




# PROJECT NARRATIVE

# AND TECHNICAL APPROACH

**WILL IT  
DRIVE**  **?**  
IN PEORIA



A diagram showing a top-down view of a car with blue sensor waves emanating from it, indicating its field of vision or sensor range. The car is positioned on a road with lane markings.

Ms. Sarah E. Tarpgaard  
Contracting Officer  
U.S. Department of Transportation  
1200 New Jersey Avenue SE  
Washington, D.C. 20590

Re: USDOT Automated Driving System (ADS) Demonstration Grant Application

Dear Ms. Tarpgaard,

The Tri-County Regional Planning Commission (TCRPC), as the lead applicant for this grant under the ADS program, looks for a favorable review of this application from USDOT. A successful outcome would greatly enhance the ongoing regional initiatives to create a new economic growth driver centered on autonomous vehicles.

The Greater Peoria Area in Central Illinois offers USDOT unique and distinctive attributes that differentiate the region and this Grant Application from others. These attributes include...

- **WORLD CLASS Expertise** – AutonomouStuff's (AS) management team and engineers located in nearby Morton Illinois will be fully engaged in helping to craft the best-in-class technical and data requirements of the grant.
- **Integrated Demonstration Projects** - The proposed demonstration projects have been framed to complement each other to provide practical, useful and statistically valid research data outcomes applicable to USDOT future rulemaking needs.
- **Effective Public/Private Partnerships** – An actively engaged group of public and private partners is committed to long term deployment and financial support of a sustainable open platform autonomous vehicle ecosystem in the region during the program period and beyond.
- **Transportation Mode and Environmental Diversity** – Diverse transportation systems in the region include...urban and rural freeways, rural highways, urban surface streets, and construction zones. Also, the wide range of seasonal conditions experienced in Peoria offer every type of extreme in temperature and precipitation to effectively test ADS models.
- **Positive Regional Economic Impact** – As the future of transportation is embracing Autonomous Mobility, so, too, does Central Illinois as it seeks to leverage its considerable AM assets to stimulate the creation of more jobs, more income and increased overall economic growth.


As the Metropolitan Planning Organization for our region, sponsoring this application is central to TCRPC's transportation and community development mission. We look forward to the opportunity to meet the objectives set forth by USDOT and the proposed TCRPC ADS Program.

Sincerely,

A handwritten signature in black ink that reads "Eric W. Miller".

Eric Miller, Executive Director  
Tri-County Regional Planning Commission

Grant Applicant:  
Tri-County Regional Planning Commission

A stylized blue graphic of a city skyline with various building silhouettes, located at the bottom right of the page.

<b>Summary Table</b>	
Project Name/Title	"Will it Drive in Peoria?"
Eligible Entity Applying to Receive Federal Funding (Prime Applicant's Legal Name and Address)	Tri-County Regional Planning Commission 456 Fulton Street, Suite 401 Peoria, IL 61602
Point of Contact (Name/Title; Email; Phone Number)	Mr. Eric Miller, Executive Director emiller@tricountyrpc.org 309-673-9330
Proposed Location (State and Municipalities) for the Demonstration	East Peoria, IL; Morton, IL; Peoria, IL
Proposed Technologies for the Demonstration (briefly list)	L3 Ford Starcraft Transit Bus, Autoware, CARMA, and Cohda Wireless DSRC radios
Proposed duration of the Demonstration (period of performance)	3 years
Federal Funding Amount Requested	\$8,345,000
Non-Federal Cost Share Amount Proposed, if applicable	\$1,485,000
Total Project Cost (Federal Share + Non-Federal Cost Share, if applicable)	\$9,830,000

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## 1. EXECUTIVE SUMMARY

You may have heard the phrase “Will it play in Peoria?” More than 100 years ago, that phrase gained notoriety because entertainment acts would determine the widespread appeal of shows based on the reaction of the diverse Peoria region. Now, Peoria will again be a test market. This time, the test market is for connected and autonomous vehicles (CAVs). CAV technology has the ability to change mobility for people across the globe. “Will it drive in Peoria?”

There is a regional history for innovation in the CAV industry. Farming, mining, and passenger vehicles from Peoria are sold around the world. Local industry leaders in this space include Caterpillar, Komatsu, and the lead corporate provider of this grant application, **AutonomouStuff** (AS). Combining AutonomouStuff’s products and analysis with support from local government agencies, automobile insurance providers (State Farm), and infrastructure design professionals (Hanson Professional Services Inc.) enables the demonstration project team to understand the data from every angle. A list of contributing members, in addition to AutonomouStuff, is in Table PN-1.

*Table PN-1: Contributing Members*

Local Public Agencies	Core Corporate Partners
Peoria County	Peoria CEO Council
City of Peoria	OSF Hospital
Tazewell County	State Farm
Village of Morton	Nexmobi
Peoria-Pekin Urbanized Area Transportation Study	Greater Peoria Economic Development Council
Illinois Department of Transportation	Illinois Autonomous Vehicles Association
Greater Peoria Mass Transit District (CityLink)	Hanson Professional Services, Inc.

“Will it drive in Peoria?” is more than a catchy phrase used for this demonstration grant. Because the use of CAVs is so transformational, the regional vision is to create a one-of-a-kind, open platform ecosystem for the deployment and development of CAV technologies. The members of the metropolitan planning organization unanimously support the initiative, and traction for the vision is spreading across Illinois. Corporations and government agencies will be allowed access to the ecosystem to test their ideas and business models. The concept is an effort to support innovation, strategic collaborations, and long-term regional economic growth by way of the CAV market. The grant funds will seed the initial building of the ecosystem. Nexmobi, a not-for-profit corporation, will lead the long-term development, evolution, and marketing of the ecosystem. **The forecasted economic impact to the Peoria region is estimated to be 800 technology jobs and over \$500 million over the next 10 years.**



Six L3 Ford Starcraft commercial transit vans will run on four fixed routes for two years. Each of the routes were developed to serve a transportation need in the community while conducting the demonstration. Each route operates in a different transportation contextual environment, allowing for diverse challenges that can be tested.

