The City of Hillsboro ND Demonstration Project

Part 1: Project Narrative and Technical Approach

UNIVERSITY OF NORTH DAKOTA
COLLEGE OF BUSINESS & PUBLIC ADMINISTRATION

NDSU | UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
SMALL URBAN AND RURAL TRANSIT CENTER

Valley Senior Services
helping seniors maintain independence

Experience Hillsboro
SMALL TOWN. BIG OPPORTUNITY.

Feonix
MOBILITY RISING

matbus
go green & ride with us!

GRAND FORKS

iteris

CSAIL

PIVOT STRATEGIES

navya

The United States Department of Transportation Federal Highway Administration
Automated Driving System (ADS) Demonstration Grants 2019
CFDA Number: 20.200 Highway Research and Developments Program

SMALL TOWN. BIG OPPORTUNITY.

City of Hillsboro

19 S Main Street / P.O. Box 400
Hillsboro, ND 58045
(701) 636-4620 / Fax (701) 636-4621
www.hillsboro-nd.com

March 21, 2019

The Honorable Elaine L. Chao
Secretary
The United States Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

RE: Letter of Transmittal for the Automated Driving System (ADS) Demonstration Grants 2019
CFDA Number: 20.200 Highway Research and Developments Program

Dear Secretary Chao;

The City of Hillsboro is pleased to submit an application for the ADS Grant for our project, Automated Mobility on the Great Plains --- The City of Hillsboro North Dakota Demonstration Project. The team that we have put together comes from across the country and we have brought together groups that typically in the past have not collaborated. We hope that as you look through the application, you and the DOT team will see the strength, commitment, and collaboration that our team is comprised of.

We are making sure that we are keeping the public informed and safe thought-out the whole project. We want to find out as much as we can with the data and research in the project to help DOT, other communities, states, and federal agencies. To can make informed decisions about how the future of automated transportation will look across the country. With the help of the research teams we will be able to help the policy makers shape that way policy and legislation is enacted, so that the safety and economy of America is maintained as a priority.

We hope that you will look at this application and know that rural America is sometimes underserved in the way of mobility and transportation. With this project we are researching to see how we can make that better for rural America. We did not look at the issues from just one perspective, we looked at it from several and are doing the research and implantation to see if the problems can be solved and then duplicated across America.

Secretary Chao thank you for your time and commitment you have put into the future of transportation in America.

Experience Hillsboro
SMALL TOWN. BIG OPPORTUNITY.

Levi Reese

Vice President of the Commission
City of Hillsboro North Dakota

Commissioners: Terry Sando – President / Levi Reese – Vice President / Dave Sather / Mike Kress / Lorraine Tibert
Matt Mutzenberger – Auditor / Jim Anderson – Public Works Director / John Juelson – City Attorney

PART 1 – PROJECT NARRATIVE AND TECHNICAL APPROACH

Table 1 - Introduction - Project Summary Table

Hillsboro ND ADS Grant Application Summary	
Project Title	*"Automated Mobility on The Great Plains - The Hillsboro ND Demonstration Project"*
Eligible Entity/Primary Applicant	The City of Hillsboro, ND 19 South Main Street Hillsboro, ND 58045
Point of Contact	Mr. Levi Reese, Hillsboro ADS Project Commissioner Email: levi.reese@hillsboro-nd.us Phone: 701-550-9322
Proposed Location	Hillsboro North Dakota as project center and 60-mile radius. (Service area expands throughout the region in three phases.) GPS coordinates: 47° 39' 2.1204'' N and 100° 26' 13.2432'' W.
Proposed Technologies for the Demonstration	1. Autonomous Shuttle (Navya) 2. MapLite rural autonomous vehicle (MIT-CSAIL) 3. Mobility as a Service Software (Feonix – Mobility Rising)
Federal Funding Amount Requested:	$9,880,663
Non-Federal Share	-0-
Total Project Cost	$9,880,663

PART 1 – PROJECT NARRATIVE AND TECHNICAL APPROACH

Table 1 - Introduction - Project Summary Table

Hillsboro ND ADS Grant Application Summary	
Project Title	*"Automated Mobility on The Great Plains - The Hillsboro ND Demonstration Project"*
Eligible Entity/Primary Applicant	The City of Hillsboro, ND 19 South Main Street Hillsboro, ND 58045
Point of Contact	Mr. Levi Reese, Hillsboro ADS Project Commissioner Email: levi.reese@hissboro-nd.us Phone: 701-550-9322
Proposed Location	Hillsboro North Dakota as project center and 60-mile radius. (Service area expands throughout the region in three phases.) GPS coordinates: 47° 39' 2.1204'' N and 100° 26' 13.2432'' W.
Proposed Technologies for the Demonstration	1. Autonomous Shuttle (Navya) 2. MapLite rural autonomous vehicle (MIT-CSAIL) 3. Mobility as a Service Software (Feonix – Mobility Rising)
Federal Funding Amount Requested:	$9,880,663
Non-Federal Share	-0-
Total Project Cost	$9,880,663

Part 1 – Project Narrative and Technical Approach
Table of Contents

A. Executive Summary – Vision and Objectives

The City of Hillsboro North Dakota's vision is to be the nation's first rural autonomous mobility ecosystem. In the US, according to the National Highway Traffic Safety Administration there were 35,092 traffic fatalities in 2015. ***Rural areas accounted for 53% of the fatal crashes and 54% of the fatalities.*** There are over six million lane miles in rural communities, serving 60 million Americans, yet information surrounding autonomous vehicle behavior and public attitudes, adoption, and perspectives in rural areas is extremely limited.

Technologies to be deployed in the ***Automated Mobility on The Great Plains*** pilot include:

- autonomous L4 shuttle in-town,
- autonomous L5 technologies in passenger vehicles
- micro-transit shuttles to urban areas,
- volunteer drivers providing shared ride services on-demand, and
- mobility as a service technology connecting all public, private, and specialty mobility options together via app, online platform, and call center within a 60-mile radius.

This pilot will provide an estimated 750 TB of data to be available for public use. This data will enable countless findings to advance the state of the practice, expand capacity, and gain insight to improve safety on our rural roads. The weather variations in the region will also allow for testing all technologies performance and behavior in snow, rain, mud, and dust storms.

Currently, Hillsboro is served only by a single transit system with limited service five days per week with advanced booking. ***With this pilot, service will be expanded to offer service seven days a week – providing vital connections to employment centers, schools, and medical facilities.*** With a population of 1,402 for the city and 8,013 for Traill County where Hillsboro is located – the community provides an excellent sample size for monitoring impact during the pilot. While seemingly a small population size, of the United States' 19,492 municipal government agencies, 16,623 (85%) represent a population base of 10,000 or less. Thus, understanding and making impact relevant to these smaller communities is essential for widespread innovation adoption.

Partners with the City of Hillsboro in this pilot are dedicated to improving safety on our rural roads and include global leaders in automation, intelligent transportation systems, robotics, rural transit, public health, and mobility as a service. In addition, all existing public transit provider leaders are working alongside the innovation team as the guiding force and sustainability partners for the rural ecosystem. The pilot will roll out in three phases. In phase I, **Navya** will deploy an L4 shuttle inside the city. In phase II, the **Massachusetts Institute of Technology** (MIT) Computer Science and Artificial Intelligence Laboratory (CSAIL) will deploy an L5 passenger vehicles providing first and last mile service in concert with volunteer drivers. In phase III, **Valley Senior Services** will be expanding its service from five to seven days a week, adding two additional vehicles to its fleet and offering micro-transit services connecting to **Fargo and Grand Forks public transit.**

Feonix – Mobility Rising will recruit volunteer ride share drivers and provide the Mobility as a Service (MaaS) technology connecting all the services, creating for residents to have a single point of access and call center to use to book rides for Phases 1-3. **Iteris** will provide the data management oversight and expert leadership on establishing a smart mobility ecosystem. Additional private partners include **Amazon** Web Services and **What3Words** navigation.

