparing the operational CO2 emissions across various travel modes for four different city pairs in the United States, reveals traveling by bus or rail

significantly reduces operational CO2 emissions compared to car or air travel (Simon et al., 2022).

Table 8. Operational CO_2 emissions (total) by scenario and main mode of travel – last-mile emissions included.

City Pair	Car‡ (kg CO_2/per.)	Bus* (kg CO_2/per.)	Air†,+ (kg CO_2/per.)	Diesel Train (kg CO_2/per.)	Train (w/ car)‡ (kg CO_2/per.)	Electric Train (kg CO_2/per.)
Boston – New York	135.0	26.7	141.1	N/A	N/A	25.3
Los Angeles – San Diego	87.0	15.2	105.0	44.2	N/A	N/A
Washington – Orlando	548.0	121.9	273.5	210.6	369.2	N/A
Washington – Orlando (Family of 4)	137.0*	111.1*	246.6*+	185.5*	224.2*	N/A
St. Louis – Chicago	193.9	37.1	184.4	47.3	N/A	N/A

‡ Assumes last-mile mode was a car for all scenarios.
*Assumes car emissions are split among four people.
+ Air and bus service only includes passengers as air service does not allow for car transportation.

Operational CO2 emissions (total) by scenario and main mode of travel – last-mile emissions included (Simon et al., 2022).

Application of Electric Vehicles:
The intercity bus industry is undergoing a shift towards sustainable solutions and practices, with a growing focus on electric vehicles. Major manufacturers like Motor Coach Industries (MCI) and Van Hool are introducing electric versions of their full-size intercity coaches. For example, the MCI D-series coach is currently undergoing testing by USDOT at the Altoona Bus Test Center in Pennsylvania.

Current electric coaches have a range of 170 to 230 miles, with high-power plug-in charging taking around four hours to reach a full charge. Although they are not yet well suited for long-distance routes with continuous operation, electric buses have higher potential for shorter commutes with midday layovers and routes under 150 miles. Additionally, electric coaches could service feeder routes from smaller cities or rural areas, showcasing their adaptability within diverse transportation networks. To fully realize the benefits of electric intercity buses, a robust national charging infrastructure is essential (Schaper 2022).

Emerging Niches in Intermodal Bus Travel:
Luxury bus services offer a potential alternative to air and car travel for business travelers, particularly for trips between 200-500 miles. These services can provide comparable or even faster door-to-door travel times compared to airplanes on certain routes, potentially at competitive prices. They may also offer a more relaxed and work-supportive environment compared to both air and passenger vehicle travel, due to amenities like Wi-Fi, work desks, and food service.
Their lower passenger density (20 to 30 passengers) compared to traditional intercity buses suggests a potentially smaller carbon footprint, particularly for medium-distance travel. However, more comprehensive analysis is needed to confirm environmental impacts of luxury services vs. traditional motorcoaches and other modes of travel.

COBENEFITS

SAFETY

Intercity bus services contribute to roadway safety by providing a reliable and comfortable transportation option, reducing the risks associated with long-distance driving, such as fatigue. Nearly 17% of fatal crashes in the U.S. involve a drowsy driver (Tefft, 2012).

ECONOMIC GROWTH

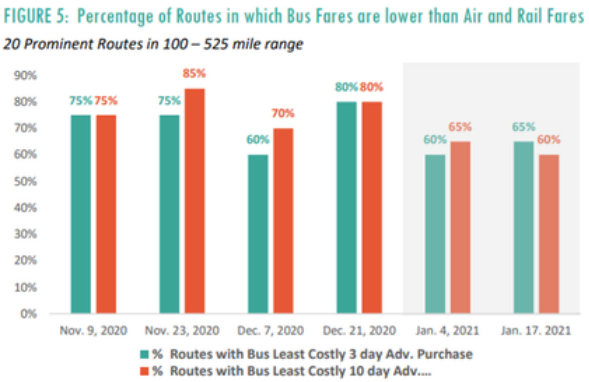
By connecting communities and promoting travel to diverse destinations, intercity buses stimulate economic activity. Motorcoach travel and tourism generates as many as 1.98 million jobs in communities across the United States, paying over $86.4 billion in wages and benefits (American Bus Association 2023).

"Student tourism" in the United States represents a significant portion of motorcoach tourism, encompassing 30.1 percent of passenger trips, highlighting the importance of intercity buses in facilitating student travel experiences (John Dunham & Associates, 2013).

ACCESSIBILITY AND EQUITY

Intercity buses represent a cost-effective alternative to driving or flying, offering affordable fares and reducing the financial burden of travel for individuals and families.