- Two of the routes work together to give seven hours of free rides to an underserved population, including mentally disable veterans and the recently homeless. The residential and grocery store routes provide a new transit line that connects residents of the South Side Office of Concern's apartment buildings in downtown Peoria to groceries, urgent medical care, pharmacies, and general stores.
- The OSF Hospital route allows the demonstration of potential cost savings for businesses to support CAV development. The route will supplement an existing OSF operation to transport hospital staff back and forth between off-site parking. OSF will provide ample outreach to the staff to make sure they are aware of the safety benefits of CAVs and address any concerns.
- The commuter route was developed to make the most of every mile put on the vehicles. Because the vehicles would be driving between Morton and Peoria every day to download data and receive maintenance services, the commuter route was formalized to take advantage of the diverse roadway types the route will use. It will allow demonstration of the benefits of platooning passenger vehicles on interstates and rural highways.

Because of the region's small geographic footprint, it is economically feasible for the demonstration to test CAV performance on rural highways, rural freeways, urban freeways, suburban roads, and multimodal urban streets. In each of these environments, the CAVs will illustrate the ability of connectivity and open source solutions, like Autoware and CARMA, to enhance safety with localization. Along the different routes, the CAVs will experience interactions with connected buses, optimized traffic flow at signals, platooning at high speeds, navigating freeway and urban street work zones, dealing with winter weather and low light conditions, and adjusting for unexpected movements from heavy pedestrian movement, bicycles, and parked vehicles.

The demonstration vehicles will collect data over 300,000 miles on roads owned by the Illinois Department of Transportation, City of Peoria, City of East Peoria, Tazewell County, and Village of Morton. The project schedule is shown in Figure PN-1.

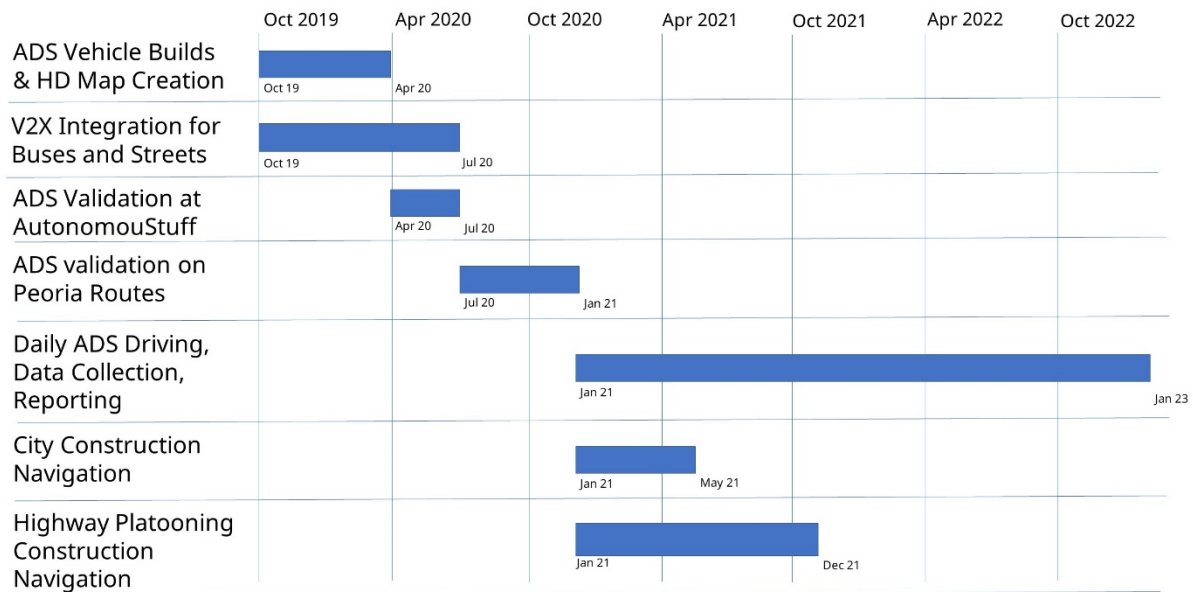


Figure PN-1: Project Schedule

## 2. PROJECT GOALS

When reading the NOFO, it is clear that a selected demonstration project must safely integrate automated driving systems (ADS) on highways and streets. The theme of transportation safety is prevalent through the NOFO, and it was easily inferred that the data provided by the demonstration would be used to set baseline rules and regulations for the future integration of ADS. The “Will it drive in Peoria?” demonstration will provide the USDOT with data from driving six L3 Ford Starcraft commercial transit vans for 400 days along four different routes (see Figure PN-2, Figure PN-3, Figure PN-4, and Figure PN-5).