The implementation period will be from October 2019 – September 2022 over a 3-year span. There are little to no infrastructure requirements for implementation and all technologies are existing and require minor modifications for set-up and integration. From before the first trip is taken and throughout the pilot, the City of Hillsboro and partners in the region will work to secure additional resources to sustain the mobility ecosystem into the future, past the grant period.

Ridership for Traill County by the existing transit system only provides 1,500 rides per year, which equates to approximately 30 trips each week. ***With the mobility options provided under the pilot, the goal will be to see trips increase by 4 times to 120 trips per week conservatively.*** During the pilot, trip purpose (employment, health care, groceries, social services, etc.) will be tracked, allowing the program to provide quantifiable economic and social impact.

North Dakota State University, The Small Urban and Rural Transit Center, part of The Upper Great Plains Transportation Institute as well as the **University of North Dakota** – Department of Political Science and Public Administration will study and monitor the impact to the community as well as provide additional research findings on MIT's data as well as the state and federal policy and regulations surrounding expansion for these critical advancements in mobility for national adoption in rural communities. In addition, **Pivot Strategies** will provide insight and support to both academic partners in demonstrating the economic impact and public health benefits for local hospitals, clinics, transit partners, and insurance companies. **The evaluation period will run from October 2019 to March 2023** occurring in parallel with the implementation period as well as extend an additional year for analysis of findings.

The City of Hillsboro has lost too many precious members of their community to vehicle fatalities. Recently, three young women in their early 20's were driving home at 9:30 PM just 12 miles outside of town and the driver lost control of the vehicle. Two of the girls – Mercedes Rowley and Teja Beyer - died at the scene when the vehicle crashed. Instead of the girls coming home that night, police officers were knocking on mom and dad's doors delivering the news that their daughters were gone. It is every parent's worst nightmare. Dreams are shattered, families often are torn apart, and communities suffer. This tragedy is more common in rural communities than urban, despite only 20% of the population calling these communities home. *Furthermore, most of the vehicle fatalities we see today will be preventable through the technologies and mobility enhancements that will be deployed and demonstrated in this pilot.*

The ***Automated Mobility on The Great Plains*** pilot will lay the groundwork of information and networks necessary for saving thousands of lives on our nation's roadways from a layered approach including technology enhancement, public engagement, and policy analysis.

B. Stakeholder Team and Project Partners

Achieving a primary ADS Grant goal, Hillsboro has assembled an experienced stakeholder team of researchers and technology providers to help design, manage and execute the demonstration project. These Stakeholders and their affiliation and principal role in the demonstration project is listed below.

Those stakeholder organizations participating in the Demonstration and principal role are:

North Dakota State University, The Small Urban and Rural Transit Center, part of The Upper Great Plains Transportation Institute, Fargo, ND

- Project Research Team Lead
- Project Demonstration / Testbed Design Phases I-III

The Computer Sciences and Artificial Intelligence Laboratory (CSAIL), The Massachusetts Institute of Technology (MIT), Cambridge, MA

-Project Phase II Testbed Design
-Integrator, Technology Demonstrator and Data Gatherer – Project Phase II

Feonix – Mobility Rising, Lincoln, NE

-Project Test Bed Design
-Mobility as a Service Technology
-Integrator and Designer, Project Phase I, II, & III
-Outreach

Iteris, Inc., Santa Ana, CA

-Project Data Management Plan Lead
-Demonstration Project Operational Predictive Analysis

Pivot Strategies LLC, Ventnor, NJ

-Management Consultant & Healthcare Advisor, Healthcare Management Systems

Navya - North America, Saline, MI

-Autonomous Shuttle Vehicle Provider
-Data Collection and Dissemination
-Test bed Design and Operations

The University of North Dakota – Department of Political Science and Public Admn; UND Research Institute for Autonomous Systems (RIAS), Grand Forks, ND

-Research and Report on Public Policy on Uniform Automated Vehicle Regulation

-Study for Autonomous Technology-Centric Economic Development

The Center for Rural Health, The University of North Dakota, School of Medicine and Health Sciences, Grand Forks, ND

-Project Public Policy Resource for Rural Health Care Access

Cities Area Transit, (C.A.T), City of Grand Forks, ND, Public Transit Division

-Public Transit Integrator and Provider, Project Phase III

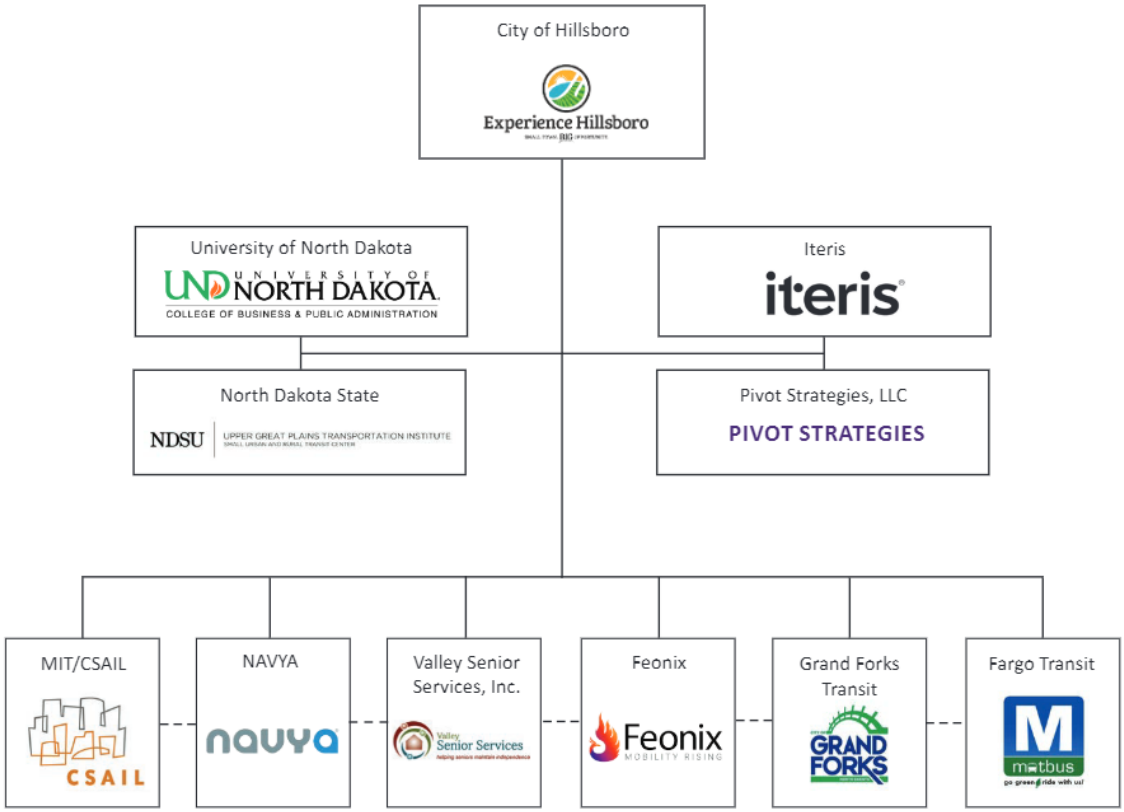
MATBUS, Public Transportation System, Fargo, ND

-Public Transit Integrator and Provider, Project Phase III

Valley Senior Services, Hillsboro and Mayville, ND

- Trail County Public Transit Provider, Project Phase III Micro-Transit Extension

