# New Mobility Opportunities in a Rural Context


by

Natalie Villwock-Witte, PhD, PE
Assistant Research Professor/Research Engineer

Western Transportation Institute
College of Engineering
Montana State University

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# EXECUTIVE SUMMARY

The evolution of technology has given new life to previously considered transportation options. As an example, while rideshare has been around since at least the 1980s, with the support of a smartphone, the concept of rideshare has evolved into transportation network companies (TNCs). However, while TNCs have become more popular with urban residents, the ability to use new modal options supported by technological advances has lagged in rural areas. This research first looked at the new mobility options that have become available more recently (carsharing, ridesharing, TNCs, mobility-as-a-service, shared mobility, and microtransit) and reviewed literature with a focus on identifying research that discusses these mobility options in a rural context. In addition, a survey was distributed to communities that have a TNC operating within their jurisdiction to better understand challenges and benefits from their viewpoint. The most commonly cited challenges by survey respondents, which generally coincided with that found in the literature include: low population density, competition with other modes, safety, equity, congestion, convenience, and coordination. The most commonly cited benefits by survey respondents, which generally coincided with that found in the literature include: congestion, environmental, equity, increased mobility options, parking, social, reduced transportation costs, and convenience. Notice that three of the challenges and benefits overlap, although from opposing viewpoints: congestion, equity, and convenience. As a whole, the lack of research on more novel mobility options as a result of technological innovations as applied in the rural context suggests that there is a lot of opportunity for further advancement. Performing demonstration projects, much like that discussed regarding technological innovations in urban areas, is a recommended first step. Synthesizing what worked and what could be improved based on a multitude of implementations across the United States could provide additional mobility options to rural Americans, which in turn could expand their access to employment and education opportunities, as well as essential and desirable services. Case studies of implementations in rural areas (e.g. Needles Carshare) should be developed to serve as a record of the growing knowledge.

# 1. INTRODUCTION

As technology advances, transportation is being redefined. Emerging technologies are not only expanding options for how one travels – in some cases, they may influence whether a person needs to make the trip at all.

In the U.S., the primary focus of the transportation network has been travel by individual vehicle. Recently, there has been a shift from an emphasis on *every* individual of driving age owning a private vehicle to the sharing of vehicles or rides. There are a variety of approaches to providing transportation related to sharing vehicles or rides, some overlapping, including:

1. Carsharing
2. Ridesharing
3. Transportation Network Companies (TNCs)
4. Mobility-as-a-Service (MaaS)
5. Shared Mobility
6. Microtransit

However, these new mobility options have been primarily focused on the urban environment. There are and will remain, many opportunities to deploy these new mobility options in rural areas.

The primary purpose of this research is as follows:

- Understand how the new or the evolution of previously considered transportation options may or may not fit in a rural context based on the available knowledge to date, and
- Understand the **benefits** and **challenges** of ridesharing from the perspective of local agencies.

The next section presents the methodology for this research. Then after, a literature review is presented, focusing on identifying journal articles, periodical articles online, and other reports that address the new transportation options with some mention related to the rural context. The results of the local agency survey are discussed in the subsequent section. Finally, the researcher presents conclusions and recommendations for how rural Americans can benefit from some of these mobility innovations.

# 2. METHODOLOGY

The two components of this research were a literature review and a local agency survey. For the literature review, the author drew on a variety of search engines and reviewed references of reports, journal articles, and periodical articles to identify relevant literature. The review focused on research about six types of shared mobility (carsharing, ridesharing, transportation network companies, mobility as a service, shared mobility and microtransit), as well as technology that can be used in place of a trip. The primary focus was to find studies that discuss these mobility options in a rural context; however, given that rural applications of these technologies have been limited to date, some studies from larger cities have been included where applicable.

Another component of the literature review was to identify information about the business models of ridesharing providers. Since many ridesharing providers are private entities, not all entities are willing or required to share information about their business models. The information collected as a result of this literature review is summarized in Chapter 3.

To better understand the **benefits** and **challenges** of ridesharing in a rural environment, a survey was sent to local agencies in communities where a transportation network company (TNC) reported operating. (Note: TNCs are commonly still grouped with rideshare.) The localities were identified on a Lyft webpage (current in 2017) as being within the TNC's service area (1). The Uber website was also consulted, and while generally, the service areas overlapped with those identified on the Lyft website, the Lyft website tended to identify more specific cities, as compared with the general regions identified by Uber. Therefore, the list taken from the Lyft website was used to determine which agencies to contact. In the end, this means that the results may be potentially biased in that one may expect that most of the small agencies contacted would be familiar with a TNC. However, it was also of interest to understand the level of awareness among local agencies about the TNCs operating in their area. Future efforts could expand on these findings by taking the information learned as a result of this effort and contacting other local agencies outside of this list in the identified states and those beyond the scope to see how their knowledge and opinions of benefits and challenges are consistent or differ.

The six-question survey was emailed to 185 communities from July 18, 2017 through September 20, 2017, with follow-ups approximately a week after the first contact. A significant challenge of contacting local agencies is that when emailed, many of the email addresses resulted in a return-to-sender, indicating that the intended recipient had left the agency. While the focus was on small communities, the survey was emailed to some larger communities as well with the hope of being able to provide a comparison. The survey results are discussed in Chapter 4, and the full survey is included in the Appendix.

# 3. LITERATURE REVIEW

The following sections discuss literature that relates to: 1) carsharing, 2) ridesharing, 3) transportation network companies (TNCs), 4) mobility-as-a-service (MaaS), 5) shared mobility, 6) microtransit, 7) sources that cover multiple of the aforementioned transportation options, and 8) technology in place of a trip. The bolded text highlights important findings from the literature. Underlined text corresponds with benefits and drawbacks identified by survey respondents in the subsequent section.

## 3.1. Carsharing

A 2003 journal article by Shaheen et al. discussed carsharing and station car growth (2). They conducted a longitudinal study of thirteen carsharing programs and five station car programs from June 2001 through July 2002 through email questionnaires and telephone interviews to uncover trends and developments. Station carshare programs are similar to a company fleet. They found that high start-up costs prohibited new entities from entering the carsharing realm. They also found that insurance was significantly prohibitive in achieving efficiencies, although at the time reported crashes were relatively minor (e.g. property-damage only). However, it seemed that **insurance premiums** more significantly impacted carsharing operations as compared with station car programs because the latter often had insurance coverage through company fleets. Shaheen et al. highlighted that station car programs were significantly smaller than carsharing programs (e.g. 121 vehicles vs. 455 vehicles; 163 members vs. 12,098 members). More importantly, they noted that **eighty percent** of shared-used use vehicle members live in the **twenty-five most densely populated cities** in the United States.

The Victory Valley Transit Authority (VVTA) that administers transit near Needles, California, a community of about 4,000 residents, approached Enterprise Rent-A-Car to create a small carshare transportation option for the community ( (3), (4)). It has been in operation since August of 2016. Health care and grocery shopping are only available within communities in neighboring states, as Needles is just over the border from Nevada and Arizona. Such trips are reportedly the primary purpose of carshare users. The carsharing program consists of two vehicles: a Nissan Altima (a small passenger vehicle) and a Dodge Caravan (a minivan). A fee of $5/hr is charged, which includes membership and fuel. The vehicles are available seven days a week, twenty-four hours a day. There is no membership cost or sign-up fee. Those **without a bank account** can make use of the program as a result of payroll debit cards. The program consists of fifty members. Members access the vehicles at the local credit union. Gas cards are provided to members, and the cost for fuel is integrated into the hourly fee. An additional fee is charged for those who return the vehicle with less than a quarter tank of gas.

## 3.2. Ridesharing

This section discusses ridesharing, including the history and evolution. Volunteer driver programs have been grouped within the ridesharing categorization. Smartphone enabled rideshare systems (e.g. Lyft and Uber) are discussed in the next section, transportation network companies (TNCs), with some reference to them occurring in this section showing the transition from the descriptor of for-profit ridesharing to TNCs.

In *Ridesharing in North America: Past, Present, and Future*, Chan and Shaheen document the evolution of ridesharing (5). They define ridesharing as both, *"the grouping of travelers into common trips by car or van"* and *"non-profit, with similar origins and/or destinations for both driver and passenger."* They more specifically noted that cab sharing, taxis and jitneys are not included. An interesting statistic cited in the paper is that vanpools and carpools contribute to **seven times** the passenger-miles when compared with public transportation. The following ridesharing classifications scheme was proposed by Chan and Shaheen:

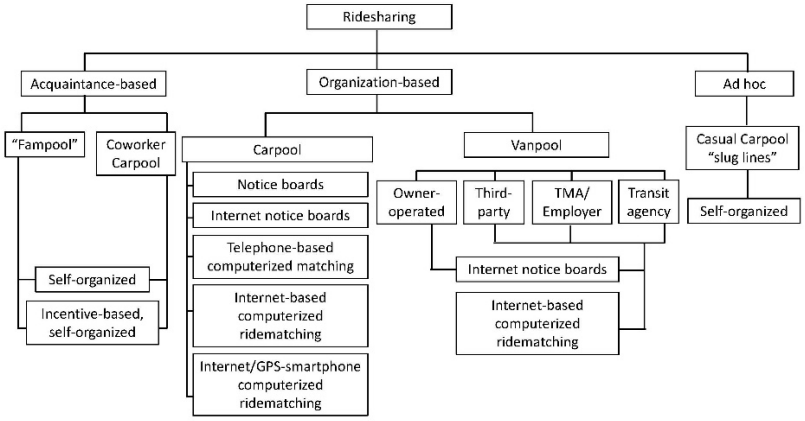



**Figure 1: Proposed Ridesharing Classification (5)**

They cited many societal benefits that have been proposed by others: **reduced energy consumption, emissions, traffic congestion and parking infrastructure demand**. At the individual level, they reported the following benefits: **reduced travel costs, travel time savings** (by making use of high-occupancy vehicle lanes), **reduced commute stress, and preferential parking**. They identified behavioral barriers to the adoption of ridesharing including: sacrificing **flexibility and convenience** associated with a private automobile. Other barriers include an imposition on **personal space and time**, aversion to **social situations**, and concerns with **personal security**, although they assert that this is a "*perceived risk*." The authors divide the evolution of ridesharing into five phases:

1. Car-sharing clubs (1942-45)
2. Major responses to energy crisis (1960s-1980s)
3. Early organized ridesharing (1980-97)
4. Reliable ridesharing (1999-2004)
5. Technology-enabled ridematching (2004-present)

The document highlights a 1979 national initiative, the National Ride-Sharing Demonstration Program. Chan and Shaheen noted that park-and-ride facilities are a critical component for ridesharing and that cheaper gas prices are a disincentive to ridesharing. They also noted that during early organized ridesharing, *"programmes were deemed unsuccessful due to low use"* subsequently citing that one program **only had six logged ridematches**. It was concluded that phase 3 programs could not overcome the *"critical mass"* barrier. For phase 5, Chan and Shaheen suggested that ridesharing is more appropriate for those with *"regular schedules,"* and that it may not be as appropriate for **less tech-savvy users**. In their opinion, a *"high subscriber base is required."* The paper identified 638 ridematching services in North America as of July 2011; however, they also stated that, ***"Those located in sparsely populated rural areas which appeared***

***to have very low use, were excluded."*** Chan and Shaheen concluded that: 1) technology interoperability and integration, 2) enhanced casual carpooling, and 3) public policy will have the most significant influence on ridesharing in the future. Technology, in their opinion, was reported as the biggest factor to *"overcome the critical mass barrier."* An interesting suggestion was that a *"ridematch aggregator"* may overcome some of the barriers between companies that provide rideshare by searching the databases of all of the unique ridesharing databases to match the desired ride, similar to www.kayak.com or www.orbitz.com for air travel. Chan and Shaheen also suggested that marketing and public education regarding how rideshare can contribute to **reducing climate change and traffic congestion** may increase participation. Finally, they identified two incentives that can further encourage ridesharing: social networking and financial benefits.

A Transportation Scholar at Glacier National Park, Susan Law, developed a ride-matching database with the goal of reducing single-occupancy work trips (6). The ride-matching database was web-based. Through the online database, park employees were able to enter in a planned one-time or ongoing trip. Other employees were able to search the database by origin, destination, and/or date to either identify a ride for themselves or offer a ride for a co-worker. It was also thought that drop-offs or pick-ups of items could be achieved through this service. The main incentive behind the program was that park employees could "do their part" to support **congestion-reduction** on the Going-to-the-Sun Road.

Furuhata et al. (7) defined ridesharing as: *"a joint-trip of at least two ridesharing participants that share a vehicle."* They discuss *"unorganized ridesharing"* and define it as that which involves family, colleagues, neighbors, and friends. Furuhata et al. noted that while this type of ridesharing still exists, limited and inefficient communication methods limit its scalability.