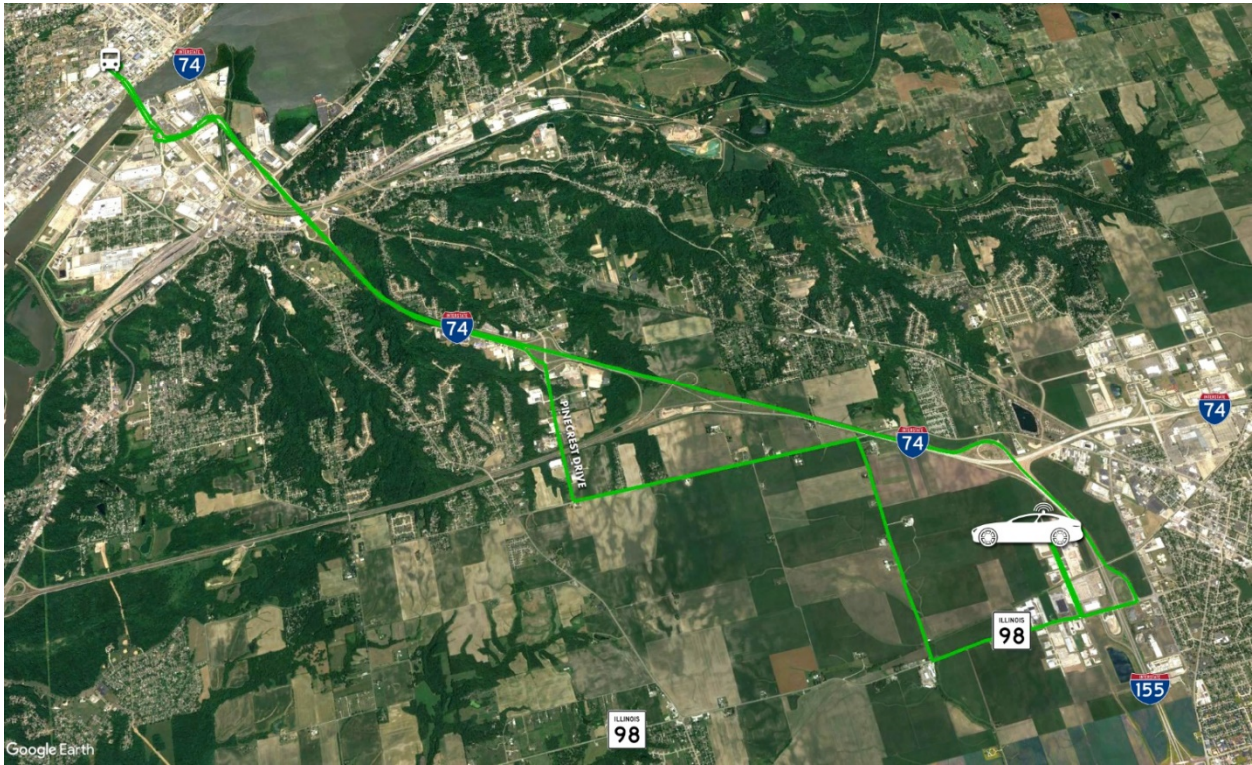


Figure PN-2: Commuter Route Map







Figure PN-3: OSF Hospital Route Map



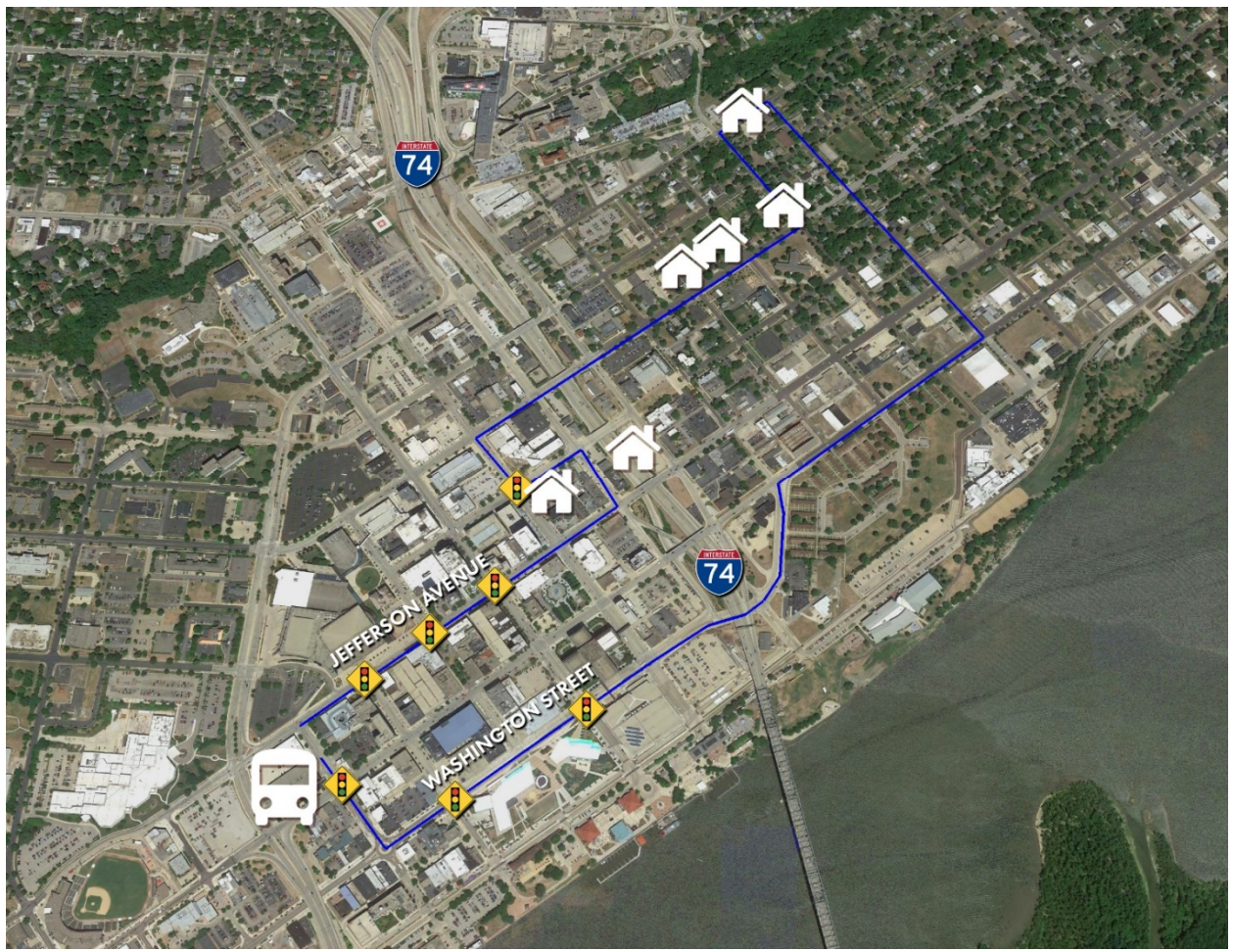


Figure PN-4: Residential Route Map



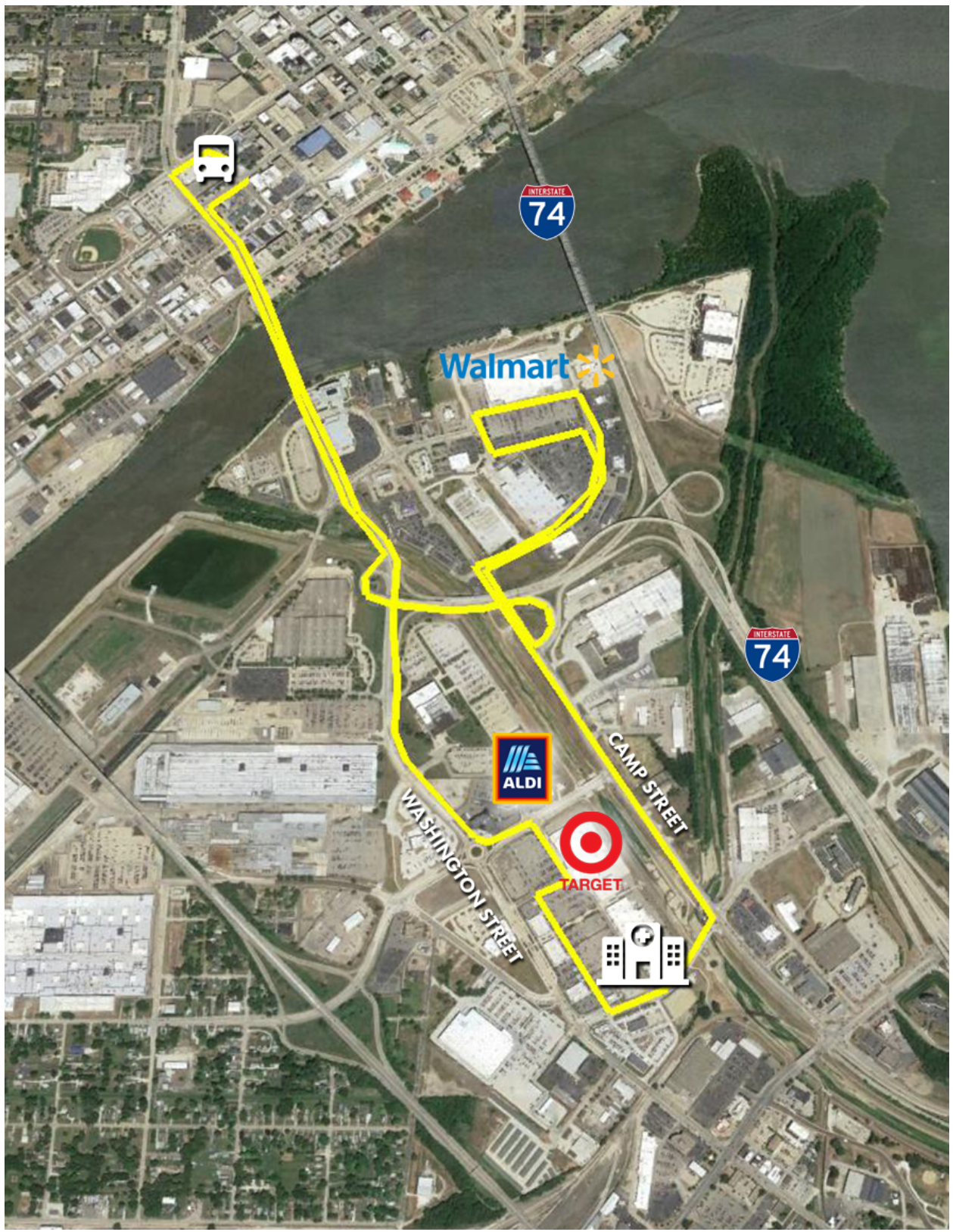


Figure PN-5: Grocery Store Route Map



The three ADS tests are:

1. Study the use of open source autonomous driving software to reduce ADS deployment and research costs. The software used:
  - Autware (used for perception, localization, and motion planning)
  - CARMA (used for enhanced V2V bus positioning, SPaT traffic lights, traffic flow optimization in V2X corridor, highway platooning, and work zone navigation)
2. Autonomously drive ADS vehicles across multiple environments for two years to generate the data needed to develop ADS standards for a variety of situations and public road types.
  - City (including daily transport hospital workers)
  - Urban (including daily public transport)
  - Highway (including six ADS vehicles platooning)
  - Winter weather
  - Heavy pedestrian movements
  - Low light driving
  - Construction zones
3. Study the impact of connectivity infrastructure on ADS vehicles.
  - Two V2I corridors with six DSRC/V2X-equipped traffic signals
  - 30 V2V-equipped Greater Peoria Mass Transit District buses showing benefits of V2V for ADS
  - DSRC/CV2X-enhanced localization for buses broadcasting position to ADS vehicles in corridors and at CityLink transit center
  - V2I-based work zones to study impact on ADS highway platooning
  - Standard ADS city and highway driving

CAV STANDARD  
ACRONYMS USED

**CARMA** – Cloud-Assisted Real-time Methods for Autonomy

**DSRC** – dedicated short-range communications

**SPaT** – signal phase and time

**V2V** – vehicle-to-vehicle communication

**V2I** – vehicle-to-infrastructure communication

**V2X** – vehicle-to-everything communication

How the proposed demonstrations meet each goal is discussed below.