Figure 1 – Project Stakeholder Team Organizational Chart



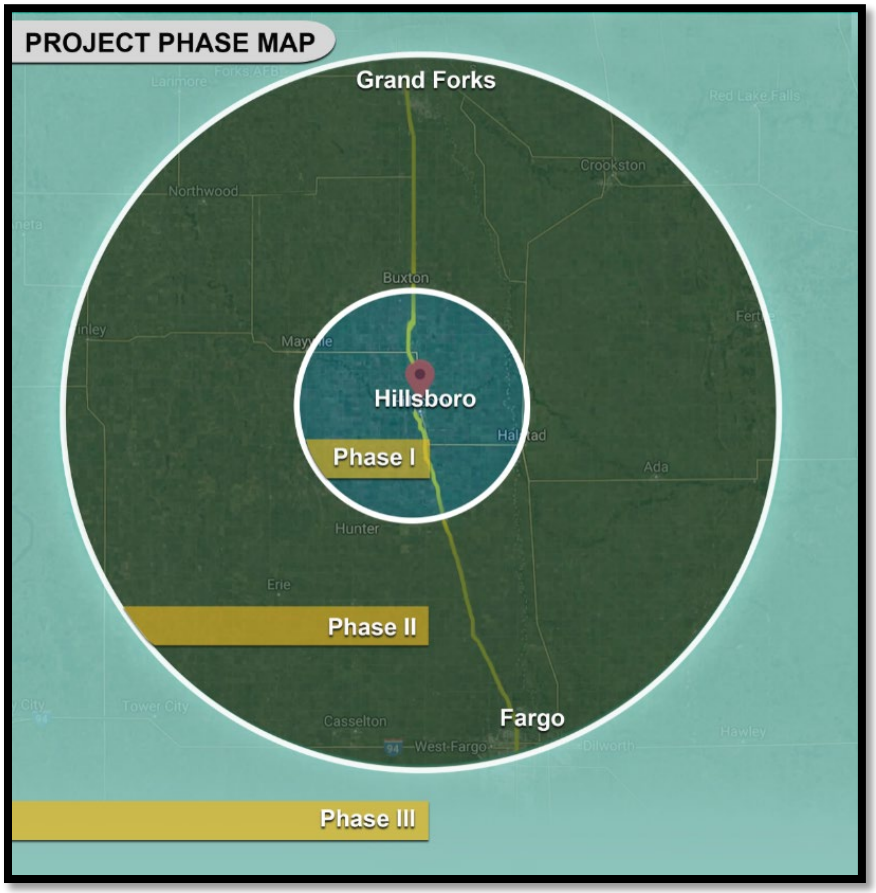
The Feonix Mobility as a Service Technology will connect all the transportation providers together, which is represented by the dotted line connecting the mobility options in the region.

C. Geographic Area of the Demonstration

While the geographic center of the project is the City of Hillsboro, ND, the project test bed over the three contemplated phases of the Project, extends in a 60-mile radius in all directions from Hillsboro City Center. Figure 2, shows the geographic coverage area by concentric circles from Hillsboro. The approximate population base of the three phases are as follows:

Phase I: 1,603
Phase II: 8,121
Phase III: 343,933

Figure 2 – Demonstration Project Phase Geographic Coverage Area



D. Period of Performance / Project Milestones

The proposed milestones for the Period of Performance for all three phases of the project, including a final data evaluation and research study findings component, is 45 months, commencing October 1, 2019 with the signing of a grant agreement and ending with final reports to US DOT in June of 2023. *Full details on the Project Schedule can be found in Part 2: Management Approach, Staffing Approach, & Capabilities.*

Key Project Milestones are as follows:

- Grant Award and Grant Agreement Signing: June 2019 to Sept 30, 2019
- AV Procurement / Test Bed Design Final: October 2019 to December 2019
- Data Management Plan Final: December 2019
- Training and Testing of AV & MaaS in Service: December 2019 - January 2020
    - Phase I – Navya AV Begins: January 2020
    - Phase II – MIT – CSAIL AV & Volunteer Ride Share Drivers Begin: March 2020
    - Phase III– Micro-Transit Shuttles Begin: June 2020
- March 2022: Final Data Collection on MaaS and Micro Transit systems
- Sept 2022: Three year wrap up meeting; submission of NAVYA, Rideshare and Micro-transit Systems Data (Phases I, II and III)
- March 2023: Completion of MIT C-SAIL project (Data Management Plan access continues into Years 4 and 5)
- June 2023: Project Close Out/End of Period of Performance

II. Demonstration Project Alignment with DOT ADS Project Primary Goals

In her recent Keynote Address announcing the DOT's roll out of "Preparing for the Future of Automated Vehicles 3.0", Secretary Chao once again emphasized that "automation has the potential to improve safety significantly" and that all stakeholders should work to "address existing barriers to safety innovation and progress". The City of Hillsboro and its stakeholder team have accepted the Secretary's charge and have charted a course to address the DOT's goals for Safety, Data Gathering for Rulemaking and Collaboration under the ADS grant program in the following ways:

A. <u>Safety</u>

Safe and reliable AV operations underlie the primary goals of the Hillsboro ADS grant demonstration project, which are to:

1. Increase the mobility of small urban and rural residents through improved public transportation and mobility options by studying the acceptance of autonomous vehicle technologies by rural residents, road users and potential AV shuttle riders;
2. Increase awareness and develop strategies to boost trust in the technology among various user bases;
3. Test the feasibility of AV shuttle operations in extreme winter conditions and analyze AV vehicles (shuttle and shared ride) operation and maneuverability for various weather conditions such as rain/ice and snow; and
4. Study the methods that AV technology can enhance mobility for rural community residents and specifically for residents who are transportation-disadvantaged (low income veterans, elderly, disabled, children, students, etc.)

The pace of automated driving and autonomous vehicle introduction will be determined by the implementation and adoption of safety regulations and the coordination of the uniform integration of those regulations across multiple affected jurisdictions – Federal, State and Local. In that regard, key participants in the proposed Hillsboro ADS demonstration project have taken the lead in proposing safety standards to the primary government regulatory bodies, including The U. S. Department of Transportation and The National Highway Traffic Safety Administration.

A principal focus is to address the Federal Motor Vehicle Safety Standards (FMVSS) for autonomous busses/shuttles. A key participant in the Hillsboro project, Navya, a French company that is in the process of constructing manufacturing facilities for autonomous vehicles in the State of Michigan, presented on January 19, 2019 its safety findings and recommendations to NHTSA, a first by this sector of the Automated Vehicle industry.

A second key issue facing effective safety regulation is the uniform application or coordination of safety laws and enforcement across the broad spectrum of Federal, State and Local regulatory bodies. There is in effect across America, a "patchwork" of differing regulations, and as one of the technology providers to this demonstration said,

> ***"There is no consistency from State to State on what is required to legally operate. In certain states we must provide a simple letter informing the DOT of where, when and how we are operating. In other states, we must go through a protracted exercise providing large amounts of technical information***".

One of the key research tasks of the Hillsboro project is to look at this issue. Research team members from The University of North Dakota will be studying and assessing the regulatory environment surrounding autonomous vehicles, not only in Hillsboro, but also the county, state, and federal levels. Policies currently in place were not developed with autonomous vehicles in mind and are likely to require revision to incorporate best practices for these vehicles. The goal will be to identify existing regulations that could link to autonomous vehicle usage in rural communities like Hillsboro, research best practices developed in other jurisdictions, and then suggest a model regulatory structure. This will be supplemented with information on unanticipated challenges and solutions that emerge during the demonstration project. This information will be gathered from interviews with participants (city leaders, law enforcement, citizens) at various points throughout the project.

B. Data for Safety Analysis and Rulemaking

The Hillsboro ADS demonstration project test bed has been designed to ensure safety data gathering and sharing of project. A national leader in data analytics and dissemination in the automated vehicle space, Iteris, Inc., is leading the Data Management (See Data Management Plan - Part 3) task for the Project Team in collaboration with Amazon Web Services, and will be employing the latest real time information sharing technologies.

