North Central Texas Council of Governments

KITTELSON & ASSOCIATES

AV2.1 FINAL REPORT

AV2.1: CONDUCT A PLANNING PROCESS TO HELP THE NORTH TEXAS REGION PREPARE FOR AUTOMATED VEHICLES AND RELATED TECHNOLOGIES

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INTRODUCTION

Technology impacts all aspects of transportation, and these technologies are ever evolving.

Local agencies need guidance on how to plan for uncertainties in the future of transportation. Proactive planning can help North Central Texas communities create unified plans to use technology to solve local and regional transportation needs.

Decision makers want to understand **HOW** technologies could change travel behaviors and land use patterns, **WHEN** these impacts are likely to occur, and **WHAT** additional infrastructure or policy changes, if any, agencies may need to support the future travel demands.

This report summarizes the AV2.1 study, "Conduct a Planning Process to Help the North Texas Region Prepare for Automated Vehicles and Related Technologies." This study was led by the North Central Texas Council of Governments (NCTCOG). This final report is organized with the following chapters:

WHAT ARE EMERGING TECHNOLOGIES?

There are many new technologies that are transforming the transportation industry as we know it. This report differentiates between various technologies to give agencies guidance on the specific applications, status, impacts, and challenges for each. Emerging technologies include:

Aerial Mobility is a concept envisioning a multi-use air transportation network for passenger mobility, cargo delivery, and emergency management. Compared to existing aviation services, aerial mobility typically refers to smaller, highly automated, lower-altitude vehicles making short trips.

Curb Space Management Technologies help increase the curb's functionality and improve safety and access for all travelers including personal vehicles, public transit, ride-hailing services, commercial deliveries, and other mobility options.

Data Guidance from low-cost sensors and personal data-sharing devices have proliferated, and their sensing and computational power has advanced. These changes have dramatically increased the volume, speed, and granularity of data available from public and private sources.

Emerging Vehicle Technologies. Innovations in vehicle technologies can be generalized in the following categories: Automated, Connected, Electric, and Shared-Use (or ACES).

- **Automated Vehicles** are equipped with sensors that allow them to operate with little to no human input.
- **Connected Vehicles** can communicate with other vehicles, infrastructure, or other wireless technologies.
- **Electric Vehicles** include electric motor-powered vehicles and may get their power from batteries, fuel cells burning hydrogen, or hybrids using gasoline engines to supplement the electric motor or battery.
- **Shared-Use Vehicles** include mobility services used by multiple travelers for a variety of trip services. Examples include ride-hailing (such as Uber and Lyft), micromobility (bike and scooter share), carsharing, ridesharing (carpool), microtransit (flexible, dynamic routes), and public transit.

Highway Systems Technologies include devices used to gather and disseminate data about the status of roadways and transit systems, and other Intelligent Transportation Systems (ITS). They serve to detect, control, and inform users while they are traveling.

Integrated Technologies include multi-modal trip planning, real-time information and navigation, and integrated payment applications to enhance personal mobility across different modes and providers. These technologies may also include more holistic, flexible land use design and innovative mobility management approaches like variable pricing or incentives to dynamically manage the entire mobility ecosystem and influence traveler behavior such as destination, time of day, mode, route, and facility choices.

Micromobility refers to mobility options, under the umbrella of active transportation, using small, lightweight vehicles operated by users at speeds typically below 20 mph. Examples include both human-powered and electric bicycles, scooters, skateboards, and cargo bikes.

HOW ARE TECHNOLOGIES CHANGING TRANSPORTATION?

New technologies are changing how we travel, when we travel, the cost of travel (time or money), or replacing the need to travel at all (like teleworking or telemedicine). These changes to travel patterns and behaviors can lead to changes in land use patterns (such as where people live or work, or the locations of freight distribution centers).

Some transformational technologies are in use today and are already impacting travel behavior and land use patterns. For example, many North Texas residents, students, and employers quickly adopted telework or virtual learning due to the COVID-19 pandemic. Increasing e-commerce demands have moved goods warehouses and distribution centers closer to urban areas.

Some technologies will require local government support, such as expanding electric vehicle charging infrastructure.

Some technologies are in pilot phases, such as Texas Department of Transportation's (TxDOT's) Connected Freight Corridor, Arlington's Rapid AV ride-hail program, Wing's drone delivery pilot, and sidewalk delivery robot pilots on several college campuses in the region.

Some impacts are still unknown, like the sustainable cost of emerging technologies or the travel behavior impacts of new modes of transportation like automated vehicles.

HOW IS NCTCOG PREPARING FOR THIS CHANGE?

NCTCOG is preparing for emerging transportation technologies through a three-phase Automated Vehicle 2.0 (AV2.0) program. The objectives of the AV2.0 program are to:

- Make future mobility planning resources available to stakeholders in the region
- Provide resources for stakeholders to prepare for and support future mobility
- Look beyond technology available today to plan for future scenarios and impacts

The three phases of the AV2.0 program are:

1 **Planning (AV2.1)** – Connecting North Texas Communities with Emerging Transportation Technologies – Helping North Texas communities plan for the arrival of emerging transportation technologies, such as automated vehicles (AVs). AV2.1 developed guidance for local agencies to proactively plan for the effects of emerging transportation technologies. This understanding and readiness will help the region apply for federal, state, or local deployment funding to deploy or support new technologies. This final report marks the completion of AV2.1.