A study using data from 20 bus routes in January 2021 found bus travel was cheaper than air and rail fares 60 to 85 percent of the time (Schwietrman et al., 2021).



The percent of routes in which bus fares are lower than air and rail fares (On the Brink: 2021 Outlook for the Intercity Bus Industry in the United States).

Unlike traditional train or air travel, intercity buses can offer a network of pick-up and drop-off locations closer to where people live, work, and play. This expands access to transportation for those with limited means or without access to personal vehicles. These

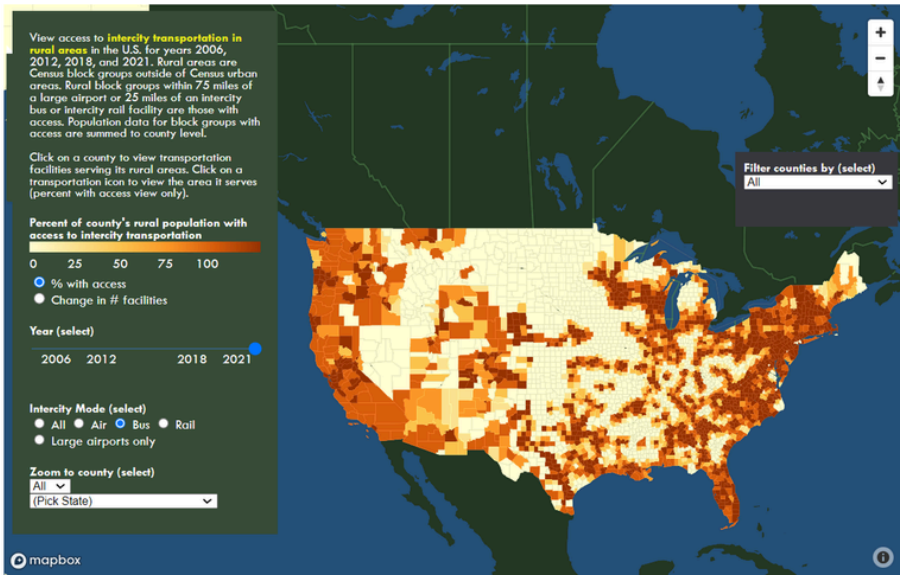
benefits are fully realized when stops provide a comfortable and secure pre- and post-boarding experience (Talbott 2011).

Implementing alternative ticket purchasing methods ensures inclusivity and accessibility for diverse populations, including elderly individuals and non-banked individuals.

Watch the National Rural Transit Assistance Program (National RTAP)'s video on how intercity bus transportation supports equitable and affordable access.

RURAL COMMUNITIES

Intercity bus services play a vital role in connecting rural communities to regional transportation hubs and activity centers, enhancing access to essential services, employment opportunities, and educational institutions.



Map displaying intercity bus access across U.S. counties (U.S. DOT, Bureau of Transportation Statistics, Access to Intercity Transportation in Rural Areas).

COST CONSIDERATIONS

One of the strategic advantages of intercity buses lies in their lower capital investment compared to heavy rail – intercity buses can leverage the existing right-of-way already established by roadways. Other primary expenses may include acquiring vehicles, planning, and marketing the services, and paying for private carriers to operate and maintain them.

COST OF SUPPORITING INFRASTRUCTURE

Charging infrastructure:

Level	Type	Chargers per pedestal	Per-charger cost
DC fast	Networked 50 kW	One	$28,401
DC fast	Networked 150 kW	One	$75,000
DC fast	Networked 350 kW	One	$140,000

ICCT, 2019

OPERATION AND MAINTENANCE COSTS

A paper sponsored by the Natural Sciences and Engineering Research Council of Canada, details the maintenance and operations cost composition by percent of total cost in Table 2 (Nookala and Kahn).

TABLE 2 TYPICAL INTERCITY BUS CARRIER COST COMPOSITION *(8)*

Cost Item	Percentage of Total Cost
Bus unit leasing	11.3
Driver	
Wages and benefits	41.4
Expenses	2.1
Subtotal	43.5
Bus operation	
Tires	2.1
Fuel	11.9
Insurance	1.5
Licensing	1.2
Miscellaneous	0.8
Subtotal	17.5
Bus maintenance	
Wages and benefits	10.2
Parts	5.4
Cleaning	1.3
Exterior repair	2.0
Other	1.4
Subtotal	20.3
Administration overhead	7.4

FUNDING OPPORTUNITIES

FTA's **Nonurbanized Area Formula Grant Program (Section 5311) Funding** requires 15 percent of each state's overall Section 5311 funding allocation be spent on rural intercity bus projects under Section 5311(f) unless the state certifies to the FTA that there are no unmet rural intercity needs, and that it has determined that there are no needs as the result of a consultation process that includes outreach to the intercity carriers and other stakeholders.