LibreTaxi is an **open sourced** application that allows any developer the ability to take the code and modify it to their local needs (8). Payments are exchanged in **cash**, with the rider and driver agreeing to a fee for the trip. Furthermore, there are no limitations on who can sign up to serve as a driver. Users of the application are expected to **"already know"** one another. The article notes that those who cannot legally work in the U.S. could use the application to provide rides as well as those who may be considered to be too old by TNCs to serve as drivers.

The Lawrence OnBoard rideshare system was deployed in Lawrence, Kansas ( (9), (10), (11)). Lawrence is approximately halfway between Kansas City and Topeka, Kansas with a population of about 89,500 people (in 2012). Lawrence OnBoard has been likened to a formalized version of hitchhiking. As such, O'Brien and Dunning (10) outlined the evolution of hitchhiking: it started as an act of kindness or patriotic duty during gas rationing occurring in World War II, evolving to a fear of hitchhikers starting with the American Automobile Association's "Thumbs Down on Thumbers" campaign and cinema productions like *The Hitch Hiker* and the *Texas Chainsaw Massacre* that associated fear or evil with hitchhikers. Lawrence OnBoard, which was originally overseen by the non-profit Lawrence OnBoard Association, was created to address three needs:

1) undesirably long headways for city buses, with many stops,
2) no public transportation options for outlying small towns (e.g. Eudora, Lecompton, and Perry), and
3) no transit connection between Lawrence and Kansas City or Topeka.

There also seemed to be some motivation to launch Lawrence OnBoard as part of the sharing economy, noting that it *"squeezes good value out of the unused bits of our society that would otherwise go to waste,"* and that *"A personal car uses less than 1% of its energy to move a*

*passenger, and 80% of our passenger capacity is driving around empty."* Elements of the system include: 1) participants are registered, vetted, and have identification, 2) training is provided to members, 3) window clings are provided to drivers, 4) riders are given dry-erase boards with the Lawrence OnBoard logo, 5) pickups can occur anywhere, provided the location is safe for pick-ups, and 6) riders can text the Lawrence OnBoard office as a safety check. Between September 11, 2012 and October 28, 2013, 121 rides were taken by 18 riders. O'Brien noted that many of her **neighbors provided her with the rides**, noting that it allowed her to learn about what was going on in the neighborhood. Most trips began within Lawrence; most riders waited, on average, 7.1 minutes, with a median of 5 minutes for a ride. This coincides with O'Brien's suggestion that **short, local trips** are best served by the program. The age range of users varied from 18 to 69. O'Brien and Dunning reported the following sentiments of the generations that used the system: Baby Boomers reported reminiscing of hitch-hiking; Generation Xrs reported a wariness with hitchhiking; and Millennials wanted an application (a.k.a. app). The ability of a rider to get a ride was highly influenced by the pick-up location and making it clear to potential ride providers that they desired a ride. The **presence of seat belts**, adequate room in the vehicle, and a non-smoking driver influenced the **comfort** level of the rider. It was also reported that in one vehicle interior door handles did not work. Information about the program for potential drivers and riders was conveyed through Facebook, blogs, newsletters, radio and local news. O'Brien and Dunning noted that **interpersonal familiarity**, which can more commonly be found in rural areas, is an advantage of such smaller communities when compared with large, urban areas. In contrast, suggested drawbacks include that rides would not be provided during the evening (there is no visibility to see the riders or the signs) and that **transporting small children** would be challenging (the lack of a car seat). An additional safety precaution that was abandoned during deployment of the system was texting license plate numbers of drivers to the system director; difficulty remembering the number, a concern with creating distrust between rider and driver, and a desire not to impede the movement of the driver were all reported as deterrents to this safety feature being implemented. Lawrence OnBoard was later piloted with venture capital as CarmaHop and was discontinued when **a sustainable business model was not achieved**. O'Brien suggested that the Lawrence, Kansas area does not have transit and it does not have the *"critical mass of people"* needed for TNCs.

Rural Rides, operated by Arrowhead Transit, is a rideshare program in Northeastern Minnesota that supports: 1) rideshare matching, 2) volunteer driver services, and 3) individualized transportation planning to assist low-income individuals in getting to work (12). The primary goal of the program is to enable clients to become transportation self-sufficient. The program reports that it is extremely successful in ***"getting people to work."*** The program spans four counties that cover 13,000 square miles with approximately 170,000 people. The program was started as a result of a finding from a 2007 human services coordination transit plan that community members were not pursing or were *"losing jobs because they lacked the transportation resources to go to work or interviews."* The document noted that funding at the time was provided by the Job Access and Reverse Commute (JARC) grants (note: this program no longer exists), the Department of Human Services' Employment & Training Department, and the Blandin Foundation. It identified several barriers that motivated starting the program including: 1) **limited access to public transportation**, 2) shift work, 3) the need for wheelchair-access vehicles, 4) the lack of a driver's license, and 5) challenges with **transporting children** to and from daycare. To qualify for the program, a candidate must live at or below one hundred fifty percent of the poverty level, be at risk of losing a job, or be unable to engage in the job search (e.g. attend an interview). Participants

are typically restricted to a **three-month** period of support, with approximately $150 in travel costs allowed each month.

In *Volunteer driver programs at risk from changing demographics, ridesharing services* (13), it was highlighted that volunteer driver programs in Minnesota are diminishing. The article noted that small towns and rural areas are most often served by volunteer driver programs. The article describes Uber and Lyft as ridesharing services, noting that rideshare drivers **expect to earn income**. Recommendations include changing Minnesota laws to clearly identify the difference between volunteer drivers when compared with *"ridesharing subcontractors and employees"* and to allow volunteer drivers to *"claim 'no load' miles"* (those accrued traveling from the volunteer's location to their rider's location).

In *Volunteer Driver Programs in Minnesota: Benefits and Barriers* (14), Douma reviewed volunteer programs within the state of Minnesota. The study was done by surveying providers across the state. While 230 providers were identified, contact email addresses were only determined for 188 providers (81.7%). Of the 188 providers who were invited to respond to the survey, only 45 responses (23.9%) were achieved. The definition of a volunteer driver included three characteristics: 1) transportation is provided with a **private vehicle** (not through an organization), 2) **insurance** is provided privately by the driver, and 3) mileage reimbursement is only at or below Internal Revenue Service-defined rates (and for other approved trip-related expenses). The author found that the **flexibility** and **low cost** afforded by volunteer drivers cannot be achieved through another model. Demographics, in that the Baby Boomer generation is larger than Generation X, and Generation X does not generally have a lot of individuals within their generation looking to *"productively spend their time as their children moved out of the house"* is one reason why there are fewer volunteer drivers. Douma also noted that driving for a TNC may provide competition for those who might otherwise be willing to provide rides as a volunteer driver, unless the individual has **"altruistic motives."** Regulations, primarily in terms of insurance, were a primary factor that was influencing a lower than historical participation by drivers in volunteer driver programs. A good quote that summarizes the issue, provided in the report, is:

*"We are hearing concerns from **insurance** companies regarding if volunteer drivers [are] needing more than just personal coverage."*

Therefore, potential volunteer drivers are choosing not to participate because they cannot pay or choose not to pay higher insurance costs. The report identified users of volunteer drivers including local governments, human service providers, public transit providers, faith-based organizations, and other non-profit organizations. Purposes for which volunteer drivers provided trips include non-emergency medical appointments, work/school, and general errands. Another important point made by the author was that these services operate in **small towns and rural areas** where other forms of public transportation are not present. Provider responses indicated that more than half of the volunteer drivers were between the ages of 65 and 69. The majority of volunteer drivers were coordinated through non-faith-based nonprofits, with county human service providers coming in second as most frequently using volunteer drivers. Sixty-eight percent of respondents reported not having enough volunteer drivers to meet demands; this has resulted in the cancelling of trips including those to medical appointments.

In 2014, Anderson (15) identifies what he calls, "for-profit ridesharing." He discusses how traditionally, ridesharing has been touted as an *"ecologically desirable means of reducing vehicle*

*miles of travel (VMT)."* He focuses on experiences in San Francisco, California, a large urban area. He noted that e-hailing services that started in California differentiated themselves from taxi services by: 1) putting a cap on annual driver income, and 2) by charging a suggested donation in place of a "fare." The drivers also use their **own private vehicles** and are not employees of the services. Because they sold themselves as rideshares, they were able to sidestep many of the rules that traditional taxi services had to adhere to. The California Public Utilities Commission (PUC) eventually rejected for-profit ridesharing as being categorized as ridesharing and did not categorize them as taxi services, but instead began calling them "transportation network carriers." The author notes, however, that ***"Despite the PUC's ruling, these services are still being referred to as "ridesharing" in the media and popular discourse."*** Anderson suggests that overall VMT are both added and subtracted by for-profit rideshare. They are additive because they *"can provide increased access to transportation, for instance to non-car-owners, or non-drivers"* and subtractive because they encourage *"shared rides, supplementing fixed-route transit systems by enabling multi-modal trips, and eliminating wasteful driving such as searching for parking."* Anderson further notes that true ridesharing presumes *"that the driver would take the trip with or without a passenger."* Additionally, he notes that because the pay in for-profit ridesharing needs to compensate for unpaid miles, *"for-profit ridesharing is better represented by the taxi model."* Anderson reported wanting to better understand the motivations and strategies of for-profit drivers. Twenty drivers from different for-profit rideshare providers were interviewed in the San Francisco, California area from November 2012 through February 2013. Anderson used the snowball sampling method in that some of the initial interviewed drivers recommended other drivers to interview. Anderson categorized drivers as: 1) incidental, 2) part-time and 3) full-time, where the driver only drove occasionally, had short shifts, and was using it as the primary source of income, respectively. He found that incidental drivers do not view driving for a for-profit rideshare company as a job, do it more for the social motivations, are unlikely to travel long distances out of their way to pick-up a passenger and therefore are typically associated with a reduction in VMT. Part-time and full-time drivers were found to add to VMT and be motivated to be part of the company for economic reasons. From a rural versus urban perspective, one important point made was that **drivers bring their vehicles into the city to drive, which would therefore increase congestion**. He also suggests that for-profit ridesharing would be difficult in more rural areas unless high "donations" were requested.

The Rural Health Information Hub (RHIhub) provided an overview of ridesharing (16). First, this source described three models: 1) *"one or more organization operates the same vehicle during different periods of time,"* 2) *"passenger trips are combined for passengers with common destinations"*, and 3) global positioning systems are used *"to calculate a driver's route and arrange a shared ride."* The article, however, suggests that Lyft and Uber are a type of *"real-time ridesharing."* Some interesting examples of rideshare programs were identified: Dakota Area Resource Transportation Services (DARTS) Vehicle Coordination Program (Dakota County, Minnesota); Madison Transit Authority vanpooling (Madison County; Washington); and JAUNT (Virginia). The article identifies challenges as coordination, maintenance, and perceptions.

Several of the findings regarding rideshare are of particular interest to rural areas. The Glacier National Park ride-matching, LibreTaxi, and Lawrence OnBoard (CarmaHop) examples could be categorized as "acquaintance-based" (5) or "unorganized ridesharing" (7), as all riders rely on knowing those drivers providing the rides. There seems to be a suggestion that these are the only types of ridesharing programs can that can operate in rural areas. Douma (14) also suggested that less formalized and often less expensive volunteer driver programs are most applicable to small

towns and rural areas. Several pieces of literature identify challenges in terms of transportation for children ( (9), (10), (12)).

## 3.3. Transportation Network Companies

Transportation network companies (TNCs) require users to have a **credit card** and **mobile phone** (17). From a rural perspective, both of these aspects may be a problem, especially considering a research study that showed that those in rural areas have lower annual household incomes, which may prohibit them from owning a credit card and/or cell phone (18). More importantly, while someone in a rural area may have both of these items, they may not always *consistently* own them. Finally, access to Wifi for rural Americans is often more challenging.

Considering how influential TNCs like Uber and Lyft have become, *Transformational Technologies in Transportation: State of Activities* (19) only discussed these entities in a limited fashion. The article describes such a company as a "mobility service." Furthermore, the report describes it as a *"consumer-orientated ride service accessed and paid for through personal devices."* The document also identifies **human drivers as the greatest expense**. Another descriptive term is, *"on-demand, networked ride services."* As demonstrated by all of the aforementioned names that have been attached to companies like Lyft and Uber, there is a lot of confusion.