When envisioning the AV2.1 program, NCTCOG used the following terminology: "Automated Vehicle" or "AV" refers to both connected and autonomous vehicles. The term is inclusive of technologies that are precursors to the introduction of AVs, such as emerging modes of micromobility and rideshare, and related to AVs, such as vehicle-to-infrastructure technology.

2 **Partnerships (AV2.2)** – Funding to help North Texas communities build effective partnerships with the AV developers when they deploy AVs in the community.

3 **Investment (AV2.3)** – Making strategic investments in AV service as a region to explore use cases that are important to the region but not being adequately addressed by the private sector.

In addition to the AV2.0 program, NCTCOG is preparing for emerging technologies by:

- Collaborating on TxDOT's **Connected Freight Corridors Project**
- Leading a **Freight Optimization Project** to improve flow of freight
- Standardizing work zone reporting using the **Work Zone Data Exchange** Specification
- Utilizing **connected vehicle data**—especially video—to improve maintenance, operations, and safety through a Situational Awareness App
- **Advancing electrification** to support automated vehicles
- Calming traffic, **creating safer streets for all people**, including for bicyclists and pedestrians will improve operational environment for automated vehicles
- Leading **Uncrewed Aircraft System (UAS)** education, planning, and pilots

WHERE ARE WE TODAY?

Some technologies are here today, while others are being tested and piloted for deployment. The **Existing Conditions Report** details the current state of transportation and emerging technologies in North Central Texas. By knowing the existing conditions (or baseline), agencies can monitor trends, understand impacts, and determine what is feasible to meet the region's transportation needs.

North Central Texas is building off a strong foundation. The region is leading numerous efforts to plan for emerging technologies, including:

Updating and Including Emerging Technology in Key State and Regional Planning Documents. Numerous plans that address emerging transportation technologies were reviewed. State and regional plans include:

- Texas Long Range Transportation Plan: Texas Transportation Plan 2050
- Texas Transportation Improvement Program (TIP)
- NCTCOG Long Range Transportation Plan: Mobility 2045
- NCTCOG Transportation Improvement Program 2019 – 2022
- TxDOT Texas Freight Mobility Plan 2018.

TIP projects at the regional level include enhanced communications for vehicle-to-vehicle (V2V) and vehicle to-infrastructure (V2I) applications, infrastructure maintenance, and digital installations in the right of way. Long-range plan improvements include both infrastructure installations and projects to modify driver behavior.

All local agencies will need to continue to monitor industry trends and regularly update planning documents based on new developments or key lessons learned from emerging technology deployments. The planning process will need to keep pace as the market evolves.

Funding Innovative Pilots and Deployments. NCTCOG launched a multiphase funding opportunity for AV deployment under the AV2.0 program (Table 1). As pilot deployments continue to evolve, local agencies should continue to monitor trends, document lessons learned and conduct comprehensive evaluations to understand what worked and what did not. Dallas-Fort Worth (DFW) Clean Cities, a program of NCTCOG, for example, documents electric vehicle trends from regional maps and local success stories. The outputs from these efforts can help agencies update existing conditions and planning documents. The technologies that will be deployed and tested through AV2.0 include:

- Automated Vehicle (AV) Shuttle
- AVs as Service Delivery Tools
- App-Based Ridesharing
- AV Trucking
- Automated Parking
- Curb Management
- Connected Vehicle (CV) communication
- CV Emergency Alerts
- CV Traffic Signals
- Broadband Access/ Virtual Transport
- Neighborhood Delivery Bots
- Public Transit Buses
- Teleoperation

Table 1. NCTCOG AV2.2/2.3 Funded Projects

Proposer *Title*	Project Purpose	Partners
City of Arlington ***AV RAPID Tech Expansion***	/ Two-year continuation of Arlington RAPID automated ride-hail service, which has been growing ridership (200+/day) and has a predominately low-income, transit-dependent ridership base. Adding teleoperation and emergency vehicle alert technology, which will help speed transition to fully driverless operation.	**University of Texas Arlington, May Mobility (Toyota), Via**
City of Fort Worth ***Open-Access Autonomous Truckport***	/ Increase the efficiency of Interstate 35W, which serves as one of the Metroplex's key lifelines and faces high levels of traffic congestion. Leverage the existing supply chain ecosystem within Alliance Texas to improve transportation efficiencies focused on drayage and long-haul movements.	**Alliance Texas, and leading autonomous trucking developers spearheaded by Kodiak Robotics**
City of Fort Worth ***South / Southeast Fort Worth Projects***	/ Three projects supporting City of Fort Worth Resolution 5028 12 2018 (Task Force on Race and Culture): / Technology Application of Expanded ZIPZONE Transit Service in Zip Code 76104. / Pilot Project on Design and Implementation of Equal Access to the Internet as a Travel Demand Management Tool: Southeast Fort Worth Lancaster and Rosedale. / Western Application of Next Generation Traffic Signals: Emergency Vehicles and Transit Vehicles.	Multiple local and technology partners
City of Richardson ***Infrastructure Upgrades and Senior AV Ride Services***	/ Upgrade infrastructure at 10 locations to supplement AVs with crucial information, including vulnerable road user location information and traffic signal status, using Cellular Vehicle-to-Everything communication. Provide AV ride services for seniors and the underserved to/from various points of interest in the city, including Network of Communities Ministries, Richardson Public Library, City Hall/Civic Center, YMCA, First United Methodist Church, USPS, and Arapaho Center Station.	**University of Texas at Dallas**
DART ***Transit Bus Automated Vehicle Purchase and Deployment***	/ Purchase and deploy in transit service four 40-foot Society of Automotive Engineers (SAE) Level 4 automated transit buses. These buses will be placed into service on DART's Love Link route, which operates between the Inwood Road/Love Field Station and Love Field airport.	**NCTCOG, City of Dallas, Love Field Airport**
Dallas College ***Dallas College Autonomous Vehicle Initiative***	/ Deploy autonomous shuttles on and around campus to provide practical learning and internship opportunities for students engaged in the program. Provide better mobility options for students and visitors and explore how AV technology can achieve that goal.	**Various AV companies**