FHWA's **Surface Transportation Block Grant Program (STBG)** provides flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals.

FTA's **Grants for Buses and Bus Facilities Program** supports state and local efforts to replace, rehabilitate and purchase buses and related equipment and to construct bus-related facilities, including technological changes or innovations to modify low or no emission vehicles or facilities.

FTA's **State of Good Repair Grants Program** provides capital assistance for maintenance, replacement, and rehabilitation projects of high-intensity fixed guideway and motorbus systems to help transit agencies maintain assets in a state of good repair in urbanized areas.

FHWA's **Congestion Mitigation and Air Quality Improvement (CMAQ) Program** funds can be used to, install electrification infrastructure for buses, and support intermodal stations. CMAQ funds can also be used towards transit amenity improvements.

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
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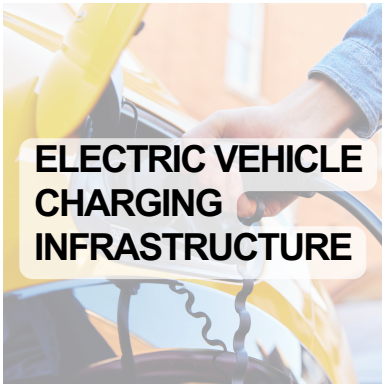
COMPLEMENTARY STRATEGIES

Intercity rail and intercity buses together offer travelers flexible and efficient options for long-distance travel.

Trip planning tools and modal integration support intercity bus operations by providing travelers with comprehensive information on routes, schedules, and ticketing options, enhancing the overall travel experience.



Electric vehicles and charging infrastructure are essential for the advancement of electric intercity buses.

Park and Ride facilities offer convenient locations for travelers to park their vehicles and seamlessly transfer to intercity buses.

View All Strategies

CASE STUDIES

KAYAK PUBLIC TRANSIT

Kayak Public Transit in Pendleton, OR is administered by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The agency operates a rural regional transportation system reaching into southeastern Washington and northeastern Oregon, with three fixed routes and four long distance commuter bus services spread throughout four counties and connecting 15 communities. The name "Kayak" is reflective of the Cayuse/Nez Perce word "K'ay'ák which means "to be free of obstructions". Some of those obstructions or obstacles were people not having a vehicle, not living in the town where they're employed, and not having access to education and medical services. Their transportation service currently provides nearly 100,000 rides per year. Kayak Public Transit was awarded the National RTAP 2019 Tribal System Award for their innovation, efficiency, commitment, and performance in the tribal transit industry.

BRECKENRIDGE FREE RIDE

The Free Ride system in Breckenridge, Colorado, a mountain destination that attracts year-round visitors, uses intercity buses to address traffic congestion and promote environmentally friendly travel options. The bus system is a convenient, and reliable option for users that otherwise would be traveling in private cars. The town Transit Agency, in a Livability Grant to the federal government, cited a reduction of 202,336 pounds of CO2 emissions in a year from choice riders using the system (National Academic Sciences, 2012).

GREENWAY PUBLIC TRANSPORTATION

Greenway Public Transportation provides fixed-route, flex-route, and demand-responsive transportation in rural North Carolina through Western Piedmont Regional Transit Authority (WPRTA). Greenway saw the need to expand their service to rural areas, particularly to meet the needs of underserved riders. The service expansion initiative took about three years and involved many stakeholders, including county municipalities, government leaders, the Community Foundation of Burke County, representatives from the manufacturing and industry sectors, and non-profit organizations. The routes were tailored to include low-income and affordable housing as bus stops so underserved populations could access transit to get to town. There was a "ride-free" promotional period to help people learn and become acclimated to using public transit. This new route was advertised by the local public housing authority. After implementing the new flex routes, Greenway saw an increase in ridership of nearly 70%, from 1,300 riders in 2018 to 2,200 in 2019.

JUMP TO: Overview | GHG Reduction Potential | Co-Benefits | Cost Considerations
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IMPLEMENTING INTERCITY BUS SERVICE: **WHAT TO READ NEXT**

Successful intercity bus networks rely on strong local, State, and private sector collaboration. Key considerations for State and local agencies may include:

Safe and Comfortable Bus Stops
Agencies can invest in bus stops with adequate shelter and amenities. In some cases, establishing a transit hub may be necessary to serve as a centralized location for intercity bus services, facilitating seamless transfers between routes and connecting with other modes of transportation. Coordinating with existing infrastructure such as transit centers or transportation hubs can optimize the use of resources and improve connectivity within the transportation network.