The NDSU and UND research teams will also gather safety-related data through interviews and surveys with riders, residents, law enforcement officials, and other stakeholders throughout the project period. The research team will also document safety issues identified by the Public Safety Committee. The information gathered through these additional mechanisms will be reported to USDOT for use in their rulemaking efforts.

C. Collaboration

A hallmark and key strength of the Hillsboro ADS demonstration is its national collaborative network of key stakeholders from the public, private and academic sectors. A total of 12 entities with distinguished faculty and national leaders from private organizations with relevant project experience in the rural transportation, public transportation, mobility and autonomous vehicle space have joined forces to actively collaborate in designing, implementing, operating and evaluating the results of this multi-phase demonstration project.

Recognizing the existing web of state regulations that are relevant to autonomous development and the inherent complexity of coordinating them to accommodate autonomous systems, the breadth of experience and expertise present in the Hillsboro group offers substantial advantages. The project team's geographic diversity can be leveraged to help develop a model regulatory framework for rural deployment of AV technology.

The data collection process has already begun with the City of Hillsboro conducting a series of public informational forums and meetings to apprise the local population of the project goals and implementation plan and to solicit feedback on the proposed demonstration operations. This practice will continue throughout the project, supplemented by the data collection efforts of the NDSU and UND research teams. See Section V: Research Approach for details.

III. Project Alignment with DOT ADS Program Focus Areas

The Project Stakeholder Team working in collaboration finds the following Project goals align with the DOT-specified Project Focus Areas in the following manner:

Significant Public Benefits: The vast majority of autonomous driving pilots currently fielded have taken place in densely populated urban environments. However, it is actually those who live in rural areas that stand to derive the most benefit from autonomous mobility systems. While the typical city offers a myriad transportation options including buses, subways, taxis, and rideshare services, these options are not typically available to the rural population. For the 60 million Americans who live in these areas, the only transportation option is often owning and operating a personal vehicle. This can be a challenge for people struggling financially, the elderly, or anyone with a disability that prevents them from safely driving a car. This project aims to be among the first to address this challenge by providing autonomous mobility as a service system for those who need it most in rural areas, including seniors, veterans, individuals with disabilities, and low-income families unable to access critical services.

Addressing Market Failure and other Compelling Public Needs: Private industry has fielded numerous autonomous vehicle pilots in cities across the US from San Francisco, CA to Phoenix, AZ. However, these pilots all have one thing in common: they are located in densely populated urban areas. This decision is a sound one from a business perspective based primarily on two factors: Firstly, urban areas are much more densely populated, which increases the financial incentive and makes it more likely they can recoup their investment. Secondly, the high degree of structure present in urban areas (well-maintained roads, lane markings, curbs, etc.) ease some of the technological challenges. By focusing on rural areas, this project will provide transportation options to an underserved population that has been neglected by the private sector.

Economic Vitality: The Applicant will apply for Federal waiver of Executive Order 13788 "Buy America" to enable it to procure and demonstrate a foreign manufactured-autonomous vehicle assembled by Navya, Inc. Navya is actively working with the National Highway Traffic Safety Administration (NHTSA) to promote and implement safety regulations that will allow for the introduction of American-manufactured autonomous vehicles. It is currently building a manufacturing facility in Saline, Michigan.

Complexity of Technology: Phase I of the project will demonstrate an L4 Navya "Autotom" autonomous electrically-charged shuttle bus capable of accommodating up to 15 passengers. Phase II of the demonstration will feature autonomous mobility-on- demand service and pilot test a new system developed at MIT-CSAIL specifically to provide fully autonomous (L5) transportation in rural communities. Out of an abundance of caution, the vehicles will have a safety driver present to ensure the safe functioning of the vehicle at all times. However, while the vehicle is in autonomous mode, it is capable of completing the entire mobility pipeline without any human intervention. This includes receiving trip requests, identifying routes, driving the passenger safely from their pickup location to their destination while obeying traffic rules and detecting and sharing the road with other users, vehicles, and pedestrians.

Diversity of Projects: While Phase II of this project focuses on personal mobility for the rural community, these personal autonomous vehicles will connect passengers to the autonomous shuttle buses rolled out in Phase I. These phases therefore demonstrate the full range of project areas including public and personal transportation. Furthermore, while we focus here on personal mobility, 97% of the United States is comprised of rural areas, which implies any successful autonomous freight delivery system will need to be capable of operating in rural environments. We anticipate the knowledge gained from fielding this pilot will be extremely useful for other modes of autonomous transportation in rural areas including freight.

Transportation-challenged Populations: Transportation can be a struggle for the elderly. However, for many of the 46 million Americans over 65, maintaining the ability to travel without relying on assistance from others is an important part of maintaining their independence and quality of life. Additionally, persons who are disabled may not be physically capable of operating their own vehicle.

In rural areas in particular, this issue is compounded by the lack of alternative options such as buses, trains, taxis, or rideshare services. By providing mobility as a service in these areas, this project provides a means of traveling independently.

Prototypes: The vehicle prototypes used in this demonstration have been developed at Navya and MIT-CSAIL and a platform for proving cutting-edge innovations in autonomous mobility technologies. These vehicle prototypes have been used to successfully demonstrate new technological breakthroughs with results published in multiple, peer-reviewed, scientific conferences and research journals.

In order to safely operate the prototypes on the public roads of North Dakota, the Applicant and its autonomous technology shuttle provider Navya will jointly apply for a special HS-7 ruling from the Federal Motor Vehicle Safety Standards.

IV. Requirements

A. Project Demonstration and Research Objectives

Effective project management is essential to the successful completion of this project. For accomplishing the research objectives of the project, Dr. Jill Hough will serve as the principal investigator (PI); Dr. Ranjit Godavarthy will assist the PI, and serve as Co-PI. PI and Co-PI will be responsible for and lead most of the tasks and project management activities. Robert Wood PhD and Jason Jenson PhD will collaborate with Hough and the team to integrate University of North Dakota research objectives. They will work in collaboration with Dr. Daniela Rus and Graduate Researcher Teddy Ort of MIT's Computer Science and Artificial Intelligence Laboratory (MIT-CSAIL).

1. Determine outreach and awareness strategies needed for educating and gaining trust with AV vehicle operations in the rural community of Hillsboro, and with rural community residents in general.

2. Study the potential acceptance of autonomous vehicle technologies on MaaS platform by rural community residents, road users, and potential AV shuttle/vehicle riders.

3. Study the opportunities, advantages, and challenges for operating AV technologies for transit services, and other transportation services such as ridesharing and micro-transit in rural or small community setup.

4. Analyze the feasibility of AV shuttle and vehicle operations in extreme winter conditions. Further, impact of various weather conditions on AV vehicle operations and their safety aspects will also be studied.

5. Analyze ways Hillsboro AV pilot project (with services fixed route shuttle, and ridesharing services) can enhance mobility options for rural community residents, and specifically for residents who are transportation disadvantaged including veterans, elderly, disabled, low-income residents, residents without driver's license, children, students, etc.

6. Determine safety metrics and conduct safety analysis for various AV vehicles and their operations demonstrated in the pilot project.

7. Prepare guidance documents and best practices toolkit for AV operations in rural community setup, and in winter weather conditions.