Proposer *Title*	Project Purpose	Partners
DFW International Airport (DFWIA) ***Self-Parking Vehicle / Curb Management / Parking Management Test Site***	/ Develop a test bed to test automated parking using Low-Speed Vehicle Automation (LSVA), Supervisory Parking Management (SPM), and Active Curb Management (ACM).	**NREL**
City of McKinney and South Dallas ***AV Wellness Wagons***	/ Use vans outfitted to serve as telemedicine and other service delivery studios and deployed using broadband-enabled teleoperation to provide health care services to underserved communities in McKinney (suburban, semi-rural environments) and South Dallas (urban environment). Provide food and medicine delivery.	**City of Dallas, City of McKinney and technology partners**
Paul Quinn College (PQC) ***Automated Delivery of Produce in the South Dallas Food Desert***	/ Use automated and/or remote-controlled vehicles (bots) to deliver fresh produce from Paul Quinn College's We Over Me Farm to 250 pre-determined single-family homes and key locations in a defined service area.	**City of Dallas and technology partners**

KEY FINDINGS FROM THE EXISTING CONDITIONS REPORT

/ **Personal mobility.** Many roadways in the region have high congestion levels and unreliable travel times during peak travel periods. Local emerging technology mobility efforts include high-speed rail, demand-responsive passenger services, first-mile/last-mile connections via micromobility, mobile ticketing and scheduling applications, and people movers.

/ **Freight movement.** Increasing traffic congestion in the region will have a negative impact on freight movement. Automated trucking, unmanned aerial system (or drone) delivery, and enhanced traffic and congestion management strategies could improve freight movement reliability.

/ **Equity.** The North Central Texas region is committed to providing the same level of access to essential destinations to all residents, irrespective of their residence location, race, age, gender, income, and/or abilities. Agencies need guidance on how to develop equity-focused policies and programs related to emerging technologies.

/ **Safety.** There were 917 crash-related fatalities in North Central Texas in 2021. Emerging technologies could provide new opportunities to improve transportation safety in the region.

/ **Infrastructure readiness and resiliency.** Public infrastructure that supports emerging technologies includes roadways, traffic management systems, sensors, and the electric grid. Infrastructure readiness and resilience can be measured through assets, data, and integration. Supporting projects have been deployed across North Central Texas by cities in collaboration with private industry and university partners, such as Intelligent Transportation System (ITS) installations, automated vehicle deployments, and expanded internet services for residential areas. Agencies want guidance on when and what to invest in.

WHICH TECHNOLOGIES SHOULD COMMUNITIES PLAN FOR?

We created a **Market Analysis Report** to help municipalities understand which technologies are coming to North Central Texas, including:

- **Aerial Mobility**
- **Highway Systems Technologies**
- **Curb Space Management Technologies**
- **Integrated Technologies**
- **Data Guidance**
- **Micromobility**
- **Emerging Vehicle Technologies**
  (Connected, Automated, Electric, Shared)

The market analysis report outlines:

/ Status and trends in emerging transportation technologies,

/ Likely applications and adoption timelines,

/ Potential challenges to greater deployment,

/ Potential challenges to ensuring equitable deployment, and

/ Opportunities for public sector involvement.

Following is a summary of key challenges and opportunities for each of the technologies. For more detailed information on the current status, adoption timelines, and technology applications please refer to the full Market Analysis Report. The **Market Analysis Report** and **AV Hosting Handbook** also provide more specific examples of the opportunities identified in the following tables.

Aerial Mobility

Challenges	Opportunities
Ensuring safety and security of systems to gain public trust	/ Encourage aerial mobility network developers to build redundant systems. / Educate key stakeholders about policies and provide training for aerial mobility jobs. / Incorporate resilience and contingency management plans from the start.
Fast-changing regulatory environment to integrate aerial mobility in the airspace system	/ Provide policy recommendations and comments to the FAA and state government through the NCTCOG Legislative and Policy UAS Safety and Integration Initiative Working Group.
Flexibility and scalability as the market emerges and grows	/ Continue to test aerial vehicles and systems in both urban and rural areas and adopt successful practices that can be scaled. / Use Working Groups to bring public and private stakeholders together to anticipate change and be flexible as future of aerial mobility becomes clearer. / Identify the best locations and land uses for building a regional network of locations where aerial vehicles will take off and land.

