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Michigan's Rural Transit Enterprises and Their Attributes

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Abstract

Technology is an integral part of modern transit systems, and this is especially critical in rural areas where "transportation and connectivity are vital for rural development" (Kamalesh et al., 2023). However, rural transit users often face significant challenges in accessing public transportation due to limited connectivity and infrastructure. Many technologies used in large transit systems, which rely heavily on digital infrastructure and robust internet connectivity, are less effective in these rural areas. In Michigan, 57 rural public transit agencies provide an estimated 5.6 million trips annually, covering 37,000 square miles. These agencies vary in size and capacity, but on average, each agency provides 93,184 annual trips with a fleet of 20 vehicles and a staff of 28, serving an area of 620 square miles. A survey conducted by HNTB in 2022 classified the technology readiness of these rural agencies into four levels, ranging from novice to expert. In the spring of 2024, another survey was conducted at the Michigan Public Transit Association (MPTA) annual conference to reassess technology readiness, identify technological barriers, and evaluate the potential benefits of introducing advanced transit technologies in these rural settings. This study examines the current state of Michigan's rural transit systems in 2024, drawing on surveys from the Michigan Public Transit Association (MPTA) annual conference and prior research by HNTB (2022). Key focus areas include: 1) Advancements in technology readiness for the agencies compared to past experiences. 2) Rider demographics and trip purposes. 3) Funding mechanisms and expenses of the systems. 4) Voter support through millage approvals in recent elections. Based on the findings, a set of recommendations is made on leveraging strategic communication, technology adaptation, and understanding user needs. The goal is to develop a framework for rural transit systems to improve service levels in terms of user-centered design to enhance accessibility, efficiency, and satisfaction via advanced technologies and a statewide Mobility-as-a-Service (MaaS) platform.

Keywords

Rural Transit Systems, MaaS, Technology Readiness, Voter Support

1. Introduction

Rural transit systems (**Figure 1**) are essential for connecting residents to critical services like healthcare, education, and employment, yet their effectiveness is often constrained by limited technological infrastructure. In Michigan, most rural transit agencies offer dial-a-ride services, which require complex coordination—scheduling trips, dispatching vehicles, processing fares, and reporting to grant providers. For medical or school trips, timeliness is critical, adding complexity compared to urban fixed-route systems (Berg & Ihlström, 2019). Also, transit systems as a part of scheduling, have to plan for the rider's return trip to home after their medical/school related appointments. Despite these challenges, technologies such as mobile apps, real-time tracking, automated fare collection, and digital schedules—common in urban settings—offer potential benefits for rural providers (Shaheen & Cohen, 2021; Peterson et al., 2020). These tools can improve efficiency by optimizing scheduling, enhance user experience through on-demand options and mobile payments, and increase accessibility by bridging geographic gaps (Kamalesh et al., 2023; Via Transportation, 2022). However, rural users face barriers, including limited digital literacy and poor internet connectivity, which hinder adoption (Yu & Liu, 2024).

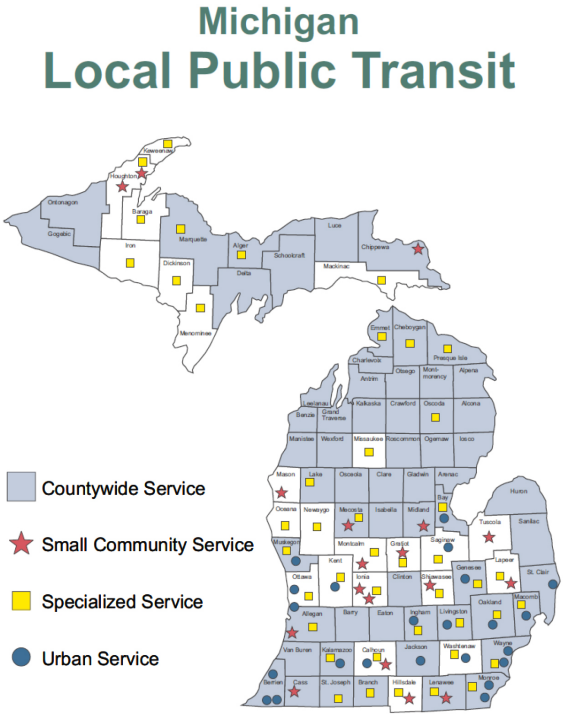

Figure 1. Location of Michigan's Rural Transit Systems (HNTB, 2022).