In *Transportation experts see Uber and Lyft as the future. But rural communities still don't use them*, Shrikant cited that only **nineteen percent** of Americans in rural areas use "ride-hailing apps" (20). An interesting point made in the article is that car ownership is inefficient, citing that buying, selling and maintaining vehicles is not done well by families. Limitations related to internet access and lower use of **credit cards** are cited as a rural barrier to ride-hailing adoption. The author specifically cited that *"Uber and Lyft both depend on **good cell service**."* The article also suggested that the longer rides and no cost for parking often found in rural areas are contrary to the **short trips** and high cost associated with **parking**, two aspects specific to urban areas that are driving an interest in TNCs. The article cited one driver from Davis, California who earned $18 for two hours of work when operating in a rural area as a deterrent for drivers of TNCs to operate in such communities. It also identified a driver in Haines, Alaska (population 1,374) who got "kicked off" the Uber platform because there were not enough ride requests, **internet** was "spotty" and Uber's maps did not include all of the destinations desired by potential riders. This driver subsequently started her own ride-hailing business, **Red Cab**. However, while credit card adoption and internet were cited as barriers, the author later concludes that, *"it's not the regional differences in credit card and internet access that's holding back Uber and Lyft in rural areas; it's the simple fact that **ride-hailing apps aren't available**."* The author suggested that: 1) median income, 2) population density, 3) unemployment, and 4) licensed drivers were the variables that indicated the potential success of ride-hailing services if an application were available.

A significant concern associated with TNCs is **safety**. More recent news articles ( (21), (22) ) have identified horrendous examples of outcomes where there is a mistaken identity for someone using a TNC. Therefore, while LibreTaxi, as an example, reports no vetting of drivers, there is some concern regarding TNCs that proport to vet their drivers, but that it is still not rigorous enough.

In summary, as noted during a review of rideshare examples, another big difference between companies like Lyft and Uber as compared with LibreTaxi is that there is no cash exchange for the ride for the former, whereas this is the only exchange for the latter. From a rural perspective,

there is likely more of a dependency on cash transactions, particularly as the area becomes more and more rural ( (19), (20)). Furthermore, as mentioned many times, because of the requirements to have connected phones for TNCs, there is a need to address limitations of the communications infrastructure in rural environments. With only nineteen percent (20) of those in rural areas using ride-hailing applications, there is a significant potential to provide service for these types of companies in the rural context.

## 3.4. Mobility-as-a-Service

Douglas reported on the presence of Liberty in Nebraska (23). The author described Liberty as a twenty-four hour *"ride hailing service that would complement public transit in rural areas."* Another periodical article described Liberty as, *"How an Uber Copycat Can Fill the Transit Gap in Rural Nebraska"* (24). It noted that the purpose of this transportation provider was to fill the transportation gap in allowing people to access: 1) the grocery store, or 2) to visit the doctor. The article also highlighted the need for transportation in a rural environment and its relationship to "quality of life." The article highlighted two reasons why operating in the rural environment has been unappealing to TNCs to date: low population density and minimal driver profit.

On March 16, 2017, the researcher participated in a webinar put on by Valerie Lefler, co-founder of Liberty (25). Liberty likened its services to the movement pioneered in Finland, Mobility as a Service (MaaS); Liberty promoted itself as a "booking service." The webinar was entitled, "Liberty Mobility as a Service." The presenter indicated that Liberty hoped to address limitations of local policy and geography in providing transportation to rural residents. Liberty viewed itself as a "transportation broker." The presenter indicated that unlike other urban-focus ridesharing companies (i.e. Uber and Lyft), Liberty shares its data with the communities that it works with. (Note: Communities are now writing into contracts requirements regarding data sharing with TNCs.) Liberty operated both through a call center and through a phone application. (Note: The need to provide support via telephone to a service in a rural area is unsurprising, as the study, *Mobility Mindset of Millennials in Small Urban and Rural Areas* (18), found that telephone was the most effective option for connecting with rural residents, particularly those in Montana.) Liberty's goal was not to become a provider that hires many drivers; rather, the goal was to *"fill in the gaps"* between existing services. Potential services that are leveraged range from church vehicles and senior vans to those provided by the area agency on aging. Liberty offers to: 1) enhance technology, 2) provide the Enterprise Portal, 3) provide coordination between riders and Liberty Drivers, and 4) offer a smartphone application and call center. Liberty actively searches out those with disabilities to serve as drivers and makes it a primary focus to ensure that those with disabilities can get to their jobs. The Federal Transit Administration (FTA) provided subsidies to Liberty as the company had a rigorous drug testing policy. It used 5310 funding for deployment and Rural Transportation Assistant Program (RTAP) funding for planning. There is an application for both the driver and the rider. Future efforts discussed were to include a photo of the vehicle that will be picking up the rider via the application, as this feature is a requirement in Texas (one of the desired deployment states). On average, Liberty reported that trips cost $17. When the cell phone is out-of-range to a network, the GIS is stored in the phone. Yet, Liberty purports that the application was designed specifically to work on a low bandwidth. For an entity to use the Enterprise Portal, there is both a monthly fee and a booking fee. The monthly fee ranges from $29 to $250. The booking fees range from $2.50 to $2.90. While Liberty offers customer and driver ratings, Liberty acknowledged that many do not like such ratings. Liberty reported working on using the Nimblevox Text notification system. Unfortunately, it would appear that Liberty

Mobility Now, Inc. is in bankruptcy as of January 2018 ( (26), (27)). This outcome highlights the challenges with creating mobility options apart from the private vehicle in rural environments.

In, *A Mobility Information Management System for Rural Transportation: A Case Study in Northwest Alabama* (28), the goal was to provide information about trip access to individuals in a region in order to provide them with all of their transportation choices. Anderson suggested that rural transit providers expand their role from just managers of transportation to *"mobility providers."* The researcher developed an internet-based interactive system that allowed the coordination of twenty-seven transportation service coordinators within a five county (Lauderdale, Colbert, Franklin, Marion and Winston) region in northwest Alabama. The researcher identified three steps for creating the online system: first identifying information, then allowing transportation providers to enter and modify, culminating with providing access to the public. For step one, eight types of data were collected: 1) agency information (name, address, contact), 2) operating schedule (e.g. days of week, hours of service, holidays), 3) technology level (software programs, internet access, agency web pages, email capability), 4) type of service (e.g. fixed route, demand response, contracted), 5) **payment types (cash or voucher)**, 6) qualification criteria (youth, elderly, disabled), 7) service area (cities and counties served), and 8) fleet capabilities/demand. It appears that the Mobility Information Management System, described here in 2003, no longer exists. (Clicking on "Need a Ride" (29) on the Alabama Rural Transit Assistance Program leads to a broken link.) This highlights the impact of technology, and how rapid changes in transportation are making it difficult for providers to stay on top of the new innovations, which in some cases have thus far been sustained (e.g. TNCs) but in other cases no longer exist (e.g. LibertyNow, LawrenceOnBoard).

## 3.5. Shared Mobility

A report released by the American Public Transportation Association (APTA) on *Shared Mobility and the Transportation of Public Transit* (30) identified **four** key findings:

1. *"The more people use shared modes, the more likely they are to use public transit, own fewer cars, and spend less on transportation overall,"*
2. *"Shared modes complement public transit, enhancing **urban mobility**,"*
3. *"Shared modes will continue to grow in significance, and public entities should engage with them to ensure that benefits are widely and equitably shared,"*
4. *"The public sector and private mobility operators are eager to collaborate to improve paratransit using emerging approaches and technology."*

Murphy et al. presented the concept of "supersharers," which they defined as, *"people who routinely use several shared modes, such as bikesharing, carsharing, and ridesourcing."* The work discussed the results of an online survey of 4,500 shared mobility users who were located in the **large, seven cities** of: 1) Austin, 2) Boston, 3) Chicago, 4) Los Angeles, 5) San Francisco, 6) Seattle and 7) Washington, DC. The results of those surveys indicated that rail and bus transit were the most commonly used shared modes. Murphy et al. categorized the trips into three purposes: commutes, errands and recreation. Survey respondents who reported transit experience only, shared-mode experience, and supersharers reported 1.5, 1.05 and 0.72 cars per household, respectively. Murphy et al. also noted that those who made use of shared mobility options reported being more physically active. The authors reported that survey respondents who identified using ridesourcing (a.k.a. TNCs) did so most often between 10pm and 4am, when **public transportation is often unavailable or only runs infrequently**. They also concluded that shared transportation

modes are more often substituted for personal automobile trips rather than public transportation trips. In addition, ridesourcing, from the survey data collected, was **most often used for social trips**. While a question was not asked specific to alcohol consumption and transportation choices, in an open-ended question, more than 100 survey respondents reported using a ridesourcing trip after imbibing. In contrast, **few reported using ridesourcing for commuting**. The report identified the significant increase in paratransit trips from 68 million to 106 million from 1999 to 2012, with an average cost increase from $14 to $33; it highlighted the desire to improve mobility and lower costs while still striving to improve the rider experience. The resource identifies services provided to those at the end of the age spectrum: SilverRide for older adults and Shuddle or HopSkipDrive for children. The report suggests that **microtransit and one-way carsharing** are potential solutions to ***"increase transit access to outlying communities."***

In *Implementing Distance-Based Fees Through the Shared Mobility Model* (31), Buckeye discussed the opportunities that shared mobility creates to collect fees to maintain the transportation system based on distance traveled instead of through fuel. He notes that, *"The invisibility of the motor fuel tax has skewed public perception of the true costs of providing the roads on which we drive."* He discusses shared mobility as a "business concept." Buckeye notes that, *"new types of transportation services and technologies are rapidly emerging and maturing."* Buckeye aptly described shared mobility as that which provides mobility through services (see previous section) rather than individual vehicle ownership. He notes that it is offered on an *"as-needed basis."* Buckeye only briefly discusses the need to "overlay" how **time-of-day**, **jurisdiction**, and **facility type** could possibly impact a distance-based fee; this would be particularly relevant to rural areas. He also provides a good definition of carsharing: *"localized car rental services requiring a subscription."* Two examples identified were car2go and ZipCar. Buckeye notes that the vehicles shared can be part of a fleet owned by an entity, or, as seen in some new offerings, allowing individual owners to rent out their vehicles (see previous section on carsharing). Buckeye also suggests that ridesharing is a *"marketing term for modern taxi services"* but also noted that the term ridesharing has now migrated to the term, "transportation network companies." Furthermore, he suggests an evolving understanding by car manufacturers where vehicles are now not only for travel but also for experience. The determination of the "rate" will be an important consideration for using shared mobility as a manner to administer fees to maintain the system. Buckeye questioned, "*What is an "appropriate" charge to maintain the system?*" Along these lines, he notes that the rate may have to be adjusted to account for inflation.

It is interesting that Murphy et al. (30) suggested that carsharing would be a good fit for outlying services, when as identified by Chan and Shaheen (5), *"eighty percent of shared-used use vehicle members live in the twenty-five most densely populated cities in the United States."* This suggests a need for more research on mobility options beyond the private vehicle that are good fits for the rural context.

In the ridesharing section, several pieces of literature identify challenges in terms of transporting children ( (9), (10), (12)). Yet, while limited, there are reportedly such offerings like Shuddle and HopSkipDrive (30).

## 3.6. Microtransit

On November 1, 2018, the researcher attended the webinar, *Small Places, Smart Mobility* (32). Link on Demand, which operates as a partnership between Lone Tree, Colorado and Uber, was discussed. The speaker, Jeff Holwell, indicated that Link on Demand is a microtransit solution.

Lone Tree, a suburb of Denver, reportedly has 13,000 residents, but the population doubles during the work week. As such, Link on Demand was originally conceived to address the last mile for many entering the community; however, Lone Tree has found it to be mostly utilized by residents, based on anecdotal information. The service has evolved from one vehicle to two, with approximately 3.9 rides per hour. The vehicles are 12-passenger vehicles, and they are driven by Lone Tree drivers. Lone Tree sees the microtransit service as a way to put off otherwise having to expand roads and intersections, a costly proposition. Lone Tree's drivers have reported that the **top five destinations are retail-based**, which is important to the service, which heavily depends upon the sales tax for operating revenue. (Note: This data is anecdotal as Lone Tree did not require Uber to provide data; Lone Tree reported that it was more interested in providing the service than requiring that Uber share their data.)