Curb Space Management Technologies

Challenges	Opportunities
Demand for curb space is increasing with existing and emerging modes	/ Implement curb management strategies and plan for regular updates and adjustments based on new data or the emergence of new mobility options. / Establish a “sandbox” approach to test new technologies. A “sandbox” approach provides a structured test environment to test innovations and evaluate what works and what doesn’t before scaling up a particular solution.
Lack of useful real-time data on curb use for planning purposes	/ Collect data on existing parking utilization and curb space usage, building on NCTCOG’s Regional Parking Database.
Communicating and coordinating curb management strategy	/ Develop an outreach plan with targeted messaging based on common stakeholder concerns such as the removal of on-street car parking. / Consider needs of people with disabilities and those without a smartphone or credit card.

Data Guidance

Challenges	Opportunities
Forming new partnerships with both public and private stakeholders	/ Develop a data management framework that allows agencies to partner with others to collect, maintain, and analyze data. / Partner with local entrepreneurs and academic institutions to create new uses for agency-generated data.
Addressing cybersecurity vulnerabilities	/ Develop cybersecurity plans to protect data. / Revise procurement policies to require all contractors to prove how their systems would adhere to agency cybersecurity plans.
Lack of capacity of public agencies to manage large amounts of data	/ Strategically build agency capabilities and expertise around data management.
Costly third-party solutions for data management and risk of being locked into proprietary data vendor solutions	/ Budget for ongoing data needs and consider how procurement policies can be adapted to encourage new data sets to be piloted before being adopted agency wide.

Emerging Vehicle Technologies

Automated

Challenges	Opportunities
Planning for future needs with new stakeholders entering the market, technological changes, and uncertain future impacts	/ Invite industry partners to participate in the planning process and collaborate with public agencies on supporting investments. / Conduct scenario planning to estimate impacts of multiple potential AV scenarios.
Updating land use policies, parking and development codes, design standards, and curb management policies to accommodate new technology	/ Anticipate shifts in parking demand and an increase in curbside drop-off space. / Consider changes to land use policy (walkable, bikeable trips), and parking and curb space pick-up/ drop-off space, to support AV technology.

Connected

Challenges	Opportunities
Cost of CV technology and uncertainty of future technology adoption	/ Collaborate with auto industry, which is shifting towards cellular communications to equip more vehicles with CV technology. / Reference success stories from CV deployments. / Leverage planned CV projects through NCTCOG’s Transportation Improvement Program (TIP).
Reliance of CV communications on cellular communications or high-speed internet access, which can be challenging in rural areas	/ Leverage Infrastructure Investment and Jobs Act (IIJA) (2021) funding for broadband expansion, including middle-mile fiber networks needed to support cellular communications.

Emerging Vehicle Technologies (Continued)

Electric

Challenges	Opportunities
Perception of electric vehicles as less affordable, especially for low- and moderate-income households	/ Provide tax credits for new vehicle purchases, although affordability is driven primarily by vehicle manufacturing economies of scale. / Combine the transition to EV with efforts to expand accessible transportation options to reduce dependence on automobiles.
Electric battery concerns, including range anxiety, lack of charging stations, and battery replacement worries	/ Seek federal IIJA or state Texas Emissions Reduction Plan (TERP) funding opportunities. / Make data-driven decisions for placing charging infrastructure and collaborate across borders.

Shared-Use

Challenges	Opportunities
Increased Vehicle Miles Traveled (VMT) from deadheading – empty vehicles traveling from a drop-off to the next pick-up	/ Prioritize more efficient modes (such as public transportation, walking, and biking). / Pricing mechanisms or travel demand management strategies could discourage deadheading miles and encourage shared-use vehicles to complement transit.
Evolving business models with mergers, acquisitions, and changes in operational models	/ Focus planning efforts on applications of technology, rather than specific technologies or vendors, which may change over time.
Reluctance from companies to share data with agencies due to security, privacy, and proprietary concerns	/ Encourage shared mobility operators to use common data specifications to facilitate easier sharing of data.

Highway Systems Technologies

Challenges	Opportunities
Increased access to detection devices can lead to decision paralysis when considering which data to purchase or use	/ Develop an objectives-based performance management plan to evaluate what data is needed to inform decisions related to specific objectives.
Maintaining interoperability among thousands of detection, control, and information devices	/ Develop communications standards and performance-based specifications as devices are upgraded to ensure interoperability across devices.
Sharing data across multiple agencies in North Central Texas	/ Continue planning a "data lake" deployment, which will allow for sharing of detection information across the region and state. The benefit of a regional data lake is that the data would (ideally) be in the same format, in a common database, reducing the burden on users. A regional compilation of local APIs may also be beneficial but is likely to be more burdensome for users. / Educate agencies on the benefits of Waze Communities Partnerships and Work Zone Data Exchange (WZDx) programs as a means of sharing information across boundaries.

Integrated Technologies

Challenges	Opportunities
Building partnerships and integration between public and private mobility providers	/ Explore opportunities for collaboration among modes and providers, including supplementary service (such as first-mile/last-mile connections and late night/off-peak service).
Lack of data sharing agreements with private mobility providers due to privacy and proprietary data restrictions	/ Establish data management procedures that protect customer privacy and proprietary data. / Narrowly tailor data requests, knowing what data to ask for and how you will use it.
Coordination between local agencies in the delivery of mobility services	/ Integrate mobility management into regional plans and operations. / Build on existing regional coordination and active system management.