To address these challenges, the Michigan Department of Transportation (MDOT) is developing a statewide MaaS platform. Initiated with a 2020 Request for Information that drew responses from 19 vendors, this platform aims to integrate mobility options, allowing riders to plan, book, and pay for trips seamlessly (HNTB, 2022; MDOT, 2024b). However, agency readiness varies, as earlier assessments revealed inconsistent facility condition tracking (HNTB, 2022). Building on this foundation, this paper examines Michigan's rural transit systems in 2024, using data from HNTB (2022) and a 2024 MPTA survey. It explores technology readiness, rider profiles, funding, and voter support, proposing strategies to improve service delivery through targeted technology and MaaS integration, informed by innovations like those showcased in recent MDOT media events (MDOT, 2024a, 2024c).

2. Data and Methodology

At the 2024 Michigan Public Transit Association (MPTA) annual meeting, a survey was conducted among transit agency professionals—including directors and operational managers—who attended the conference. The primary goal was to assess the current state of technology readiness, identify barriers, and capture rider needs and operational challenges within transit systems. The survey consisted of two multiple-response questions, two ranking questions, seven open-ended questions, and several demographic questions. Of the 52 respondents, 32 represented agencies serving rural areas, and this paper focuses solely on their responses. The questions were designed based on a similar survey conducted by HNTB in 2022, which explored the technological readiness of all 57 of Michigan's rural transit systems. Using the HNTB (2022) findings as a benchmark, a chi-square test was performed to evaluate the current state in technology adoption. Additionally, qualitative open-ended responses, multiple-answer selections, and ranking data were analyzed to provide deeper insights into challenges and priorities. Supplementary data on rider demographics, trip purposes, funding, and voter support were sourced from MDOT's 2023 Public Transportation Management System Performance Indicators Report (MDOT, 2023a, 2023b), June 2024 media reports, and the 2024 Rural Transit Fact Book (Small Urban and Rural Transit Center, 2024; Litman, 2017). Descriptive statistics from this data further illuminated the critical hurdles and goals faced by rural transit systems.

3. Findings

3.1. Advancements in Technology Readiness Levels

The Advancing Rural Mobility pilot project, funded by a USDOT SMART grant, has introduced online tools to enhance rural transit access since July 2024. Despite this, technology readiness levels among Michigan's rural agencies show limited progress since 2022. The 2022 survey categorized agencies into four levels:

- Level 1 (Novice): Minimal use of CAD or AVL, with interest in adoption.
- Level 2 (Basic): Use of either CAD or AVL, but not additional technologies.

- Level 3 (Intermediate): Use of both CAD and AVL, exploring advanced solutions.
- Level 4 (Expert): Implementation of innovative technologies like app-based booking, open for new opportunities for further advancement.

The latest data was summarized in Table 1.

Table 1. Technology readiness levels between 2 years.

Technology readiness levels		
Level	2022 (Proportion, n)	2024 (proportion, n)
1—Novice	0.28 (16)	0.22 (5)
2—Basic	0.38 (22)	0.40 (10)
3—Intermediate	0.25 (14)	0.28 (7)
4—Expert	0.09 (5)	0.08 (2)

A chi-square test indicates no significant shift in distribution between two years ($p > 0.05$), suggesting stagnation in the state of technology readiness.

This result showed that technology readiness varies across agencies, with some still relying on traditional methods while others have adopted a wide range of technologies to improve efficiency, safety, and customer experience. Representatives from a number of rural agencies provided the answer to the question: "What are some technologies that your agency has implemented that have been successful for your agency and why? Why was this technology selected and what does it solve?". The following is a summary of responses (number of mentions are displayed within parenthesis), which gives us some insight into the stagnation of advancement and the current state of technology readiness.

- Dispatch Software including CAD (11): Many agencies have implemented dispatch software that allows for tablet use by drivers and apps for riders. This software provides drivers with more information about riders and stop locations, and allows riders to book their own calls and check the status of their trips. Dispatch software has also enabled an increase in the number of riders and improved scheduling efficiency. CAD software has been implemented to improve the scheduling process, limit the number of rides on a route, and streamline operations.
- Scheduling Software and Phone Apps (5): Scheduling software and phone apps have been adopted to streamline the scheduling process and reduce the time needed to complete reports. Some agencies use Google Calendar for scheduling due to its affordability.
- Maintenance and Training Software (1): Maintenance software is used to track bus maintenance, which is beneficial for reviews and inspections. Training software, such as Tapco, is used for new driver training, including videos and workbooks/tests.
- Tablets and GPS Systems (5): Tablets are being used in vehicles to replace paper manifests, allowing for real-time updates and more efficient communica-

tion. GPS systems are installed on board vehicles to improve tracking and routing.