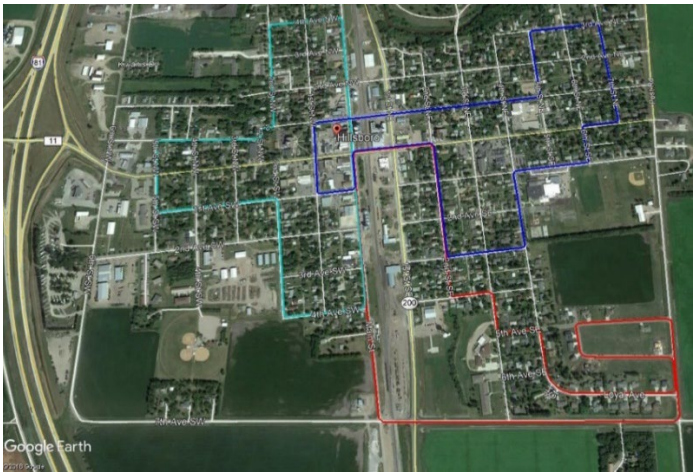
B. Project Demonstration Plan

The applicant proposes to design and deploy a Demonstration project in three sequential phases, each corresponding to a different set of service challenges and opportunities.

Phase 1 Demonstration Profile and Construct

The City of Hillsboro proposes a mobility hub transportation framework using SAE Level 4 Navya autonomous shuttle, combined with Level 5 AV ridesharing and micro-transit services operated together on a Mobility as a Service (MaaS) platform. The MaaS platform in the rural community of Hillsboro will primarily include one Navya Level 4 shuttle on a fixed-route circulator route connecting most frequent destinations and activity generators in the city; the shuttle will have an attendant on board to answer any questions or assist riders. This circulatory route will be complemented with an on-demand ridesharing service and a micro-transit service. Ridesharing and micro-transit services will connect to mobility hub points in the city of Hillsboro, which will be Navya shuttle stops. See Figure 3 for the proposed Navya shuttle route map.

Figure 3 – Proposed Navya Shuttle Routes in Hillsboro, ND



Phase II Demonstration Profile and Construct

The Phase II autonomous demonstration will include a mobility-on-demand service that allows residents who reside or work in the area surrounding Hillsboro, ND to request a ride to and from their location and a designated pickup/drop-off point in the city of Hillsboro for jobs, medical visits, appointments, restaurants, shopping, etc. Ridesharing service will be operated by Feonix Mobility Rising using its software platform and by hiring volunteers. The ridesharing service will begin with traditional vehicles and will later be integrated with MIT CSAIL's L5 retrofitted vehicles for providing on-demand rides. CSAIL vehicles will be tested with safety driver on-board along with few demonstrations without safety driver.

The designated pickup/drop-off point will coincide with a stop on the Autonomous NAVYA shuttle system, which will operate within the city. This will facilitate transfer from the personal mobility-on-demand system to public transit. Highly visible informational signage will be placed at all road ingress and egress into the city noting that Hillsboro is an "autonomous vehicle testing site". Signs will also be placed around the town noting where the AV shuttle stops will be located.

The autonomous vehicle will be clearly marked with appropriate decals to ensure that other road users are aware that it is part of the demonstration project. Users will be able to utilize an application such as on a computer or mobile phone to summon a ride. These applications will be accessible to persons with disabilities and include options for both English and Spanish speakers. Furthermore, because this service is intended to serve a rural area where not every destination has an easily recognizable address, the service will also allow choosing pickup/drop-off points using a "What3Words" location, which provides universally recognizable location labels to every point on the globe. A designated safety driver will remain in the vehicle at all times while it is operating autonomously and will be capable of transitioning the vehicle to manual mode and completing the trip in the event of any unexpected interruptions to the autonomous operation. This demonstration will focus on the underserved population in the rural communities surrounding Hillsboro by enabling them to access the city for medical, business, shopping, or recreational purposes.

Phase 3 Demonstration Profile and Construct

A growing base of commuters travel to and from Hillsboro and nearby urban commercial centers such as Fargo, ND (distance 50 miles) and Grand Forks, ND (distance 40 miles) for work, medical appointments, business travel, etc. Also, veterans currently do not have a transportation service to access Veterans Hospital facility located in Fargo, ND. To accommodate veteran's transportation needs, and commuter service demand to nearby cities, a micro-transit service will be operated to cities Fargo, Grand Forks and Mayville, ND as well as Ada, MN, and other communities based upon the need. The micro-transit service will be operated by Valley Senior Services on MaaS platform. In Hillsboro city, the micro-transit service will be connected to a transportation hub point.

The fixed route Navya shuttle, ridesharing service, and micro-transit service will be hosted on a MaaS platform provided by Feonix - Mobility Rising. Potential users could pay or request for rides for one or more of the three transportation options on a single platform.

Demonstration Project Summary

The central initial automated driver vehicle technology to be demonstrated will be an autonomous electric-powered 15 passenger shuttle bus operating at the rural city center of the project, Hillsboro. This operation, described as Phase I will include setting up the Navya autonomous shuttle as a circulatory fixed route service essentially within the City limits. Phase II will extend the scope and reach of an interconnected service to introduce a ridesharing service to bring people living outside the municipal boundaries and connect them to mobility hub points which will be the Phase I Navya shuttle stops. Phase III will include deploying micro-transit service using a van/bus for commuter service to nearby cities. This commuter service will also serve as veteran's transportation service for accessing medical facilities in Fargo, ND. Delete reference to Figure 2

C. Data Gathering and Sharing

The key project partners which will be garnering data to be shared with the pilot include Navya, MIT-CSAIL, Feonix, and academic partners, North Dakota University and North Dakota State. Highlighted data points are listed below and additional information can be found in Part 3 – Draft Data Management Plan.

Navya:

NAVYA provides access to data from their supervision platform, NAVYA Lead. This platform provides for fleet monitoring of diagnostics and location in real-time. In addition, NAVYA Lead provides real-time video streaming of front, rear, and onboard cameras along with current weather conditions.

- Current charge of the shuttle's battery
- Speed of which the shuttle is currently traveling
- Mileage the shuttle has traveled
- Temperature inside and outside the shuttle cabin
- Positioning of the shuttle on a visual map
- Status of the shuttle (whether its operating in autonomous mode or manual mode)

Specific events – for example if emergency stops were triggered, any obstacles the vehicle encounters; and the actions the shuttle takes when faced with an obstacle.
NAVYA LEAD also provides real-time camera streaming (Inside Viewing shuttle camera, and two outside viewing camera's (1) Front Viewing Camera (1) Rear Viewing Camera)

Figure 4: Nayva *arma* Shuttle Vehicle

Reports which will be generated from the real-time system which will be shared include:

- Vehicle speed - avg / min / max speed
- Vehicle status (Manual/Autonomous) – the time in both Autonomous and Manual
- Door status (Open/Closed) Ramp status
- Count of how many times door is opened/closed
- Battery consumption - estimate
- Count of battery alerts – alerts are triggered when battery level is 20% or lower
- Emergency stop count
- Obstacle detection - obstacle detection count

MIT-CSAIL:

There is a vast array of data collected when the MIT CSAIL Vehicle is in operation. They will be doing 5 sessions for 2 week periods during the implementation phase (10 weeks of data) collecting data providing trips for the fist and last mile service to the Navya shuttle as well as the micro-transit hubs for Fargo and Grand Forks. During those weeks they are collecting data, they will go out on the roads and be one of the vehicles providing rides scheduled for volunteer drivers. During those trips the volunteer will not drive but act as a care partner in the vehicle to provide that continuity of care and help ease concerns of their passenger with a local member of the community. The passengers will be contacted ahead of time to ensure they are okay with the trip. The MIT-CSAIL vehicle will always have an MIT safety driver at the wheel. Data collection will be scheduled during all types of weather to maximize seasonal road conditions.

Figure 5: MIT-CSAIL: L5 Passenger Vehicle

MIT CSAIL MapLite Autonomous Driving Data Collection Plan

During autonomous operation, the MapLite autonomous vehicle will collect data for performance analysis and evaluation. Due to the high rate at which data is collected, the data will initially be stored locally on the vehicle server. At the conclusion of each test run, the data will be uploaded to the data storage location for analysis and sharing. The data that will be shared includes the following broad categories:

1. Raw Sensor Data
2. Analyzed sensor data
3. Performance Evaluations
4. Task level metrics

The data will be described in more detail in the following sections.