Micromobility

Challenges	Opportunities
Right-of-way obstructions impact mobility, people walking	/ Consider lock-to requirements, enforcement regulations, parking zones, and additional parking infrastructure tailored to micromobility. / Engage public to increase awareness for both users and non-users of rules and regulations.
Collisions with vehicles, dangerous riding habits, and low helmet usage	/ Create safer spaces to ride (and discourage poor riding behavior) and lower speeds of motor vehicles on all roads to reduce safety risks and crashes involving vehicles.
Equitable access to micromobility options	/ Include performance requirements within Equity Zones, geographic areas where operators must operate a certain number of devices. / Encourage companies to provide options for people who are unbanked, people without smartphones, people with disabilities, and low-income travelers.

KEY FINDINGS FROM THE MARKET ANALYSIS REPORT

/ **Technology is changing rapidly.** The planning process should be flexible to adjust to changing technologies, business models, regulatory frameworks, and market conditions. Agencies should plan for applications of technology, rather than specific technologies, which may change over time.

/ **Lay the groundwork early.** Engage with stakeholders to understand common challenges, build partnerships, and establish strong relationships to deliver transportation access needed today while preparing for future technological changes.

/ **Manage the increase in the quantity of data.** Public agencies will need to develop new data management approaches to collect, analyze, manage, share, and utilize data to understand and improve the transportation system.

/ **Plan for multiple possible future scenarios.** Many technologies are still in the research and development stage. Until the technologies are in the hands of the general public in real-world use, and until the sustainable price point of the new technologies or services is known, the long-term, real-world impacts of emerging technologies remain unknown. Agencies need to consider multiple potential future scenarios and monitor system performance and trends to learn how these new technologies are impacting the region.

WHAT MATTERS TO RESIDENTS?

The project team engaged with residents, businesses, and regional stakeholders through a project website, public meetings, an online survey, focus groups, and Project Advisory Committee meetings.

PROJECT WEBSITE

The project website (**www.connectntxfutures.org**) is the public's central information hub for the project. It provides materials for the public to learn more about emerging transportation technologies, including:

- / Informational videos
- / Project reports
- / Meetings notes
- / Automated vehicle lesson plan
- / Resources on AV deployment efforts locally and nationally

PUBLIC MEETINGS

We held two virtual public meetings. Meeting recordings and questions and answers are available on the **Get Involved** page of the project website.

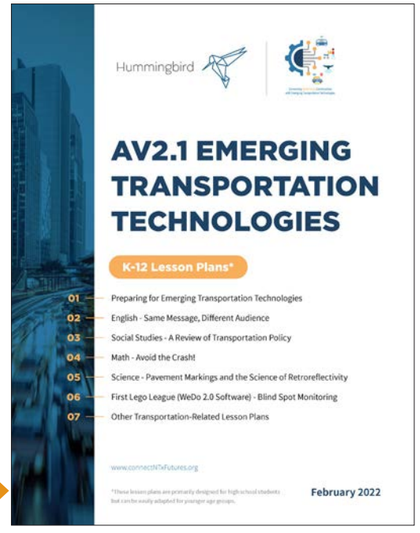
AUG 2021

Public Meeting #1 (August 2021) introduced attendees to emerging transportation technologies through a video and interactive presentation. Participants shared feedback through live polling and learned how to provide more input through the project's online survey.

FEB 2022

Public Meeting #2 (February 2022) discussed education and workforce development needs to prepare for emerging technologies.

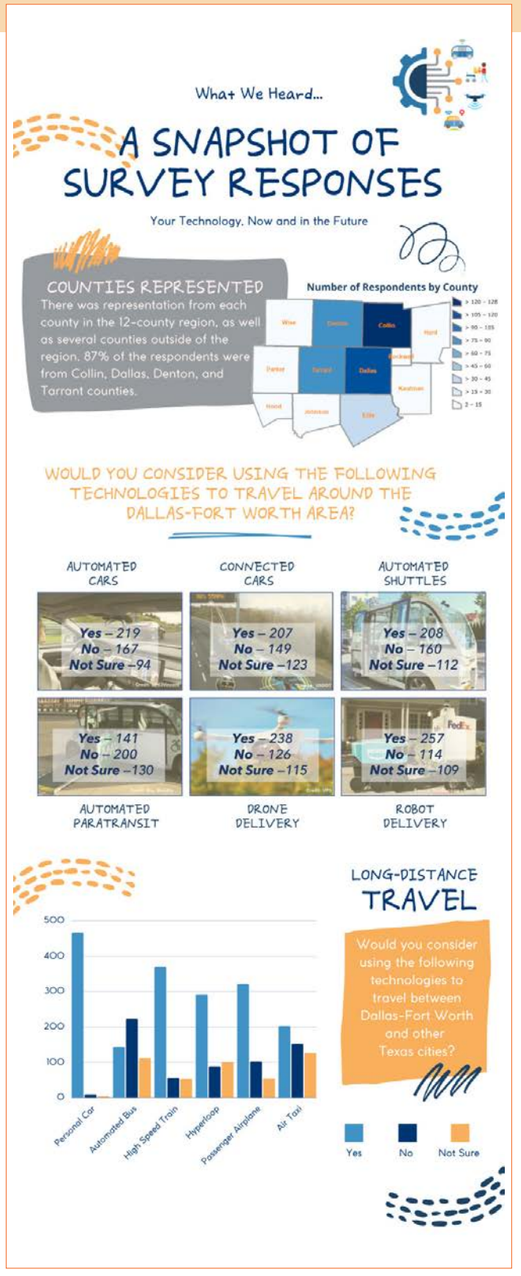
We presented the **K-12 lesson plan** our team developed about automated vehicles to help excite the next generation of leaders and problem solvers in the region.