## 3.7. Sources Addressing Multiple Mobility Options

In 2016, the Texas Transportation Institute (TTI) released the report, *Dynamic Ride-Share, Car-Share, and Bike-Share and State-Level Mobility: Research to Support Assessing, Attracting, and Managing Shared Mobility Programs – Final Report* (33). Miller at al. reported conducting executive interviews, focus groups, and surveys. All of the collected information was from within Texas. Miller et al. suggested that mobility programs are more prevalent or possible because 1) technology capabilities have advanced, 2) government and personal economics are uncertain, and 3) transportation systems are at or beyond capacity. Miller et al. cite the Federal Highway Administration (FHWA) definition for rideshare, *"a strategy that involves travelers using advanced technologies, such as smart phones and social networks, to arrange a short-notice, one-time shared ride. These real-time tools facilitate a dynamic carpooling activity aimed at helping to reduce the number of auto trips and vehicles trying to use already congested roadways."* They discussed: 1) Sidecar, 2) Carma Carpool, 3) iCarpool, 4) eRideshare, 5) Uber, 6) Lyft, 7) ZimRide, 8) Ridester, 9) Carpool World, 10) RidePost, 11) NuRide, 12) RideScout, 13) City Mapper, 14) GreenTrip, 15) BlaBlaCar.com, and 16) Aktalita.

Miller et al. (33) discussed in more detail Carma, BlaBlaCar.com, Lyft and Uber. Carma was described as a dynamic ride-share pilot project with the Central Texas Regional Mobility Authority (CTRMA) in late 2013, which would address travel demand management along 183A and Manor Expressway in Austin. Carma seeks to address social goals by combining drive-along trips into one ride-share trip. BlaBlaCar.com was identified as long-distance rideshare. Lyft was previously called Zimride; Lyft now offers Lyft, Lyft Line, and Lyft Plus. Lyft Line tries to pair travelers traveling in the same direction to reduce costs. Lyft acquired Hitch. Uber has UberX, Uberpool, Taxi, Black, SUV and LUX. UberX is identified as "everyday use." The type of vehicle in large part dictates the type of Uber service.

Miller et al. (33) suggested that **convenience**, **financial limitations**, **and environmental concerns** may influence one to consider non-private automobile alternatives. They specifically indicate that while demand is mostly in the urban areas, some small towns and universities towns have begun adopting mobility technologies. Miller et al. provide a map using the existing knowledge in 2014 and indicate that there were 27 rideshare programs with more than 165,000 registered users. It is unclear how many of these users may be using multiple programs. Miller et al. specifically identify that there has been resistance by the taxicab industry and officials regarding the popularity of rideshare programs. One important point made by the authors is that, *"Private providers are hesitant to disclose proprietary information."* Miller et al. suggest the benefits of these programs

are: 1) smartphone integration, 2) user-friendly interface, 3) global positioning system (GPS) tracking functionality, 4) ride-matching algorithms, 5) user profiles, 6) social network integration, 7) driver and user rating system, 8) **cashless** transactions, 9) and real-time maps showing the closest drivers. They indicate that, *"The technological and operational aspects offered by TNCs such as Uber suggest that **their business model could be replicable in small towns or rural areas where car and vanpool programs have previously demonstrated success, but there is no research at this time to confirm that notion**."*

Miller at al. (33) also used focus groups to explore public perceptions of mobility programs. They identified themes from these focus groups as being: 1) convenience, 2) safety & security, 3) cost, 4) education, and 5) usage. An online survey was sent to large cities in Texas (Austin, Houston, Dallas, Fort Worth, El Paso and San Antonio) via TravelSurveys.org, and 500 survey responses were received. Ten percent of these survey respondents indicated that they felt that mobility services would allow them to reduce the number of vehicles in their household. Twelve representatives from rideshare, carshare, and bike-share programs were interviewed as well as government, consultants and academics. Miller et al. concluded that the success of a shared mobility service is based on 1) agency involvement, 2) regulations, 3) regional travel characteristics, and 4) population. Social networking was identified as a significant tool in promoting ridesharing programs. One benefit of TNCs is the reduction of impaired driving. The report cited a reduction of alcohol-related deaths ranging from 3.6-5.6% in California.

In *Ride On! Mobility Business Models for the Sharing Economy* (34), Cohen and Kietzmann indicate that shared mobility solutions can help to address deficiencies in public infrastructure. In fact, they specifically state that, *"While mandated to serve even outlying areas with lower density, doing so leads to significant deficiencies in public transit. When people live further away from transit stops, local authorities cannot economically deliver service."* Cohen and Kietzmann also indicate that shared mobility service will reduce the need for private vehicle ownership. Cohen and Kietzmann cited a definition that indicates that ridesharing *"consists of carpooling, flexible carpooling, vanpooling, and peer-to-peer (P2P) ridesharing."* They also cited Lyft and Uber as examples of "P2P ridesharing."

In *A New Way to Go: The Transportation Apps and Vehicle-Sharing Tools that Are Giving More Americans the Freedom to Drive Less* (35), carsharing, bikesharing, ridesharing, and taxi hailing and TNCs are discussed. The report defines carsharing as enabling *"subscribers to access cars located in their neighborhoods and on their college campuses, providing participants with the mobility benefits of access to a car without having to bear the burden of owning one."* Ridesharing is defined as, *"pair ordinary people with open seats in their cars with individuals who need a ride."* Taxi hailing and TNCs were described as arranging *"rides with ordinary drivers…via smartphone."* An interesting carsharing statistic provided is the following:

> *"Each carsharing vehicle replaces nine to 13 privately-owned vehicles, and the average carsharing participant reduces his or her driving by 27 to 56 percent. About 25 percent of carsharing participants sell a vehicle after joining while another 25 percent forgo vehicle purchases they otherwise would have made."*

Dutzik et al. (35) also state,

> *"The cumulative impact of new transportation services on vehicle ownership likely exceeds that of the individual services."*

Another important point made in the document was the **need of the non-transportation infrastructure to support technology-enabled transportation**. They stated,

*"Local and state governments should expand access to technology-enabled services to areas beyond the major cities in which they have taken root, surmount economic and other barriers to the use of those alternatives, and explore the potential uses of Internet and mobile communications technologies in expanding access to high-quality public transportation in areas that currently do not have the population density to sustain such service."*

Dutzik et al. (35) note that young Americans are the first to adopt new technologies (TABLE 1).

**Table 1: Changes in Adoption of New Technologies, from 2000 to 2012 (35)**

| | **Internet** | **Broadband** | **Cell phone** | **Smartphone** |
|---|---|---|---|---|
| **2000** | 46% | 5% | 53% | 0% |
| **2012** | 82% | 72% | 88% | 46% |
| **% Increase** | 78.3% | 1340% | 66.0% | undefined |

Dutzik et al. (35) defined the *"sharing economy"* as *"an economic model based on sharing, swapping, bartering, trading or renting access to products as opposed to ownership."*

Dutzik et al. talk about how technology allows the user to compare offers and the importance that users of these technology put in protecting *"their online reputations."* Another important point made by the authors is that, *"Industries that had seemed invulnerable little more than a decade ago…have had their **business models upended**."*

The document also cited, *"A study of the inclusion of wi-fi on Amtrak trains in California's Capital Corridor estimated that the addition of the service increased the number of trips by 2.7 percent, with the greatest impact on new riders."* In particular, Dutzik et al. noted that it allows people to multi-task, where they can both travel to their destination while getting some work done.

Dutzik et al. (35) suggest that technology-enabled transportation services *"may expand access to non-driving alternatives to groups of people who do not currently have access to them by making those alternatives less expensive, more efficient or both."*

Dutzik et al. (35) also talked about the importance of radio frequency identification (RFID) cards. These allow access to shared vehicles without the presence of a person.

Two types of carsharing were identified: fleet-based services and peer-to-peer networks. Fleet-based carsharing can be round-trip or one-way. The one-way service requires that the users keep the vehicle within a defined zone. Peer-to-peer was defined as, *"match ordinary individuals interested in renting their cars with willing renters."* The company overseeing the peer-to-peer renting of the vehicle serves as "matchmaker," independent insurance agent, and 24-hour roadside support. The company also ensures the safety of the vehicle or users and pre-screens renters.

*"Transit agencies were surprised as software developers who were riders began requesting data and creating web-based tools."* Dutzik et al. highlighted the application, iNap, which allowed a college student to sleep on the bus, with the application alerting the user when the desired stop approaches.

*"…the biggest payoff may turn out to be in less populated areas."* As an example, they noted that, ***"benefits of real-time arrival information are likely to be greater for riders of rural transit systems, which experience less-frequent service, than for users of urban systems."*** They continued with, *"Transit agencies that support ridesharing, for example, often do so to provide some measure of service to outlying areas that may not be dense enough to support fixed-route transit service."*

Dutzik et al. specifically noted that carsharing and ridesharing can *"reduce demand for expensive and space-consuming parking lots and structures."*

Dutzik et al. noted that technology-enabled transportation services are typically launched in *"wealthy cities"* where they have *"dense populations of 'early adopters.'"* They noted that a challenge to many may be a working **credit card or bank account**.

As discussed earlier with the Needles Carshare example, the program was set-up so that someone without a bank account could use it. This was further discussed by Shrikant (20) and Mohaddes and Sweatman (19), and again by Dutzik et al. (35).

## 3.8. Technology in Place of a Trip

An article in The Chronicle of Higher Education, *Rising Cost of Gasoline Pinches Students at Rural Community Colleges* (36), discusses the significant distances that some students commute to and from their community college in rural areas. Sander identifies few solutions to the problem, other than online courses and block scheduling. One solution that was identified, but whose success or lack-there-of was not described, was at the University of New Mexico at Gallup. The university created a *"giant map of the college's service area,"* which was posted in a central area of the college to encourage students to rideshare. (Note: The employee who identified this program is no longer with the University of New Mexico; therefore, no additional information regarding the current status of the program could be determined.)

## 3.9. Summary of Literature Review

This section discussed mobility options in terms of: 1) car sharing, 2) rideshare, 3) transportation network companies, 4) mobility as a service, 5) shared mobility, 6) microtransit, 7) a combination of the above, and 8) technology in place of a trip. However, at least two of the solutions that were tried in rural areas (Liberty Now and Lawrence OnBoard (a.k.a. CarmaHop)) no longer exist.

More than eighty percent of carsharing occurs in the twenty-five largest U.S. cities. From a rural mobility standpoint, the question then becomes, has carsharing just not considered small urban and rural areas, or do aspects like population density truly influence the ability to provide this mobility option in such a context. The fact that Needles Carshare, deployed in 2016, is still in operation today, suggests that population density is not as much of an issue as previously considered. Instead, insurance was identified as an issue for many of the mobility options (e.g. carsharing) ( (2), (14), and (35)), and also for those that have been in existence and are vital to small urban and rural areas (e.g. volunteer drivers), in part because of the implications of the new mobility options (e.g. TNCs). Furthermore, cash versus cash-less transactions seem to be a dividing line.

Volunteer driver programs rely heavily on social altruism to attract and retain enough drivers to provide rides. However, as noted by Mohaddes and Sweatman (19), the costs associated with a human driver are the most expensive aspect of non-private mobility options like TNCs. Therefore,

there is likely not an end in sight regarding the limited number of drivers for volunteer rideshare being outstripped by ride demand.

Definitions of rideshare varied, sometimes depending on the number of people riding in a car or van. Ridesharing specific to rural and small urban areas was sometimes called "unorganized ridesharing." It was also typically described as being associated with rides given between family, friends, colleagues and neighbors (e.g. people who may expect to know one another), but this was also reported as the challenge with scalability, in that inefficient communication between needs for a ride and an available driver limited the use ( (7), (8)).

Two articles ( (10), (12)) noted that the lack of public transportation in rural areas is one of the driving forces behind many of the concepts and services that were implemented as a pilot, suggesting that there is a significant need that may be inhibiting the ability of small urban and rural areas to achieve economic well-being without transportation solutions. Rural Rides (12) is a specific example of a service developed to get people to work, thereby supporting the economic well-being of the region. Douma (14) also highlighted the benefits of volunteer ridesharing programs in supporting work opportunities.

An interesting point made by Dutzik et al. (35) is the impact, not of the individual technology enabled services (e.g. TNCs, bikeshare, carshare), but the "cumulative" effect of these services on vehicle ownership. Yet, this highlights the concept of creating ***redundancy*** **in the transportation system**. What happens to a family or person if their vehicle breaks down, they cannot afford a repair, and they have no access to another vehicle? This is a problem that is particularly relevant to rural areas.

An interesting aspect of the "sharing economy," most enthusiastically adopted by the younger generations, is that it essentially allows those who cannot own something to still enjoy a service (e.g. a vehicle, a place to rent, etc.) even if they cannot afford to purchase it themselves. Another benefit is that is removes the need to perform maintenance.

While Lawrence OnBoard (10) addressed some needs, it had several notable limitations. For example, by restricting the system from operating after dark, potential usage will be limited during the winter months when days are short. There was no discussion of addressing the needs of persons with disabilities. Furthermore, while a person could make an intercity trip, one-way, it was not clear how this person expected to return. It was interesting that ultimately, O'Brien (11) concluded that the system's business model was not sustainable (supported by the ending of the program).