> Read InterCity Transit's guidance on Intercity Bus Stops.

First/Last-Mile(s)
Addressing the journey to and from intercity bus facilities is crucial to ensure accessibility for all riders. Implementing feeder services or carpool programs can facilitate connections for passengers traveling from remote areas or areas without direct access to bus stops. Providing convenient and reliable transportation options to and from bus facilities enhances the overall travel experience and encourages modal choice towards intercity bus services.

Bus charging infrastructure on key corridors can **support an industry shift towards electric vehicles.**

> See FHWA's EV Toolkits for Rural Electric Mobility and Urban Electric Mobility infrastructure.

Parking Guidelines and Permitting
Coordination between city DOTs and private operators to establish clear parking policies, can minimize unnecessary idling and ensure smooth layovers between trips.

> See the University of Delaware UTC's reference document Curbside Intercity Bus Industry: Research of Transportation Policy Opportunities and Challenges.

KEY CONSIDERATIONS FOR BUS OPERATORS:

Tracking Systems and Signage
Implementing bus tracking systems or on-site support allows passengers to monitor bus arrival times and receive real-time updates on potential delays, ensuring passenger safety and comfort, particularly in adverse weather conditions or during nighttime travel. Utilizing signage and outreach campaigns can effectively communicate the benefits of bus travel and inform passengers about routes, schedules, and fare options.

> Pace buses in Chicago, Illinois, facilitates data collection and communication between drivers and passengers using Intelligent Bus System (IBS) technology. Read more here.

Accessible Booking and Ticketing
Establishing a seamless booking process will help attract new ridership. User-friendly features such as those below contribute to overall convenience and accessibility:

Having to purchase tickets online can be challenging, especially for elderly and non-English speaking riders. To address this, intercity bus operators can implement alternative ticket purchasing methods such as phone reservations or in-person ticket sales at terminals. Additionally, providing multilingual customer support and offering clear instructions in multiple languages on the booking platform can enhance accessibility for non-English speakers.

Implementing accessible options for individuals who may not have access to traditional banking methods is crucial for ensuring inclusivity and equity in intercity bus services. Some operators, such as Greyhound offer cash payments at convenience stores and participating retail spaces, allowing users to make reservations online and then complete their payment in person.

Offering new schedule options that require transfers necessitates that bus lines deal with late-arriving buses, cancellations, customer confusion, and other issues at transfer points. Metasearch travel websites, including Busbud and Wanderu are pivotal to making travelers aware of the new schedule options, allowing them to comparison shop, and providing customer support.

RESOURCES

GENERAL RESOURCES

Depaul University Chaddick Institute for Metropolitan Development Intercity Bus Research Hub: This research on intercity bus service spans nearly a decade, with year-in-reviews for the past five years highlighting the innovation and technological advances undertaken by the intercity bus industry in the United States.

TOOLKITS AND MODELING APPROACHES

U.S. DOT Bureau of Transportation Statistics Intercity Bus Atlas (ICBA): The ICBA is a mapping application which features scheduled intercity bus service data. The BTS collects the data from various provider websites, compiles them into a single, geospatially enabled database, and then publishes them for research, analysis, and planning.

American Bus Association Local Economic Impact Study: This interactive map details information on the local economic contributions of motorcoach-based group tourism in counties and select cities across the United States. When an area is selected a report can be generated to share with stakeholders.

Transportation Research Board Toolkit for Estimating Demand for Rural Intercity Bus Services: This toolkit provides a sketch-planning guide and supporting CD-ROM–based tools that can be used to forecast demand for rural intercity bus services.

FHWA Congestion Mitigation and Air Quality Improvement (CMAQ) Calculator Toolkit: This toolkit is designed to estimate the air quality and greenhouse gas reduction benefits of different projects, including transit buses.

RURAL SPECIFIC

FTA National Rural Transit Assistance Program (RTAP): This is a program of the FTA administered by the Neponset Valley TMA, serves to create rural and tribal transit solutions through technical assistance, collaboration, training, and transit industry materials. They host trainings, resources, and peer networking for public agencies and rural operators.

FTA and Transportation Research Board Effective Approaches to Meeting Rural Intercity Bus Transportation Needs, TCRP Report 79: This report addresses funding for intercity bus projects; discusses barriers to implementation; and identifies strategies for initiating, preserving, and enhancing effective intercity bus transportation.

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For more information visit the DOT Climate Change Center, https://www.transportation.gov/priorities/climate-and-sustainability/dot-climate-change-center