goMARTI
MNDOT FINAL REPORT

MARCH 2025

goMARTI™ OFFERED BY THE PLUM CATALYST

DEPARTMENT OF TRANSPORTATION

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ACKNOWLEDGEMENTS

goMARTI community champion Myrna Peterson loves to say “it takes a village” when describing the breadth and depth of the partners who have all come together to deploy this autonomous vehicle pilot into Grand Rapids, Minnesota. The goMARTI project could not have happened without the dedication and support of the local community advocates, volunteers, City and County leadership, State DOT CAV Champions, local operations team, transportation tech partners, and beyond all else, the riders, who have made this project such an overwhelming success!

Thank you all for everything you have done and continue to do to support the ongoing success of this new transportation program.

Cheers!

EXECUTIVE SUMMARY

goMARTI stands for Minnesota's Autonomous Rural Transportation Initiative, and was a winter weather, rural, accessible, on-demand transportation pilot demonstration program deployed in Grand Rapids, Minnesota.

Phase 1 of goMARTI was the third Minnesota Department of Transportation (MnDOT) led autonomous vehicle pilot project across Minnesota, following the Med City Mover in Rochester, MN and Bear Tracks in White Bear Lake, MN. goMARTI brought a unique opportunity to perform cutting edge autonomous vehicle research in a rural community with harsh winter weather, using on-demand, micro-mobility transportation whilst simultaneously providing wheelchair capable transportation access at no-costs to riders.

The pilot program was focused on learning and evaluating aspects of the following goals:

1. Advance and inform the operation of automated vehicle technology in rural, winter conditions.
2. Engage and educate the local community by providing real-world automated vehicle experiences.
3. Provide safe, accessible mobility for residents, especially those with transportation challenges.
4. Understand what economic development this innovative pilot brings while attracting future talent and technology to the Iron Range.

Nearing the end of the operational pilot period, the project was awarded a federal grant from the Federal Highway Administration (FHWA) paving the way for 3 more years of operations targeted to start early 2025. This allowed MnDOT and the Department of Iron Range Resources and Rehabilitation (IRRR) to approve continuing the initial pilot operation until that time. Thus, the 18 month pilot window was extended for nine extra months resulting in a 27-month pilot effort which will be summarized in this final report.

This report will include summaries of operational insights, impacts of community engagement activities, best practices and lessons learned when implementing an accessible AV pilot program in a rural community in a winter climate.

After 27 months of operation goMARTI 1.0 moved 18,698 people and sustained 1.3 riders per service hour, a considerable feat in a community of about 11,000. goMARTI grew exponentially in ridership over the first two years, highlighting the great outreach and communications work the team did during the launch and continued throughout the first two years of operation.

Initially, usage by community members and visitors was slow, but as the project team listened to the community's suggestions, iterated and improved stop locations, and advanced the AV operational domain, ridership grew. Improvements to the autonomous performance of the vehicle

continued to advance thanks to the hundreds of thousands of miles the vehicles drove through challenging weather including snow storms, rain, fog, and below zero temperatures. This data was essential to the training and improvement of the Autonomous Driving Kit (ADK).

The project team gained invaluable insights and documented opportunities to improve. A list of some of these learnings and insights are as follows;

- Onboard operators will perform multiple roles
- Stop location and accessibility are critical to adoption
- goMARTI has introduced multiple new complementary technologies
- The value of a local call center in a rural community can not be overstated
- Involve the community, adapt current stops and evolve the operation
- Play the long game; ridership did not develop overnight
- Choose the best AV for the job; it must be able to drive at or near the speed limit
- Fill a need - besides groundbreaking AV research, goMARTI offered accessible mobility for all
- Offer year-round technology; it's no good if it can't operate in a broad range of weather and seasons
- Recognize how transportation can change lives for the better

If you are interested in learning more or finding out how to get involved: connect with the team via email at hello@gomarti.com, visit us at www.gomarti.com, or call 2-1-1 for more information.

ACRONYMS AND ABBREVIATIONS

ABBREVIATIONS

AV - Autonomous Vehicle

ADAS - Advanced Driving Assistance Systems

ADK - Autonomous Driving Kit

AVO - Autonomous Vehicle Operator

IASC - Itasca Area Schools Collaborative

IRRR - Department of Iron Range Resources & Rehabilitation

KPM - Key Performance Metrics

MaaS - Mobility as a Service

MnDOT - Minnesota Department of Transportation

ODD - Operational Design Domain

TERMS

Autonomous Vehicle (AV) - A vehicle that can perform some level of driving without human input. The goMARTI vehicles can operate autonomously, but can also accommodate a human driver taking over to perform manual driving tasks at their discretion.

Autonomous Vehicle Operator (AVO) - The goMARTI project required a person to be responsible for operating the vehicle, even when in autonomous mode. goMARTI refers to these people as Autonomous Vehicle Operators (AVOs), and they are in the driver's seat at all times during the operation of the vehicles to maximize vehicle safety.

On-demand transit - On-demand transit systems offer flexible, convenient travel by allowing users to request rides in real-time. This improves accessibility and minimizes wait times through intelligent routing and real-time data.

Operational Design Domain (ODD) - The ODD (operational design domain) defines the conditions, scenarios, and environments in which an autonomous vehicle can operate safely. As the vehicle's capabilities advance, its ODD can be expanded.

Point-to-point transit - The concept of point-to-point transit is that a vehicle will take you directly from point A to point B without following a set route. Unlike traditional bus services with multiple stops along a fixed route, point-to-point provides direct travel that is similar to a taxi service.

Micro-Transit - This type of transit service utilizes smaller vehicles, such as cars, minivans, scooters, and bikes, to provide transportation services. This is in contrast to the traditional full-sized buses that are typically used by city bus lines and other mass transit routes.

App-based services - Services accessible through an app, such as ride-hailing services like Uber, food delivery services like Grubhub, streaming services like Netflix, and virtual healthcare services (telehealth).

INTRODUCTION & BACKGROUND

goMARTI is an on-demand point-to-point micro-mobility operation. This means rides can be requested at the time of need and a vehicle will be deployed to the nearest pickup location to transport the rider to a drop off location nearest the rider's destination. While this pilot demonstrated and advanced the capabilities of self-driving vehicles, all goMARTI vehicles had an AVO behind the wheel to ensure safe and reliable operation.

In addition to demonstrating rural-capable self-driving vehicles, goMARTI sought to tackle the challenge of providing accessible transportation to a rural, winter weather community. Transportation access is important in all communities, but can be particularly challenging to tackle in a rural, more sparsely populated environment. Even more so for community members who cannot or prefer to not drive.

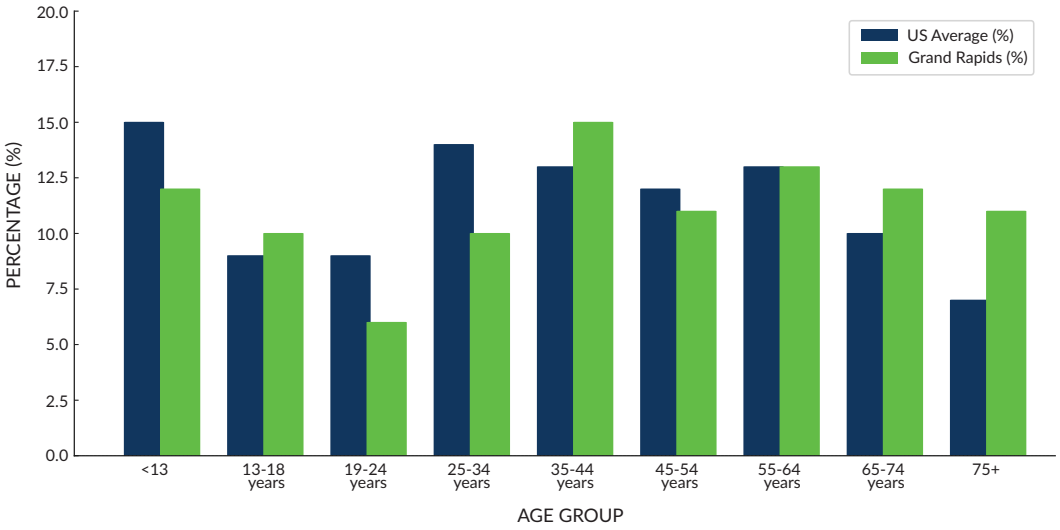
Transportation has been a long-standing challenge in Grand Rapids, MN, as in many rural communities. Myrna Peterson, co-founder of the non-profit Mobility Mania and other community advocates, had been searching for solutions to improve transportation access, particularly for those unable to drive. Their efforts led to a partnership between the City of Grand Rapids, the PLUM Catalyst (a Minnesota-based strategy and social innovation incubator company), and May Mobility (a Michigan-based autonomous vehicle technology company) to explore funding opportunities for accessible, self-driving vehicles in Grand Rapids.

As part of their CAV Challenge program, MnDOT approved funding to support the goMARTI project in partnership with other local funders. In this case, it was the City of Grand Rapids. goMARTI is the third MnDOT-lead AV pilot spanning three different population densities and utilizing varying technology. Urban was represented with the Med City Mover, a pilot near Mayo Clinic in Rochester, MN. A suburban pilot program, Bear Tracks, was deployed in White Bear Lake, MN connecting the YMCA with affordable housing and adult care facilities. Both the Med City Mover and Bear Tracks tested low-speed, self-driving, electric, multi-passenger shuttles. GoMARTI, represents a rural deployment in a rural community. Together these three pilots allowed MnDOT to compare operations across different types of communities and gather insights on community acceptance and perception.

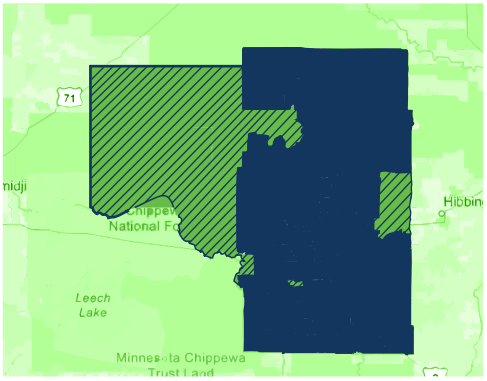
Grand Rapids has a population of 11,280 making it a larger rural hub supporting dozens of smaller towns within a 50 mile radius. City officials recognized that goMARTI could provide transportation access to community members who lacked it, and saw the potential for economic and workforce development by introducing this new technology to their region. They championed goMARTI to join their community for these reasons.

While goMARTI was piloted to provide transportation to anyone in the community, the project specifically focused on reaching those without regular transportation access. Elderly, people with disabilities, folks who do not or can not drive, and as we learned, teenagers were amongst the focus population groups for the program. In Grand Rapids, for example, 15.6% of people have a disability (compared to 7.4% statewide), 18.2% of people are in poverty (compared to 9.3% statewide), and 24.6% of people are aged 65+ (compared to 16.7% statewide) (U.S. Census Bureau).

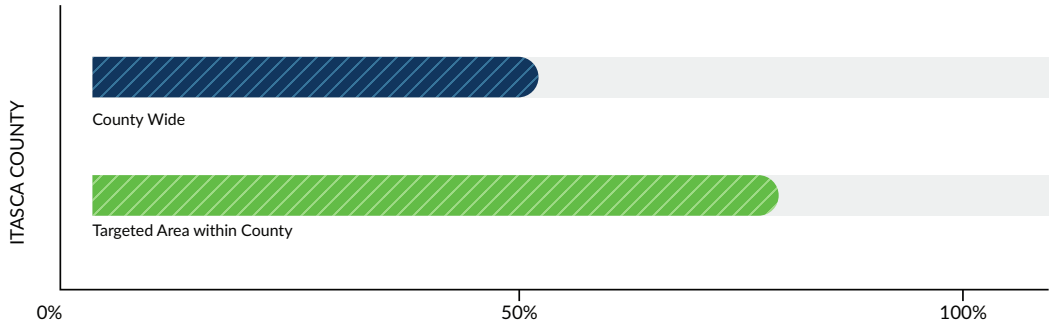
AGE GROUP DISTRIBUTION: US AVERAGE VS GRAND RAPIDS



Additionally, the USDOT Equitable Transportation Community (ETC) Explorer gave the population centers in and around Grand Rapids an extremely high transportation insecurity score.



TRANSPORTATION INSECURITY DATA



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Itasca County ranked 84% overall in the transportation disadvantaged communities index, with four census tracts in the 95th percentile. This high percentile indicates an extreme need for transportation solutions in the region, especially in those four census tracts that scored in the bottom 5% (a score of 95% transportation disadvantaged), signifying a severe lack of transportation options.

Despite the rapid advancements and adoption of innovative transportation models in urban and suburban areas, rural communities continue to face significant challenges in integrating these new solutions into their existing infrastructure. This disparity in transportation development is creating a growing divide between urban and rural areas, leaving rural residents with limited access to efficient, affordable, and reliable transportation options. The lack of adequate transportation in rural areas has far-reaching consequences, impacting economic development, access to healthcare, education, and overall quality of life for rural residents.

While technologies like on-demand transportation, micro-transit, and autonomous vehicles are the new normal (or at least being piloted) in city centers, many of these technologies have not made their way out into rural communities. There are many different rationales for this lack of rural transit innovation: population density, housing density, challenging operational domains, roadway infrastructure and pavement marking quality, high speed internet prevalence, unsustainable funding via traditional funding model options, availability of experienced grant writers and experience working with state and federal grant administration, and many more.

The goMARTI team proposed this project to better understand the applicability of work done in urban city centers to the rural community; as well as to learn the validity of the different challenges and scenarios when moving from urban to rural.

This report offers a broad overview of the pilot program and key takeaways, rather than a daily account of specific goMARTI activities. Our goal is to provide actionable insights and best practices to inspire similar initiatives in other rural communities.

Contained in this final report is a synopsis of the full pilot experience. It starts with a summary of our planning, outreach and community engagement, which really solidified the details of the pilot. It then recaps the execution and operation of the project, and concludes with the results of our efforts, lessons learned and next steps both for goMARTI 2.0, as well as unanswered questions the reader may wish to tackle in a deployment of their own.

FUNDING, GOVERNANCE & PARTNERSHIPS

The organizational structure of a project, especially innovative projects utilizing multiple funding streams, can significantly impact its success. Creating a clear governance model improves transparency in decision-making and clarifies roles, which is crucial for community buy-in and overall project success. The following section will provide an overview of the funding strategy, governance model, and the various project partners involved in goMARTI.

FUNDING STRATEGY

The project's initial funding strategy guided the development and the success of the goMARTI pilot program. The project planning team worked with the community to determine their interests in ownership and on-going programmatic decision-making. The local stakeholders wanted to maintain the ownership in the initial pilot program, so they had the decision-making power in the future should the program move to scale. Therefore, they aligned the fundraising locally toward at least 50% of the pilot program costs. With the goal in mind of >50% local funds, the team designed a funding strategy to cover the initial pilot costs.

The initial pilot pooled five local partner resources (cash contributions and in-kind support) to support the pilot program costs: City of Grand Rapids General Funds, Itasca County COVID relief funds, IRRR Development Partnership grant funds, Blandin Foundation strategic project funds, and Mobility Mania in-kind time.

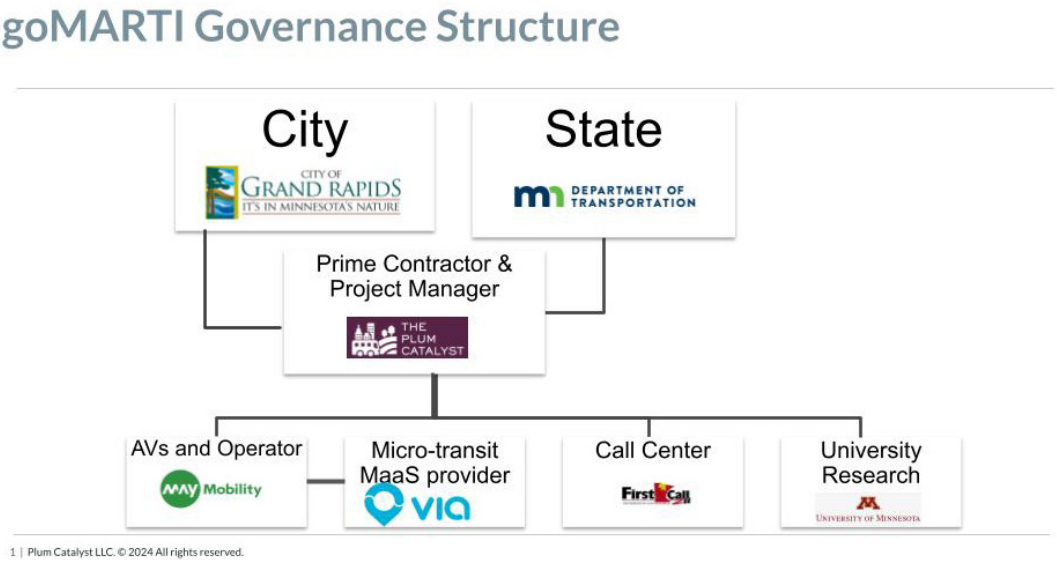
Additionally, the team aligned on utilizing remaining match funds from the MnDOT CAV Challenge project, which also provided State resources such as oversight, in-kind contributions (route signage), and procurement support.