Raw Sensor Data

The following table details the raw sensor data collected while the vehicle is in operation:

Data Source	Data Type	# per Vehicle	Data Rate (KB/s)	Total Data Rate (KB/s)
CAN Bus	Vehicle State Information	1	4.7	4.7
Wheel Encoders	Wheel Speed	2	3.5	7.0
IMU	6-Axis Accelerations	2	31.2	62.4
Cameras	Video	5	15,000.0	75,000.0
LiDAR (Close-range)	2D Pointcloud	4	384.0	1,536.0
LiDAR (Far-range)	3D Pointcloud	1	48,750.0	48,750.0
Magnetometer	Magnetic North Direction	1	11.2	11.2
GPS	GPS Coordinates	1	11.6	11.6
Barometer	Atmospheric Pressure	1	3.2	3.2
Output Log	Control Commands	1	6.8	6.8

The raw data stream from all sensors together is 125.39 MB/s. While video will always be stored temporarily until the conclusion of each run, in the interest of storage efficiency, the video streams could be removed after a sufficient waiting period leaving about 50 MB/s remaining.

Note, that while much of this raw data will be immediately useful for the planned performance metrics, they could also prove a valuable dataset for alternative measures such as automatically detecting and identifying road quality issues, or for creation of precise high-quality maps.

Feonix – Mobility Rising: MaaS
With the Mobility as a Service system in place coordinating trips, the following metrics will be able to be shared:

- Average Trip Distance
- Average User Wait Time for Ride and Actual Trip Time
- Rider Satisfaction
- Passenger Satisfaction
- Origin and Destination Trip Category Types (Healthcare, Shopping, Social/Leisure, Work, etc.)
- Method of Booking (Call Center, Computer Platform, iOS App, Android App.
- Percent of Trips with a Wheelchair Accessible Vehicle
- Total Miles Traveled (By Provider and By Mode of Transportation)

Academic Research Data: North Dakota University & North Dakota State
North Dakota State University's Small Urban and Rural Transit Center will work with various project partners involved to gather information, and available data to produce guidance documents, research analysis summaries/results, and best practices toolkit for AV operations in rural setup and winter weather conditions. Some of the research outputs North Dakota State University research team will produce include:

- Guidance document on outreach and training activities needed for rural communities while preparing for AV operations.
- Survey responses and results for Trail County residents, and AV vehicle riders.
- Stakeholder support and input for AV operations in rural communities.
- Feasibility of AV operations in rural community setup.
- Guidance and best practices for conducting AV operations in various winter conditions.
- Safety analysis of identified safety incidents from Navya and CSAIL vehicle operations.
- Provide metrics for enhanced mobility for veterans, and other transportation disadvantaged groups.
- Produce best practices toolkit for various AV operations in rural communities, county roads, and highways/freeways.

D. AV User Interfaces and Input / Output Procedures

The Navya autonomous shuttle provides the following interfaces and input /output procedures:

The shuttle is not controlled remotely, but rather through a Touchscreen onboard the vehicle. The SHUTTLE can operate in either a "Metro" mode or in "On-Demand" which will have different levels of control through the touchscreen. If in "Metro" mode, the SHUTTLE will perform all of its functions automatically except in the case of an emergency or at a 4-way stop intersection.

In the case of a 4-way stop intersection, at this time, the shuttle will come to a stop on its own, however, the safety attendant is the means in telling the SHUTTLE (by pressing a button on the touchscreen) to "go" when the SHUTTLE has the right-a-way. Interaction with the touchscreen is minimal in this mode because of the high level of automation. If in "On-Demand" mode, the Safety Attendant will interact with the touch screen which effectively tells the SHUTTLE which bus stop to proceed to next. Using the "On-Demand" mode ensures that the SHUTTLE is not driving on the open roads without passengers because it is counter to our mission of reducing congestion. Additionally, the Safety Attendant can perform diagnostic checks and view other operational data through the touchscreen, but the SA requirement is considered to be minimal.

The MIT CSAIL provides the following interfaces and input /output procedures:

The MIT-CSAIL Autonomous vehicle is controlled primarily through the MaaS mobile ridesharing application or calling the MaaS Call Center Toll Free Phone Number that will be set up by Feonix. With regard to the app functionality, users can request a pickup, input their desired destination, or modify or cancel their trip. The application will be accessible to those with special needs as well as both English and Spanish speakers. Once the vehicle has received a request, it will plan and drive to the pickup point autonomously.

The passenger will notify the vehicle through the app when they are ready to depart. During the drive to the passenger's destination, there will be a safety driver in the vehicle at all times. However, no input is necessary from the safety driver during normal operation. The vehicle contains a number of safe ways for passengers or the safety driver to cancel a trip or intervene during an autonomous ride. Firstly, the user can cancel the ride in progress either through the mobile app, or via touchscreen in the vehicle. In this event, the vehicle will immediately find a safe place to pull off the road and come to a stop.

Secondly, if it should be necessary, the safety driver can touch the brakes at any time and the vehicle will immediately transition to manual mode. In that event, the safety driver will operate the vehicle until a safe stopping point. In addition to these methods for interacting with the vehicle during a trip, the vehicle displays information regarding the ride during autonomous operation via a touchscreen. This screen communicates to the passengers their progress towards their destination, the expected arrival time, and the route the vehicle intends to take. A sensor view also allows passengers and the safety driver to see any road users such as other vehicles, bicyclists, or pedestrians in the sensor view to help the passengers feel confident that the vehicle is aware of any potential hazards and planning accordingly.

E. Project Scalability

The data created and shared during this first groundbreaking rural pilot will provide a gateway for additional research to be conducted as well as more pilots are explored on the frontier. The US contains over six million miles of rural roads, which is more than twice as much as the roads contained in all urban areas combined.

However, many autonomous mobility pilots currently focus on small urban communities due to the ability to create detailed, high-definition 3D maps of these areas. While these tests may offer valuable insight, they don't scale well because operation is limited to the few miles of roadway included in the map. Creating these HD maps requires hours of manual labor and can be prohibitively costly to update and maintain over time. On the other hand, the MapLite autonomous driving system developed at MIT-CSAIL forgoes the use of HD maps entirely. Instead, by focusing on using the sensors on board the vehicle for both the dynamic and static navigation constraints, MapLite is capable of driving on roads it has never seen before, similar to the way human drivers do. By utilizing MapLite to provide autonomous mobility to the rural area surrounding Hillsboro, this project will provide data on the viability of an autonomous mobility system that can much more easily scale to the millions of miles of rural roads across the country.

In terms of project scalability from the perspective of expanding service, the research plan and outcomes will lay the framework including the cost, operations management, public engagement strategy, and safety insight for those communities in small urban and rural towns to utilize in launching a similar framework.

F. Outreach and Knowledge Transfer

The project team has outlined a strategy to encourage utilization of the service and implement a multi-faceted public outreach program to share details and results of the demonstration on a regional and national level. Features of this plan include:

1- Feonix will assist the City of Hillsboro in establishing a website page dedicated to local public information about the services available, research opportunities, public hearings, announcements for residents, etc. In addition, Feonix will coordinate with the program partners to establish a website for the pilot research team that will get into the technical components of the pilot, sensor data examples, reports, and other analysis from academic partners.

2- Once service begins, weekly promotions, updates to availability, and expansion of service area will be done via print and social media. Every gas station within the county and along the corridors to Grand Forks and Fargo will have posters and business cards with information about the MaaS app and call center number to learn about and book transit services. Additionally, libraries, senior centers, hospitals, schools, employers, and social service areas such as the food pantry will provide space in the community billboards and directories as well as share in their community e-newsletters about the new mobility options available. Major announcements about each phase of expansion will receive a paid Facebook advertisement for a 2-week period.