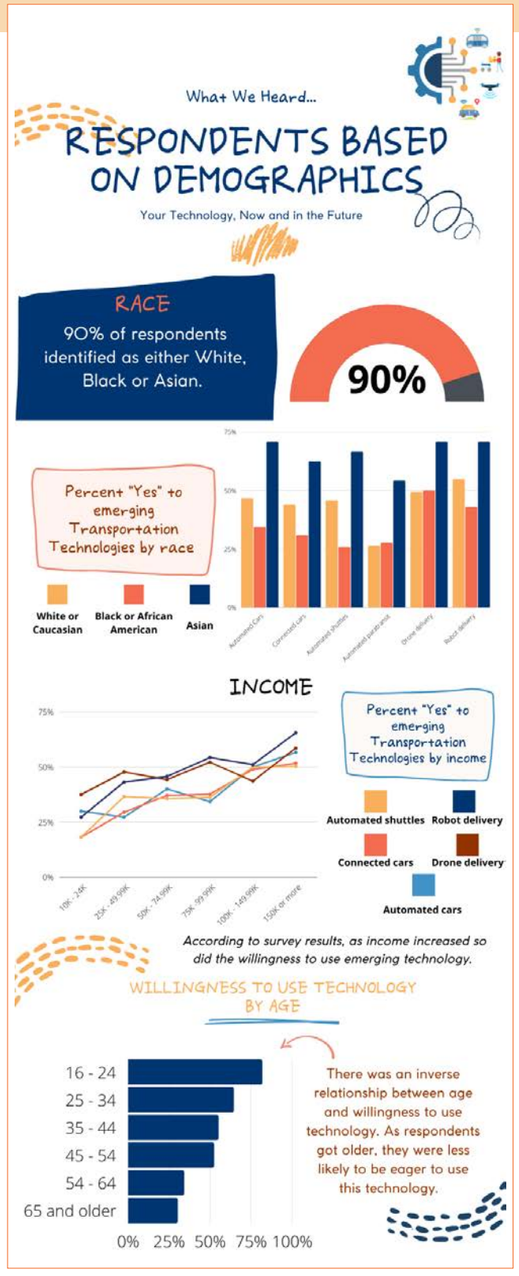


ONLINE PUBLIC SURVEY

We used an online survey to ask North Texas residents and employees about their current transportation modes, use of current transportation-related technologies, and perspectives on emerging transportation technologies. We received 483 survey responses. The **Engagement Phase 1 Report** summarizes the survey responses.

Generally, there was mixed willingness to use automation technologies for travel around the DFW area. There were differences in willingness by age and income. Younger respondents are more willing to consider using emerging technologies. As household income increased, so did the willingness to use emerging technology. The following infographics illustrate what we heard from the survey.





FOCUS GROUPS

We engaged 83 residents through 12 focus groups to gain a deeper awareness of the public's needs and perspectives on current, new, and emerging transportation technologies. The **Focus Groups Report** summarizes what we learned. The focus group findings align with the survey results.

The key themes heard in the focus groups were:

- Map apps are most used technology (though smartphone cost is a concern for one minority group).
- Rural residents are also concerned about limited access to transportation options, slow internet or poor cellular coverage, and delays caused by railroad crossings.
- Minorities are most excited about new technology but are concerned about fair/equitable access.

PROJECT ADVISORY COMMITTEE (PAC)

We held eight bi-monthly PAC meetings to present, review, and collect feedback on analyses, key findings, and deliverables throughout the project. The PAC was made up of a diverse group of about 20 stakeholder representatives from local and state transportation providers, local governments, technology developers, workforce and education institutions, and other community organizations. The PAC meeting minutes are available on the project website **Get Involved** page.

MORE INFORMATION ON AV2.1 PUBLIC ENGAGEMENT

For more information on public and stakeholder engagement conducted as part of this project, including public surveys and focus groups, please refer to the **AV2.1 Engagement Phase 1 Summary Report**, **Focus Group Report**, or **What We Heard From Residents** on the project website.

HOW WILL AVs AFFECT TRANSPORTATION AND LAND USE?

Transportation planners try to predict future needs by studying a range of potential scenarios a region might face. Some of the guiding questions they ask during this Scenario Planning process include:

What does transportation look like in 2045 under different scenarios?

How might major economic activities change transportation needs?

How does low growth, no growth, and high growth influence:

- **Where people live?**
- **How people move around the state (travel patterns and modes)?**
- **The ability to plan for and respond to climate change or disasters?**
- **Implementation of new technologies?**
- **The financial stability of each transportation mode?**

What are and where are the investment priorities for each scenario (including capital improvements, expansion, safety, operations, and maintenance)?

The greatest uncertainties in planning are the private sector market forces and what will emerge as the sustainable price point of automation and other emerging transportation technologies.

Currently, planners do not have enough data to assign probabilities to potential future scenarios. Agencies can be proactive by identifying a diverse suite of potential future scenarios to start with and agilely adapting as more information emerges from external market forces.

SCENARIO DEVELOPMENT

The **Scenario Development Report** explains how we developed seven potential future transportation automation scenarios for the region, and how we selected three of these scenarios for further modeling evaluation under the AV2.1 project.