- Cameras and Security (2): Bus cameras are used to investigate driver complaints and accidents, enhancing safety and security for both drivers and passengers.
- Real-Time Tracking and On-Demand Services (2): Real-time tracking and on-demand services via apps have been introduced to enhance the rider experience and operational efficiency.
- Communication and Customer Service Enhancements (2): New dispatching and routing software, along with rider apps, have improved service by allowing customers to book and pay for trips directly, receive real-time notifications, and contact the agency easily. Upgraded phone systems with text message follow-ups and call-back options have been implemented to improve customer service.
- Fare Collection and Payment Systems (2): Two agencies have upgraded to credit card software to make it easier for passengers to pay for their rides.
- Pen and Paper (1): One agency is still using traditional methods like pen and paper for reservations.

Furthermore, agencies also face a lot of challenges which is reflected by the answer to an enquiry: "Did your agency implement technology that had challenges or did not go according to plan? If yes, how did your agency overcome those challenges?" For 16 out of 25 rural agencies who responded, it was reported that most technology projects haven't gone according to plan, requiring flexibility and adjustments. Communication and managing changes have been key to dealing with these issues. In particular,

- App and Tablet Issues: The app has been unreliable, with frequent downtimes and no easy way to pay for single rides. Tablets have also had cellular connectivity problems.
- Training and Support: The subcontractor's general manager did not effectively train the staff on new technology, requiring the program coordinator to provide one-on-one training and support during the launch.
- Delays with PC Trans: After purchasing PC Trans, delays in receiving software and tablets caused significant setbacks. The team had to rely on old software and paper manifests for over two years.

In answering the question: What are your agency's current internal technology needs (this is the need of the agencies)? "Dispatching system" ranked the first with 12 mentioned, followed by "Realtime Information" and "Infrastructure/Vehicle-Based Safety Applications" with 9 mentions each. These answers echo with the answer from last question "dispatch software did not meet the expectation." Real time information also aligns with this aspect of the problem.

While answering the question: What are the greatest technology needs of your agency's riders (this is the rider's need)? The ranks were (listing from most important to least): Realtime Data/Information (2.48); Digital Fare Collection/Mo-

bile Wallet (2.55); Mobility-as-a-Service (3.72), On-vehicle rider amenities (i.e., WiFi, assistive technology) (3.85); Assistive Technology (visually, hearing and physically impaired support) (3.95); Bus stop and station amenities (4.93). It is noticed that MaaS was not seen/considered as the greatest need by the agencies. Agencies prioritized dispatching systems (12 mentions) and real-time information (9), while riders valued real-time data (rank 2.48) and mobile payments (2.55) over MaaS (3.72), suggesting limited awareness of its potential (Shaheen & Cohen, 2021).

In addition, during a Solution Design workshop, held in MDOT secondary complex on Feb 20, 2025, the project team had one-on-one conversation with a number of Michigan's rural transit operators. They expressed their limitation about their technical skills as well as bargaining power (due to the size of the system) while selecting/procuring any technology. Above and beyond the upgrading of technology and protecting them from any possible cyber-attack has also been a challenge. These responses further highlighted operators' concerns about technical skills, system scale, and cybersecurity risks (Poltimäe et al., 2022).

3.2. Composition of Riders and Trip Purposes

Michigan rural transit systems serve a diverse population, with 38% of passengers classified as elderly or disabled (E&D), and 28 out of 57 agencies reporting over 50% E&D ridership (MDOT, 2023a). A recent University of Michigan study found that over half of Michigan's adult rural population living below the poverty line face transportation insecurity, with 6% lacking vehicle access (USDOT, 2024). Michigan rural transit systems also serve a diverse range of trip purposes, including access to healthcare, education, employment, and essential services. These systems are crucial for residents who rely on public transportation as their primary means of mobility. The 2024 survey ranked trip purposes: medical (2.125), commuting (2.59375), errands (2.65625), leisure (3.59375), and school (4.03125). These patterns highlight transit's role in meeting basic needs, particularly in harsh Michigan winters where real-time information is vital.

3.3. Funding Sources and Expenses

According to the MDOT revenue/expense report (MDOT, 2023b), funding primarily stems from the Comprehensive Transportation Fund (CTF), supported by the Michigan Transportation Fund and auto-related sales taxes. In case of Michigan's rural transit the breakdown is Federal (16%), State (30%), Local (47%), and Farebox Revenue (7%) (MDOT, 2023b). Local funding predominates, indicating agencies could seek more federal support to ease this burden (Godavarthy et al., 2014). Meanwhile, nearly all agencies (52/57) generated revenues exceeding eligible expenses, suggesting capacity to allocate funds for technology purchasing, training, and adoption advertising (HNTB, 2022). **Figure 2** below depicts the distribution of revenue and eligible expenses per vehicle and per passenger across agencies.