The benefits described by O'Brien suggest that to some degree, the sharing economy offers an opportunity to re-find human connections that have been replaced by technology.

Scarcely talked about in the literature is the impact of the sharing economy when the younger generations begin to have children, who have more stringent and often cumbersome transportation requirements (e.g. car seats, riding in the back of a vehicle) ( (9), (10), (12), (30)). Will these generations then abandon sharing of vehicles, leaving it to the next generation of "young people," but still resulting in an overall reduction in the need for vehicles? Will they readopt these technologies once the children become large enough to ride without additional restrictions?

To date, it seems that rural areas have been overlooked in research studies to better understand the opportunities and barriers related to shared mobility. One paper stated "*Those located in sparsely populated rural areas which appeared to have very low use, were excluded;"* yet the same paper later acknowledged that in the early rideshare programs, only six matches in large urban areas were

made for a specific rideshare program. This suggests that just like the urban area, rather than completely abandoning the concept, there is a need to learn more about how to use tools to create mobility for small urban and rural residents.

Based on all of the literature reviewed, it seems like there could be problems with the cashless payment in rural areas with limited communications coverage. For example, poor signal reception may lead to the inaccurate calculation of the cost of the trip. It is also unclear if there is any difficulty in transferring cashless payments if the cell phone does not have reception.

In one regard, introducing TNCs to a rural area may be easier than in urban areas. In urban areas, there can be resistance to TNCs, because they are considered to be in conflict with taxicabs. However, many rural areas have limited if any taxicab service, so this should be less of a problem and TNCs could potentially fill a much-needed gap.

Rural areas still have a high occurrence of crashes resulting from driving under the influence. Could the success of reducing impaired driving in the urban areas be transferred to the success of TNCs or ridesharing in the rural areas? If so, ridesharing has the potential to enhance not only the mobility needs of rural areas, but also safety.

As identified by sources in the literature review, shared mobility solutions can assist with addressing deficiencies in public infrastructure. There is a definite need to address these types of deficiencies in the rural context, where public transportation systems may not exist. Long miles and the relative high cost of owning and operating a private vehicle limit many rural residents' ability to get to jobs, perform necessary shopping and get to doctor's appointments.

One might wonder if shared mobility is the precursor to the introduction and acceptance of autonomous vehicles, as users are becoming more accustomed to not having their own vehicles and using technology that will allow them to get around.

# 4. SURVEY OF LOCAL AGENCY VIEWPOINTS ON RIDESHARE

In the process of reviewing the literature, the researcher observed that little was known about the perspective of local agencies regarding rideshare. Therefore, a short survey was conducted to better understand the opportunities and challenges that local agencies face when rideshare exists within their jurisdiction.

The researcher identified a list of 547 localities served by Lyft, a transportation network company (TNC) (1). (Note: TNCs are commonly referred to as rideshare by the general population ( (13), (15), (16)). Within the transportation industry, transportation network company is becoming the preferred term. However, at the time of this research, "rideshare" was used in the survey. Therefore, both terms are used in this document.) Researchers were able to identify contact information for **185** (33.8%) of these communities, a list of which can be found in the Appendix. While the focus was on small communities, the survey was emailed to some larger communities as well with the hope of being able to provide a comparison.

In total, **sixty-three** records (34% of 185) were identified within the collected data. The information contained within each record, however, ranged anywhere no information (someone who answered no questions) to a fully completed survey.

The surveys were collected from July 18, 2017 through September 20, 2017. One entity entered the survey, identified the name of the community, but provided no further information. There was a duplicate entry from one community in Alabama; it was removed as only one contained information. A total of **forty-six** surveys (24.9%) were originally retained; however, there were duplicates from Casa Grande, AZ and the City of Sonoma, CA. Yet, because the responses regarding the description of the city, town or municipality were consistent, both answers were retained, as the information from both parties complemented each other. There was no contradiction in the content.

The following **six** questions were asked of respondents who provided information for the survey (full survey can be found in the Appendix):

1. What is the name of the city, town or municipality that you represent?
2. Which of the following best describes the city, town or municipality that you represent?
    a. Big, dense city
    b. Big-city suburb
    c. Lower-density city
    d. Suburb of lower-density city
    e. Small city
    f. Small town
    g. Outlying rural area
3. To the best of your knowledge, what ridesharing opportunities currently operate within the agency's jurisdiction?
4. What do you see as **challenges** to rideshare within your agency's jurisdiction?
5. What do you see as **benefits** to rideshare within your agency's jurisdiction?
6. Please provide any other comments that you feel need to be considered regarding ridesharing operating within your agency's jurisdiction.

## 4.1. Agencies Represented & Self-Identified Community Size

Figure 2 shows the geographical location of responses along with groupings of the community size. With the exception of Arizona, the majority of the responses were from the east and west coast. Table 2, in the Appendix, identifies the communities that responded to the survey, their Census 2010 Total Population (37) (where available), and the community self-identified qualitative size category.


**Figure 2: Geographical Location of Responses & Community Size**

The researcher compared the qualitative categories assigned by respondents to the U.S. Census Bureau's 2010 data to see how well they correlated (Figure 3).

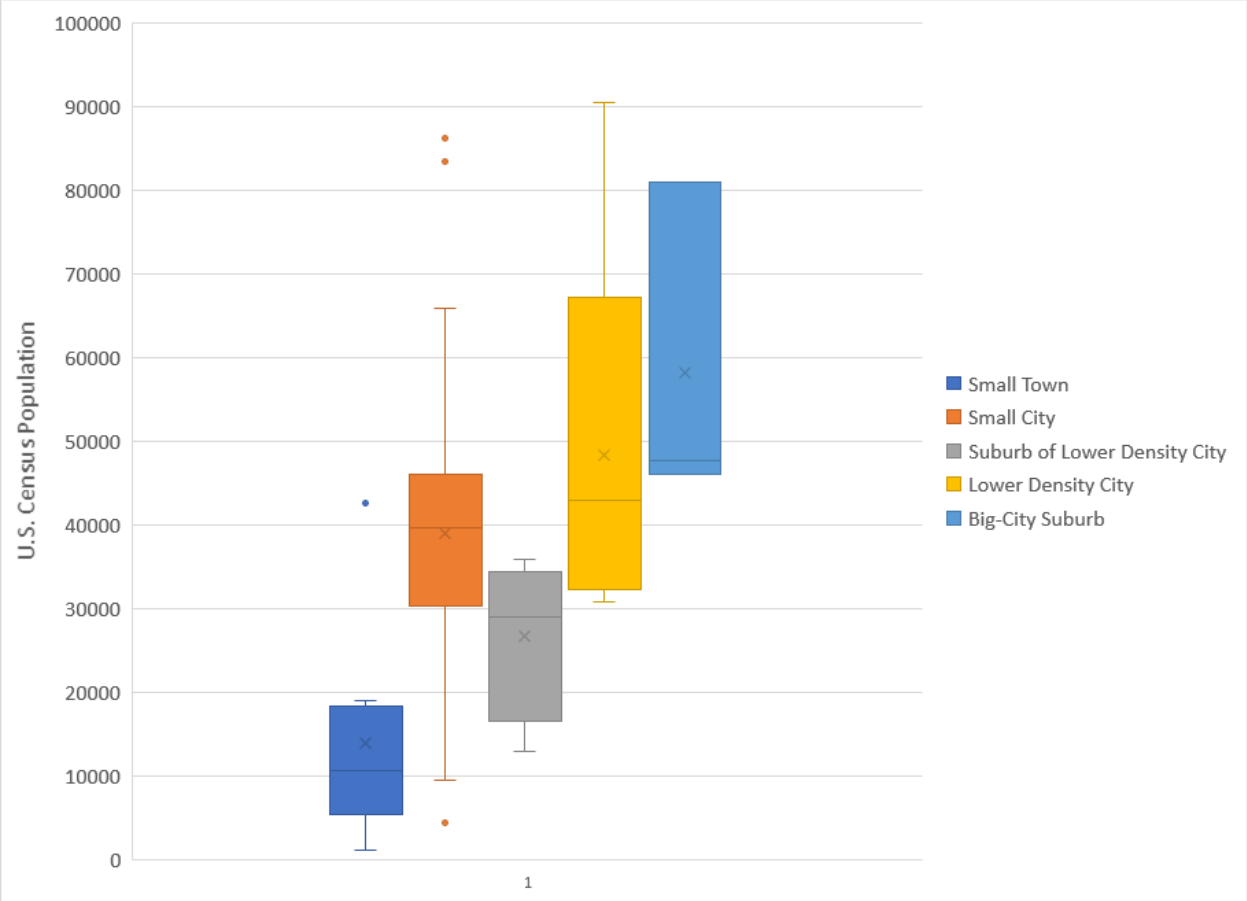



**Figure 3: Qualitative Self-Identified Community Size vs. 2010 U.S. Census Population**

Most of the communities, as expected, chose the following two categories: Small Town and Small City. With the exception of the category, Suburb of Lower Density City, overall survey respondents reported qualitative categories that generally matched the population sizes of their communities as shown by the bars moving up the y-axis when moving from left to right.

## 4.2. Operating Agencies

Eighteen (39.1%) and fifteen (32.6%) entities indicated that Uber and Lyft, respectively, operated within their jurisdiction. Seven entities (15.2%) reported no rideshare providers and three entities (6.5%) reported that the number was unknown. Note that while the list used to identify local agencies for the survey was taken from the Lyft website, a TNC, the fact that only about thirty to forty percent of responses identified Uber and Lyft indicated that either: 1) the information on the website was not up-to-date, 2) local agencies were unaware of their operation, or 3) the respondent did not view TNCs as rideshare.

Additional rideshare providers identified by survey respondents include:

1. Joyride (City of Tuscaloosa, AL);
2. Foothills Caring Corps (Cave Creek, AZ);
3. Valley Metro Rideshare (Apache Junction, AZ);
4. van pooling (Casa Grande, AZ);
5. Scoop and Desoto Cab (City of Dublin, CA);
6. Scoop (Menlo Park, CA);
7. select private entities (Chico, CA);
8. ctrides (New London, CT);
9. van pooling (City of Post Falls; ID);
10. taxi service (Pittsfield, MA);
11. rideshare (Barnstable County, MA);
12. MAX Transit bus (City of Holland, MI);
13. island transit buses (Galveston, TX);
14. feasibility of micro-transit (Park City; UT);
15. New River Valley Regional Commission (Town of Blacksburg, VA); and
16. Teton Rideshare (Jackson, WY).

## 4.3. Challenges

Survey respondents were asked what they saw as **challenges** to rideshare within their agency's jurisdiction. Most of the responses focused on challenges associated with **low population density, competition with other modes, safety, equity, congestion, convenience, coordination**, and a few other less frequently identified challenges. These response categories are described in the sections that follow, and selected quotes from some of the responses are included as illustrative examples.

### *Low Population Density*

Many entities, particularly those that have a very small population (e.g. 5,500), identified population density as a challenge to rideshare.

> *"We are at too low of a density to make [the] connection worthwhile economically."*

One respondent even suggested that bicycling was a better alternative because of the small size of the community (e.g. 2 square miles). It was suggested that those commuting to their place of employment out-of-town may benefit from ridesharing. However, another respondent suggested that because of "dispersed" housing, coordinating the commute to the place of employment would be difficult.

### *Competition with Other Modes*

A few survey respondents recognized the inherent competition between rideshare and both transit and private vehicles.

For transit, one entity noted that it has a transit system. Yet, this seems to overlook the different in-service provisions that rideshare entities offer in comparison to transit. However, one respondent seemed to narrow in on the difference in service provisions with: "*hour head-ways…discourages commuters from relying on the bus system.*" Another survey respondent noted

the challenge with integrating the rideshare providers with transit, in that there is a need to identify staging areas where vehicles can drop off and pick-up passengers to provide connections to the first and last mile of a traveler's trip. Another respondent identified the lack of existing transit as a problem, potentially suggesting that ridesharing could be developed to serve as a proxy for a transit system. Another respondent noted that an existing private company shuttle service already provides rides to potential rideshare and public transit users.