Upon starting the pilot program, the team began preparing for an on-going pilot expansion by applying for additional Federal Discretionary grant programs, and in early 2023 was awarded the Advanced Transportation Technology and Innovation (ATTAIN) program funding.

In general, the team approached funding strategies by strategically identifying funding opportunities such as:

- Local Funds: Such as above budgets and programs used in the goMARTI pilot.
- State/Regional: Such as the MnDOT CAV Challenge, IRRR Development Partnership, Other DOT or Economic Development grant programs
- Federal Formula: Micro-transit turnkey services are eligible
- Federal Discretionary: Several innovation grants such as ATTAIN (goMARTI 2.0) are eligible for transit agency, state, MPO and city applications
- Other Grants - other fed programs and universities often have interest in AVs and the community impact and data.

GOVERNANCE STRUCTURE



The goMARTI project's governance structure was a key component of its success. This included the Prime Contractor and Project Manager establishing the project's guiding principles, developing clear communication strategies, designing clear operations, and outlining risk management expectations.

KEY PARTNERS AND PROJECT ROLES

The project's success can be attributed to the Project Partnership model. Outlined below are the partners and their roles.

THE MINNESOTA DEPARTMENT OF TRANSPORTATION (MNDOT)

MnDOT was the lead agency on the goMARTI project, providing oversight and guidance on project decisions. Funding for the goMARTI project was obtained through MnDOT's CAV Challenge program.

CITY OF GRAND RAPIDS

The City of Grand Rapids was instrumental to the success of goMARTI. As host and financial contributor, the City also provided snow and ice management for shuttle stops, installed and maintained signage, and advocated for the project to the community. Regular meetings with City officials ensured that goMARTI met the City's expectations and furthered the possibilities of public transportation.

THE PLUM CATALYST

The PLUM Catalyst was the Prime Contractor and Project Manager for the goMARTI pilot project. In addition, PLUM provided planning, grant writing, led workforce development, engagement and outreach, secured gap funding, and managed all subcontractor relationships.

MAY MOBILITY

May Mobility was the autonomous vehicle technology provider supplying pilot vehicles and operations, maintaining and upgrading AV and ODD capabilities, managing the route, and providing

vehicles and staff for many community engagement events. In addition, May Mobility recruits and manages local AVO staff to operate the vehicles on route.

VIA TRANSPORTATION

Via provided back-end routing and software solutions for managing on-demand micro-transit solutions like goMARTI. Via also developed and maintained the May Mobility App, which users used to book rides.

211 - FIRST CALL FOR HELP

First Call provided call center support for booking goMARTI rides over the phone, answered questions, and helped callers use the app to set up a profile or book rides. In addition, 211 provided community engagement support delivering hundreds of flyers to homes on the route to promote awareness and hosted numerous lunch-n-learn events with local community members where they were able to learn about 211 services including goMARTI.

UNIVERSITY OF MINNESOTA

The University team was responsible for two research projects:

1. Evaluating Community Transportation Needs and Efforts to Meet Them
2. Exploring the Potential of Mobility Hubs.

In addition, the UofM Center for Transportation Studies published a Policymaker's Summary, and created and managed the Data Management Plan.

The Mobility Hubs research was conducted by Tom Fisher and Joseph Yang from the Minnesota Design School, and focused on opportunities to design shuttle stops to maximize mobility

The Community Transportation Needs research was conducted by Frank Douma and Evelyn Weiner from the Humphrey School of Public Affairs and focused on the viability of AV transportation in rural Grand Rapids.

ADDITIONAL PARTNERS

DEPARTMENT OF THE IRON RANGE RESOURCES & REHABILITATION

The Department of Iron Range Resources and Rehabilitation (IRRR) contributed funding through their Streetscapes grant program for route signage, mobility hubs research, song contest, and a student project. They also contributed funding through their Development Partnership grant program for the first year of shuttle operations, and provided a strong regional voice to advocate the value in bringing high tech companies and jobs to the region.

BLANDIN FOUNDATION

The Blandin Foundation contributed funding toward the first year of shuttle operations, recognizing the connection between lack of transportation options and building a vibrant rural community.

MOBILITY MANIA

Mobility Mania, a non-profit founded by Myrna Peterson, is dedicated to identifying and addressing accessibility issues, promoting accessibility awareness, and improving accessibility across Northern MN and beyond. Myrna and her counterpart Lisa Arnold, provided invaluable community advocacy and are local goMARTI ambassadors.

GOALS

These are the 4 goals of the pilot project:

1. Advance and inform the operation of automated vehicle technology in rural, winter conditions.
2. Engage and educate the local community by providing real-world automated vehicle experiences.
3. Provide safe, accessible mobility for residents, especially those with transportation challenges.
4. Understand what economic development this innovative pilot brings while attracting future talent and technology to the Iron Range.

Each goal represents an important component of the success and value of the overall pilot project.

WINTER WEATHER

The persistent changes in road conditions and weather during winter continually challenge the accuracy and limits of sensor technologies in autonomous vehicles (AVs), making winter weather testing one of the most difficult operational design domains. The conditions at pickup and dropoff locations and general driving conditions can change significantly in a short amount of time, making the testing of AVs, especially public transportation vehicles, in this environment extremely valuable and informative.

This pilot project was designed to:

- Evaluate AV performance in adapting to changing winter conditions
- Assess the differences in stop location accessibility between winter and summer
- Understand the winter maintenance requirements for successful AV operation

COMMUNITY ENGAGEMENT

The goMARTI pilot program sought to engage and educate the local community about autonomous vehicles by providing real-world experiences. A successful pilot program depends on ridership, which can be impacted by lack of awareness or information. Therefore, a major goal was to increase community awareness and understanding of autonomous vehicle technology, as well as gather community input.

To achieve this, the project aimed to:

- Engage with the community at various events
- Participate in local transportation education opportunities
- Assess the community's transportation needs and how the program addresses those needs
- Collect community opinions and insights on autonomous vehicles

> *"Thank you for helping the community with mobility."*

ACCESSIBLE TRANSPORTATION

The pilot program also aimed to provide safe and accessible mobility for all residents, particularly those with transportation challenges.

This focus on accessibility was demonstrated in multiple ways:

- by providing transportation access to individuals who are unable or choose not to drive (especially those using mobility devices);
- by offering various methods for booking rides, regardless of physical ability or smartphone access; and
- by providing a no-cost transportation solution to ensure that rides are accessible to everyone, regardless of their financial situation.

ECONOMIC IMPACT

This pilot project aimed to measure the economic development and future growth potential of the Iron Range through innovative technology and talent attraction.

Key aspects of this project included understanding the local economic impact, which can be evaluated by:

- Tracking the creation of new technology jobs in the region
- Providing local shopping and business access to residents who previously only had online options
- Generating state and national press coverage that highlights the local community
- Attracting visitors from outside the state and internationally as a result of the pilot

PILOT SETUP & LAUNCH

The pilot planning and preparation began long before the project launched. This section of the report will discuss key aspects of the setup and launch of the goMARTI pilot program. A thorough discourse of the pilot plan and execution is contained in the Deployment Management Plan, which can be found attached in its entirety in Appendix E. This document contains guidance and plans for safe operations, risk assessment and mitigation plan, emergency management plan, details on vehicle storage and licensing requirements, summaries of operations and maintenance requirements for the vehicles, and a plan for development and build out of the zone, stops, signage, as well as operational plans like queue management and app functionality.

SELECTING LAUNCH TIMING

Launching a self-driving vehicle pilot requires immense planning and preparation, with many factors to consider. A successful launch can spur project momentum and set the project up for success. One important aspect is the timing of the launch. When planning the timing of a launch, there are internal project considerations and external factors to keep in mind. Factors that can be unique to a self-driving shuttle project include weather, contracting, and the amount of pre-work needed.

In rural Minnesota, launching goMARTI during winter months was not feasible, as adoption of new transportation options is significantly more challenging for potential riders during cold and snowy weather. Therefore, the project team had an early October deadline to launch the pilot. This deadline led to a condensed pre-launch schedule because the contracting process took longer than anticipated. Self-driving vehicle projects are new and complex, requiring extensive coordination between different partners; they do not often fit into an agency's or organization's standard contracting process. Due to this, goMARTI experienced significant delays in getting all partners under contract. These delays, along with the need to launch prior to the winter months, affected the planned pre-launch schedule. The project team could not complete the desired amount of pre-launch community outreach and engagement, as they needed to focus on preparing for operational logistics and details. When planning a self-driving vehicle launch, it is important to build in more pre-launch time than anticipated due to the unique nature of a self-driving vehicle pilot and factors such as weather and contracting.

COMMUNITY INPUT TO HELP DEFINE OPERATIONAL DETAILS

The initial pilot program service design was informed by community listening sessions conducted to understand how the community would utilize a new on-demand micro-transit system. These sessions, detailed in the Community Engagement section of this report, were conducted prior to the launch of goMARTI.

An important aspect of the pilot setup was determining the days and times of operation. The aim was to align with existing transit options while also meeting community needs. At the time, the existing transit offered a circulator service from 9am to 3pm, visiting each stop once per hour.

DEFINING THE PILOT ZONE

The first step in developing a route and stops was identifying the pilot zone. The project's goal was to create a variety of stops focused on community areas of interest within the City of Grand Rapids. Points of interest, medical facilities, shopping centers, places of worship, restaurants, neighborhoods, and living facilities were all key considerations. The service was designed with stops throughout the zone, allowing anyone using the service to reach most destinations within a few blocks. A smaller zone that provided access to most key locations within the city was preferable to a larger zone that did not.

STOPS

Identifying stops for a new transportation initiative is inherently challenging. In an attempt to be impartial, initial stop locations were chosen near clusters of businesses or community-identified destinations. Stop names were based on intersections to promote equity.

However, we have since learned that prioritizing accessible and safe transportation sometimes necessitates door-to-door service, which outweighs the initial goal of impartiality. Enabling transportation access is a core principle of goMARTI.

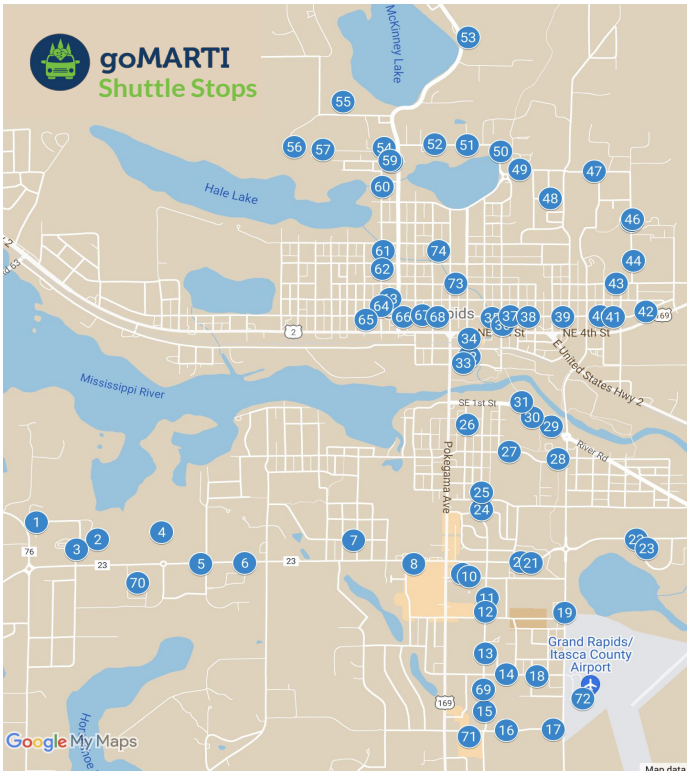
Additionally, we discovered that the community primarily uses landmarks, rather than street names, for navigation. Therefore, stops are now more intuitively named after the nearest business, restaurant, or residential community.

Exact stop locations were scouted and selected based on rigorous safety standards, ensuring sufficient space for safe vehicle entry and exit. The project team collaborated with the Grand Rapids City Engineer to review and approve all proposed stop locations.

A major ongoing effort is assessing stop quality from both vehicle and rider perspectives, as well as continuously evaluating the potential for new stops within the route to optimize community access.

MAP

The map below is helpful for a number of reasons, but it is primarily used to communicate goMARTI stop locations to riders who are planning their trips around town. It is especially useful for community members who book by phone or do not have access to the app, as the map allows them to find their pickup location.



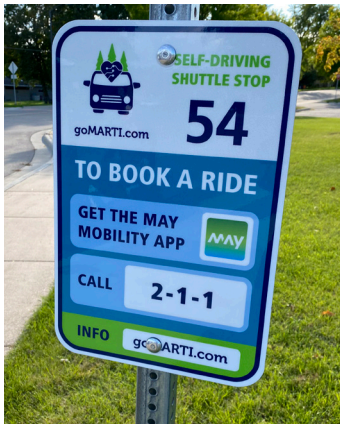
To access the most current static map : goMARTI Shuttle Stops

A dynamic version of the map is available on google maps as well as on the goMARTI website GoMARTI.com Map

These links are regularly updated to reflect any changes to the stops or routes and are frequently included in project marketing materials.

SIGNAGE

The pilot project team debated the role and need for signage, given that the app will provide location-based guidance to pickup and drop-off locations. Maintaining and relocating signs as stops are modified requires periodic attention to ensure accuracy. However, riders have provided regular positive feedback on the benefit of having a physical marker to confirm their location.

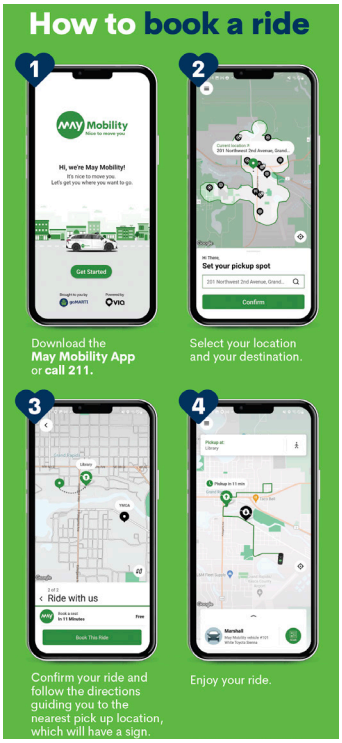


For communities where ride-hailing services are not the norm, or where there are no existing, designated bus stops or consistent stop placements, the team recommends budgeting for and implementing signage to mark shuttle stops.

The signage design process should focus on several key factors:

- Designating the shuttle stop location with a clear and consistent marker
- Advertising that the shuttle serves the area
- Informing the community how to ride and where to learn more

While signage rules and regulations are less rigid than for traffic signs, ADA signage standards and all safety requirements for signage (post, size, height, etc.) should be considered. The project team collaborated with MnDOT's Signing Engineer to ensure the signs meet all necessary requirements.



THE APP

The full end-to-end rider experience starts at the time of finding and booking a ride all the way through exiting the vehicle at the destination. A key component of the full ride experience is the app, as it is designed to be the single point of interaction for the rider.

Since this was a new service and likely different from what people have experienced before, it was important to have an app that is easy to use. Having the app helps the rider visualize the route and stops. It allows them to book on demand. They then get notifications about the ride status. The rider also uses the app to scan in to start their ride. The app even allows push notification messaging for us to report service outages for holidays, or for us to announce upcoming events.

VEHICLE SPECIFICATIONS

At the start of the project, a thorough analysis of available vehicles was conducted to identify an all-electric, wheelchair-accessible passenger or light-duty vehicle equipped with a drive-by-wire system compatible with autonomous driving controls. Unfortunately, no existing vehicle platform met these requirements. The primary challenge was, and remains, finding an electric light-duty vehicle that can be converted into a wheelchair-accessible vehicle. This is because the battery cavity in the floor often precludes the area where the ramp needs to be built into the vehicle (whether a rear or side entry). At the time of this report, only vehicles like the Ford e-Transit are available, which is a larger medium-duty shuttle with insufficient range (110 miles max) for rural applications.

Therefore, the Toyota Sienna Autono-MaaS platform was chosen. This hybrid wheelchair-accessible minivan is optimized for autonomous integration and comes in two variations:

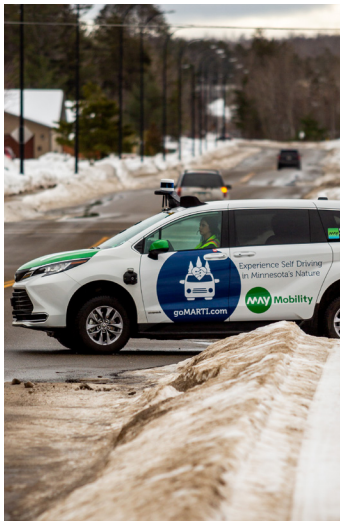
- A rear-entry wheelchair-accessible version that can carry 1 wheelchair rider via the ADA-compliant wheelchair ramp and 2 additional passengers (or 4 passengers if a wheelchair is not present).
- A standard version that can accommodate groups of up to 5 passengers.