3- Due to the opportunity of the MaaS platform to be utilized in an organizational setting via an enterprise computer platform, Feonix and local partners will begin to work with the local hospital, senior centers, and major employers in the region to book rides. Staff at each of these agencies will be able to provide support in coordinating transportation on behalf of patients or residents unable to drive or employees who may be unable to drive or who lost their license. Print materials and technology demonstrations will be given by the local Feonix staff or City's project manager. These presentations will be done based upon the schedules of the senior leadership in the organization but are anticipated to be as often as weekly throughout phases II and III.

4- Monthly the project manager for the City of Hillsboro will collaborate with Feonix to distribute an email newsletter that will share activities completed, next steps, and lessons learned. This will be available for subscription from the local public website as well as the research program website.

5- Quarterly webinars will be done and available to the public on major findings, community engagement, and next steps. The project team will collaborate with national organizations to promote and share the webinars with their members. Organizations that will be coordinated with senior leadership and medial departments include ITS America, National Aging and Disability Transportation Center, Easterseals, National Rural Transit Assistance Program, American Public Transportation Association, Council of University Transportation Centers as well as non-transit related entities including the U.S. Chamber of Commerce Executives, National Association of Rural Health, and National Economic Development Organizations. The webinars will be recorded and hosted on the public and technical websites with their respective slide decks.

6- The project team will also meet quarterly during phase II and III to specifically identify possible white papers, journal articles, and conference presentations that could be developed and provided to further distribute and expand pilot project findings.

VI. Approach

A. Research Approach

Effective project management is essential to the successful completion of this project. For accomplishing the research objectives of the project, Dr. Jill Hough will serve as the principal investigator (PI); Dr. Ranjit Godavarthy will assist the PI, and serve as Co-PI. PI and Co-PI will be responsible for and lead most of the tasks and project management activities. Robert Wood PhD and Jason Jenson PhD will collaborate with Hough and the team to integrate University of North Dakota research objectives. They will work in collaboration with Dr. Daniela Rus and Graduate Researcher Teddy Ort of MIT's Computer Science and Artificial Intelligence Lab. Ms. Flora Castillo, of Pivot Strategies will provide guidance and engage the research team regarding overall program design, health care expertise, leadership, and community impact.

Task 1: Gather lessons learned from completed/on-going AV implementations/pilots.

A comprehensive literature review will be conducted in this effort to review relevant on-going and completed projects in the focus areas of SAE 1-5 levels of AV operations; their implementations on test facilities and public roads; performance/challenges/opportunities for various SAE level AV vehicles on public roads; outreach activities and training programs implemented for deploying AV vehicles on test facilities and public roads; and strategies implemented to gain trust among community members, potential riders, pedestrians, road users, and community stakeholders. Information gathered from this task could be useful as guidance for implementation of various tasks planned in this three phase study, as well as accomplishing the research objectives of the study.

Task 2: Conduct outreach activities by engaging various stakeholders

From Task 1, the research team will identify various outreach and awareness programs implemented for educating and preparing community residents with upcoming AV operations. Along with this input, new and innovative outreach strategies that could specifically benefit educating rural community residents in and around the city of Hillsboro about the city's three phase AV project will be developed by the project team. Outreach and awareness activities will be conducted throughout the project timeline; these activities will however be rigorously conducted few weeks before each phase launch. Along with the city of Hillsboro, support from community stakeholders such as health institutions and clinics, sheriff's office, local businesses, educational institutions, etc., will be requested for conducting outreach activities. During the outreach activities, emphasis will be given to certain aspects of the AV pilot project such as: importance of Hillsboro's AV pilot project being the city's first public transportation service; potential for increasing transportation options for residents and commuters; enhancing the mobility of transportation disadvantaged population; etc., This task will produce guidance on outreach and training activities needed for rural communities while preparing for AV operations.

Task 3: Acceptance and feasibility of AV operations for MaaS enabled public transit operations in rural areas.

Surveys will be conducted with Traill County residents few weeks before phase 1 Navya vehicle deployment to gather input such as: knowledge of AV technologies; acceptance of AVs by rural community residents, road users, and potential AV riders in and around the city of Hillsboro; trust with AV technologies; willingness to ride AV shuttle/vehicles in and around the city of Hillsboro gauged based on various demographic population; level of comfort of road users sharing the road with AV shuttle/vehicles, etc. Along with surveys, interviews will be conducted with community stakeholders and local business owners about the feasibility of AV operations in rural setup, impact of AV public transit operations on community resident's mobility, quality of life, economy of community, etc. Surveys and interviews will be conducted again during implementation of phase I (Navya shuttle operations), phase II (on-demand AV ridesharing operations), and phase III (micro-transit services) of the project to gauge the trust, acceptance, willingness to ride, feasibility of AVs in rural setup, and support for AVs and MaaS in rural communities.

Surveys/interviews will be conducted with riders on Navya shuttle, CSAIL-Feonix Mobility Rising AV ridesharing service, and micro-transit service. Different factors that will be studied through AV rider surveys/interviews include level of comfort of riders in AV shuttle/vehicles, flexibility and accessibility of AV shuttle/vehicles to potential riders, interest of riding AV shuttle gauged based on various demographic population, accessibility of AV shuttle/vehicles for riders who are disabled or elderly, etc.

Along with surveys and interviews, NDSU researchers will gather all needed input from entities involved in the project such as City of Hillsboro, Navya team, Feonix Mobility Rising, MIT CSAIL team, and Valley Senior Services to determine and document the opportunities, advantages, and challenges for operating AV technologies for MaaS enabled public transit services in a rural community setup.

Task 4: Study the feasibility of AV operations in extreme winter conditions, and other weather conditions

Most of the initial AV implementations have been conducted in tropical climates where there is no interaction with snow and subzero temperatures. This project and research efforts will also specifically focus on feasibility, operational efficiency, and potential challenges of three phase AV operations in extreme winter conditions. In this task, NDSU researchers with assistance from various involved entities will analyze the feasibility of vehicle operation and maneuverability for various winter conditions such as rain, snow fall, blizzard, snow/slush/ice on road, snow kicked on to the road from curbs, snow banks, extreme winter weathers, etc. Sensor data, vehicle GPS and map positioning data, photos and videos collected from Navya vehicles and CSAIL vehicles, and other relevant data gathered from Navya shuttle and CSAIL vehicle will be used for conducing winter feasibility operations of AV vehicles under various weather conditions The data points will be used to analyze instances/locations of efficient operation of Navya shuttle, battery performance varying with demand of service and weather conditions, vehicle autonomous mode performance in summer vs. winter vs. summer/winter weather events, positioning of shuttle on a predetermined route, causes for emergency stops/slowdowns, etc.,

Further rider experience, and comfort during the winter AV operations will also be studied. This objective will aim to develop guidance and best practices for conducting AV operations in various winter conditions.

Task 5: Determine safety metrics and conduct safety analysis of AV pilot operations

Data available from Navya shuttle, and CSAIL AV vehicle will be used for determining safety metrics for safety evaluation and safety analysis. During the three phases of pilot operations, all emergency stops/slowdowns made by vehicles, near misses to avoid conflicts, and any events compromising the safety will be analyzed in detail. This safety analysis will identify causes for emergency stops/slowdowns and safety incidents, and provide countermeasures to overcome and enhance safety of AV vehicles. Further, the safety analysis will provide guidance and suggestions to enhance AV vehicle features to overcome occurring safety incidents/events during the operations. Safety analysis will also be conducted specifically for various winter weather conditions.