Several survey respondents compared the challenges of ridesharing with the private vehicle. One zeroed in on the lack of interest by affluent citizens in participating in a *"carpool with 'strangers.'"* Another suggested that rideshare could not compete with the *"autonomy of a private vehicle."* Along these lines, one survey respondent noted that since parking was free and very accessible, it makes rideshare unappealing. A survey respondent noted:

*"Auto-oriented nature of the business does not promote walkable, livable neighborhoods."*

### *Safety*

Three different survey respondents stated safety concerns, which were primarily related to the comparison of taxi providers to those of rideshare vehicles. An example follows:

*"By state law, commercial passenger vehicle regulations which apply to taxis do not apply to rideshare vehicles, raising both fairness and safety questions."*

### *Equity*

There are two perspectives regarding equity that were highlighted by survey respondents. The first is ensuring equity of service when considering those with disabilities or lower income residents. Rideshare, if thought of in terms of TNCs, is often expensive and therefore may be out-of-reach to lower income households in a community. Rideshare providers are also less likely (if at all) to be able to accommodate those needing a wheelchair. The second perspective is related to the limited number of choices of rideshare providers. However, the number of providers is generally changing over time (e.g. the bankruptcy of Liberty) and the locations where some provide service (e.g. Lyft and Uber) are changing. Somewhat related to equity is the target audience for the service: the local population or tourists to the area. The following sentiment sums up the equity challenges when comparing rideshare providers and taxi services:

*"…we see far more benefits than challenges aside from the political challenges we will no doubt face from the taxi/for-hire transportation industry."*

### *Congestion*

Two survey respondents suggested that congestion in their community can make ridesharing challenging. One survey respondent stated:

*"…road can take 30 min to travel 2 miles during certain rush times."*

Another respondent suggested that during a special event, rideshare providers who come from other states to accommodate traveling needs of visitors cause congestion because there is no limit to the number of rideshare operators within the jurisdiction.

***Convenience***

Several respondents suggested that rideshare is less convenient than a personal vehicle, noting challenges such as flexible work schedules versus set work schedules, the need to travel during the day to meetings outside of the office (where a vehicle is not provided by the employer), the requirements of a caregiver (e.g. mom or dad) in dropping off a child at school or leaving for an emergency, and the desire to trip chain where supplies for a subsequent activity are stored within the vehicle (e.g. skis/bikes can be stored on/in the vehicle for direct access after work). One survey respondent summed it up well:

*"complexity of people's lives to be willing to give up the schedule flexibility that a personal vehicle provides."*

***Coordination***

The lack of ability to coordinate schedules was identified as a challenge to rideshare. One person put it in terms of the lack of *"centralized coordination,"* in that *"commuters are going in multiple directions."* However, another survey respondent suggested that rideshare is problematic because residents only commute out-of-town.

***Other***

Survey respondents also identified the following as challenges to rideshare for their agency: staff limitations for managing such a program, public awareness of the transportation option, infrastructure (like whether parking lots near freeway exist to serve as meeting places for carpools), weather, and limitations associated with transporting items (e.g. carrying sports equipment). A survey respondent highlighted these and other challenges with the following:

*"Some of the barriers include staggered work schedules, limited availability of all-wheel drive vehicles needed for our winter weather conditions (average snowfall per winter is 16ft with record snowfall of 50ft), and lack of park and ride facilities."*

***Summary***

Low population density, competition with other modes, safety, equity, congestion, convenience, and coordination were the main themes identified by survey respondents as challenges to rideshare for their community. However, some of the responses, particularly those associated with coordination, seem to contradict one another. Convenience, related to being able to drop off and pick-up children at daycare, particularly if they are sick, was also identified as a challenge for the Rural Rides system in northeastern Minnesota (12). Safety is a challenge expressed by more dense communities as well. Surprisingly, none of the respondents mentioned the lack of cell phone coverage in rural areas as a safety concern (even though it is assumed to be a way to call for help if needed). However, this could potentially reflect a reduced dependence on cell coverage in rural areas as reception can be spotty.

## 4.4. Benefits

Survey respondents were asked what they saw as **benefits** to rideshare within their agency's jurisdiction. Benefits identified by survey respondents fell into the following categories: congestion, environmental, equity, increased mobility options, parking, social, decreased transportation costs, and convenience.

### *Congestion*

Many survey respondents suggested that ridesharing would reduce congestion by reducing the traffic volume. One survey respondent then linked the reduction in traffic to reducing the need to widen roadways. Another survey respondent saw the benefits of providing additional commuting options to nearby towns and cities often to connect to places of employment, and to address congestion during large events.

### *Environmental*

The second most often cited benefit by survey respondents related to environmental benefits. Air quality improvements, a reduction in greenhouse gases (as implied by fewer emissions), fewer carbon emissions, ecological benefits, and promoting sustainability were all cited by survey respondents.

### *Equity*

Equity was cited from several vantage points. At least one survey respondent stated that those who cannot drive will benefit from rideshare. Another talked about the affordability of getting to a place of employment, because the cost of owning and operating a private automobile was often out-of-reach. Another survey respondent cited the mobility need for international students without a vehicle. Two quotes from different survey respondents that more fully reflect these sentiments are below:

*"Our public transit system serves mostly low-income residents. The system is not terribly useful to anyone else and is barely useful to the main service population. A meaningful rideshare program may be a better benefit than expanding the public bus system."*

*"The average age in [our community] is 54, 62 in [another community]. Often people bring their elderly parents to [the state] to live, then go to work, thereby stranding their parents. We are encouraging "attainable" housing in our commercial Core so that the millennials and less affluent workers can at least walk or bike to work and shopping. At present, the above are commuting 30-40 minutes."*

### *Increased Mobility Options*

Overall, comments related to this category focused on how rideshare would help provide a diversity of mobility options. Several survey respondents reported seeing rideshare as increasing

mobility options for their community, with some specifically citing the present lack of public transportation options. In at least one comment, this was particularly noted in reference to taxis: it was suggested that the limited use of them makes it unappealing for anyone to operate such a business in that community. Another survey respondent noted that residents are drawn to communities located in different directions and suggested that rideshare serving each of these destinations could be a potential solution. The following quote from a survey respondent highlighted the link between increased mobility options and parking (discussed in the next section):

*"As a municipality, we see rideshare programs as a solution of the "first mile/last mile" barrier and a means to address parking demands in our Historic Old Town District where available land is extremely limited and valuable. As a resort town, we also view ridesharing [as] a solution to addressing parking at the bases of the ski resorts. Additionally, we also see ridesharing as an alternative for visitor[s] that choose not to bring a car or if they do, that we can promote a "park once" philosophy."*

### *Parking*

Many survey respondents cited a reduced need for parking as a benefit of rideshare. This was at both transit stations and at places of employment. Many tied the desire to reduce parking needs to that of *"making more land available for a higher and better use."*

One survey respondent tied the reduction in a need for parking to creating equity between affluent residents and workers:

*"We are in the process of implementing paid parking in the Old Town area of [the community] and we also see this as an alternative to service industry workers that may disproportionately [be] impacted by paid parking as opposed to the more affluent resident or commuter that may not be financially impacted by paid parking."*

### *Social*

A few survey respondents suggested that ridesharing would create an option to socialize. One survey respondent even suggested the following:

*"A benefit would be spending time with co-workers."*

### *Reduced Transportation Costs*

A few survey respondents cited some form of reduced transportation costs as a benefit. One suggested that creating competition with taxi services would drive down prices. Another suggested a general reduction in the portion of a person's budget devoted to transportation costs. One survey respondent specifically cited a reduction in the cost of operation and ownership of a vehicle.

***Convenience***

A few survey respondents cited convenience as a benefit of rideshare. It was suggested that routes and/or schedules could be more easily modified than transit, thereby making rideshare more convenient. And one person suggested convenience in terms of reduced stress by sharing the driving responsibilities.

***Summary***

Comments by survey respondents suggested that a reduction in congestion, an improved environment, an increase in equity, an increase in mobility options, a reduced need for more parking, increased socialization, a decrease in transportation costs, and convenience are potential benefits that they would envision or already have observed as a result of rideshare being present in their communities. As identified under increased mobility options, the ability to coordinate ride needs between those traveling to small towns was a benefit also cited by O'Brien and Dunning (10) for the Lawrence OnBoard rideshare system. An increase in mobility options was also identified as a benefit for the Rural Rides system in Minnesota (12). The two most commonly cited benefits, congestion reduction and improved environment, are not necessarily consistent with existing literature. Several studies ( (5), (6), (15), (33)) suggest that while rideshare may provide congestion and environmental benefits (if the combined trips do not increase out-of-the-way miles), TNC operators may be contributing to an increase in both congestion and emissions. Regarding social benefits, it was interesting that no one identified the potential benefits from addressing driving under the influence (38), considering that there are suggestions that it can be more of an issue in rural areas (39).

## 4.5. Other General Comments Offered

Several survey respondents provided general comments, which are summarized within this section. In addition, some of the feedback, particularly within the benefits section, could be less categorized as benefits and more as suggestions or ideas on how to make rideshare successful. These were integrated into the general comments offered.

Two of the general comments noted the challenges of weather for their area, with one respondent providing the following details, *"limited availability of all-wheel drive vehicles needed for our winter weather conditions (average snowfall per winter is 16ft with record snowfall of 50ft)."*

A few comments directly related to public transportation, with three almost contradictory viewpoints. One seemed to suggest that since the community had a transit system, sufficient mobility options existed and ridesharing was not necessary. In contrast, another comment noted a public transit system that served low-income individuals but indicated that the service provisions for the system were undesirable, even to these primary users. As a result, this respondent thought that rideshare may be a better solution. A third respondent expressed concerns over the "cannibalization" that rideshare systems have on otherwise transit users.

The remaining comments talked about incentivization, lack of success of previous rideshare programs, land use, diversity of transportation options, conflict between rideshare and current providers, use applications, marketing, implications on after-work activities, and learning. They are as follows:

1. *Need to find a way to **incentivize** (preferred parking, acknowledgement, $, etc.)*
2. *Other vanpooling/carpooling options have been explored but have **not been successful** or gained momentum.*
3. *What **land uses** are in the general vicinity and the interaction between the riders and the built (existing or future) environment.*
4. *Overall, the City and region would benefit from **diversity** in transportation options.*
5. *Do not underestimate the **push back** a jurisdiction will experience from the for hire/taxi industry.*
6. *…such a program/service should have a very easy to use and **dynamic app.** for ride booking/reservations.*
7. *More **marketing** might help such as profiles on individuals to show cost savings, ways they accommodate their lifestyle into ride sharing*
8. *For small communities with big **recreational opportunities**, rideshares are difficult to implement. People drive because they can put their skis/bikes in their car and go play directly after work.*
9. *We are interested in **learning** how we can integrate this more into our community. We would love some direction.*

## 4.6. Summary

The researcher wanted to better understand *challenges* and *benefits* of rideshare in small communities, from the viewpoint of the local agency. A list of locations where the TNC operator Lyft (often commonly referred to as a rideshare provider) offers service was pulled from its website. Of the 547 communities that were identified, the researcher was able to identify contact information for 185, typically focusing on smaller communities. A survey was sent to these agencies, and while sixty-three impressions were made, only forty-six viable responses were obtained. From these responses, it was found that the local agency's qualitative viewpoint of its agency matched well with its quantitative size, as determined using U.S. Census population data. Just over thirty percent of respondents identified Lyft as operating within their jurisdiction. It is unclear whether those not identifying Lyft within their community either did not know of its presence, do not view Lyft as a rideshare operator, or if there was another reason (e.g. service has since ceased).

The challenges and benefits offered by survey respondents in some cases overlapped (e.g. congestion, equity and convenience). However, there were also several differences. Overall, there were more clear categories of challenges than benefits. Categories of clear challenges included: low population density, competition with other modes, safety, and coordination. Clear benefit categories included: environment, increased mobility, parking, and decreased transportation costs.

# 5. CONCLUSIONS & RECOMMENDATIONS

There are examples of mobility options that go beyond the private vehicle ownership model that have been successful in small urban and rural areas (Needles Carshare); there are also many examples of failures (LibertyNow, Lawrence Rideshare). However, in order to better understand and provide a framework for successful implementations, more experimentation is desperately needed. Furthermore, some of the more recent micromobility options (e.g. scooters) that are growing in popularity in the urban areas have, to the author's knowledge, had limited implementations in a small urban or rural context, with Bozeman, Montana being one such example. This section summarizes some of the findings from the literature review and survey.

As discussed in the literature, insurance proved to be a problem for entities attempting to enter the carsharing business. This may suggest that when considering small and rural communities, the scale of such communities may make implementation of new mobility options in the rural context problematic, as the cost of insurance may prohibit some otherwise good opportunities from flourishing.