**a. Safety**

During the demonstration grant period, the L3 vehicles will be developed, deployed, maintained, and operated by AS. AS was selected because of its status as a global leader in development, deployment, and data analysis activities in the autonomous



vehicle industry. With AS staff nearby in Morton, IL, the vehicles can be serviced and redeployed quickly on an as-needed basis to ensure that the systems remain safe and road-worthy. Advantages of using AS include:

- Relationships with state-of-the-art technology manufacturers
- Development of HD maps that will be used for pre-emptive knowledge of road semantics and enhanced localizations. All routes will be validated.
- Full system validation at the AS technical center in Morton
- On-site vehicle operation validation
- Employment of trained safety drivers
- Installation of V2X communications to improve safety for other vehicles, pedestrians, and bicyclists

The other considerations for safely integrating ADS vehicles into the transportation system include infrastructure condition and public perception. The team and demonstration projects were designed with these challenges in mind. For infrastructure condition, the projects will traverse roads with varied pavement condition index ratings. Staged construction zones and detour routes will be traversed to determine their effects on ADS vehicle operation. These activities will coincide with giving rides to people while making the community comfortable with the ADS vehicles being on the road. The local government agencies are planning to enable this effort through public relation campaigns aimed at informing the public about what is occurring.

## **b. Data for Safety Analysis and Rulemaking**

The main deliverable to the USDOT is the collection and analysis of the data generated by the ADS vehicles. The vehicles will run on four routes for 11 hours per day over the course of two years. The CAV software will collect the raw sensor data and store it on removable disk storage in the vehicles. The data will be uploaded daily to an AS storage device. Operating the vehicles over this time frame will generate enormous amounts of data for the USDOT.