VEHICLE STORAGE SITE SELECTION

Dealing with northern Minnesota weather means weeks of negative temps and feet of snow each year. Finding indoor storage for the vehicles was essential. Having vehicles parked indoors also allows for easy cleaning and daily maintenance of the AV sensors as well as eases data downloading and frequent vehicle system updates.

WORKFORCE & ECONOMIC DEVELOPMENT

This autonomous vehicle pilot provided us with several opportunities to develop, deliver and improve AV related workforce training. The conversation about training and workforce needs as the community was preparing for the pilot highlighted several career pathway strategic alignment opportunities which became parallel efforts in the community.



TRAINING

When introducing a technology-focused pilot project like goMARTI, having well-trained staff and project representatives is as important as having a good communication plan. Therefore, training the AVOs and Call Center staff, and continuously improving that training, is essential for success.

AVO TRAINING

AVOs are trained to prioritize safety above all, followed by experience, and then autonomy. Safety is paramount to a successful operation and can never be sacrificed. Operators are trained to always keep safety at the forefront of their minds, as understanding the level of safety of this technology is a core tenet of this project. Operators are also taught to ensure the best possible experience for everyone in or around our vehicles. They welcome new riders by greeting them and introducing them to our vehicle by name, and they ask the rider if they have ever ridden in an autonomous vehicle. When explaining technology, operators are trained to humanize the vehicle, describing the sensors as human senses and computers as the brain. Riders aren't the only ones for whom operators are crafting a positive experience; our operators are trained to make sure that all other road users, including both pedestrians and other vehicles, have the best experience possible. The AVO engages autonomy only when both safety and experience conditions are met. Autonomy is never prioritized over safety or the experience of those riding with or around us. The prioritization of safety, experience, then autonomy is crucial for an autonomous ride in any community.

Operators are first trained in a 4-hour online mini-course. Then they train behind the wheel, focusing on safe manual driving first. After demonstrating safe manual driving, the operators learn how to use autonomous mode. Once they prove proficient in autonomous mode, they then learn the dispatch tool where rides are assigned, and they learn to pick up and drop off riders.

AVOs are trained in best practices for wheelchair loading and unloading, ensuring that our wheelchair passengers are comfortable and confident in their ride. They are trained in the mechanical aspects of the BraunAbility ramps and straps, and how to use them with different wheelchair types, including electric and manual chairs. They are also trained in customer service for assisting people with varying levels of need based on their ability.

In this deployment, we were thrilled to partner with Myrna Peterson, a wheelchair user. Myrna helped train the team by offering to load and unload into the vans. Myrna also lent her spare motorized wheelchair to the site for use in training, which was very valuable because motorized chairs are much larger and heavier than manual chairs.

Site staff are trained by May Mobility, both on location and at May headquarters in Ann Arbor, Michigan. Site staff also attend daily fleet huddles with headquarters, as well as other tech development meetings to continue to be masters of their craft.

211 TRAINING

The call center was designed to be the first point of contact staffed 24/7 with humans who are able to help support goMARTI over the phone. The call center receives calls for several main reasons:

- To ask questions about goMARTI and general informational discussion
- To request help installing the app, creating an account, or navigating the app
- To request a ride over the phone

While the call center was initially intended to serve community members who do not or cannot use a smartphone, anyone can call for any reason. Call center staff participated in initial and ongoing goMARTI training to best serve all callers.

For general informational calls, staff were trained on the use and operation of the goMARTI service and given statistics and facts about self-driving vehicles. They also have access to a regularly updated FAQ guide containing answers to common questions. The FAQ is updated by the project team based on input and questions from call center staff.

For app-related calls, staff are trained on navigating the app, booking rides, creating accounts, and basic app troubleshooting. If unable to resolve an issue, staff can submit tickets to the app development team via the Via ticketing system or through a May Mobility email portal.

For booking rides, call center staff are trained to use the VIA VOC web-based tool. Staff received regular updates from the local VOC tool expert who participates on the goMARTI project's core operations team. A dynamic map was created to assist staff in giving instructions to callers who book rides without using the app. The call center provided regular feedback and requests through their participation in the core operations team.

Direct lines of communication between the call center and the site team who operate the vehicles have also been invaluable, particularly during the early months of the pilot.

The call center also collects feedback from callers, helping to capture the voice of the community's non-app users who would not otherwise receive app and web-based surveys.

COMPLEMENTARY PROJECTS

goMARTI created numerous jobs within the community and established Grand Rapids as a community that embraces technology. This is an economic development driver as other tech companies consider opportunities in Grand Rapids. To best prepare for technical careers, the high school and college system are evaluating career pathways to prepare and deploy highly qualified graduates into technical careers. goMARTI highlighted the importance of these pathways and identified several projects/experiences that would compliment the pilot program.

NEXT CAREER PATHWAYS

To better prepare for the upcoming autonomous vehicle pilot program, the Itasca Area Schools Collaborative (IASC) Next Career Pathways team engaged in a strategic planning effort with The PLUM Catalyst to identify opportunities to advance and improve the transportation and automotive pathways.

Specifically the goals were to:

1. Promote with and educate the local academic institutions regarding the new transportation and automation technologies; including current curriculum options and industry gaps.
2. Set-up customized training solutions and/or career pathway option(s) in IASC program, leading to future workforce development in the region around Autonomous Vehicle Technologies (Comp Science, Robotics, A.I.,Engineering).
3. Set-up strategic partnerships for the region with private industry partners
4. Facilitate IASC strategic investments in software and equipment for curriculum support (ex: LiDAR Sensors, CMU Robotics Kits)
5. Build out CAV STEM Camp curriculum option(s) with ICC/Hibbing

Since the goMARTI project launched and the strategic planning effort, the NEXT Pathways has also launched a new Automotive Tech/Transportation Pathway.

STUDENT WORKFORCE EXPERIENCE

As an output from the IASC NEXT pathways strategic planning exercise, one student experience project was proposed to be developed and deployed in conjunction with the launch of goMARTI. The Student Fixtures Experience was a hands-on, project based learning opportunity for the local high school students in Grand Rapids, Minnesota. The Fixtures project provided the students an understanding of self-driving shuttle technology by challenging them with the opportunity to design and build fixtures with features the vehicle references for enhanced localization when they are sensed along the shuttle's route.

Student Fixtures Project Summary

COMMUNICATIONS & COMMUNITY ENGAGEMENT

Communication and Community Engagement is not only a goal - but a key tenant of success with the goMARTI pilot. The project introduced many new technologies to the community. As such, building trust and understanding was paramount to increasing ridership and community utilization. The effort was also important to better understand the challenges of introducing new vehicle technology into rural communities. Key documents created to ensure a successful Engagement and Outreach effort include:

- External Communications Plan
- Brand Guidelines
- Community Engagement Plan
- Media Request Process
- Frequently Asked Questions

EXTERNAL COMMUNICATIONS

Our communications approach incorporated a variety of channels to ensure comprehensive coverage and engagement. Locally, we leveraged community events, press releases, and local media to foster a strong connection with stakeholders and residents. This grassroots approach helped build trust and facilitated active participation. The project quickly gained global recognition, highlighted by BBC News coming to Grand Rapids to record a segment. Local, state-wide, national, and international channels were instrumental in engaging a wider audience, sharing project milestones, and highlighting our innovative strategies. We ensured that our content was tailored to resonate with diverse audiences, using clear messaging.

Key insights from our communication strategy include the importance of tailoring messages to specific audience segments and using a mix of traditional and digital media to maximize outreach and engagement. It is crucial to maintain a balanced mix of localized personal interactions and broad, digital engagement tactics. Regularly assessing the effectiveness of communication efforts and adapting to feedback ensures continued success.

The team developed several marketing strategies to bring awareness to the goMARTI Pilot project, as public awareness is one of the greatest barriers to driving adoption of new technology solutions in a fairly monolithic public transportation market segment.

MEDIA REQUESTS

A robust media request process is good practice for any project, but it is essential for a state-of-the-art project like goMARTI. The project partners created and followed a media request process to ensure consistency and transparency in all goMARTI endeavors and to guarantee that primary stakeholders approve any media requests.

Media attention can be a double-edged sword: it can drive awareness and attract visitors to experience autonomous driving in Minnesota's nature, but it can also be a burden. Media requests require significant time and attention from the project management team to ensure high-quality and accurate coverage. They also place additional pressure on operations staff to provide demonstrations and other support. Media requests often include interviews, requiring training and coaching to ensure clear and concise communication.

Despite these challenges, goMARTI has benefited from a strong media presence. See **Appendix I** for a comprehensive list of media coverage for goMARTI 1.0.

COMMUNITY ENGAGEMENT PLAN

A robust community engagement strategy and plan was developed to reach the broadest range of community members and provide education and information about goMARTI. This plan included diverse community events such as large festivals, targeted outreach to specific community groups, outreach through major email lists, micro-advertising through signage placement, door-to-door advertising, and notifications via the app, call center, and website.

This community outreach provided a rewarding opportunity for team members and community advocates to share goMARTI with the community. Due to the broad range of activities and diverse stakeholders, a clear communications plan was essential. This ensured consistent messaging and clear, concise talking points to help educate and inform the community.

EXISTING COMMUNITY EVENTS

Rural communities are known for their well-attended festivals and themed weekends, and leveraging these existing community events helps maximize impact. For example, Grand Rapids, a town of about 11,000, can draw thousands of people to its annual Tall Timber Days weekend.

For larger events, goMARTI secures a high-traffic exhibitor booth and participates in the parade with a vehicle. Project-specific giveaways effectively spread awareness in any community. The vehicle is available at the exhibit space for curious individuals to investigate. Seeing the vehicle and sensor systems firsthand, and being able to ask questions, demystifies the experience and builds trust within the community.

FOCUSED COMMUNITY EVENTS

In addition to the larger community events, the team has found great success with small, focused micro-outreach events in different locations with higher densities of potential riders. In our case, the focus is on providing access to transportation while conducting this pilot, so target groups include those who cannot (or choose not to) drive like seniors and folks with mobility devices like wheelchairs. Typically, senior living communities, churches, and shopping retailers have been ideal hosts for a one to three hour focused outreach event.

Often these facilities were encouraged to reach out to the project team to request an event at their location, which was prioritized and tracked through an engagement tracker that helped align the resources necessary for each event and maximize benefit to the community while still allowing full pilot operation.

ENGAGEMENT STRATEGY

Community engagement was divided into three strategies:

- **Early engagement:** The community was informed about, consulted on, and involved in the concept, with an emphasis on gathering feedback on key features of the pilot program.
- **Engagement at and near launch:** The focus shifted to informing and educating the community on how to participate.
- **Post-launch and continued engagement:** The focus remained on informing, consulting, involving, and collaborating with the community to gather feedback to drive pilot improvements, with additional outreach to target populations and potential new participants.

The City staff defined the ultimate success of the project as the community feeling empowered to determine if they wanted to continue operations. The team regularly uses the IAP2 Spectrum of Public Participation in the design of engagement activities.

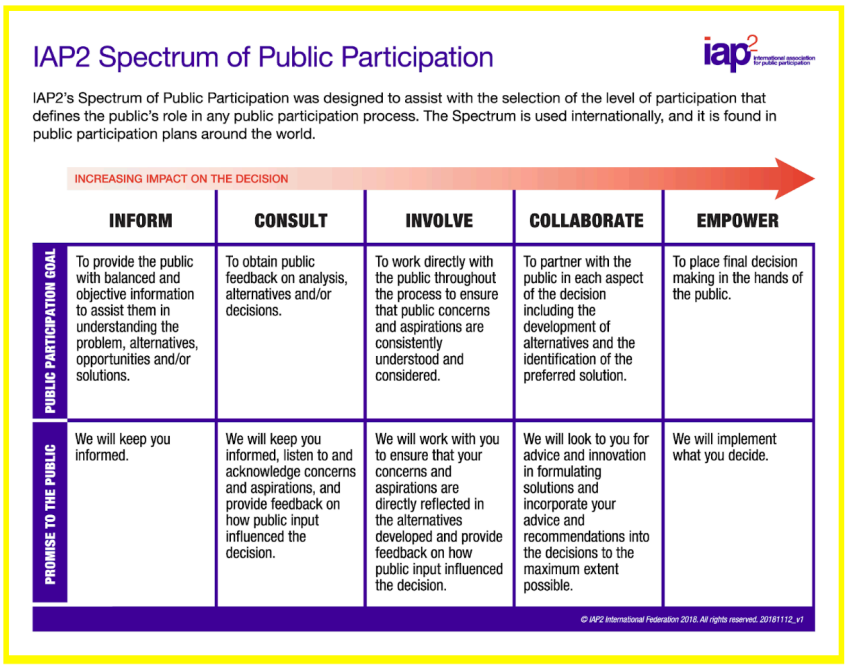
> *"Extend route to Walmart, have some morning hours on weekdays."*

> *"Please add stops for: Cohasset, LaPrairie, and Grand Rapids Walmart"*

PURPOSE OF THE SPECTRUM

The Spectrum serves as a guiding tool for organizations to determine and implement the appropriate level of public involvement in decision-making processes and assist with the following:

- **Clarify Roles:** The Spectrum helps to clearly define the role of the public in the decision-making process.
- **Set Expectations:** It sets clear expectations for both the public and the decision makers about the extent of public influence.
- **Enhance Transparency:** By specifying the level of engagement, it promotes transparency and builds trust between the public and the organization.



IAP2 Spectrum of Public Participation

IAP2's Spectrum of Public Participation was designed to assist with the selection of the level of participation that defines the public's role in any public participation process. The Spectrum is used internationally, and it is found in public participation plans around the world.

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

EARLY ENGAGEMENT

> *It's a free service that I can use to get from point A to point B.*

Initial engagement activities are fundamental to understanding public opinion and values, and is the foundation for designing a successful project-long engagement strategy and maximizing the opportunity for a successful pilot project.

COMMUNITY LISTENING SESSIONS

The primary goals of the early community listening sessions were to educate the community about the upcoming pilot program and to gather their thoughts, questions, and comments. The sessions also solicited community input to help define key aspects of the pilot program, specifically the hours and days of operation, and desired shuttle pickup/drop-off locations.

Being transparent about which aspects of the pilot the community can direct and influence aligns with the IAP2's Spectrum of Public Participation, which guided community engagement throughout the project.

SONG CONTEST

New technology introductions are always challenging. Making the introduction fun and interactive has proven to help users become more comfortable and willing to try it. Music can break through hesitation and help make experiences more fun and relaxing.

Given that goMARTI is the first self-driving shuttle project in Minnesota (especially in a rural area) that engages the community in the full cycle of a pilot launch, it was important to create innovative and fun ways for the community to feel involved and more comfortable getting to know the shuttles. Creating a project song in partnership with a local musician was a simple way to create an interesting and memorable experience with the shuttle and allowed the community to feel an easy connection to this new introduction. The Iron Range Resources & Rehabilitation (IRRR) Streetscapes grant funding was used for the recording, production and publishing of the goMARTI project song community competition. The winning song, "goMARTI is Here," has now had thousands of streams and downloads and is a local hit in the community.

To learn more about the goMARTI jingle song competition review this summary.

To listen to the song: youtube, spotify, apple music.

ENGAGEMENT AT AND NEAR LAUNCH

Community engagement leading up to the launch was primarily focused on building awareness and excitement for the project by sharing the goals of the project, explaining on-demand microtransit, and providing opportunities for the community to experience goMARTI firsthand. At this early stage, the public was just becoming familiar with the name goMARTI and starting to see the vehicles around town. FAQs about the service were common, so it was important for the project team to provide consistent information.

The engagement strategy also included outreach to local safety teams, offering first responder training for gaining entry to a shuttle in an emergency. The session covered emergency access training, vehicle inspection, and Q&A sessions. Following the presentation, officers and firefighters were invited to examine our vehicles, focusing on the ADK, battery locations, and wheelchair seatbelt system. Feedback indicated their primary concerns were battery location for fire emergencies and seatbelt accessibility for crash rescues. Through these sessions, the pilot team established a strong working relationship with Grand Rapids Public Safety, promoting open communication

regarding AV operations and safety. The goMARTI core team continues to meet with GRPD for project updates and discussion every 6 months, a practice highly recommended for any community deploying AV technology.

Another important consideration for near-launch outreach was that introducing an AV pilot in a rural community often requires a more thorough introduction to additional technologies like on-demand transportation, shared mobility, and app-based services. For many community members, this was their first exposure to these technologies, adding complexity to the rollout of a transportation pilot which integrates them all.

APP AVAILABILITY

This complexity—the required app downloads, registration, and account creation—justified the team's desire to plan for extensive community outreach and create a robust call center service to aid with app installation, account creation, and answer general questions about the technologies and operations.