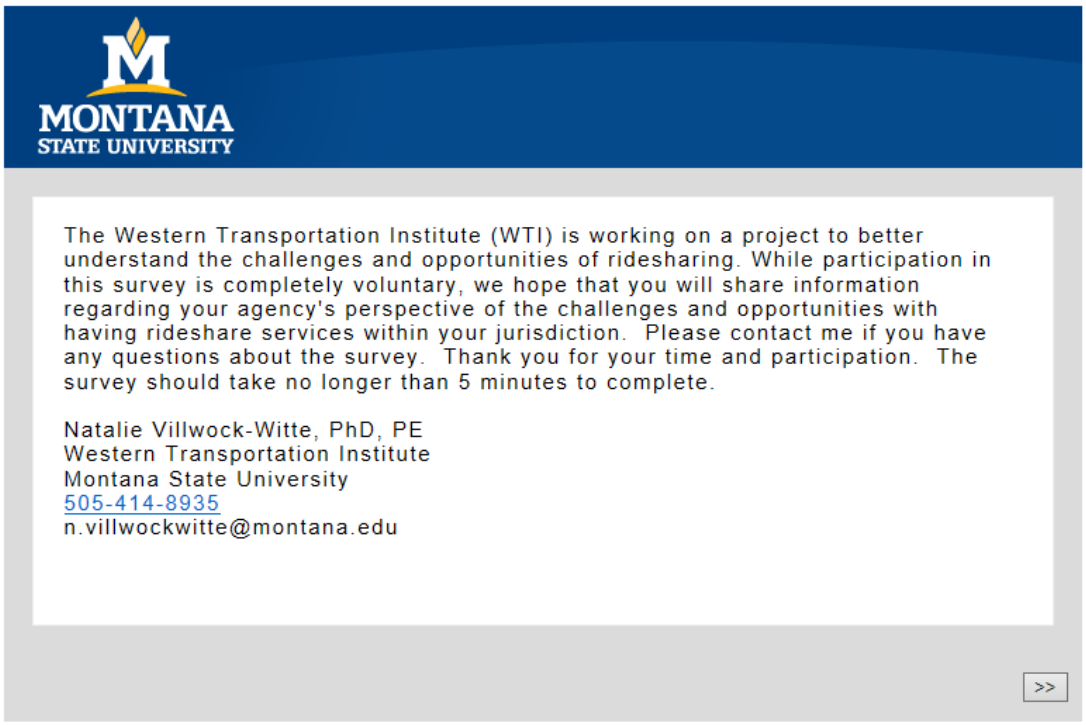
Many cite low ridership potentials in rural areas as reasons for not operating in small urban and more rural environments. Yet, as identified by Chan and Shaheen, early rideshare programs in urban areas were plagued with low ridership. In comparison, today, with technological advances (e.g. the smartphone), these programs have evolved into arguably successful transportation network companies. Therefore, it can be argued that it is not the population density that is the program, rather, it is the lack of experimentation with mobility solutions like rideshare that is the impediment. Chan and Shaheen, as an example, specifically noted excluding rural rideshare examples in their analysis.

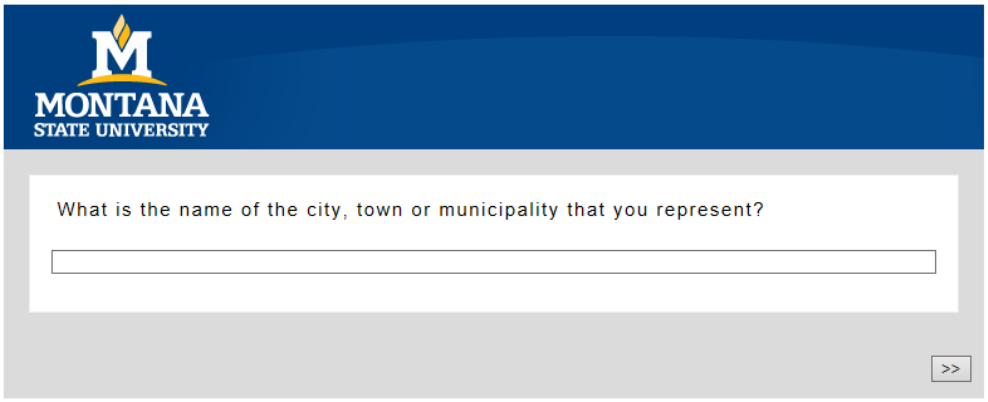
Communication between riders and ride providers, enabled through technology, has made transportation network companies successful. Yet, this in-and-of-itself is a big hurdle in rural America, where cell phone reception that would enable this communication to occur is inconsistent at best. Furuhata et al. (7) suggested a limit to scalability as a result of the lack of communication. Improvements are needed and would benefit more than just transportation options.

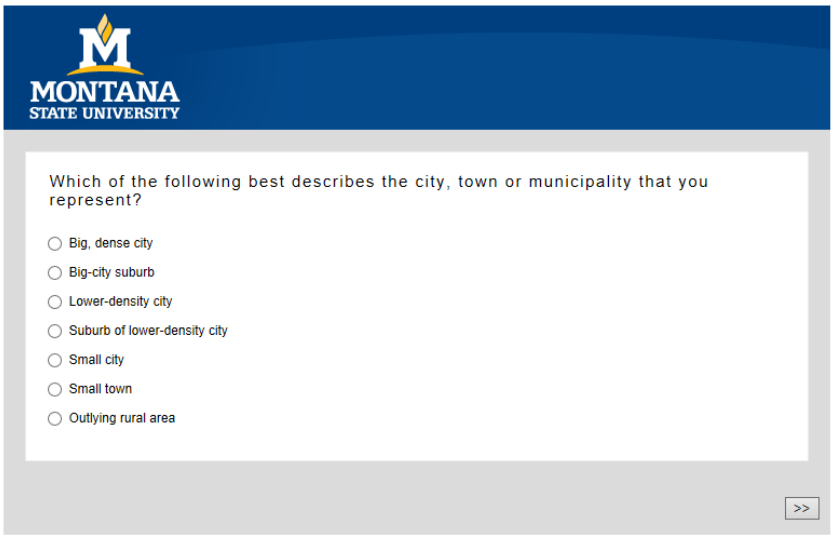
Survey respondents identified examples of new mobility options. Case studies should be developed to provide a record of characteristics of these systems and other considerations regarding implementation.

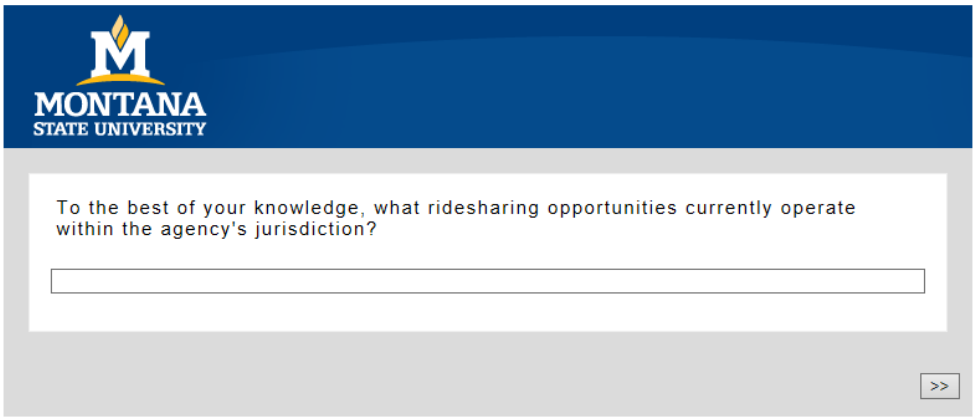
Therefore, the author recommends: 1) more experimentation of new mobility options in small urban and rural areas, 2) an improvement in communications networks in small urban and rural areas, and 3) case studies of new mobility options in rural areas.

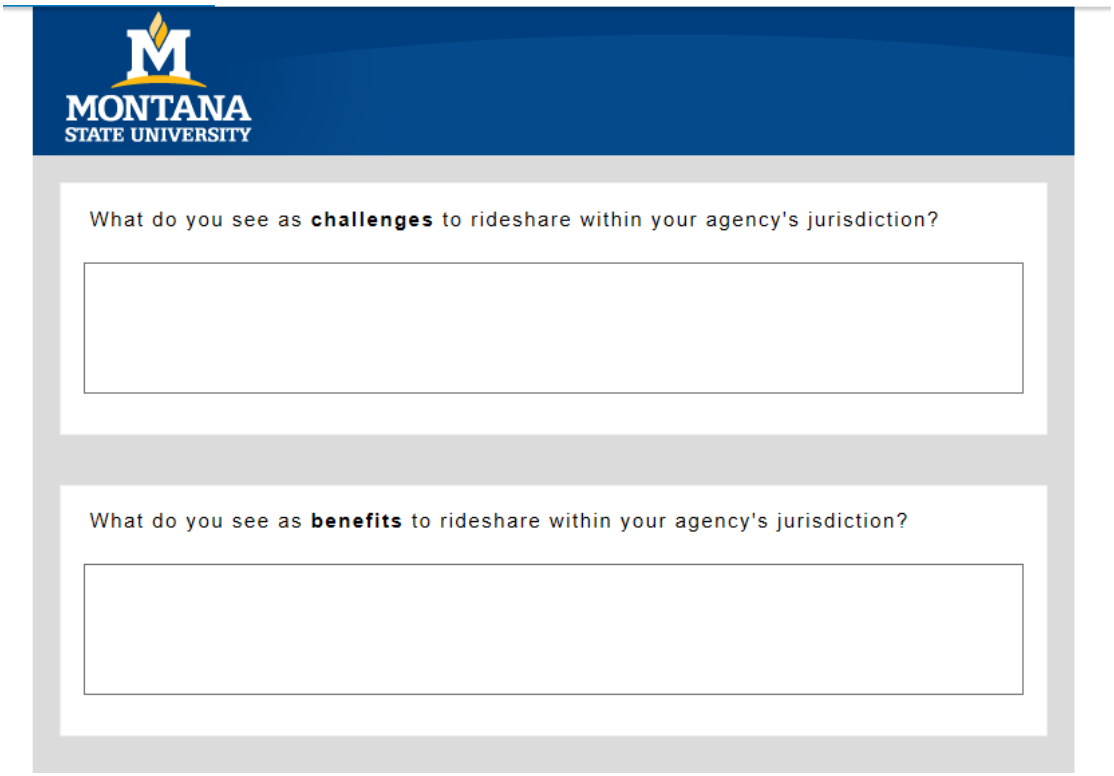
# 6. APPENDIX

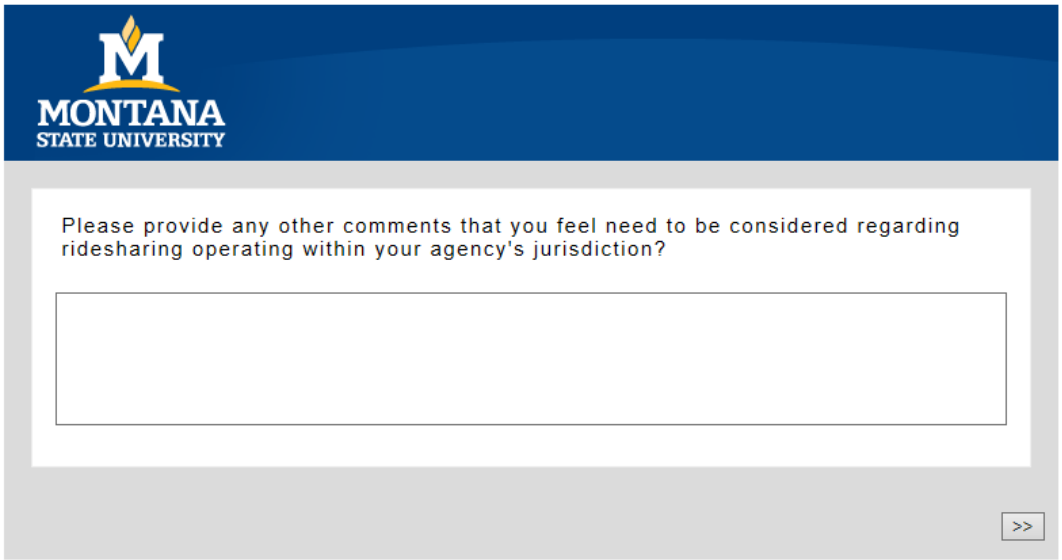

MONTANA
STATE UNIVERSITY
The Western Transportation Institute (WTI) is working on a project to better understand the challenges and opportunities of ridesharing. While participation in this survey is completely voluntary, we hope that you will share information regarding your agency's perspective of the challenges and opportunities with having rideshare services within your jurisdiction. Please contact me if you have any questions about the survey. Thank you for your time and participation. The survey should take no longer than 5 minutes to complete.
Natalie Villwock-Witte, PhD, PE
Western Transportation Institute
Montana State University
505-414-8935
n.villwockwitte@montana.edu
>>


MONTANA
STATE UNIVERSITY
What is the name of the city, town or municipality that you represent?
>>


MONTANA
STATE UNIVERSITY
Which of the following best describes the city, town or municipality that you represent?
Big, dense city
Big-city suburb
Lower-density city
Suburb of lower-density city
Small city
Small town
Outlying rural area
>>


MONTANA
STATE UNIVERSITY
To the best of your knowledge, what ridesharing opportunities currently operate within the agency's jurisdiction?
>>


MONTANA
STATE UNIVERSITY
What do you see as **challenges** to rideshare within your agency's jurisdiction?
What do you see as **benefits** to rideshare within your agency's jurisdiction?