Each driver will initiate a “snapshot” recording by pressing a button in the vehicle. The snapshot will save 1 minute of collected sensor data before the button was pushed. Approximately 50 events per vehicle will be recorded each day. The snapshots will be classified by the driver via a “high priority” or “interesting” button system. This classification is further detailed with verbal driver notes. The snapshots are combined with the sensor data to relate to the developed key performance indicators (KPIs). Potential KPIs include:

- Likelihood of driver intervention under specific circumstances
- Change in CAV system accuracy following a construction zone change
- CAV system recognition time for DSRC-enabled vehicles versus non-DSRC-enabled vehicles

- CAV system recognition time for hazards at different CAV vehicle speeds
- CAV reaction times when platooned on the interstate
- Driver-operated behavior around platooned CAVs on the interstate compared to nonplatooned CAVs

The robot operating system (ROS) “bag” raw sensor data for all 1-minute snapshots will be retained for no more than 20 weeks and will then be overwritten. This data will be available upon request for an additional charge. The 50 daily snapshots will be prioritized based on parameters agreed to by the USDOT. Using the parameters, AS will reduce the 300 daily 1-minute snapshots to 36 events that are 15 seconds each. These events will be uploaded to a Microsoft Azure location within one week of the occurrence.

The snapshot files stored in Azure will have user access control enabled. DOT and partner organizations would have access to the data through named Azure user accounts. It is assumed that DOT and partner organizations will download or copy the data from this Azure location for long-term storage and sharing. The snapshot data will remain on Azure until the end of 2023 and then it will be deleted, because it is not intended for long-term storage. The data will be maintained by AS at its facility and is available upon request for five years after the end of the grant performance period.

Please see the data management plan for more information.

### **c. Collaboration**

The spirit of collaboration is the foundation the greater Peoria community is built on. The sense of “a rising tide floats all boats” in the community extends to the ADS industry. During the fall of 2018, Nexmobi and AS undertook a project to run an L3 ADS vehicle through downtown Peoria in the summer of 2019. The team gathered the support of the city of Peoria’s staff and elected officials and has begun to discuss potential law enforcement interactions if a crash occurs. Because this demonstration route runs near the Peoria Riverfront Museum, Nexmobi is discussing the idea of educational pieces on the ADS to teach the community about CAVs. So, will it drive in Peoria? YES!

The scope for the USDOT grant application project is much larger than the scope of the summer 2019 pilot. Beginning in late January 2019, a weekly community advisory group (CAG) was convened by Peoria County. The CAG involves public and private partners that believe in the using the ADS and smart city applications as tools for economic development in the region. Organizations involved with the CAG are:

- Peoria County
- Tazewell County
- City of Peoria



- Village of Morton
- Greater Peoria Mass Transit District
- Bradley University
- Nexmobi
- State Farm
- Hanson Professional Services

Discussion topics at the CAG meetings range from how to recruit long-term contributing members, to the open source CAV platform, to CAV platform asset ownership. The CAG will continue to convene weekly during the grant demonstration period and act as a sounding board to project leaders from the Tri-County Regional Planning Commission (TCRPC) and AS. Since the regional ADS initiative began, members of the groups have reached out to social service agencies (South Side Office of Concern, Community Workshop and Training Center and Neighborhood House) and medical providers (OSF Hospital and Easter Seals) about rideshare programs.

Because CAVs can transform the automotive insurance industry, the CAG recognized the need to add that expertise to the grant team and open source platform being built in the Peoria region. The CAG contacted State Farm, and a financial and collaborative partnership has been forged to add data science and insurance industry knowledge to the team. Our team of local government officials also added Hanson Professional Services to handle infrastructure design studies, data analysis, and smart city applications.

### 3. FOCUS AREAS

Secondary to the project goals are the focus areas that the demonstrations must serve. In the case of the Peoria demonstration project, meeting the challenge of each focus area was a goal, and each aspect of the project was designed with that intent. A description of how the focus area challenges were met are described herein.

#### a. Significant Public Benefits

How does one measure project scale and public benefit? The CAG set out with the intent of:

- Driving 300,000 miles with L3 vehicles
- Creating an open source platform that illustrates a path to reducing cost barriers to entry in the ADS industry
- Building an open source platform and communication network that lays the groundwork for innovation based economic growth in the region
- Removing transportation barriers for food desert areas, medical patients, and socially disadvantaged populations with a free mobility-as-a-service program.

The designed routes and systems meet each of these goals by driving six vehicles along



four routes for 11 hours per day for approximately two years, all while delivering subsidized populations to basic-need destinations (grocery stores, pharmacies, health clinics) or workers to the hospital.

### **b. Addressing Market Failure and other Compelling Public Needs**

Commercialized CAV projects are challenging to fund because of high costs, and the resulting intellectual property is too valuable to share with anyone. The Peoria demonstration will create an open source platform that reduces the entry costs and encourages collaboration and innovation across all private industries and within the public sector.

High costs and the protection of data also slows the delivery of autonomous transportation services to low-income, disabled, rural, and elderly populations. This is why every CAV project proposed in the open source platform will perform a social-justice type of transportation service to one of those demographics. This mission will continue for all new projects brought into the platform, and the development of functionality for disabled populations will be encouraged.

### **c. Economic Vitality**

Even though the project's goal is to deliver data to the USDOT, the data must be generated by a vehicle that meets the "Made in the USA" requirement. The team discussed the importance of delivering enhanced transportation services to socially disadvantaged populations and narrowed the vehicle choices down to minivans or large passenger vans. The consensus settled on using a commercial passenger van, because it would give the South Side Office of Concern's tenants the most efficient use. Six Ford Starcraft commercial transit vans manufactured in the United States will be converted to L3 autonomy.