One limiting factor that added an extra challenge was the availability of the ride-booking application. Unfortunately, the phone app was unavailable until a few days before the pilot launch, severely limiting our ability to meaningfully engage with the community, demonstrate the app, and help with installation and account creation. We were forced to talk about the process rather than help with it. One lesson learned to share with other interested communities is to allow at least a month of engagement time with an app to educate users on how to use it and book a ride, and to aid in the installation and setup process.

POST-LAUNCH CONTINUED ENGAGEMENT

Consistent community outreach after launch is essential for increasing ridership and community acceptance.

Creating opportunities for the community to interact with and demystify goMARTI vehicles has proven successful and well-received. The challenge was to develop diverse strategies to maximize community reach with limited resources for continued outreach. The team balanced their efforts between larger, established community events and smaller, focused community events.

PORTABLE ADVERTISING MESSAGE BOARDS

In addition, the team created A-frame “sandwich board” portable signage that could be set out at a wide variety of community events taking place within the pilot shuttle zone to advertise the opportunity to utilize goMARTI to attend the event.

APP-BASED NOTIFICATIONS

Leanplum is a software tool in addition to the May Mobility rider app that enables direct rider engagement through multi-channel marketing. This third-party tool was provided to May Mobility staff as a package with the Via application and booking portal. The goMARTI project group used in-app messages, push notifications, and email channels to directly communicate with end-users about riding the goMARTI service for upcoming community events and to solicit rider feedback about their experiences.

The project group regularly assessed the community calendar and May Mobility set up Leanplum messages around key events. It was important to leverage regular communications without reaching excess so that riders would not opt-out from receiving these messages. The general guideline was one or two messages per month at most, depending on the calendar of events.

Examples of key community events include Tall Timber Days, the Itasca County Fair, fall sports such as high school football games, and holidays. Analysis was performed immediately following these events to note the impact of the notifications. The project group concluded that each community event provided an ideal opportunity to expose new riders to the goMARTI service, and many of these new riders became repeat riders thus growing overall ridership.

EMAIL UPDATES CAMPAIGN

The goMARTI website allowed us to ask stakeholders to subscribe to periodic email updates. This initially served as a conduit for disseminating news and routing updates, such as the addition of new stops in the pilot program. As the subscriber base expanded, the email updates evolved into a robust communication channel. This platform now supports the dissemination of information regarding operational adjustments due to extreme weather or holidays. Furthermore, it serves as a vital tool for soliciting feedback and notifying subscribers about events where goMARTI will be present, either for static demonstrations or to provide transportation to and from the event. Overall, e-mail updates have enhanced engagement and ensured stakeholders are well-informed.

COMMUNITY BASED OUTREACH

Community outreach is a major factor in the success of any program. The success of this pilot project's outreach was overwhelmingly due to strong community advocates who delivered the goMARTI message to a wide variety of service providers, community groups, senior living communities, and directly to homes. This group comprised leaders and representatives from First Call for Help 211, Mobility Mania, and Itasca County Health and Human Services.

These local advocates delivered the goMARTI message to thousands of local community members through a myriad of events, including job fairs, lunch and learns, client packets, handouts to walk-in community members, door-to-door outreach, and through the hundreds of calls they receive daily in support of the community.

For a more complete list of community-led outreach activities visit Appendix K.

GIVEAWAYS

The goMARTI name has become synonymous with accessible, easy-to-use transportation in Grand Rapids, due in large part to the communication and outreach efforts of the team and local community advocates.

One successful way to further share this message is to provide physical reminders that can be used to share goMARTI information, such as branded merchandise given away at events.

The team created brochures and tri-folds for the community to take and share with family, friends, and co-workers. These contain basic information about how to ride, where to get the app, shuttle stops, and hours of operation.

Branded sunglasses and can koozies were also designed to be given away at community events like festivals, parades, and concerts. These serve as a reminder that goMARTI is an accessible transportation option for all.

ENGAGEMENT IMPACT

Community buy-in can take time, especially in rural areas. While ridership has steadily grown over the 27-month pilot, widespread adoption of goMARTI wasn't achieved until about a year into the program.

Direct, face-to-face interaction is critical for informing potential riders in small communities about the transportation access goMARTI provides.

While tracking specific outreach efforts is difficult and often inaccurate, ridership numbers indicate that our collective outreach efforts have been effective. Ridership doubled from 5,000 riders in year one to 10,000 riders in year two.

This success is largely attributed to our team of local community ambassadors, who are passionate about raising awareness for the shuttle program.

DIGITAL PRESENCE

GoMARTI primarily used a public website to share information about the pilot. Additional communication methods included periodic emails sent to a distribution list and push notifications sent to phones via the app. Social media updates and presence were managed through partner pages; dedicated goMARTI social media pages are forthcoming.

WEBSITE

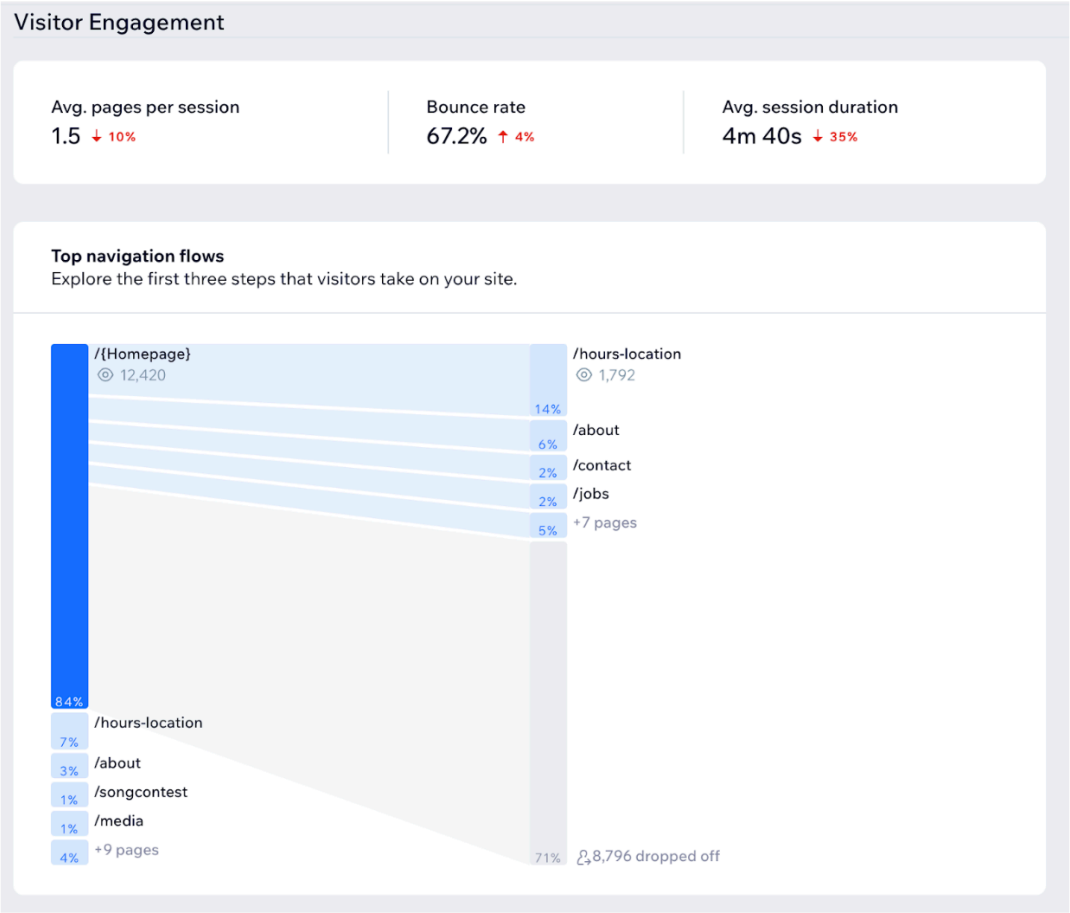
The website is our primary method of sharing information. Besides information provided within the app, weather-related closures and other rider information could be found on the website. The site included links to maps, riding instructions, app download information, a holiday schedule, a list of stops, and job postings. A newsletter sign-up was available for anyone interested in staying up to date with goMARTI.

WEBSITE INSIGHTS

The website traffic data not only serves as a comprehensive hub of goMARTI information for visitors, but also offers invaluable insights to project stakeholders. By analyzing this data, we can uncover detailed information about the geographical location of our visitors, allowing us to tailor our outreach and communication strategies. Furthermore, we can identify the areas of the project that generate the most interest and engagement, enabling us to allocate resources and development efforts more effectively. This data-driven approach will enhance the user experience, optimize project outcomes, and ensure that goMARTI continues to meet the evolving needs of its audience.

Visitor type	Page views ↓	Site sessions	Unique visitors	Bounce rate	Avg. session dura...
Summary	28,269	14,804	10,087	67%	4m, 39s

The website has welcomed about 10,000 visitors who have viewed about 28,000 pages over 14,000 sessions.



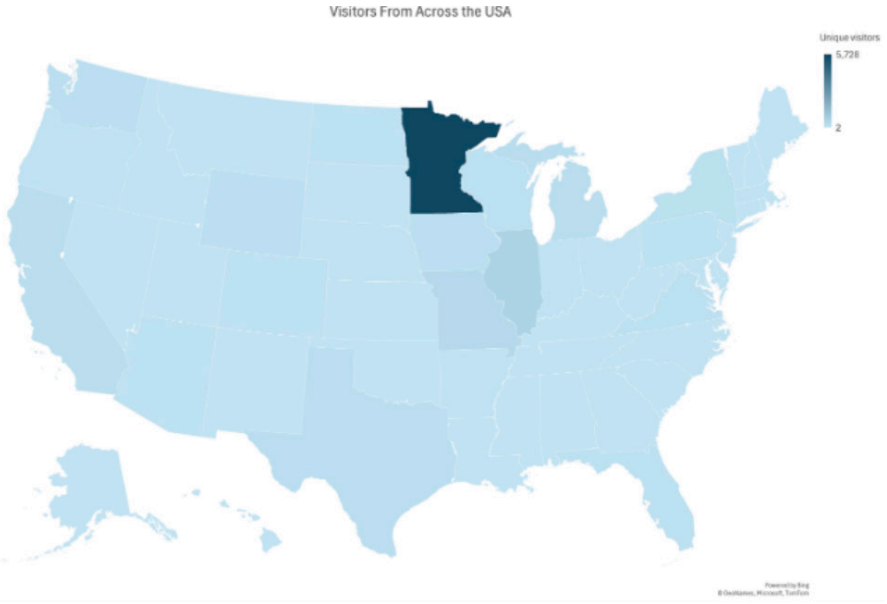
The vast majority (84%) of these visits start at the homepage and only 29% of visitors venture to any further page leading us to ensure all important goMARTI information is available on the home-page. This includes: important messages, hours of operation, how to ride instructions, options for connecting or getting support, and a map of the operational zone with stop locations.

The vast majority (86%) of site visits in a given month are *new visitors* likely looking for one of those quick information tidbits.

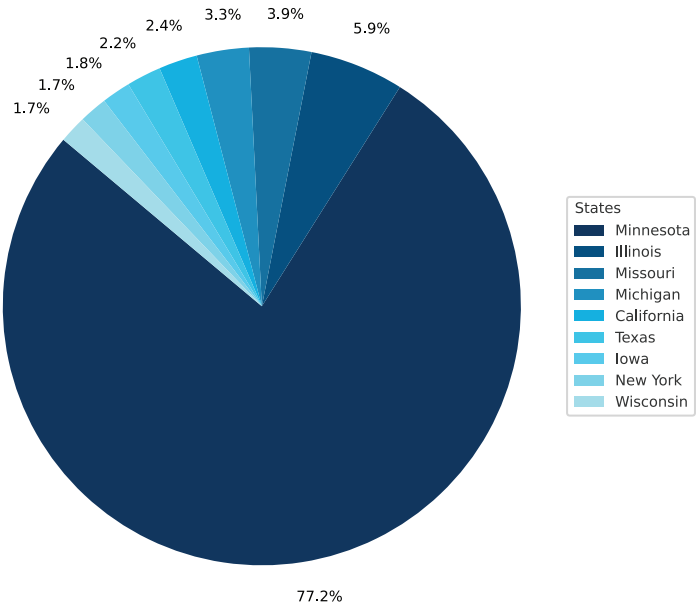
Last 30 days (Oct 7 - Today) | Filter | Customize

Visitor type	Page views ↓	Site sessions	Unique visitors	Bounce rate	Avg. session dura…
Summary	1,077	397	308	49%	2m, 23s
New	927	341	280	50%	2m, 5s
Returning	150	56	28	45%	4m, 15s

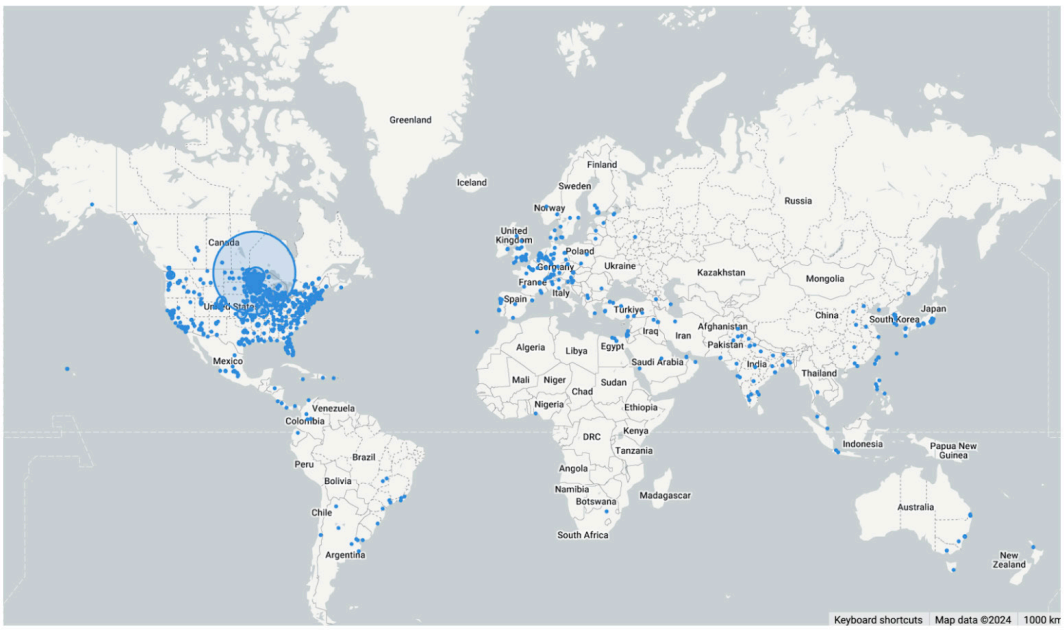
The goMARTI site has welcomed visitors from *all 50* states! About 57% of visitors are from Minnesota, leaving 43% of the unique website visitors from outside of Minnesota. After Minnesota (representing 5728/10087 visitors), Illinois, Missouri, Michigan and California round out the top 5 states visiting the website. For a full list of state visits check out Appendix M.



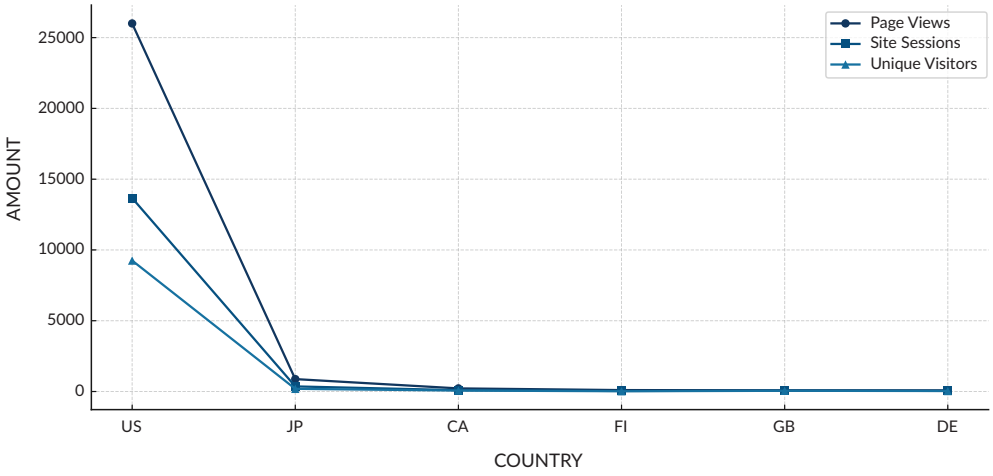
PAGE VIEWS DISTRIBUTION BY STATE



Internationally, goMARTI has received visitors from 70 different countries around the world. While the vast majority have been visitors from within the US (9,252/10,087), Japan, Canada, Finland, UK, and Germany are the top 5 international visitors.