The seven potential future transportation automation scenarios we initially developed for the North Central Texas region were:

- Connected-Automated Vehicle (CAV) Impact on Roadway Network Performance
- CAV Intersection Systems
- CAV Effect on Population and Employment Distributions
- Automated Shuttles for Improved First- and Last-Mile Travel
- CAV Technology Lane and Impact on Truck Routing
- Long-Distance, High-Speed Mass Transit Services
- Urban Air Mobility (UAM) Systems for People and Goods Movement

After consulting with the PAC and the NCTCOG travel demand modeling and transportation planning groups, the three transportation automation scenarios selected for further modeling evaluation under the AV2.1 project were:

1. **CAV Impact on Roadway Network Performance.** This scenario assumes that vehicles, that are both connected and automated, will enhance network capacity and reduce the value of time for drivers For example, as technology becomes broadly available, AVs are expected to alter travelers' perception of long trips. As riders are not under the stress of driving and are probably involved in more productive activities, they will be more willing to spend more time in their vehicles to access farther destinations.

2. **CAV Impact on Intersection Performance.** This scenario assumes that connected vehicle-to-infrastructure technology will improve intersection capacity and reduce intersection delays.

3. **CAV Impact on Population and Employment Distributions.** This scenario assumes that automated vehicles will cause travelers to make longer trips due to the decreases in their travel delay and the value of time for drivers. It captures possible growth opportunity scenarios due to AVs.

Each city or county can use these scenarios to define what it considers desired or undesired growth patterns for their area and to develop policies to incentivize their desired growth pattern.

A major assumption used for this research is that vehicles are both connected and automated (or connected-automated vehicles (CAVs)). Modeling assumes that these vehicles follow each other closely at high speeds and move through intersections more efficiently than human-driven vehicles. This is because CAVs can communicate with other vehicles so they can follow closely behind another vehicle or better judge gaps between approaching vehicles. If CAVs can communicate with infrastructure, they can have advanced warning of if a signal is red or green or if there is an incident on the road ahead.

This assumption in the modeling differs from the automated vehicles tested today that do not benefit from this assumed connectivity. As a result, they are more conservative than most human drivers. They follow at longer distances and wait for larger gaps between approaching vehicles. That conservative behavior could decrease capacity, rather than increase it.

The methods of communication are changing, and the adoption rates are still low. To prepare for future modeling research, municipalities should continue to upgrade infrastructure (like signal controllers) so it can communicate with vehicles when needed. NCTCOG and municipalities should monitor the vehicle-to-vehicle communication trends to learn if the capacity assumptions reflect real-world impacts.

SCENARIO MODELING TOOLS

We considered several modeling tools, including:

- Microscopic traffic simulation models,
- Mesoscopic simulation-based dynamic traffic assignment models, and
- Regional travel demand model (called the TAFT model)

The NCTCOG Modeling Group selected the regional travel demand modeling platform developed by the University of Texas at Austin in conjunction with NCTCOG staff (called the UTAV-TAFT model)[1]. The UTAV-TAFT model upgraded the original TAFT model to enable AV traffic modeling.

We then modified the UTAV-TAFT platform to further upgrade its ability to model the three future automation scenarios selected. We call the revised model created for this study the CMAV-TAFT model.

SCENARIO EVALUATION

The **Scenario Evaluation Report** summarizes the modeling methodology, assumptions, and results. For each scenario, we tested a range of AV fleet penetration rates (0%, 25%, 50%, and 100%). For each scenario, a set of experiments was designed to explore the impacts of the three main scenarios. We tested a total of 29 different scenario runs (or experiments).

Model input assumptions include:

- AV fleet penetration rate
- Link capacity improvement
- AV value of time reduction
- Increased speed
- Increased non-freeway saturation flow rate
- Lower signal control delay
- Demographic data for population and employment redistributions

This is the first study to apply the new capacity adjustment factors for CAVs from the *Highway Capacity Manual 7th Edition*[2] to a regional travel demand model. NCTCOG and municipalities should continue to monitor model input parameters and modify assumptions as necessary for scenario planning efforts.

1 The AV-TAFT model was developed by The University of Texas at Austin Center for Transportation Research under the NCTCOG project Travel Modeling in an Era of Connected and Automated Transportation Systems: An Investigation in the Dallas-Fort Worth Area (2017-2021).

2 National Academies of Sciences, Engineering, and Medicine. 2022. Highway Capacity Manual 7th Edition: A Guide for Multimodal Mobility Analysis. Washington, DC: The National Academies Press. https://doi.org/10.17226/26432.

KEY FINDINGS FROM THE SCENARIO EVALUATION REPORT

The **Scenario Evaluation Report** provides extensive detail on the results of the 29 scenario runs/experiments that were designed to examine potential impacts of three main scenarios. At a high-level, the key takeaways are:

- **AVs alone will not solve the region's future congestion problems.** Additional travel demand management and capacity increasing strategies are needed to meet current and future transportation needs. In the long run, CAV technologies could reduce the need for typical capital improvements and result in a potential shift of investments from adding concrete to adding technology.
- **The model results followed predicted patterns. Generally, under any capacity improvement scenario:**
  - Vehicle Miles Traveled (VMT) increases
  - Vehicle Hours Traveled (VHT) decreases
  - Average Daily Speed increases
  - Daily Delay decreases
- **Change in VMT, VHT, Average Daily Speed, and Daily Delay varies between different roadway functional classes and by time period** (morning peak, evening peak, off peak). The adoption of CAVs generally increases the daily VMT, reduces daily VHT, increases the average speed, and reduces the total daily delay compared to the base scenario. The percentage changes vary depending on the settings of the modeled scenario, as described in detail in the scenario evaluation report.
- **Agencies should collect and monitor model performance measures** from real-world deployments to determine if assumptions should be revised in future modeling efforts.
- **Local AV deployments could model smaller, sub-regional areas** to study city- or county-level impacts.