In Central Illinois, companies like Caterpillar, Komatsu, AutonomouStuff, and State Farm have developed these technologies, are researching how autonomous transportation would change their business models, or both. The local government community and the private-sector companies based in the region believe that investing in ADS can drive regional economic development. Using the grant funds to build an open source platform network for CAVs will kick-start the initiative and give the CAG a runway to begin bringing companies, large and small, to Peoria to test ideas, create data, and prove their concepts. Economic projections provided to the CAG by Nexmobi estimates that if the demonstration grant is awarded, the available platform could result in 800 STEM jobs and \$500 million in economic growth through the increased business activity in the region over a 10-year period.





Table PN-2: Potential CAV Based Economic Growth

	2020	2025	2029	10 Yr Total
I. Direct Impacts - Nexmobi				
A. AV Projects	\$ 1,500,000	\$ 15,000,000	\$ 27,000,000	\$ 136,500,000
B. Data Sales	\$ 10,000	\$ 75,938	\$ 384,434	\$ 1,133,301
C. Convention Revenues	\$ 50,000	\$ 80,526	\$ 117,897	\$ 796,871
D. Advisory Services	\$ -	\$ 160,000	\$ 2,560,000	\$ 5,100,000
Total	\$ 1,560,000	\$ 15,316,463	\$ 30,062,331	\$ 143,530,172
II. Indirect Impacts - Nexmobi multiplier	\$ 1,170,000	\$ 11,487,347	\$ 22,546,748	\$ 107,647,629
III. Indirect Impacts - Ecosystem	\$ 2,730,000	\$ 26,803,810	\$ 52,609,079	\$ 251,177,801
	<b>\$ 5,460,000</b>	<b>\$ 53,607,621</b>	<b>\$ 105,218,158</b>	<b>\$ 502,355,602</b>

**d. Complexity of Technology**

All vehicles gathering data for this demonstration will operate as L3 autonomous vehicles powered by open source software (Autoware and CARMA). The vehicles will be connected to each other, 30 driver-operated mass transit buses, and city-owned infrastructure (within and outside construction zones) with Cohda Wireless DSRC radios and roadside units (RSUs). The addition of the radios and RSUs will help determine how safety can be improved through V2X communications.

**e. Diversity of Projects**

The proposed demonstrations and accompanying routes will provide a diverse set of data for CAV deployment. The demonstrations will outline the operation, scalability, and economic impact of an open platform as well as the ability to operate CAVs with or without various infrastructure communication elements.

To test these demonstrations, specific routes were developed that serve a variety of purposes and people. Two of the routes serve users trying to conduct basic errands. These users will want a convenient and reliable trip, but the time-of-day usage for the routes may be unpredictable. The OSF route will serve staff arriving to and leaving from work during a shift change. Because everyone will arrive at once, these trips will be greatly affected by the total trip time, boarding and alighting times, and any other delays that may increase the average turnaround time. The commuter route will serve as a demonstration of a rideshare program. The users will likely be more affected by the other users on the trip. The route will help determine a commuter’s tolerance for inconvenience to save money and driving time.

Geographic diversity within a small footprint is an intrinsic advantage of the Peoria region, and it is reflected in the design of the demonstration project. The four routes enhance personal mobility through the downtown urban core and along suburban arterial and collector streets in a big box development zone, rural county and state highways, and urban and suburban freeways. The routes are also intended to support



public transit service during significant congestion associated with construction zones. The vehicles add to the public transportation service in the construction area in high-speed freeway and low-speed urban environments. Demonstration tests will be conducted in the construction zones while providing the transportation services.

**f. Transportation Challenged Populations**

The South Side Office of Concern and its tenants are supported by many federal, state, and local agencies, including:

- United States Department of Housing and Urban Development
- United States Department of Veterans Affairs
- Illinois Department of Human Services
  - Division of Mental Health
  - Division of Family and Community Services
- Illinois Department of Healthcare and Family Services
- Heart of Illinois United Way
- Peoria Housing Authority

The South Side Office of Concern’s population has many elderly and mentally disabled individuals, including veterans, who need better, more consistent transportation. While the development of ADA accessible facilities in autonomous vehicles is a long-term goal, the CAG believed that the demonstration would drive more miles and provide more test data in a more expedient manner if ambulatory individuals were provided the personal mobility opportunities at the outset.

**g. Prototypes**

AutonomouStuff is main supplier of the L3 vehicles and, through its partnership with Cohda Wireless, communications products. AS has deployed more than 450 similar vehicle platforms worldwide with its drive-by-wire open source solutions. All safety standards are met by the proposed AS systems, and each vehicle will be manned by two trained safety drivers who will switch driving responsibilities every 30 minutes.





Figure PN-6: AutonomouStuff Previous Projects

## 4. REQUIREMENTS

The proposed “Will it drive in Peoria?” demonstration satisfies the requirements contained in NOFO Section A as follows:

- Six L3 ADS Ford Starcraft Commercial Transit Vans will be built, deployed, operated, and maintained by AS.
- Six L3 ADS Ford Starcraft commercial transit vans will drive four routes daily over two years while encountering 30 connected driver-operated CityLink buses, six connected traffic signals, connected RSU base units at the transit center, and construction zones. Those routes are:
  - Commuter route: AS headquarters in Morton, IL to the Greater Peoria Mass Transit District Transit Center in downtown Peoria. This route will be driven four times daily: AM to the transit center (6:30 a.m.), midday to Morton (11:30 a.m.), midday to Transit Center (2:30 p.m.), and PM (7:30 p.m.) to Morton.
  - OSF Hospital route: Transporting St. Francis Medical Center workers from remote parking lots to the hospital. This route will be driven for 30 minutes during morning and evening shift changes.
  - Residential route: Three L3 vehicles will transport tenants from five South Side Office of Concern apartment buildings and group homes to the Greater Peoria Mass Transit District Transit Center on 15-minute headway intervals from 7:15 to 11 a.m. and 4 to 7:30 p.m.
  - Grocery route: Three L3 vehicles will transport CityLink customers from the Greater Peoria Mass Transit District Transit Center to Walmart, OSF Urgo, Target, and ALDI in the East Peoria Levee District on 15-minute headway intervals from 7:15 to 11 a.m. and 4 to 7:30 p.m.
- The data generated by the vehicles will be downloaded daily between noon and 2

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p.m. at AS headquarters in Morton. The raw data will be post-processed and uploaded to a Microsoft Azure cloud repository within one week of collection. The data will be available for download throughout the length of the demonstration plus one year. For the remaining four years after the demonstration has been completed, the data will be available by request from AS.