WEBSITE TRAFFIC METRICS BY COUNTRY

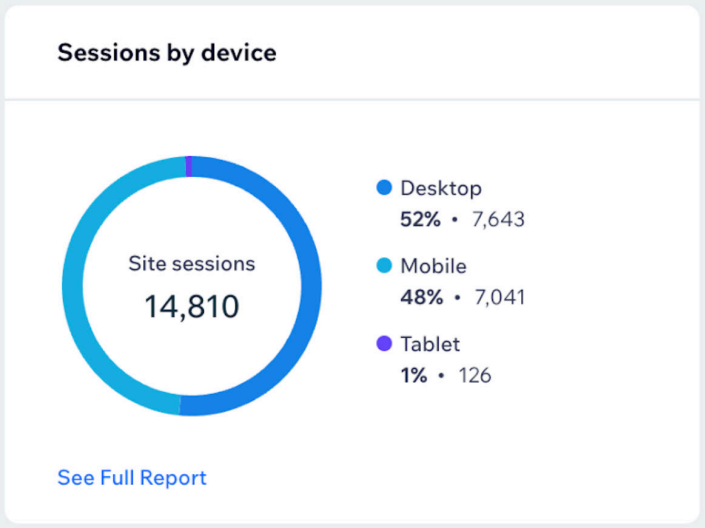


This data demonstrates the national and international attention Grand Rapids, MN is receiving as the host of this innovative autonomous vehicle pilot program.

Of the 10,087 unique visitors – 2,688 (27%) are from the Grand Rapids Area.

CITY / TOWN	SESSIONS	UNIQUE VISITORS
Grand Rapids	2,663	1,853
Hibbing	438	348
Cohasset	196	159
Bovey	141	115
Deer River	105	77
Pengilly	87	62
Virginia	33	30
Nashwauk	26	21
Coleraine	25	23
Grand Rapids Area	3,714	2,688

The visitors are almost evenly split between mobile phone and desktop visits.



Local users show a strong preference for mobile access (approximately 65%), but the farther from the pilot area the trend flips toward a higher percentage of desktop users. This suggests that local users planning to ride the shuttles primarily use mobile devices to access the website, check the map and shuttle locations, or find the app and hours of operation. Conversely, website visitors from other cities, agencies, or individuals interested in goMARTI or the pilot and research are more likely to use desktop browsers.

SOCIAL MEDIA

The team opted not to generate specific goMARTI social media pages for the pilot phase. However, pictures, news, media coverage, events, and updates were shared and re-shared via the social media channels of core partners, including The PLUM Catalyst, May Mobility, and Via.

COMMUNITY FEEDBACK

> *This was my first time using the service and I was very impressed! Easiest public transit experience I have ever had in Grand Rapids.*

Gathering feedback from the community is one of the most important factors in measuring the success of the pilot effort. Information from a diverse set of community members can provide us with knowledge on how to continue to improve and evolve goMARTI to best serve the community.

This feedback can help us understand rider demographics, gain insights about operations, learn what is working and what isn't, and gauge overall acceptance and value of an on-demand micro-transit autonomous vehicle solution for rural communities.

The pilot team sought feedback in several ways:

- A pre-ride survey to gauge the riders understanding and feelings about AV technologies
- A post-ride survey to evaluate the riders understanding and feelings about AV technology after taking a ride in a goMARTI shuttle
- An App based rating (1 to 5 stars) on their satisfaction with their ride
- Direct feedback from the AVOs as they interact with riders during transit
- Interactions with call center staff who assist in booking rides or answering questions about goMARTI over the phone

Each of these conduits offers an opportunity to learn from the community and better understand the best way to provide transportation solutions to rural communities. High level summaries and analysis are provided.

POST-RIDE APP RATINGS

Riders who book and complete a ride through the mobile application can rate their experience on a scale of 1 to 5, with 1 being the lowest and 5 the highest. From launch to the end of the pilot, there were 13,418 completed rides (survey opportunities) with 2,011 responses (15% response rate).

The following rating breakdown yields a 98.9% rider satisfaction rate:

NUMBER OF RESPONSES	RATING
1,955	★★★★★
32	★★★★
9	★★★
4	★★
11	★

DIRECT FEEDBACK TO AVOS

With operators behind the wheel, this project benefited from an ongoing form of informal rider feedback. As the AVOs were both giving rides and talking to people, they naturally became a fantastic source of community information. Daily conversations with riders about shuttle usage and

desired destinations led to project improvements for goMARTI. Rider feedback provided clues on how to maximize the service value with small tweaks. For example, adding a stop at the door of Target improved ridership there, and stops at the door of senior facilities helped those with mobility challenges. Through rider feedback to AVOs, we also learned about desired future stops, and we used that list for future expansion planning.

CALL CENTER FEEDBACK

The call center provides a mechanism for collecting feedback from a particularly important user group. Our other mechanisms for gathering feedback are surveys and ratings completed electronically via the app or email. Users that call in for rides do not receive the post ride survey or app rating request, and as a result don't have a way to submit feedback other than through the call center staff prompting for feedback.

The call center staff were trained to ask several of the rider survey questions as part of their dialogue with the callers. This feedback is then integrated with the email and app-based survey responses to provide the most complete data for any community survey insights.

SURVEY FEEDBACK

With the goal of collecting rider and community feedback on rider experience, and to better understand the public's perception of automated vehicle technology, the goMARTI project conducted pre- and post-ride surveys. The surveys were administered in a variety of ways. When someone created an account on the May Mobility app, they received a link to complete the pre-ride survey. Post-ride surveys were sent to riders after each completed ride. Pre-ride surveys were also available at community events and offered to community members calling into the 211 call center.

Over the course of the pilot, 451 pre-ride surveys were completed and 472 post-ride surveys were completed from unique riders. Some notable survey takeaways include:

- Comfort levels while riding in a goMARTI shuttle were 39% higher post-ride compared to pre-ride survey responses.
- 45% of riders were unfamiliar with CAV technology prior to riding.
- Post-ride, more than 98% of all riders reported positive feelings towards CAV technology.
- Almost all post-ride survey takers (98%) would recommend goMARTI to family and friends.
- The most frequent uses of goMARTI were daily errands, leisure, commuting to/from work and healthcare.

Full survey results and survey questions can be found in Appendix D.

> *"This technology and program are a God-send! It has been life-changing for me. A TBI left me a recluse, and the bus with its lengthy calls and then being unpredictable, I stopped all therapy, doctor, psych, and social appointments. I have now attended 6 appointments due to this service and they were desperately needed. THANK YOU SO VERY MUCH!"*

OPERATIONS

SUMMARY OF OPERATIONS

The goMARTI pilot service area covers key businesses, services, and residential areas in central Grand Rapids, MN. Shuttles operate Tuesday through Friday from 2:00 PM to 10:00 PM, Saturday from 10:00 AM to 10:00 PM, and Sunday from 8:00 AM to 2:00 PM. This schedule was developed based on community input and coordination with other local transportation providers. All rides during the pilot were free to ensure accessibility for all riders, regardless of financial status.

All aspects of the operation were detailed in several different plans, which are attached in Appendix at the end of this report and linked here:

Appendix E: **Deployment Management Plan**

Appendix J: **Emergency Response Plan**

Appendix F: **Incident Log**

Appendix G: **Software Update Register**

DASHBOARD

The May Mobility data dashboard provides easy to read insights through the aggregation of key metrics for ridership, service performance, and autonomy levels with the ability to view real-time or download data. Because this information is aggregated, it does not disclose any rider personally identifiable information(PII).

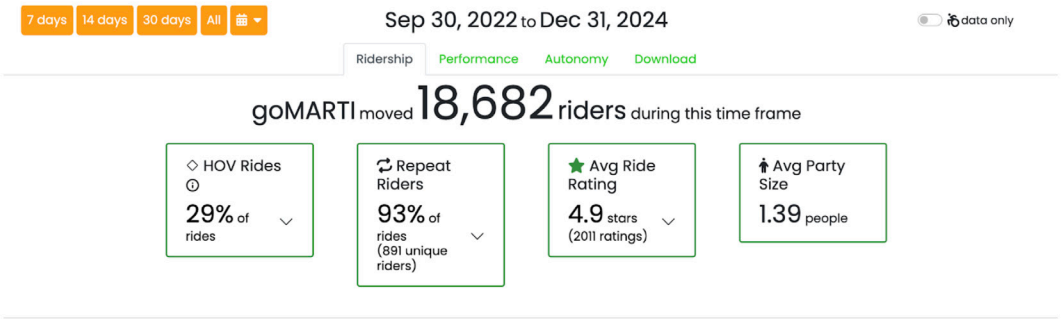
Information/data included on the dashboard includes (but not limited to):

- **Ridership:** total riders, unique riders, repeat riders, rider frequency, ride rating, daily/ weekly ridership trends, ridership by station breakdown, origin and destination request maps
- **Service Performance:** driven distances, vehicle utilization, wait times, ride completion percentage, on-time pickups, walk distance to pick up and drop off
- **Autonomy Levels:** autonomy percentages, daily performance, autonomy heatmap of the designed route
- All of this data is available for standard vehicle trips and wheelchair accessible vehicle (WAV) trips

By regularly reviewing these metrics, the project team was able to thoroughly analyze the rider experience and vehicle performance, which led to targeted improvements to the route network and service operations. The following metrics are examples of assessing the rider journey:

- **Unique riders** - the number of individuals who booked and completed a ride
- **Repeat riders** - there was historically high performance that indicated once riders took their first ride, they were comfortable in the AVs and had no hesitation to ride goMARTI again. This was validated with results from the pre- and post-ride surveys.
- **Average ride rating** - used to assess rider satisfaction with their goMARTI experience
- **Riders by stop location** - which stops were most popular and which had the highest or lowest wait times to see if adjustments to the stop locations should be made
- **Ride completed percentage** - how easy was it for riders to use the app and successfully book and complete a ride. If rides were not completed, what were the main drivers and how could they be converted into completed rides.
- **Average walking distance to pickup and drop off points** - stops were added or adjusted to make them more accessible to foot traffic for potential riders
- **Autonomy heat maps** - gave insight to which areas of the route performed better than others in autonomy, also factoring in seasonal/weather comparisons. This enabled May Mobility to improve autonomous capabilities along the route throughout the pilot.

RIDERSHIP DATA

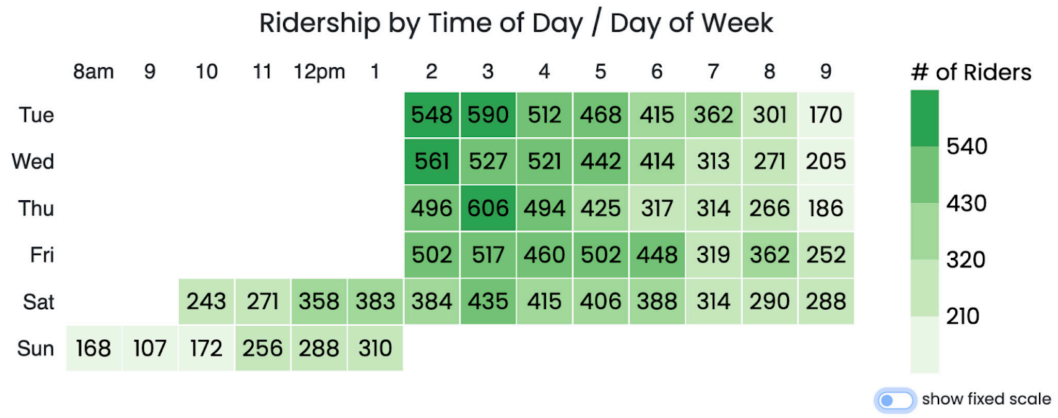


Ridership improved significantly from launch to the end of the pilot. Given the potential for harsh winter conditions, it is important to consider comparisons of the same time period year-over-year in addition to quarter-over-quarter:

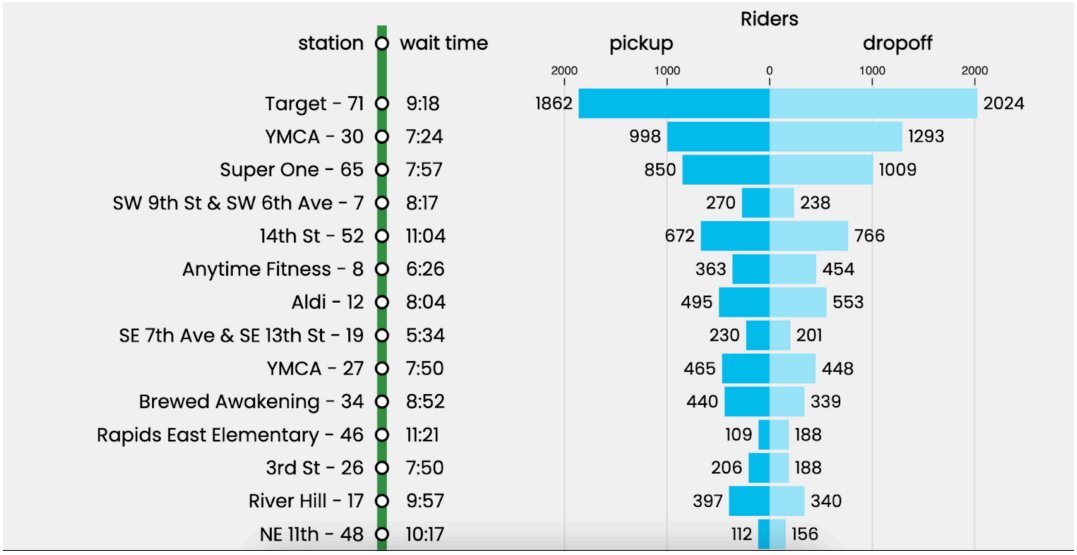
- **Quarter to Quarter from Q4 2022 through Q4 2024:** +27% > +8% > +52% > +38% > -8% > +54% > +20% > -2%
  - The only reductions were into Q1 2024 and Q4 2024 which was not a surprise as ridership typically dropped in colder months with harsh weather
- **Quarterly YoY:**
  - Q1 2024 109% higher than Q1 2023
  - Q2 2024 198% higher than Q2 2023
  - Q3 2024 135% higher than Q3 2023
  - Q4 2024 63% higher than Q4 2023
- **YoY:** 2024 71% higher than 2023

Repeat riders reached 80% by the end of Q4 2022 and did not fall below 88% in any of the following quarters. By the end of the pilot program, there were 891 unique individuals who booked and completed a ride, with 16% riding daily and 57% riding weekly. Because early rider numbers were low but consistently grew during the pilot, we determined that the key to increasing total ridership was initial exposure, since riders were highly likely to continue using the service. This was significant for boosting local community engagement efforts and leveraging Leanplum messages to advertise and increase goMARTI exposure within the community.

Average ride rating was used in addition to survey responses to judge overall rider satisfaction (the percentage of 4 and 5 star ratings). Quarterly rider satisfaction rates routinely surpassed 98%, with the overall pilot rider satisfaction rating at 99%. These extremely high satisfaction ratings, combined with positive survey results, reinforced the belief that once riders experienced their first ride in an AV, they were very happy with the service and therefore very likely to use it again.



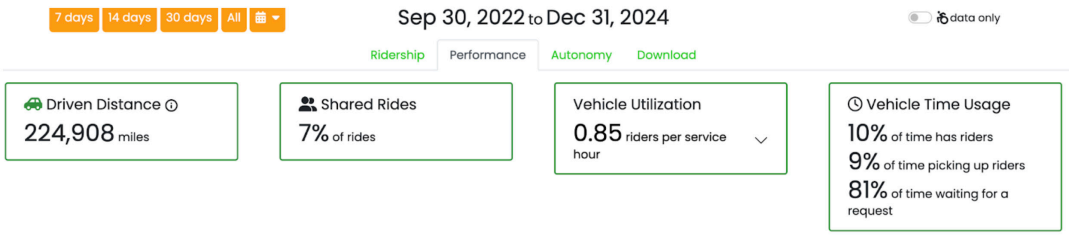
During weekdays, the majority of rides were completed during the first half of service between 2pm and 6pm local time. Saturday and Sunday service was more popular in the afternoon between 12pm-2pm, with Sunday being the lowest day for riders overall.



The most frequently used stops for both pickup and dropoff remained consistent throughout the pilot. The primary change was the adjustment of the Target stop, which led to a significant increase in Target rider volume beginning in October 2023.

PERFORMANCE DATA

The site has demonstrated high autonomy statistics, especially when compared to safety incidents or collisions. The only two incidents were minor, with no injuries, and were determined to be unrelated to autonomy. In one incident, a scooter rider who was not paying attention ran into the back of the vehicle. In the other incident, our van was rear-ended while briefly stopping at railroad tracks. The high autonomy rate and low incident rate demonstrate that the technology has performed successfully, even in a rural setting with extreme weather conditions.



Miles Traveled:

- 2022 (Oct-Dec): 21,015 miles
- 2023 (Jan-Dec): 101,847 miles
- 2024 (Jan-Dec): 102, 046 miles

RIDERSHIP

The number of miles traveled has remained consistent year-over-year, and the full 2024 data reflects this positive trend. While the number of miles traveled in 2024 remained similar, ridership

increased significantly: 5,685 riders in 2023 vs 11,566 in 2024. This increase in riders but consistent mileage can be attributed to both an increase in shared rides and an increase in the number of stops with more riders traveling shorter distances.