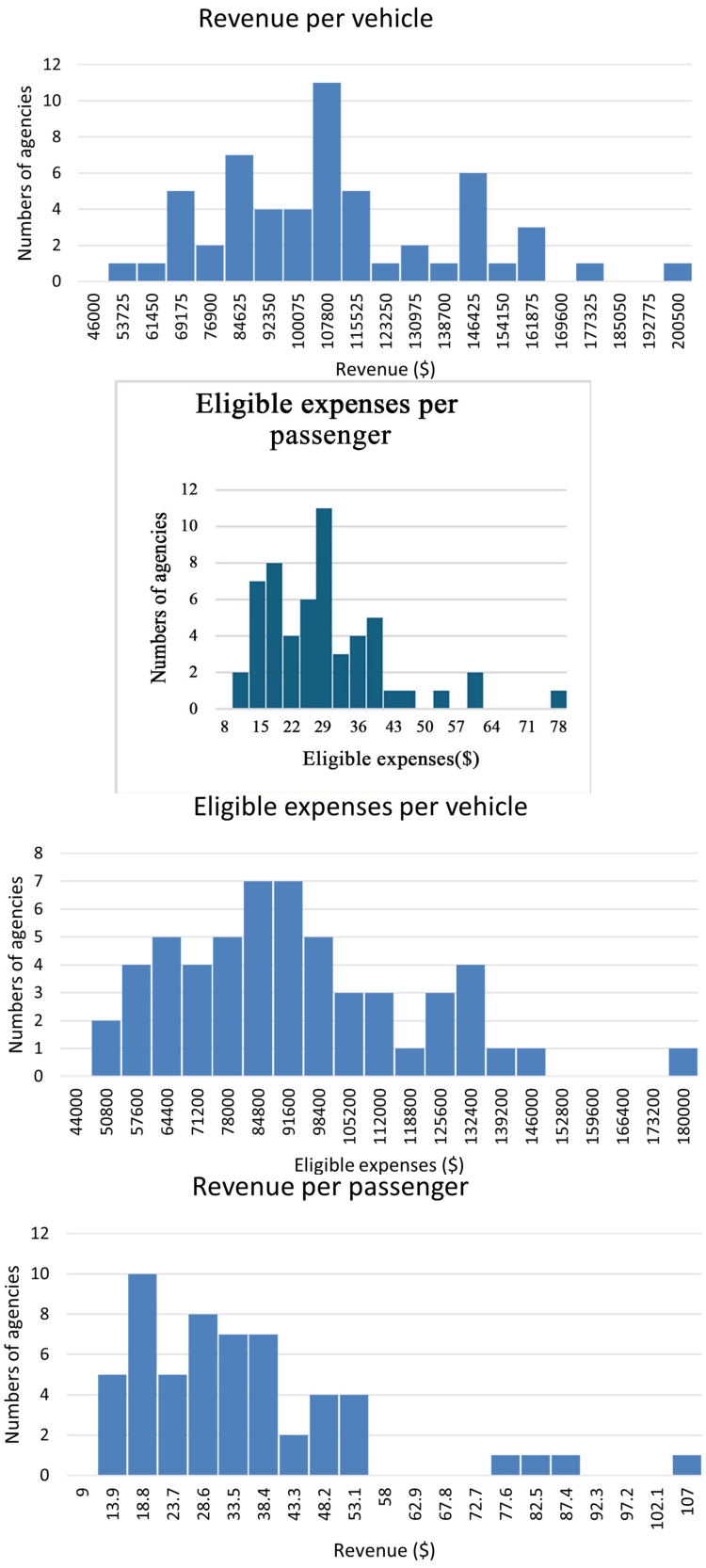

Figure 2. Distribution of revenue and eligible expenses per vehicle and per passenger across agencies (MDOT, 2023b).

3.4. Voter Support through Millage Approvals

Michigan residence has a long history of supporting public transit through mileage even though some take few election cycles to win such support (Zhong et al., 2022). Recent millage approvals signal strong public backing. Michigan's rural transit riders are very supportive of their system by approving transit related millages. In November 2024, six of seven proposals passed with strong majorities (e.g., Midland County, 75%), reflecting growing recognition of transit's value, though one (Shiawassee) failed narrowly (Detroit Transit, 2024). This aligns with broader rural transit marketing efforts (Transit Marketing, 2023).