Task 6: Enhancing mobility options for veterans, and other transportation disadvantaged groups

While Veterans have transportation networks in many rural communities, Hillsboro does not currently have a Veterans transportation network to access Veterans Hospital facility located in Fargo, ND. This study will analyze the impact of AV transportation services offered through three phases of the study in meeting and improving the Veterans transportation needs for medical appointments and other purposes. Surveys and interviews will be conducted with Veterans in Hillsboro community, and Veterans hospital facility representatives in Fargo, ND. A similar analysis will be conducted to study the impact of mobility options for transportation disadvantaged groups such as elderly, disabled, low-income residents, residents without driver's license, children, students, etc.

Task 7: Prepare final report and develop guidance documents and best practices toolkit for various AV operations in rural communities, county roads, and highways/freeways.

Combining the results and findings from six research tasks, and summary of operations and strategies from Navya, City of Hillsboro, Feonix Mobility Rising, MIT CSAIL team, and Valley Senior Services, a final report will be produced documenting research activities during the three phases of project demonstrations. Further, guidance document and best practices toolkit will be developed for implementing AV shuttles, AV ridesharing services, and ADS micro transit services in a rural community setup, and in various winter weather conditions.

Outreach efforts will be conducted to disseminate the research results and output about feasibility of rural AV operations, and winter weather AV operations. The research team will attend conferences and meetings where the results from the study could reach to target audiences with interest areas such as transportation for rural and small urban communities, veteran's transportation, public transportation for transportation disadvantaged, tribal transportation, etc. At this stage, NDSU research team plan to present the results and findings at Transportation Research Board Annual Meeting conference, CTAA conferences, and National RTAP meetings and webinars.

Task 8: Review AV and MaaS regulatory frameworks at the local, state, and federal levels.

The proposed project will operate across multiple jurisdictions, each with an unknown number of relevant laws, ordinances, and regulations not intended to accommodate the presence of autonomous vehicles. The UND research team will pursue an iterative approach to developing a model regulatory structure. This will begin by researching existing city, county, and state structures in North Dakota for potential inhibiting factors, supplemented throughout the project with input from members of a Public Safety Committee established for the purpose of monitoring safety and identifying regulatory needs as they develop. Secondly, the research team will research lessons learned from other jurisdictions deploying autonomous vehicles and incorporate their best practices. Drawing upon these activities, the team will ultimately develop a model regulatory framework for Hillsboro and rural communities across America considering a similar project in the future. This work will also contribute to U.S. DOT's principle #4 to "encourage a consistent regulatory and operational environment."

Task 9: Explore the various political dimensions of implementing the pilot for rural communities.

Public policies often succeed or fail for reasons that have little to do with their technical merits. Strong and sustained public support remains an important element of success for any policy and will be particularly important for the deployment of autonomous vehicles. Many Americans remain skeptical of their value and wary of sharing the road with them. The Hillsboro project provides an opportunity for the research team to document and study the political dimensions of this issue. Conducted at multiple points throughout the demonstration project, the research team will use public opinion and stakeholder data to identify and document the principal narratives that emerge surrounding the project. The team will also track the relative strength of political factions and how these are impacted by the messaging efforts of city leaders and other stakeholders.

Task 10: Review alternative Autonomous-Centric economic development opportunities for leveraging resources for local and state governments.

The economic development possibilities associated with autonomous systems for America's rural communities are clear, yet they remain largely unexplored by researchers. The Hillsboro project offers an opportunity to experiment with multiple automated vehicle platforms and technologies operating in a shared environment. Autonomous vehicle use in production agriculture has become common in this area, and the Research Institute for Autonomous Systems (RIAS) at the University of North Dakota has an established funded research presence in Hillsboro testing unmanned flight. For this task, the research team will explore the possibility of creating an "autonomous alley" in Hillsboro. By extending autonomous flight and other testing into the town and surrounding areas, we hope to identify a range of previously unavailable options for economic development that could be replicated in rural communities across America.

B. Addressing Legal and Regulatory Constraints

The applicant partner Navya will seek exceptions to the following two government regulatory standards: Federal Motor Vehicle Safety Standards (FMVSS): The Phase I NAVYAs shuttle at present does not presently meet FMVSS standards but there is a pathway that the applicant will follow to safely and legally deploy the technology. The steps in the approval process for FMVSS are:

1. The Applicant and Navya will first perform a feasibility study of all proposed routes. This is to be sure that the shuttle will be a successfully deployed and to determine if there is anything that needs to be added and/or changed to the proposed routes or the surrounding environment.

2. Once this step is complete, Navya will assist the applicant Hillsboro, ND in applying for a HS-7 exemption application through FMVSS. This application gives the Navya shuttle the ability to operate on public roads with mixed traffic. The application takes approximately 30 days nse.

3. Once Hillsboro receives an approval status from the HS-7 application; Navya will be able to issue a request for the shuttle to be imported to the U.S.

Buy America: The Applicant and its autonomous technology provider Navya will seek an exception to The Buy America Act or the terms of the ADS grant NOFO clause at Section F, Paragraph 2.J. entitled "Buy America and Domestic Vehicle Preferences". The applicant will follow all mandated processes to secure this exception and has allowed timing to a final government determination in the Project Schedule and Period of Performance.

C. Risk Identification, Mitigation and Management

The Applicant has identified 4 areas of Project risk and has identified an approach to how that Risk will be mitigated and managed:

1. Internal Project Management Risk

Most recently the City of Hillsboro was a direct recipient of FAA funding for airport runway, taxiway and ramp area improvements. The amount of the grant was $7 million and funded over three years corresponding to the engineering and construction plan.

For this program, the City will hire a project manager for the ADS project that has had extensive experience in managing government-funded programs and is fully familiar with all requirements for grant financial controls, processes, reports and audits, and reimbursement policies.

Supporting the Project Manager will be an assistant project manager and the City Auditor who will serve as grant financial manager for week to week operations.
The City will be a direct recipient for grant funding and will enter into subcontracts with designated Project Team members who are part of the overall project budget. The internal City Auditor, Commission Project Superintendent and City Commission president who all have extensive commercial background, will provide close project oversight.

2. Insurance Risk

The City's liability is limited to $250,000 per individual subject to $1 million per incident. Vehicles for procurement under the Project will be added to the City's current North Dakota Insurance Reserve Fund. Subcontractors employed under this ADS Project will be held to provide their own Certificate of Liability insurance to the City. With the hiring of the project manager and assistant project manager the applicant is confident it will be able to meet the requirements for grant management and information systems and its ability to meet the management standards as prescribed in 2 CFR Part 200.

3. Vehicle Operations Risk. The autonomous vehicles that are part of this program will be subject to extreme weather conditions and thereby to vehicle failure. The Applicant has designated a local vehicle repair shop who will go through the Navya vehicle training program for maintenance and repair. As a backup and second line of vehicle operating assurance, the Navya will send a technician to diagnose the issue and return the vehicle to full service operations.

4. Safety and Incident Management Risk. Serving a variety of age groups including seniors and the disabled, the Applicant recognizes that the Project may be subject to accidents and personal injury. As both a preventative /risk mitigation and remedial measure, the Applicant has made plans to form a Project Public Safety Committee, that will be managed under the Project subcontract scope of work by the University of North Dakota, Department of Political Science and Public Administration. There will be active community involvement and participation on this Committee, including local law enforcement, fire and emergency responders, insurance loss mitigation experts, senior services, local schools and medical care providers. The Committee will formulate policies and procedures for incident management, and safety controls across the project, to include informational tools, pamphlets and safety signage.

The Safety Committee will be formed in the first stages of the Demonstration before live shuttle bus operations. The Committee will meet weekly during the first months of the project phase to evaluate performance and then as the project activity dictates.

Local and regional law enforcement will advise the Safety Committee on public safety concerns from a law enforcement perspective, as well as share concerns from the public at large. In addition to test area signage throughout the City and on the autonomous bus, an aggressive public information campaign will be conducted through a multitude of public information venues.