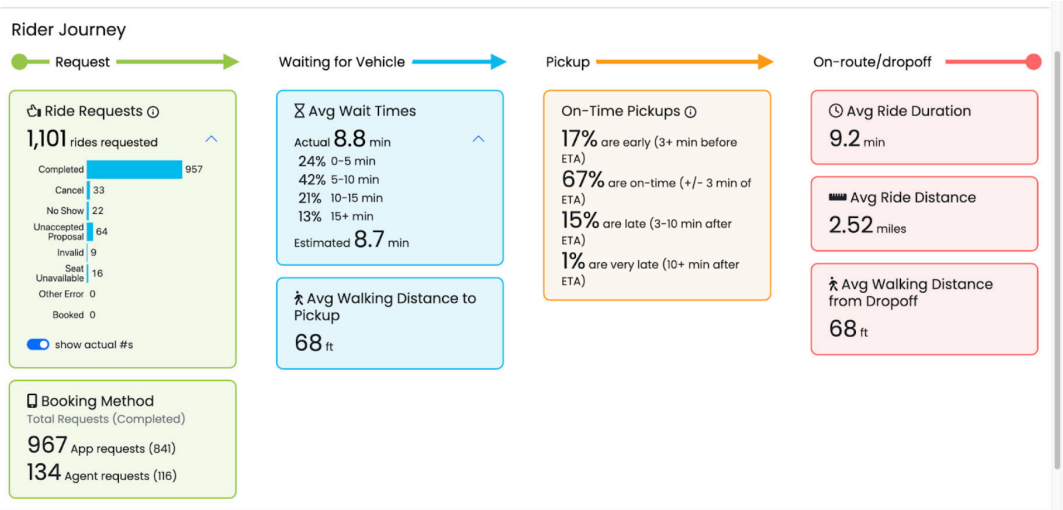
> *"I love how fast they are and how convenient they are! VERY good thing for the community!"*

WAIT TIMES

Consistent wait times remain a key focus for ensuring accessibility, operational efficiency, and a positive rider experience. 2024 saw improvements over previous periods, with average wait times demonstrating continued reductions and consistency. These improved wait times can be attributed to an updated back-end setting that prioritizes main roads over back roads, allowing for faster travel. Additionally, the increase in the percentage of shared rides has contributed to a decrease in wait times.

Average Wait Times (minutes):

- Oct 2022: 10.6
- Oct 2023: 10.4
- Oct 2024: 8.8



The average wait time in 2024 is 9.03 minutes, a decrease from 9.95 minutes in 2023. Wait time patterns signal the importance of continuous operational improvements and how riders are benefiting from predictable access.

Shared rides increased notably between 2023 and 2024, signaling a trend toward community members adopting more shared transportation options;

Shared Rides Percentage:

- 2023: 5%
- 2024: 8%

This represents a 3% year-over-year increase and demonstrates shifts toward sustainable mobility solutions and shared transportation preferences within the community.

Vehicle utilization has grown year-over-year, reflecting increasing demand and the positive effects of improved access;

- 2022 Average: 0.35 hours
- 2023 Average: 0.56 hours
- 2024 Average: 1.26 hours

Quarterly averages for 2024 are as follows;

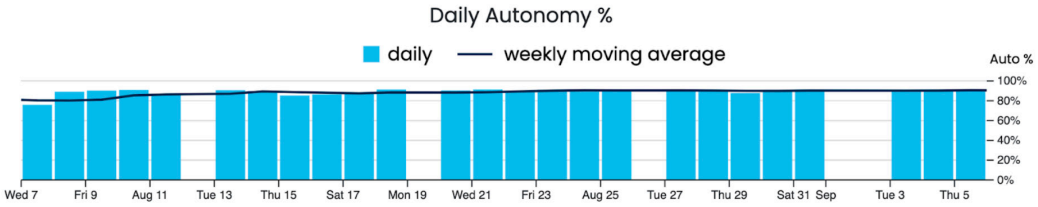
- Q1: 0.84 hours
- Q2: 1.21 hours
- Q3: 1.50 hours
- Q4: 1.49 hours

These trends highlight a steady increase in both rider engagement and the utilization of transportation options—further evidence of access improvements for the local community.

AUTONOMY DATA

While autonomy percentage is an indicator of success, there are other factors to consider. Improvements along the way have led to increased percentages, and finding those improvements are wins on their own. For example, we've learned that reducing speeds on off-roads during the winter allows the vehicles to stay in autonomy even in tougher winter conditions. We've also learned that prioritizing the main roads in winter better aligns to the timing that the city can plow, which allows us to stay in autonomy during winter storms. Additionally, May Mobility has improved the vehicle's ability to recognize and veer around blockages in the road, allowing us to maneuver around snow banks and parked cars. All of these learnings have improved the technology fleetwide.

Operations data is collected constantly, and is displayed in dashboard tools and monthly reports. With these dashboards, it is easy to see autonomy percentages, planned and unplanned disengagements of autonomy, ridership, and more. See Appendix G for a detailed report on autonomy data.



IMPROVEMENTS / AV GROWTH

The goMARTI project took incremental steps to improve safety, efficiency, and address the unique challenges of our riders. Frequent updates to stops and routes allow goMARTI to adapt and evolve based on community feedback and recommendations.

Safety - Adjustments to basic parameters such as speeds, lane position, and stop placement enable safe driving in all seasons. For example, during winter, we assessed and adjusted stop locations to

ensure safe loading and unloading of passengers, especially those with mobility challenges. Snow banks can create challenges for passengers, so we moved stops closer to walkways and away from snow and ice piles.

> *"Learning more about self-driving cars and also being able to say I rode in one when I was 84."*

We made similar revisions to speeds on the route during winter. The route was initially planned in ideal conditions during Spring, Summer, and Fall, but speeds were revised to match realistic traffic patterns in winter.

Efficiency - We added more direct routes to commonly used locations to decrease wait times, allowing us to maintain low wait times even as ridership increased.

Challenges - Many of our riders are elderly or have mobility challenges. We received feedback that these individuals wanted to ride goMARTI more frequently but were unable to travel a city block or more to get to a stop location. After hosting listening sessions with these community members, we decided to move several stops to the door of senior living facilities.

> *"Experiencing the future NOW!"*

Summary of Route Adjustments

- Total number of stops at start - 69
- Total number of stops at end of pilot - 74
- Stops that were added - Target, Majestic Pines, Tech Center, Brookstone, Airport
- Stops that were moved
  - Essentia (moved to door)
  - Pillars (moved to door)
  - Ace (moved to have better parking lot access)
  - River Grand (moved to the door)
  - St. Andrews (moved to the door)
  - Anytime Fitness (moved to the door)
- Total road miles at start - 17 (lane miles, or one way miles)
- Current total 23.14 (lane miles, or one way miles)

Target and Super One - September 2023

In September of 2023, we launched stops at the door of both Target and Super One Grocery. Many riders had told us that even more people could use the service if we could get closer to the store entrances. Since people are often carrying shopping bags, getting closer to the doors was important to us. After launching this service, we saw the stops used more frequently.

Stops Adjusted for Accessibility - Winter 2023

During the winter season of 2022/2023, we evaluated the quality of our pickup and dropoff locations, specifically in relation to winter weather conditions. Our focus was on areas where snow and ice accumulated during plowing and the actual stopping points of the autonomous vehicle. This assessment was crucial due to the unpredictable and organic nature of snow and ice accumulation

throughout the winter. As a result of our evaluation, we identified opportunities to improve the placement of vehicle doors and wheelchair ramps to enhance passenger loading and unloading. These adjustments were implemented to prevent passengers from having to navigate snow banks during pickup and dropoff. In many cases, this involved repositioning stops by 10-20 feet to align better with maintained areas. A total of 8 stops were adjusted accordingly.

Essentia Added - May 2023

Essentia Health Clinic was one of the first locations to have a door stop added. As a result of the clinic's relocation, it was determined that door service would be beneficial to patients and staff. This change improved accessibility and convenience for those visiting the clinic.

Senior Living Facilities - September 2023

Feedback from community members, particularly seniors and those with disabilities, indicated that walking even a short distance to a ride was a barrier. They requested door-to-door service at senior facilities. In response, we added stops at four senior living facilities: Majestic Pines, the Pillars, River Grand, and Brookstone Manor.

Airport Loop Park and Ride - January 2023

Grand Rapids, being a transportation hub, has received feedback from people who would like to use the service as a park and ride. In collaboration with the city, we now offer this service from the airport parking lot. People can park their personal vehicles at the airport parking lot and use the airport stop as their pickup location.

Pokegama and HWY 38 Added - November 2023

In order to keep wait times as short as possible, we added a stretch of road through the middle of the route that better connects the northern sections to the southern sections.

RURAL OPERATIONS

The recipe for success in a rural community differs understandably from that of an urban city deployment. Community acceptance and local presence are essential aspects of a successful rural project. Thus, using a community-based call center (versus a national or international call center) for local communications and engagement activities was critical.

Other keys to a successful deployment included an autonomous vehicle capable of traveling the speed limit without disrupting traffic flow, which is mandatory for community acceptance. Additionally, an operator, pedals, and a steering wheel allow for manual takeover at a moment's notice, enabling operation in bad weather or other scenarios at the edge of the operating domain.

Another unique aspect of the rural deployment was the lack of existing transit stops or infrastructure catering to mass or micro transit. This meant there were no existing bus stops and, by and large, no mid-block curb cuts, ramps, or street access from sidewalks other than at intersections. As a result, more intentional analysis was required to identify safe stop locations, and signage at shuttle stop locations was essential.

WINTER OPERATIONS

Winters in Grand Rapids can be extremely challenging with an average of over 50 days of snow and close to 60 inches of total snow per year. In addition to snow, Grand Rapids averages 178 days per year when the temperature falls below 32 degree Fahrenheit. These conditions can make driving very difficult for both human drivers and self-driving vehicles.

The goMARTI vehicles improved operations substantially from the beginning of the first winter to the end of the 27 month pilot. Key improvements include:

- Improved vehicle's ability to navigate around snow banks.
- Reduced hard stops for snowbanks and falling snow.
- Prioritized frequently used and plowed roads for safer routes.
- Improved operator training for winter situations.

Despite these improvements, there are still some limitations when operating in winter weather. When temperatures fall below 0 degrees Fahrenheit, the vehicles can no longer operate autonomously due to the minimum operating temperature of the Velodyne lidar sensor. Even when temperatures drop to 0 degrees Fahrenheit or below, the vehicles can continue operating with sensors disabled, allowing the fleet to maintain service and provide rides despite the extreme cold.

At -22 degrees Fahrenheit, the vehicles cannot be operated with cameras on, as the external cameras have a temperature limitation of -22. This means that at -22 operations are canceled for the day since we can't record the shift, making it a safety concern. Also, if temperatures reach -22 degrees Fahrenheit there are additional safety concerns for passengers and AVOs. While it's not uncommon for temperatures to reach -22 and lower, these extremes are more rare, and typically happen overnight and not during the shift. Service has only been stopped for reaching -22 or lower a few times during the pilot. See the below information regarding operation during winter weather.

As captured in the goMARTI's Pilot Report (Appendix C), the following table shows weather patterns across different months for 2023 and 2024. It includes data on the number of rainy, snowy, sunny, and cloudy days, as well as the minimum and maximum temperatures for each month. Additionally, the table records the autonomy percentage for each month. Note: Some days may have multiple weather conditions, so the total number of days for each month may not always add up to the exact number of days in that month.

2023 MONTHLY WEATHER SUMMARY

MONTH	RAIN DAYS	SNOW DAYS	SUNNY DAYS	CLOUD DAYS	MIN / MAX TEMPERATURE (°F)	AUTONOMY PERFORMANCE (%)
January	3	15	7	8	-10°F to 32°F	30.5
February	3	9	11	7	-8°F to 43°F	71.7
March	4	15	8	4	2°F to 40°F	69.5
April	1	2	18	9	24°F to 77°F	71.6
May	5	0	22	4	40°F to 86°F	83.4
June	8	0	15	7	39°F to 90°F	81.6
July	3	0	27	1	43°F to 94°F	84.3
August	2	0	26	3	44°F to 90°F	84.3
September	9	0	14	7	39°F to 86°F	84.8
October	4	5	16	6	15°F to 86°F	86.9
November	3	8	12	7	6°F to 56°F	89
December	6	14	5	6	7°F to 49°F	88.9

The Winter months of 2023 brought significant snowfall, particularly in January (15 days), March (15 days) and December (14 days), while maintaining temperatures between -10°F and 32°F. Spring saw a dramatic warming trend, with April temperatures rising from 24°F to 77°F. Summer reached its peak in July with temperatures up to 94°F and an impressive 27 sunny days, making it the sunniest month of the year. Fall brought a gradual cooling trend, with October experiencing a wide temperature range from 15°F to 86°F. The year concluded with December returning to winter patterns, featuring 14 snow days and temperatures between 7°F and 49°F. Throughout the year, there were 180 sunny days, showcasing a generally favorable climate for autonomy despite the seasonal extremes. The year maintained typical seasonal progressions while featuring well-defined weather patterns and predictable temperature transitions between seasons.

2024 MONTHLY WEATHER SUMMARY

MONTH	RAIN DAYS	SNOW DAYS	SUNNY DAYS	CLOUD DAYS	MIN / MAX TEMPERATURE (°F)	AUTONOMY PERFORMANCE (%)
January	2	9	1	12	-17°F to 52°F	90.3
February	0	6	12	9	-8°F to 48°F	92.6
March	3	11	9	8	4°F to 57°F	92.6
April	5	2	16	7	29°F to 70°F	91.9
May	9	0	14	8	2°F to 22°F	91.2
June	12	0	10	8	40°F to 86°F	91
July	6	0	19	6	52°F to 93°F	89.7
August	10	0	13	8	49°F to 86°F	89.1
September	3	0	21	6	37°F to 84°F	90.2
October	4	1	18	8	23°F to 78°F	90.9
November	3	7	12	8	-1°F to 52°F	90.7
December	2	9	5	15	-19°F to 43°F	87.4

The weather data for 2024 reveals a year of diverse and sometimes extreme conditions. January started with a cold snap, reaching as low as -17°F, while July saw temperatures peak at 93°F. The year was characterized by significant precipitation, with 45 snow days concentrated in the winter months and 59 rainy days throughout the year, particularly in June, which had a somewhat impact on autonomy. The summer months, particularly July and August, were generally warm and sunny, with July recording the highest temperature of the year. Fall brought milder temperatures and a mix of sunny and cloudy days, while November saw the first significant snowfall of the winter season. December closed out the year with a series of snowstorms and freezing temperatures, including a severe cold spell mid-month with temperatures plummeting to -19°F. Overall, 2024 demonstrated the region's capacity for weather extremes, from winter deep freezes to summer heat waves, punctuated by periods of pleasant conditions in the transitional seasons.

SITE OPERATION ANALYSIS

	2024			2023		
MONTH	CLOSED	MANUAL	PARTIAL	CLOSED	MANUAL	PARTIAL
January	3	1	2	0	2	23
February	0	0	2	0	1	12
March	2	1	1	1	2	17
April	0	0	3	2	5	7
May	0	1	6	0	7	3
June	0	1	2	0	7	5
July	0	0	3	0	0	1
August	0	0	3	0	0	0
September	0	0	0	0	0	3
October	0	0	1	0	0	1
November	0	0	1	0	0	1
December	0	3	9	0	0	6
TOTAL	5	7	33	3	24	79

Monthly site operations summary for 2023 and 2024
****Partial: Site is either partially closed, in manual, or in auto mode.**

The table provides a comparison of site operation days in 2023 and 2024, categorized as fully closed, manual mode, or partial autonomy. A significant improvement was seen in 2024, with a decrease in both manual mode days (from 24 to 7) and partial autonomy days (from 79 to 33). This improvement can be attributed to better vehicle software, operational efficiency, and AVO training. The service was also in manual mode from May 24th to June 9th 2023 due to technical issues. Overall, the table demonstrates how the site has improved in handling operational challenges, including those posed by harsh weather.

AV PERFORMANCE VS. ACCESSIBILITY

One of the most innovative features of this pilot program was the ability to perform AV transportation research and testing while also offering accessible transportation to the community. While a major benefit, this dual focus also led to questions about which aspect of the pilot was a higher priority and how to balance operations to optimize for both. Several particular considerations were important in working to that end: assessing stops for accessibility and safety, and assessing operational conditions to balance winter weather AV testing versus manual driving mode to maximize operational days.

SHUTTLE STOP ACCESSIBILITY

Accessibility is a general term describing the parameters of a shuttle stop location. For this pilot, we define accessibility from two perspectives: the rider and the shuttle. This also includes an assessment of both summer and winter accessibility, as they often have different implications.

This assessment is especially relevant to rural or other communities where there are no city bus stops already in place and maintained throughout the city. In rural areas, there are often no designated shuttle stop locations, and each identified stop is often marked only by a shuttle stop sign near the side of the road.