- An input-output user interface is not necessary for the proposed demonstration, because the vehicles will operate in a fixed-route scenario.
- The CAG is committed to sharing the status, results, and lessons learned with all interested parties, public and private. AS and Hanson Professional Services intend to cover the cost of the outreach through traditional business overhead expenses at no cost to the USDOT. This is a common business practice that is similar to speaking engagements at technical and sales conferences. SAE International has invited the project team to present to its global membership via workshops, symposia, and conferences.
- Cost and time hinder the scalability of CAV projects. The Peoria project intends to show how combining available state-of-the-art technologies with open source software can reduce costs and improve deployment time. The intent of V2X communication is to illustrate improved localization and safety without additional mapping or processing costs and time.

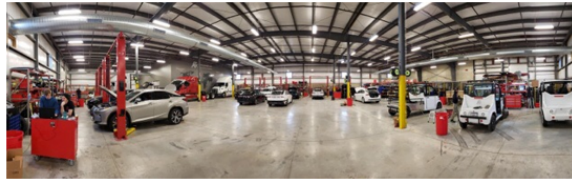
## 5. APPROACH

Implementing and evaluating the project has eight steps:

1. ADS Vehicle Builds

Building the vehicles will take place at the AS headquarters in Morton from October 2019 until April 2020. A graphic depicting the equipment that will be installed in each Ford Starcraft commercial transit van is provided.





**ADS Vehicle Assembly:**  
AutonomousStuff Vehicle Integration Center in Morton, IL

-  **Delphi ESR:**  
Mid- to long- range electronically scanning radar
-  **Mako G-319C:**  
GigE machine vision camera by Allied Vision
-  **NovAtel PwrPak7:**  
Lightweight and rugged GNSS receiver board
-  **Cohda Wireless MK6**  
On board Unit supporting DSRC and CV2X Connectivity

-  **Velodyne LiDAR:**  
Small and lightweight LiDAR sensor with 3D mobile mapping
-  **AStuff Spectra:**  
High-end graphics, AI, VR, autonomous driving computer
-  **NovAtel IMU-IGM-S1:**  
Tactical grade IMU designed to be paired with a SPAN enabled GNSS receiver



Figure PN-7: Ford Starcraft Commercial Transit Van Autonomous Equipment

## 2. ADS HD Map Builds

ADS vehicles will drive all four routes with HD maps used for pre-emptive knowledge of road semantics and enhanced localization. The HD maps will be validated following vehicle validation at AS in Morton. Updates to the maps for construction staging along the commuter, grocery, and residential routes is included in the AS budget.

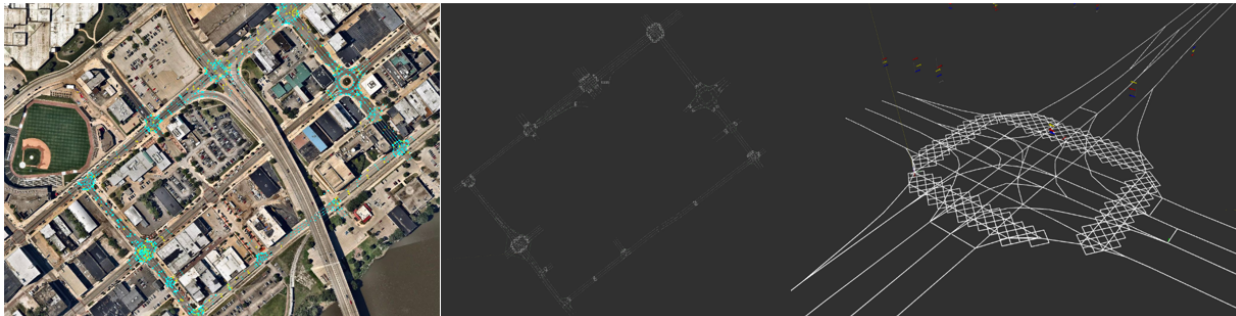


Figure PN-8: Point Cloud and Motion Planning

## 3. Open Source Software Architecture Licenses and Maintenance

A major objective to the grant project is to study the effectiveness of open source autonomous driving software. The use of this platform is intended to cultivate an environment for reduced-cost ADS research and commercial deployment. Autoware will be used for perception, localization, and motion planning. CARMA will be used for enhanced V2V bus positioning, SPaT traffic signals, traffic flow optimization in the V2X corridors, highway platooning, and work zone navigation. ROS will be used for middleware functions, debugging script, and data viewing.



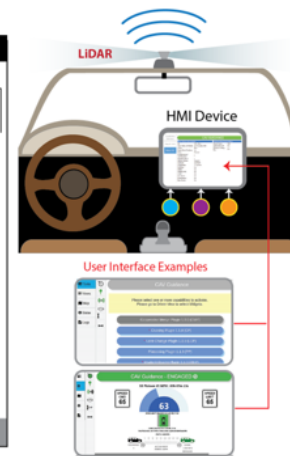
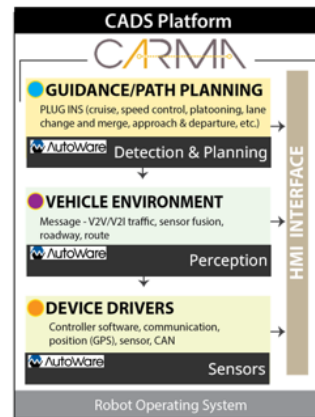
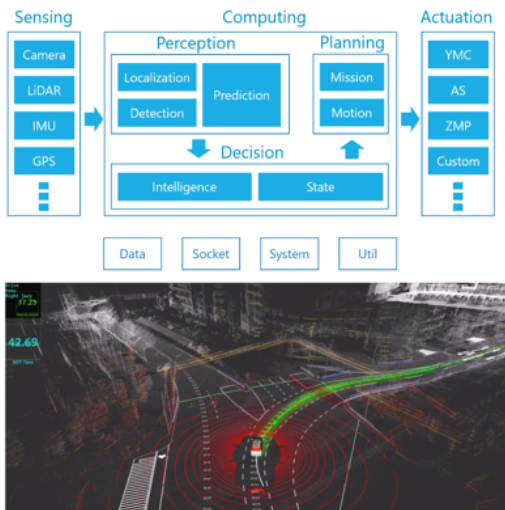


Figure PN-9: Autoware and CARMA

4. V2X Integration

Thirty driver-operated CityLink buses will be equipped with DSRC radios, which will allow for enhanced position broadcasting in the V2I corridors on the residential and grocery routes. The V2I corridors will include 10 intersections with RSUs, of which six will be at traffic signals equipped with SPaT broadcast. The L3 vehicle will have consistent, daily interaction with the deployed V2X buses. In the V2I corridors, nearby onboard units will be enabled, with position-correction abilities to test the safety enhancements of localization.