4. Discussion

While some agencies, like the top-ranked BENZE system, have embraced innovation, overall progress of all rural transit agencies in technology adoption remains slow. Barriers include unreliable apps, poor training, and high costs, compounded by rural connectivity issues. Rider needs—real-time data and mobile payments—align with agency priorities, yet MaaS, despite its potential, ranks low (3.72) in perceived importance, indicating awareness gaps (Shaheen & Cohen, 2021). Barriers like the digital divide, resistance to change, and high costs further complicate progress (Yu & Liu, 2024; Poltimäe et al., 2022).

Real-time information and mobile payment options are essential for riders, especially in Michigan, where harsh winters necessitate precise vehicle arrival times to minimize outdoor waiting. Meeting these needs effectively requires a robust technological framework, including system security, which a statewide Mobility-as-a-Service (MaaS) platform could provide for rural transit. Such a system would address critical challenges, including selecting suitable technologies, managing upgrades and maintenance, strengthening cybersecurity, and securing local funding. Michigan, the second state in the country to pursue this approach, has partnered with HNTB to pilot MaaS, advancing its rural transit system.

5. Recommendations

While it is true that no technology implementation goes perfectly, some agencies' approaches of making adjustments and moving on were practical. It's impressive how some of the agencies managed to stay flexible and find workarounds. To address the challenges, we propose: 1) For author/s of only one affiliation: To change the default, adjust the template as follows.

- **Education:** Host workshops to promote MaaS benefits, emphasizing service integration. Provide workshops and training on how to use transit technology, such as mobile apps and online fare payments. Offer demonstration sessions in community centers or through partnerships with local organizations. Partner with local radio stations, community newspapers, and rural TV channels to spread awareness (Transit Marketing, 2023).
- **Customized MaaS Platforms:** Develop an offline-capable, statewide MaaS system tailored to agency and rider needs. Involve all stakeholders—drivers,

dispatchers, riders, and others in the technology selection/adoption process (Shaheen & Cohen, 2021).

- **Funding Support:** Secure grants and federal funding to offset costs and streamline procurement (Godavarthy et al., 2014). Budget must include developing long-term sustainability plans for technologies in rural transit systems, especially in terms of training, maintenance and upgrades.
- **Training and Technical Support to the agencies:** Provide ongoing training and post-installation support, with the program coordinator offering personalized one-on-one sessions as needed. Implement structured training programs and ongoing support sessions to ensure that staff are well-equipped to use new technology (Via Transportation, 2022).
- **Tailored to special needs:** Offer training events for elderly and disabled riders, focusing on accessibility. Ensure apps and websites offer offline capabilities, such as scheduling information or ticketing options that don't require constant internet access. Offer alternative options for users who cannot access mobile apps, like SMS-based transit updates or automated phone lines (Yu & Liu, 2024).
- **Establishing riders' interest advocate group:** Engage with community leaders, influencers and active riders as advocates for technology adoption. Invite them to attend town hall meetings and legislative sessions to voice their mobility needs and request for more funding (Transit Marketing, 2023).
- **Additional strategies:** Offer multiple platforms such as Google maps, Websites, Various Apps simultaneously. Simplified interfaces, offline functionality, low-tech alternatives (e.g., SMS updates), and work with local internet service providers to improve connectivity and facilitate better access to digital platforms (Poltimäe et al., 2022; Lynott, 2023).

6. Conclusion and Future Study

Michigan's rural transit agencies stand at a pivotal moment, weighing technological promise against practical hurdles. Transit operators must recognize that their purpose revolves around serving riders. Meanwhile, drivers, as the primary point of contact for riders, play a key role in this ecosystem. Their active participation in selecting, training, and promoting transit technology is therefore essential. By adopting multi-channel marketing strategies, ensuring technological accessibility, and focusing on education and community engagement, transit systems can successfully introduce technology to rural areas, enhancing mobility and improving quality of life for users. While challenges exist, the potential for growth in rural transit technology adoption is significant, benefiting both residents and local economies. In addition, by addressing readiness barriers and embracing a tailored MaaS framework, these systems can enhance accessibility, efficiency, and satisfaction, ensuring equitable mobility for rural residents.

While this study focuses on the current state of technology in rural Michigan's transit systems. Future study could include a comparative analysis with other

states or countries that have implemented similar technologies in their rural transit systems. This would not only offer a benchmark but also provide insights into different approaches and their effectiveness, potentially offering lessons learned or best practices that could be applicable to Michigan.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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