A safe pull-off location for a vehicle does not necessarily translate to a location with safe approaches or waiting areas for riders before or after their ride. Often, sidewalks are not present, or the stop requires a person to cross in the middle of a busy street or walking distance is added in order to cross at an intersection.

Rider Accessibility

To riders, accessibility means a clean, safe, and easily accessible waiting area with a clear path to enter and exit the shuttle. This includes riders who use wheelchairs. Our assessment scored how well-suited each shuttle stop was from a rider accessibility perspective.

Being close to a location on a map does not always correlate to a short walking or rolling distance from the shuttle stop to the building's front door. Often, the shortest path directly from a stop to a door is through a culvert or grassy area, which can be impassable for those with mobility challenges or during winter snow accumulation.

Winter brings additional challenges to rider accessibility. Snowbanks, particularly in the boulevard between the sidewalk and the road, can make normally accessible summer stops difficult to navigate for riders trying to get from the waiting area on the sidewalk to the shoulder where the shuttle is waiting. Extra boulevard path plowing can help remedy this but often requires special attention from the sidewalk plow crew. Ice buildup can create slippery surfaces and will require extra preparation from snow removal crews as well.

Shuttle Accessibility

Shuttle accessibility refers to the shuttle's ability to autonomously pull into a safe stopping area for riders to load and unload. While the vehicles can be piloted manually, the goal is to advance and inform winter weather AV performance. Choosing stops that allow the vehicle to safely enter and exit the roadway, navigate the shoulder area, and provide safe access to loading and unloading from both the side doors and the rear-entry ramp are important considerations. It is also important to consider where snow is typically plowed in winter to ensure safe loading and unloading areas, even with snow banks.

Areas with larger paved shoulders a reasonable distance away from intersections are preferred. High visibility in both directions makes for better entry and exit into the roadway from the stop location. Gravel shoulders are acceptable if they are flat and wide enough for the vehicle to fully pull out of the traffic lane. Stops on lower speed roadways or side streets are preferred to faster, more crowded main streets.

Stops in parking lots or utilizing pull-through breezeways found at churches, hospitals, and living communities are possible but require slower vehicle operation, as the vehicle prioritizes safety and those areas often have more unpredictable traffic and pedestrian movements.

Optimization to Maximize Total Accessibility

Following best practices and making some incremental improvements in stop maintenance can significantly improve total shuttle stop accessibility in most situations.

If budgets were unlimited, a covered, ADA compliant bus stop at each shuttle location would be ideal, however this was out of scope for our pilot. If it is not possible to make significant infrastructure changes, here are some best practices for maximizing accessibility at shuttle stop locations:

Winter Accessibility Considerations for Stops

- **Reassess stop accessibility after heavy snowfall** and collaborate with City maintenance to maintain accessibility goals.
- **Adjust stop locations as needed** due to snow accumulation and plowing.
- **Remove snow piles from shoulders** to maintain accessibility.

Ideal Stop Location

- **Mid-block near curb cuts:** Safer for everyone, provides convenient access to trails, sidewalks, driveways, and parking lots, especially for wheelchair users.

Shoulder Maintenance

- **Paved shoulders:** Beneficial for shuttle access and wheelchair ramps, even without visible lane markings.
- **Keep shoulders clear** of snow piles and plow debris.

Pedestrian Safety and Convenience

- **Locate stops on the sidewalk side of the road** to avoid waiting areas in the road.
- **Ensure plow boulevard between sidewalk and shoulder** is wide enough for a wheelchair or two people walking side-by-side.

SEAMLESS OPERATION IN SELF-DRIVING OR MANUAL MODES

Similar to a consumer vehicle equipped with ADAS features like adaptive cruise control or lane keeping systems, the goMARTI shuttle AVO can quickly disengage self-driving mode by using the gas, brake, or steering wheel. The vehicle can then be driven manually, either on or off the AV route. Autonomous mode can be easily re-engaged by pressing the "A" button on the dash. This capability to operate fully in manual mode allows for flexible use and ensures that pilot operations can continue if self-driving mode becomes unavailable due to weather, technical issues, or any other reason.

Weather related manual operations

The Deployment Management Plan outlines the process and criteria for determining if and how the shuttle pilot will operate during a weather event. If the roads are unsafe, pilot operations will be suspended until conditions improve. The operations team can also decide to operate in manual-only mode, which prioritizes pilot operation over AV metrics. In this mode, data on manual piloting can still be collected to advance the winter weather performance of the self-driving systems. Most importantly, the shuttle can continue to provide rides during inclement weather, when transportation may be most valuable.

Technical Related Manual Operations

For any reason, the operations team could elect to pause self-driving operations, as detailed in the Deployment Management Plan. This may be necessary to evaluate a new change or validate operations as the self-driving technology continues to learn and adapt to its environment. In such cases, the vehicle will be operated manually out of an abundance of caution until the team approves a return to self-driving operations. The ability to maintain operations during technical or weather-related events is essential for providing reliable transportation to the community.

ROLE OF THE AVO

AVOs ensure safe vehicle operation, provide an excellent experience for riders and other road users, and prioritize autonomy when safe. Additionally, they are the first to receive rider feedback, making them invaluable for gathering insights on service, stop locations, hours of operation, and more. AVOs also educate the community on app functionality, stop locations, and the technology in general.

Another key responsibility of the AVO role is the safe loading and unloading of wheelchair passengers. Since no current AV platforms can autonomously load and unload wheelchair passengers, an AVO is required to perform these tasks while providing a friendly and helpful presence.

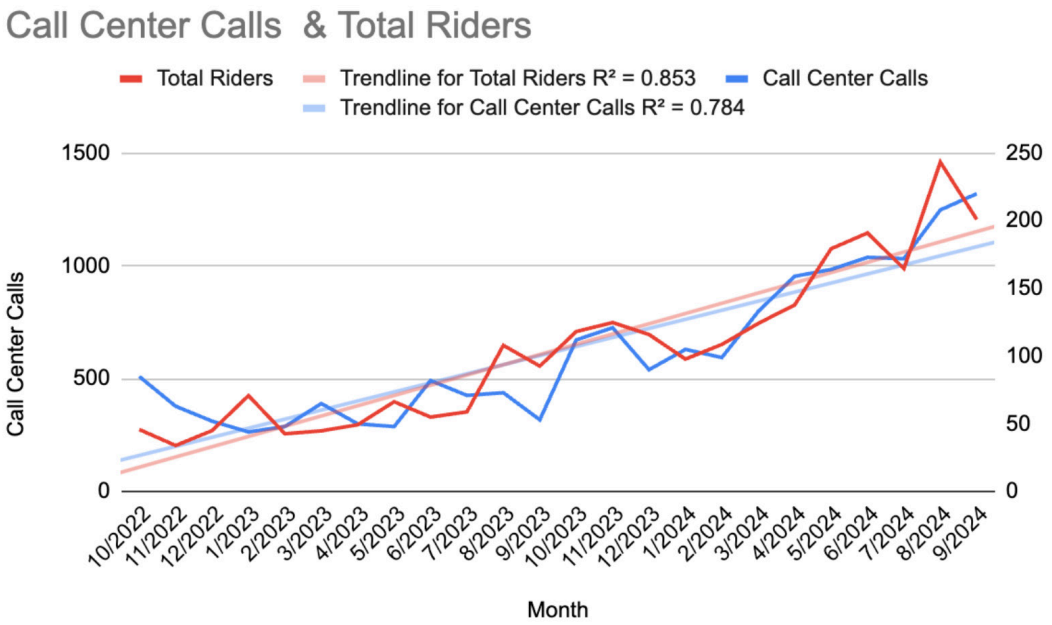
CALL CENTER

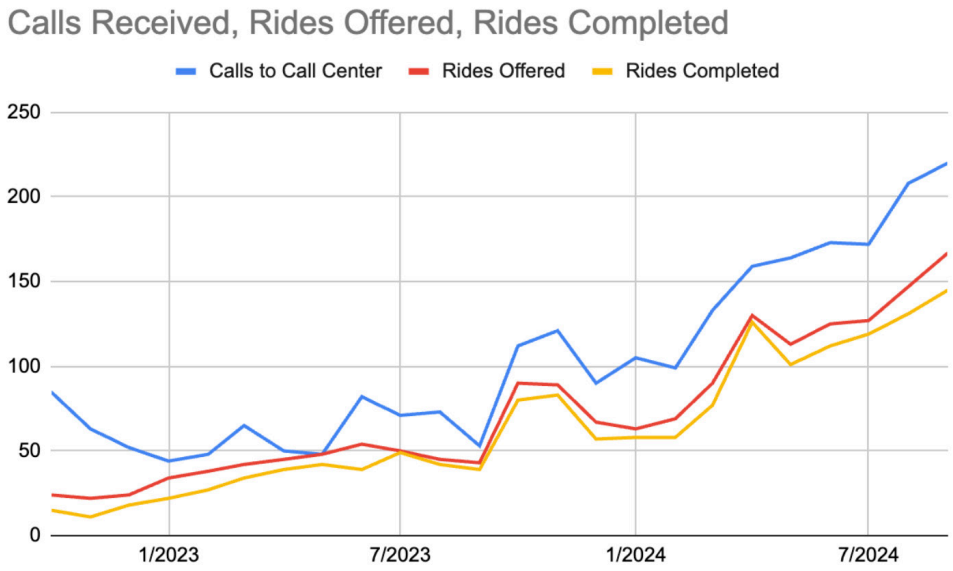
High-quality customer service is essential for any service-based deployment, especially when introducing new technology to a user base that includes a disproportionately high percentage of elderly and disabled individuals, as is the case in many rural communities. In the case of the goMARTI pilot project, the call center serves a critical function by:

- Providing general information and answering questions about the service
- Assisting users with app installation, account creation, and navigation
- Booking rides for users who are unable or prefer not to use the app

The project team strategically selected a local community-based call center to provide these services for several reasons:

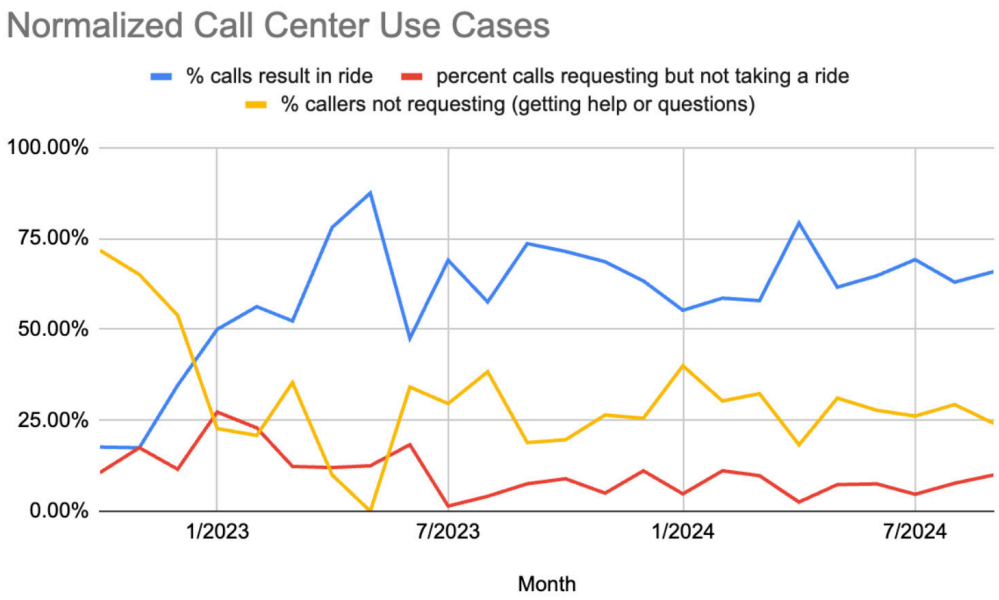
- **Local Knowledge and Understanding:** Call center employees possess unique insights into the community, enabling them to deliver valuable customer service.
- **Sense of Community:** In a close-knit community like Grand Rapids, the ability to connect with a local representative fosters trust and engagement, which are crucial for the success of the project.
- **Economic Growth:** Utilizing a local call center keeps project funds within the community, stimulating job creation and economic development, both of which are priorities for rural areas.



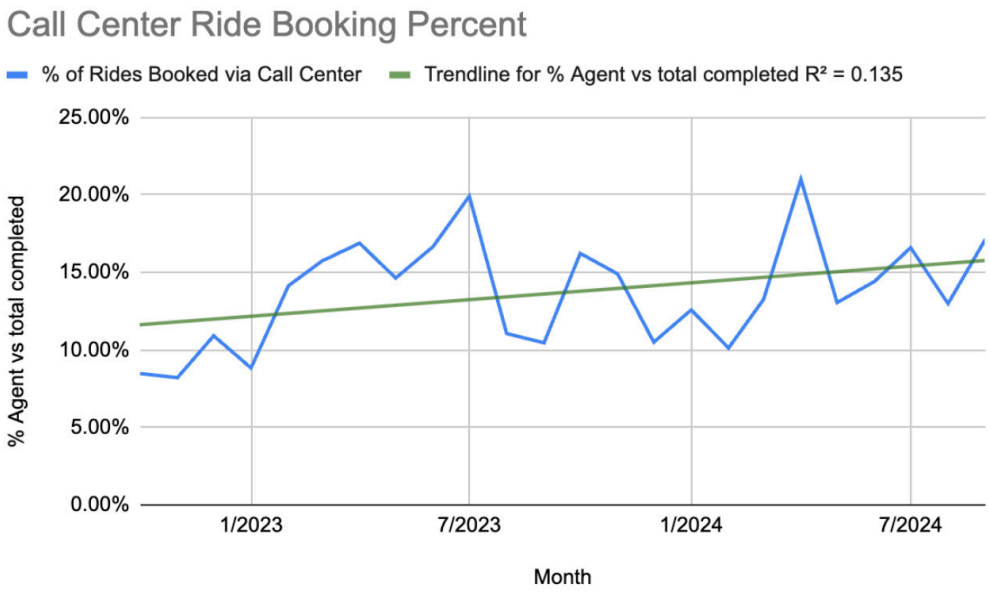


After two years of operation the call center has answered 3,306 goMARTI calls, and call volume has increased in line with ridership volume as shown in the charts above. With the steady increase in call volume, the number of rides being offered and rides completed by call-in bookings has risen proportionately. Over the 3,306 total calls, the call center has made 1,746 ride requests, resulting in 1,524 completed rides.

To understand why callers are using the call center, we can analyze caller data. If the call results in a completed ride, we can safely conclude that the rider was calling to book a ride by phone. If a ride was not offered or completed, we can conclude that the caller was seeking more information about goMARTI, the app, or how to book a ride.



The graphic shows that during the first six months, most callers sought information or asked questions rather than booking rides. Around June 2023, call patterns stabilized, with approximately 60% of callers booking rides and 30% seeking information or assistance.



This data tracks with the overall call center initiated rides hovering around 15%, after that initial 6 month warm up period (14.09% total including the first 6 months).

Evaluating the utility of a call center was a focus of the pilot, specifically as we addressed the target user groups and sought to understand rural operations. Had call center utilization dropped significantly as riders needed less help operating the app or had exhausted their questions, we might have concluded that a call center has initial value, but could be scaled back during continued operations. Had ride bookings declined as riders embraced app-based bookings, a similar scale back would have made sense.

However, as ridership increased, call volume increased proportionately, and the primary purposes of the calls remained booking rides and answering questions about goMARTI. We can conclude that the call center has and will continue to have value in enhancing the accessibility of goMARTI, in this case for people who need or prefer to book rides via a call versus an app.

KEY LESSONS LEARNED & NEXT STEPS

The primary goal of this final report is to share insights with those interested in implementing an AV shuttle within their community. The team acquired invaluable experience and knowledge across the four research project goals. Additionally, the team generated follow-up work and identified new research opportunities. This section highlights these insights and next steps, with more in-depth reporting included in the preceding sections of this report.

ADVANCE AND INFORM WINTER WEATHER AUTONOMOUS VEHICLE OPERATIONS

The operational environment for most AV pilots consists of sunny, warm-weather urban areas with clear pavement markings, well-maintained roads, and relatively low speed limits. As the first accessible winter-weather rural AV pilot, goMARTI 1.0 provided valuable lessons. Below are common themes identified throughout the pilot program and practical next steps to build upon these findings.

LESSONS LEARNED

- Don't expect perfection on Day 1. Driving in the winter is a skill honed over years of experience for humans. Similarly, computer drivers need to experience various scenarios and situations to learn the proper responses. The vehicles can learn during both autonomous and manual modes through reinforcement learning and other techniques. During the first year of goMARTI, countless scenarios were used as learning opportunities for improving the operation of the vehicles in challenging winter conditions.

- AVOs, while instructed to always prioritize safety, can sometimes be overly cautious with manual interventions, unnecessarily disengaging the autonomous vehicle. This inadvertently reduces autonomous performance and erodes trust in AV operation. Honing the AVOs' skills and comfort in differentiating between necessary and unnecessary disengagements takes time and hours behind the wheel in both adverse and ideal conditions. As AVOs become more adept, AV performance improves.