MONTANA
STATE UNIVERSITY
Please provide any other comments that you feel need to be considered regarding ridesharing operating within your agency's jurisdiction?
>>

Communities with Contact Information & Their Population Size

| # | State | Community | Population |
|---|---|---|---|
| 1 | Alabama | Alabaster | 30,352 |
| 2 | | Auburn | 53,380 |
| 3 | | Tuscaloosa | 90,468 |
| 4 | Alaska | Fairbanks | 31,535 |
| 5 | | Juneau | 31,275 |
| 6 | Arizona | Anthem | 21,700 |
| 7 | | Apache Junction | 35,840 |
| 8 | | Casa Grande | 48,571 |
| 9 | | Cave Creek | 5,015 |
| 10 | | Flagstaff | 65,870 |
| 11 | | Florence | 25,536 |
| 12 | | Fountain Hills | 22,489 |
| 13 | | Goodyear | 65,275 |
| 14 | | Kingman | 28,068 |
| 15 | | Maricopa | 43,482 |
| 16 | | Oro Valley | 41,011 |
| 17 | | Prescott | 39,843 |
| 18 | | Wickenburg | 6,363 |
| 19 | | Yuma | 93,064 |
| 20 | California | Chico | 86,187 |
| 21 | | Cupertino | 58,302 |
| 22 | | Davis | 65,622 |
| 23 | | Dublin | 46,036 |
| 24 | | El Centro | 42,598 |
| 25 | | Gilroy | 48,821 |
| 26 | | Healdsburg | 11,254 |
| 27 | | Laguna | n/a |
| 28 | | Lompoc | 42,434 |

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|---|---|---|---|
| 29 | | Los Banos | 35,972 |
| 30 | | Mill Valley | 13,903 |
| 31 | | Monterey | 27,810 |
| 32 | | Morgan Hill | 37,882 |
| 33 | | Palm Springs | 44,552 |
| 34 | | Palm Desert | 48,445 |
| 35 | | Menlo Park | 32,026 |
| 36 | | Poway | 47,811 |
| 37 | | San Luis Obispo | 45,119 |
| 38 | | Sonoma | 10,648 |
| 39 | | South Lake Tahoe | 21,403 |
| 40 | | Truckee | 16,180 |
| 41 | | Ventura | n/a |
| 42 | Connecticut | Danbury | 80,893 |
| 43 | | Greenwich | 12,942 |
| 44 | | Groton | 10,389 |
| 45 | | Litchfield | 1,258 |
| 46 | | Middletown | 47,648 |
| 47 | | New London | 27,620 |
| 48 | | New Milford | 6,523 |
| 49 | | Norwich | 40,493 |
| 50 | | Tolland | n/a |
| 51 | | Windham | n/a |
| 52 | Delaware | Dover | 36,047 |
| 53 | Florida | Boca Raton | 84,392 |
| 54 | | Bonita Springs | 43,914 |
| 55 | | Delray Beach | 68,217 |
| 56 | | Boynton Beach | n/a |
| 57 | | Bradenton | 49,546 |

| | | | |
|---|---|---|---|
| 58 | | Daytona Beach | 61,005 |
| 59 | | Fort Pierce | 41,590 |
| 60 | | Naples | 19,537 |
| 61 | | Ormond Beach | 38,137 |
| 62 | | Panama City | 36,484 |
| 63 | | Punta Gorda | 16,641 |
| 64 | | Titusville | 43,761 |
| 65 | | Venice | 20,748 |
| 66 | | Winter Haven | 33,874 |
| 67 | Georgia | Brunswick | 15,383 |
| 68 | | LaGrange | 29,588 |
| 69 | Hawaii | Honolulu | 337,256 |
| 70 | Idaho | Couer d'Alene | 44,137 |
| 71 | | Post Falls | 27,574 |
| 72 | Illinois | Kankakee | 27,537 |
| 73 | Kentucky | Bardstown | 11,700 |
| 74 | | Elizabethtown | 28,531 |
| 75 | Maine | Augusta | 19,136 |
| 76 | | Bangor | 33,039 |
| 77 | | Biddeford | 21,277 |
| 78 | | Freeport | 1,485 |
| 79 | | Lewistown | 36,592 |
| 80 | | Saco | 18,482 |
| 81 | Maryland | College Park | 30,413 |
| 82 | | Hagerstown | 39,662 |
| 83 | | Ocean City | 7,102 |
| 84 | | Salisbury | 30,343 |
| 85 | Massachusetts | Amherst | 19,065 |
| 86 | | Cape Cod | n/a |

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|---|---|---|---|
| 87 | | Holyoke | 39,880 |
| 88 | | Leominster | 40,759 |
| 89 | | Pittsfield | 44,737 |
| 90 | Michigan | Benton Harbor | 10,038 |
| 91 | | Detroit | 713,777 |
| 92 | | East Lansing | 48,579 |
| 93 | | Farmington Hills | 79,740 |
| 94 | | Flint | 102,434 |
| 95 | | Grand Haven | 10,412 |
| 96 | | Grand Rapids | 188,040 |
| 97 | | Holland | 33,051 |
| 98 | | Jackson | 33,534 |
| 99 | | Kalamazoo | 74,262 |
| 100 | | Lansing | 114,297 |
| 101 | | Midland | 41,863 |
| 102 | | Muskegon | 38,401 |
| 103 | | Saginaw | 51,508 |
| 104 | | South Haven | 4,403 |
| 105 | | Troy | 80,980 |
| 106 | | Warren | 134,056 |
| 107 | Minnesota | Mankato | 39,309 |
| 108 | Mississippi | Biloxi | 44,054 |
| 109 | | Hattiesburg | 45,989 |
| 110 | | Oxford | 18,916 |
| 111 | | Tupelo | 34,546 |
| 112 | | Branson | 10,520 |
| 113 | Missouri | Chesterfield | 47,484 |
| 114 | | Jefferson City | 43,079 |
| 115 | | Concord | 42,695 |

| | | | |
|---|---|---|---|
| 116 | New Hampshire | Derry | 22,015 |
| 117 | New Mexico | Gallup | 21,678 |
| 118 | | Taos | 5,716 |
| 119 | North Carolina | Asheville | 83,393 |
| 120 | | Cary | 135,234 |
| 121 | | Chapel Hill | 57,233 |
| 122 | | Charlotte | 731,424 |
| 123 | | Concord | 79,066 |
| 124 | | Durham | 228,330 |
| 125 | | Fayetteville | 200,564 |
| 126 | | Goldsboro | 36,437 |
| 127 | | Greensboro | 269,666 |
| 128 | | Greenville | 84,554 |
| 129 | | Hickory | 40,010 |
| 130 | | Huntersville | 46,773 |
| 131 | | Matthews | 27,198 |
| 132 | | Salisbury | 33,662 |
| 133 | Ohio | Marietta | 14,085 |
| 134 | Oklahoma | Stillwater | 45,688 |
| 135 | Pennsylvania | Allentown | 118,032 |
| 136 | | Altoona | 46,320 |
| 137 | | Erie | 101,786 |
| 138 | | Harrisburg | 49,528 |
| 139 | | Johnstown | 20,978 |
| 140 | | King of Prussia | 19,936 |
| 141 | | Lancaster | 59,322 |
| 142 | | Lebanon | 25,477 |
| 143 | | Philadelphia | 1,526,006 |
| 144 | | Pittsburgh | 305,704 |

| | | | |
|---|---|---|---|
| 145 | | Reading | 88,082 |
| 146 | | Scranton | 76,089 |
| 147 | | State College | 42,034 |
| 148 | | Williamsport | 29,381 |
| 149 | | York | 43,718 |
| 150 | Rhode Island | Newport | 24,672 |
| 151 | | Clemson | 13,905 |
| 152 | South Carolina | Myrtle Beach | 27,109 |
| 153 | | Spartanburg | 37,013 |
| 154 | Tennessee | Germantown | 38,844 |
| 155 | | Kingsport | 48,205 |
| 156 | Texas | Cedar Park | 48,937 |
| 157 | | Galveston | 47,743 |
| 158 | | Georgetown | 47,400 |
| 159 | | Pflugerville | 46,936 |
| 160 | | Rockport | 8,766 |
| 161 | | San Marcos | 44,894 |
| 162 | | Texas City | 45,099 |
| 163 | Utah | Logan | 48,174 |
| 164 | | Park City | 7,558 |
| 165 | Vermont | Burlington | 42,417 |
| 166 | | Colcheter | 17,067 |
| 167 | | Essex | 9,271 |
| 168 | | Montpelier | 7,855 |
| 169 | Virginia | Blacksburg | 42,620 |
| 170 | | Charlottesville | 43,475 |
| 171 | | Fredericksburg | 24,286 |
| 172 | | Harrisonburg | 48,914 |
| 173 | | Longview | 36,648 |

| | | | |
|---|---|---|---|
| 174 | Washington | Wenatchee | 31,925 |
| 175 | West Virginia | Vienna | 10,749 |
| 176 | Wisconsin | Appleton | 72,623 |
| 177 | | Eau Claire | 65,883 |
| 178 | | Fond du Lac | 43,021 |
| 179 | | Janesville | 63,575 |
| 180 | | La Crosse | 51,320 |
| 181 | | Sheboygan | 49,288 |
| 182 | | Waukesha | 70,718 |
| 183 | Wyoming | Cheyenne | 59,466 |
| 184 | | Jackson | 9,577 |
| 185 | | Laramie | 30,816 |

Those communities with populations of less than 10,000 are shaded.

**Table 2: Respondent Communities: 2010 Population & Self-Identified Community Size**

| State | Community | Population | Self-Identified Community Size |
|---|---|---|---|
| Alaska | Fairbanks | 31,535 | Small City |
| | Juneau | 31,275 | Small City |
| Alabama | Alabaster | 30,352 | Suburb of Lower-Density City |
| | Tuscaloosa | 90,468 | Lower-Density City |
| Arizona | Cave Creek | 5,015 | Small Town |
| | Apache Junction | 35,840 | Suburb of Lower-Density City |
| | Casa Grande | 48,571 | Small City |
| | Flagstaff | 65,870 | Small City |
| California | Dublin | 46,036 | Big-City Suburb |
| | Healdsburg | 11,254 | Small City |
| | Menlo Park | 32,026 | Small City |
| | Sonoma | 10,648 | Small City |
| | Los Banos | 35,972 | Small City |
| | Chico | 86,187 | Small City |
| | Truckee | 16,180 | Small Town |
| Connecticut | New Milford | 6,523 | Small Town |
| | Litchfield | 1,258 | Small Town |
| | New London | 27,620 | Small City |
| | Norwich | 40,493 | Small City |
| | Greenwich | 12,942 | Suburb of Lower-Density City |

| | | | |
|---|---|---|---|
| Florida | Winter Haven | 33,874 | Lower-Density City |
| | Titusville | 43,761 | Lower-Density City |
| | Panama City | 36,484 | Small City |
| Hawaii | Honolulu | n/a | Big, Dense City |
| Idaho | Post Falls | 27,574 | Suburb of Lower-Density City |
| Massachusetts | Pittsfield | 44,737 | Small City |
| | Barnstable | 45,193 | Small City |
| | Amherst | 19,065 | Small Town |
| Michigan | South Haven | 4,403 | Small City |
| | Midland | 41,863 | Small City |
| | Holland | 33,051 | Big, Dense City |
| | Troy | 80,980 | Big-City Suburb |
| Minnesota | Mankato/North Mankato | 39,309 | Small City |
| North Carolina | Asheville | 83,393 | Small City |
| | Hickory | 40,010 | Small City |
| Pennsylvania | Harrisburg | 49,528 | Small City |
| South Carolina | Clemson | 13,905 | Small Town |
| Texas | Galveston | 47,743 | Big-City Suburb |
| Utah | Park City | 7,558 | Small Town |
| Virginia | Blacksburg | 42,620 | Small Town |
| Vermont | Burlington | 42,417 | Small City |
| Wisconsin | Fond du Lac | 43,021 | Lower-Density City |
| Wyoming | Laramie | 30,816 | Lower-Density City |

| | | | |
|---|---|---|---|
| | Jackson | 9,577 | Small City |

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