5. ADS Vehicle and Route Validation

Each ADS vehicle will undergo a full system validation by AS at its technical center in Morton. The system validation will take place before any onroad testing can occur. ADS system requirements and functionality will be tested at the technical center via simulations and HD mapping.



*Figure PN-10: AutonomouStuff Vehicle and Route Validation*

The second step in the validation process happens on the routes. Each vehicle is driven along each route to test if Autware and CARMA are properly integrated with one another and the route. This part of the validation is scheduled for completion by December 2020.

#### 6. Daily Testing

After the ADS routes are validated, daily driving and data collection will commence. In addition to the daily tests, ADS vehicles will drive construction zones in urban, suburban, and freeway conditions during 2021. V2I-based work zone technologies will be implemented, with the goal of determining the impact of connectivity solutions. CARMA software will be tested to contribute updates to open source software architecture that can be deployed to all researchers and commercial users. On Jefferson Street (grocery route), CARMA systems in the ADS vehicles are proposed to communicate with work zone RSUs. On daily trips to and from Morton (commuter route), CARMA systems will communicate with work zone RSUs to assist with the lane changing, merging, and diverging operations happening in the ADS vehicle platoons.

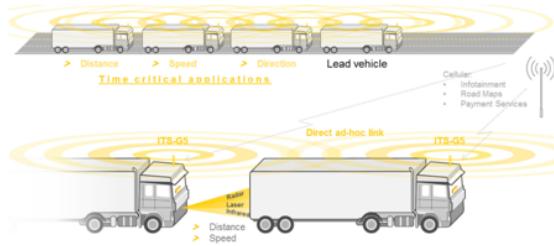


Figure PN-11: CARMA in Construction Zones

## 7. Data Storage

The specifications of the data storage are discussed above in the requirements and available in the data management plan.

## 8. Data Management and KPI Development

The “Will it drive in Peoria?” team understands that the USDOT is essentially paying for the data it needs to develop testing standards, rules, and regulations for safe autonomous vehicle deployment. Through daily data collection, the L3 ADS vehicles will develop two years of varied and comprehensive data. It is the intent of the team to create KPIs that show where ADS vehicle performance is challenged. KPIs will be developed in conjunction with the USDOT to ensure that proper performance scenarios are measured.



		Road Features						Environment			
		Unsignalized Intersection	Single lane road segment	Double lane highway	Crosswalk	T intersection	...	Clear	Snowing	Rainy	...
Driving Behaviors	Stop for traffic signal										
	Resume from stop					4					
	Stop for vehicle			1							
	Maintain speed										
	Centerline deviation		1				1				
...											

Figure PN-12: Example KPI Table

Other measures of effectiveness will center on social outcomes associated with the better transportation alternatives for South Side Office of Concern’s residents, determining benefit-cost ratios for infrastructure projects related to ADS, congestion reduction, crash reduction, work zone crash reduction, and work zone congestion monitoring. Engineers — two from AS and one Hanson Professional Services — will be dedicated to project data support. Support functions include data collection, KPI generation, system maintenance, calibrations, system and software debugging, and ADS computer bus and software update implementation.

The “Will it drive in Peoria?” demonstration does not need to address any legal, regulatory, or environmental obstacles. No exemptions from the Federal Motor Vehicle Safety Standards, Federal Motor Carrier Safety Regulations, or any other regulations are required to complete the project. Additionally, the Buy America Act and domestic vehicle provisions will be met with the purchase of Ford Starcraft commercial transit vans assembled in in the United States and is taken one step further with the L3 assembly occurring in Morton.

Any successful project must be furnished with the proper tools to identify, mitigate and manage risk. Many steps have already been taken to manage the partnerships that are required for a robust, regional response. For budget risk, AS has given the TCRPC a binding quote to cover all the work associated with the grant other than the Hanson Professional Services data analysis and TCRPC legal and administrative efforts. Additionally, regional partnerships exist between the local governments; each is represented on the TCRPC because it is the designated metropolitan planning organization for the region. Included in the letters of commitment is a statement clarifying the relationship between the TCRPC and

Nexmobi. Nexmobi will pass-through local share financial contributions donated in support of the demonstration, and TCRPC will turn over the vehicles and communication systems to Nexmobi at the conclusion of the demonstration grant.

Financial risk is only one part of the equation when implementing new technologies in a community. The project team understands that social acceptance and perception could affect the project's outcome. For this reason, the TCRPC's executive director and the community advisory group will have regular oversight and communications with the AS management team. The regularly scheduled meetings and public outreach events will be used to drive input from all stakeholders. Since the founding of the CAG, it has identified that communicating with local law enforcement, the Illinois Department of Transportation, and local agencies that assist underserved populations is key to mitigating and managing social risks. Information will be distributed to these groups and made easily available to create better project messaging and understanding. Better project messaging will clearly describe the project objectives, create public acceptance of CAV operations, and drive better participation in the CAV rideshare program. In the long run, the public campaign could support educational opportunities and STEM career growth in the region.

Local government agencies and private organizations have committed financial resources as nonfederal resources. To date, \$1.485 million in financial commitments, all cash contributions, have been either passed by board resolution or guaranteed by letters of commitment from elected officials and corporate sponsors. Of the \$1.485 million in funding, \$360,000 is from corporate entities. Each organization that has committed financial support has agreed to an annual funding share to be paid to the TCRPC during 2020, 2021, and 2022. Full transparency and accounting for the funds will be done through the TCRPC's Unified Work Plan.