- Winter weather road debris can impact AV performance, but this can be minimized by a combination of winter weather road maintenance (plowing) and updates to the vehicles' sensing systems.

- As the vehicles collected data over the months of operation, new operational domains were identified and added to the AV functionality. Roundabouts, certain parking lots, and covered pull-through pickups were all enabled in autonomous mode as the pilot progressed and the team had enough data to ensure their safe execution.

- The flexibility to seamlessly switch between autonomous and manual mode has enabled the vehicles to continue providing rides to the community as the autonomous technology develops. This has proven invaluable as we learn more about AV capabilities while offering reliable rides to community members who rely on them.

- Creating a winter weather closure process has enabled the team to prioritize safety and close operations if driving becomes too dangerous, while also providing a process for ensuring no riders are left stranded due to weather-related closures.
- An AV system that can be tuned for operation in winter is another valuable capability to maximize operational performance as we learn more about autonomous driving in winter weather.
- When piloting a project, it is essential to have a sustainable funding option for future operations if the project is successful, or have a clear communications plan for the project ending. It can be harmful to community trust if a successful project that citizens rely on ends without plans for future funding or open communication.
- The right solution might differ from what was originally piloted. While AV testing was the focus from MnDOT's perspective, on-demand micro transit was the most successful and impactful part of the project in considering continued operations in some capacity.

NEXT STEPS

- The student fixtures project improved vehicle localization accuracy by installing localization points on a road segment lacking sufficient objects for geolocation. Future work could include a prediction tool to help communities identify roadways needing additional localization points when assessing AV readiness.
- Expanding the operational domain of vehicles to include scenarios currently performed in manual mode, such as unprotected left turns, presents further opportunities.
- Cell phone coverage is essential for autonomous vehicle operations and on-demand transportation. Understanding minimum cellular requirements for AV operations and creating a tool for assessing cellular coverage and speeds can aid communities planning for AV readiness and future AV pilots.
- Research opportunities exist in understanding how AVs navigate intersections with non-AVs or other AVs in rural settings and developing techniques to evaluate these interactions and inform intersection safety and AV readiness.

COMMUNITY ENGAGEMENT

The cornerstone of this project, and often cited as its key differentiator, is the community engagement effort. As discussed throughout this report, a strong emphasis on engagement resulted in a robust community goMARTI voice. Many lessons were learned, and many new questions were identified throughout the process.

LESSONS LEARNED

- Engaging local advocates to serve as community ambassadors was crucial for building community support and awareness for the shuttle program.
- Community involvement in shaping operational hours and stop locations fostered community buy-in and provided valuable feedback for service improvements.
- Building trust and ridership in a rural community takes time, with widespread adoption of the goMARTI shuttle service occurring after approximately one year.

- The outreach team observed a shift in community perception from initial curiosity about the service to inquiries about how to use it, necessitating a change in messaging strategy.
- Direct, face-to-face engagement, such as the door-to-door outreach by community ambassadors, significantly increased awareness and ridership among residents who were previously unaware or uninformed about the service.
- The project team needed to educate the community not only about autonomous vehicles but also about on-demand transportation and app-based services.
- The local call center proved invaluable, providing support and information to callers and addressing a wide range of questions, ultimately encouraging them to try the goMARTI service.
- A local call center is essential for any rural on-demand transportation solution, especially for the target demographic.

NEXT STEPS

- Developing continued opportunities for community engagement helps the project team evaluate the value of different aspects of the project offerings. Formalizing that effort through community groups and periodic events can help to get more relevant feedback from a broader group of users.
- A future goal for community engagement is to create outreach campaign plans that better seek input from target populations and demographics, enabling maximum impact to our operation.
- Creating a Facebook/Social Media Presence: For its goMARTI 2.0 debut, the project team will establish an official social media presence on Facebook. As internet usage evolves, social media pages are becoming a more prevalent (or at least preferred) means of communication than traditional websites. Therefore, the team will invest time and resources to build a social media presence for goMARTI 2.0. Communities tend to self-select their social media platform of choice, so learning community preferences will aid in building a successful digital presence. The team has registered goMARTI profiles and will launch with content around the official project expansion, providing a convenient place for users to get quick updates, information, and news as the program progresses.
- The call center provides value to riders who don't use cell phones and can collect feedback and information from that group, who are unlikely to access app-based or web-based surveys. Developing a process for capturing call center feedback would give access to input from this harder-to-reach demographic.
- Understanding the value or differentiators between call-in and app users will ensure that we serve all aspects of the community as well as possible. Given access to feedback from both groups, it would be beneficial to analyze differences in the needs and values of app versus call-in riders.
- A valuable next step is to evaluate long-term viability and success models, ensuring continued transportation options for the community.

ACCESSIBLE TRANSPORTATION

Accessible transportation encompasses more than physical accommodations like wheelchair ramps. The successful goMARTI pilot explored multiple aspects of accessible transportation, paving the way for future advancements in this critical field.

LESSONS LEARNED

- Providing transportation to social, educational, recreational, and medical events and appointments can significantly improve people's lives.
- Accessibility requires more than just wheelchair access to a vehicle.
- Identifying stop locations that balance rider and traffic safety, accessibility in different weather conditions, and community demand is crucial.
- The operator's role in communicating with passengers, sharing expertise, and securing wheelchair riders is essential for rider safety, comfort, and acceptance.
- Minimum age requirements for unaccompanied minors were an important aspect of accessibility that the team initially underestimated. Careful consideration of the impact on young people in the community has allowed consented access to transportation for students, providing them with a means of transportation they would not otherwise have.
- No-cost rides were a pillar of accessibility, addressing financial barriers for the community. The team was surprised that the "free" aspect triggered criticism from some who questioned government spending and use of taxpayer dollars. Having a robust communications plan and strategy to communicate the program's benefits and opportunities, as well as the value of the "free" aspect for truly assessing long-term viability, is essential when conducting outreach.

NEXT STEPS

- In addition to mobility, age, and financial accessibility, pilot accessible transit solutions can target other underserved communities, such as those with sight, hearing, and intellectual or developmental disabilities (IDD). goMARTI 2.0 can explore solutions for these populations to further improve overall accessibility.
- As an AV pilot, it is key to understand the technology readiness gaps. The automation of loading and securing a wheelchair rider is essential for advancing toward an accessible driver-out solution. While prototype solutions are in development, a pilot program to evaluate wheelchair accessibility solutions would advance and inform the state of the art.
- Another accessibility technology gap in the EV space is the availability of a light-duty (minivan or similar) vehicle with ramp access. Microtransit solutions are most economically viable with the lower competitive pricing of consumer vehicles, which function as the primary transportation solutions in on-demand microtransit. Converting these vehicles into wheelchair-accessible vehicles is often performed by cutting into the floor to install a ramp. In most EVs, the battery is located in the floor, making modification impossible. An opportunity exists to advance battery design to be wheelchair-vehicle accessible by reserving a section of the vehicle pan for ramp compatibility.
- Accessible vehicles have specific requirements for optimal pickup and drop-off locations, often requiring more room for ramps and loading/unloading of passengers. These loca-

tions are desirable near the main entrance to the facilities being served, but other vehicles often park or wait in the designated shuttle stop area. There is an opportunity to design and test different marking strategies, as well as work with local public services to create enforcement plans for deterring parking and waiting in shuttle stop locations, similar to handicapped parking or fire lanes.

- Digital mapping allows for flexibility in zooming, panning, and labeling all of the shuttle stops into an interactive map. However, a paper or static map improves accessibility for those who cannot or do not want to interact with a digital map. Creating an easy-to-use map that fits on a single piece of paper is an opportunity and one of the most requested features in feedback from senior communities and social service providers.

ECONOMIC IMPACT

Measuring the economic impact of a pilot program can be challenging. This goal was focused on investigating the potential economic impact of a permanent transportation solution like goMARTI on the community. To that end, we share key metrics that can indicate economic impact, as well as opportunities to expand this work.

LESSONS LEARNED

- Employment resulting from the project itself is a first order economic impact metric, and while we are not a major operation, the project has hired around twenty individuals as community catalysts, operational leaders, supervisors, vehicle technicians, and AVOs. This number will scale up as the project scales up, and will continue to evolve into a true attribute of economic impact to the community.

- goMARTI attracted visitors to the Grand Rapids area, boosting the local economy through hotel stays, shopping, and dining. The project brought in over 100 visitors, most of whom were first-timers, to experience Grand Rapids.

- The team found that goMARTI's success attracted additional events to Grand Rapids, including conferences and workshops that chose the location due to goMARTI's operations. For example, the Community Transportation Association of America's State of the Industry Seminar and Smart Rural Seminars both hosted events in Grand Rapids.

- The presence and success of goMARTI in the community has positively influenced the federal government to award funding for goMARTI 2.0, resulting in approximately 12 million dollars for transportation over the next three years. In addition to continuing to provide no-cost transportation for the community, the funding will support employee wages, service fees, and overall economic growth through the execution of this project.

- goMARTI's success has paved the way for additional MnDOT grants, allowing goMARTI to expand into neighboring communities and further economic growth through funding and spending on these additional, adjacent goMARTI activities.

NEXT STEPS

- As goMARTI 2.0 comes online, resulting in expanded hours, stops, and the introduction of electric vehicles, there will be a need for additional operators, supervisors, and other roles. Understanding the overall employment pool needed for a scaled and sustainable goMARTI operation in the Grand Rapids area will outline the workforce needs and economic impact of an on-demand transportation operation in a rural community.

- While goMARTI's hours of operation were not aligned with most workforce needs, the program presents an opportunity to understand how on-demand microtransit in rural areas could address workforce transportation needs and what the impact of such a program could be on the region's economic development.
- A better understanding of the operational costs that directly impact economic growth in the community will allow us to concretely share the benefits of goMARTI, specifically regarding regional economic growth. For example, in goMARTI 1.0, the shuttles purchased approximately 7,500 gallons of gasoline from service stations in the community, utilized local maintenance shops, and rented operations site space locally.
- Working with community businesses and retailers to measure and quantify the impact of goMARTI offering transportation to their facilities would be a valuable improvement to the current anecdotal impact estimates.
- One future opportunity to evaluate the economic impact of an AV shuttle program is to formalize correlations between different metrics and key economic indicators. The team has identified different data sets being collected that may correlate to economic impact:
    - # visitors drawn to the region
    - # of Rides for visitors in the city (is there a way to track that with the profile setup?)
    - # of people hired and trained through the project
    - # of students engaged (fixtures project, song contest)
    - # of rides to places where businesses are stops, or stops where people are likely to spend money once they get there (Target, Super One, Ace, Central Square Mall, Post Office, Old Central School, Brewed Awakening, Rapids Brewing, Aldi)

CONCLUSION

goMARTI successfully advanced AV technology in rural, winter conditions while providing accessible, on-demand transportation to the Grand Rapids community. Over 27 months, the program transported 18,698 riders, steadily increasing adoption through strategic community engagement, operational improvements, and technology advancements. Key insights from the pilot—including the importance of stop accessibility, local support services, and year-round AV reliability—will guide future deployments, supported by a new FHWA grant extending operations for three more years.

KEY TAKEAWAYS

- Expect that onboard operators will perform multiple roles
- Stop location and accessibility are critical to adoption
- goMARTI has introduced multiple new complementary technologies
- The value of a local call center in a rural community can not be overstated
- Involve the community, adapt current stops and evolve the operation
- Play the long game; ridership did not develop overnight
- Choose the best AV for the job; it must be able to drive at or near the speed limit
- Fill a need - besides awesome AV research, goMARTI offered accessible mobility for all
- Offer year-round technology; it's no good if it can't operate in a broad range of weather and seasons
- Recognize how transportation can change lives for the better

After twenty seven months and nearly 20,000 riders the goMARTI pilot program is coming to a close. Through every season, a near record 110 inches of snow in winter 22-23, and a quarter of a million miles of autonomous driving, the pilot program has clearly demonstrated the value of on-demand microtransit in rural communities. Great advances in understanding and operational domain were achieved over the course of the project. The Federal Highway Administration has awarded goMARTI with funding to continue and expand the pilot program to further advance the research and deployment of autonomous and new electric vehicles throughout Grand Rapids and neighboring communities.

The goMARTI team is excited to be able to offer free-of-charge rides to the community for three additional years with this funding. Our core ridership group consists of daily or near-daily riders who have embraced goMARTI as a reliable, often only transportation option. A key deliverable for goMARTI 2.0 is to identify and validate sustainable funding models to continue operations beyond the conclusion of the ATTAIN grant funding.

ABOUT THE AUTHORS

JUSTIN JOHNSON

DEPUTY PROJECT MANAGER - GOMARTI
DIRECTOR OF TECHNOLOGY - THE PLUM CATALYST

justin@theplumcatalyst.com

Justin is the Director of Technology for The PLUM Catalyst, a strategy and innovation consulting firm focused on future mobility and next generation transportation initiatives. Justin is the deputy PM for the autonomous vehicle deployment goMARTI, and is actively involved with various CAV task forces across several state and national consortia. He has a degree in Electrical Engineering from the University of Minnesota and holds 28 patents for his work in technical fields.

THOMAS JOHNSON-KAISER

MNDOT GOMARTI PROJECT MANAGER
CAV POLICY AND PLANNING MANAGER - MNDOT

thomas.johnson-kaiser@state.mn.us

Thomas Johnson-Kaiser is the CAV planning and policy manager at MnDOT, where he leads the development and implementation of CAV policy and CAV-related public and stakeholder engagement. He previously served as the public engagement manager for MnDOT's Communications and Public Engagement office. In that role, he helped provide tools, resources, and training to MnDOT public engagement practitioners and consultants who conduct public engagement on MnDOT's behalf. Prior to that, he served as the CAV engagement and project manager and as a project coordinator in MnDOT's Office of Research and Innovation. He holds a BS in Economics and Political Science from Iowa State University.

MYCHAEL MULHERN

DIRECTOR OF CUSTOMER SUCCESS - MAY MOBILITY

mychael.mulhern@maymobility.com

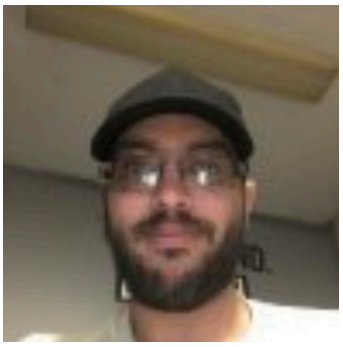
Mychael Mulhern is the Director of Customer Success at May Mobility. He joined May in October 2022 and is responsible for the Customer Success team's overall vision and strategic planning. May's Customer Success team delivers an exceptional customer experience by optimizing the customer journey, driving product adoption and engagement, and maximizing customer value from May's product and service offerings. Before joining May, Mychael worked as the Director of Customer Success and Customer Support for a financial risk management company.

JON DEGE

SITE MANAGER FOR GRAND RAPIDS MN - MAY MOBILITY

jon.dege@maymobility.com

Jon Dege is the Site Manager for May Mobility in Grand Rapids MN. He joined May Mobility in July of 2022 and has overseen all site operations since. Jon is certified in training autonomous vehicle operators, has been featured on the BBC's Technology's Golden Age, and was a guest speaker at the MN Transportation Conference in 2024. Prior to joining the goMARTI project in 2022 Jon was a college instructor at the University of Minnesota's College of Liberal Arts, and was an Academic Director at the Art Institutes, where he began his journey finding ways to use technology to connect people.



CORY PAULLEY

IT ADMINISTRATOR - FIRST CALL 211

cpaulley@firstcall211.net

Cory Paulley is the IT Administrator for First Call for Help. He joined the goMARTI project in 2022 working alongside May Mobility and The PLUM Catalyst to coordinate the phone line for booking rides and has since stayed involved to help coordinate where needed.

APPENDIX

APPENDIX A: RISK REGISTER
Risk Register

APPENDIX B: LIST OF STOPS
goMARTI List of Stops

APPENDIX C: COMPILED RIDERSHIP & AUTONOMY STATISTICS
goMarti Pilot Report

APPENDIX D: SURVEY RESULTS & ANALYSIS
Survey questions

Survey analysis summary

Survey analysis report

Survey analysis slides/graphics

APPENDIX E: DEPLOYMENT MANAGEMENT PLAN
Deployment Management Plan

APPENDIX F: INCIDENT LOG
Incident Log

APPENDIX G: SOFTWARE UPDATE REGISTER
Update register

APPENDIX H: COMMUNICATIONS AND ENGAGEMENT PLAN
goMARTI Communications Plan

APPENDIX I: LIST OF MEDIA COVERAGE
www.gomarti.com/news

Additional goMARTI News

APPENDIX J: EMERGENCY RESPONSE PLAN
goMARTI Emergency Response and Communications Plan

APPENDIX K: CALL CENTER OUTREACH
First Call 211 Outreach Summary

APPENDIX L: MEDIA REQUEST PROCESS
goMARTI Media Request Process

APPENDIX M: WEBSITE DATA REPORTS
Site Visits by Location

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www.gomarti.com

DEPARTMENT OF TRANSPORTATION

www.dot.state.mn.us

DESTINATION CAV

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