FUTURE SCENARIO EVALUATION RESEARCH NEEDS

Our analysis was an initial effort to understand the potential impacts of CAV adoption in the North Central Texas region. The assumptions should be reviewed and updated as more information becomes available about the real-world impacts of CAVs. Below is a list of additional actions and analysis to consider.

- The analysis could be extended to consider other transportation automation scenarios, including automated trucks, teleworking, and automated vehicle ride-hailing services. Some of these scenarios, such as the automated vehicle ride-hailing services, would require significant modifications to the regional model, which is beyond the scope of this study.
- Agencies should collect and monitor model performance measures from real-world deployments to determine if assumptions should be revised in future modeling efforts.
- The region needs a data repository for the different transportation automation pilot studies conducted in the DFW region. This data repository is essential for calibrating and validating models that can accurately predict the transportation system's performance under adoption of these technologies.
- The regional model enables quantifying the performance of the entire region and benchmarking it against other capital improvement projects. However, there is a need to model these scenarios at the city or county level using higher-resolution modeling platforms capable of capturing CAV traffic flow characteristics, especially those related to car-following behavior and data-sharing at connected intersections.

HOW WILL AVs AFFECT TRANSPORTATION FINANCES?

Transportation funding comes from a variety of sources at the local, state, and federal level. Existing revenue sources include state and federal fuel taxes, vehicle registration, titling and licensing fees, oil and gas production taxes, sales taxes, oil lubrication sales taxes, toll revenue, vehicle inspection fees, and traffic violation citations. Local revenues come from parking, local vehicle registration fees, and property and sales taxes.

Rapid population growth in the region, coupled with rising construction costs, aging infrastructure, and increased congestion are already straining transportation funding.

The **Financial Report** provides a high-level assessment of how automated transportation may affect local entity finances. The report also explores potential strategies for engaging the private sector to generate new revenue streams to supplement or replace funding streams affected by automated transportation and related technologies.

Emerging technologies—including more fuel-efficient EVs, shared mobility, and AVs— will likely have significant impacts on traditional funding streams for local governments and entities. The financial report details these potential impacts, including:

- **Curbspace Reallocation and Parking Revenues.** Shared mobility and automated vehicles may lead to a reduction in parking demands, a change in parking usage patterns, and/or an increase in demand for curbside drop-off space, each of which is likely to disrupt traditional parking revenue.
- **Fuel Tax revenues.** Revenue from motor fuel taxes is likely to continue to decline in real buying power terms. As market share for electric vehicles grows and fuel-efficiency of internal combustion engine vehicles continues to improve, per-gallon gas tax revenues will decrease.
- **Vehicle Registration and Licensing Fees.** AVs and shared mobility may impact travelers' car ownership and driving preferences. Some research has suggested that as fully automated vehicles become widely available, car ownership may decline in favor of on-demand shared AV fleets.[3]
- **Traffic Enforcement and Fines.** Parking fines, speeding tickets, court fees, and traffic violations may decline if AVs are programmed to follow local traffic laws. Shared AV fleets may also rarely need to park at a curb for an extended period, reducing the revenues from expired parking meter fines.
- **Tolling Revenue.** CAVs could increase roadway capacity. This could potentially lead to more toll revenue. VMT could increase, resulting in more tolling, if people are more willing to live farther away from destinations or because AVs or shared-use vehicles are making zero-occupancy trips.
- **Motor Fuel Lubrication Sales Tax.** Revenues from the tax on the sale of motor fuel lubricants are likely to decrease. EVs do not require conventional oil changes and tend to require less maintenance than internal combustion engine vehicles.
- **Transit Fares.** Private automated vehicle ownership could shift travelers away from public transit. Automated ride-hailing, with reduced labor costs, may further compete with transit prices. On the other hand, automation could provide labor cost savings for transit agencies, which could be used for increased transit routes and frequency. In addition, shared AV fleets could help fill first- and last-mile gaps. They could expand the reach of public transit and attract new riders (and fare revenue) with easier access to public transit stops.

3 Sustainability. The Effects of Mobility as a Service and Autonomous Vehicles on People's Willingness to Own a Car in the Future

Emerging transportation technologies are likely to impact existing funding sources, but also provide opportunities to open new funding streams that do not currently exist. Local agencies should assess the strategies to determine what is most feasible for them and, if necessary, work with state legislatures to remove and replace any policies inhibiting planning for or addressing the financial impacts of emerging transportation technologies. The Financial Report identifies opportunities for new revenue streams and implementation examples from other agencies around the country including:

- **Establish Curbspace Pricing Mechanism.** With cameras (like those used in roadway tolling) and parking space sensors, cities could establish dynamic pricing mechanisms for curbspace usage to replace lost parking revenue.
- **Establish Charging Fees.** Local entities may partner with fleet operators to share the costs of installing new EV infrastructure, as well as opportunities to charge fleet operators for access to charging locations.
- **Update Registration Fees.** Gas tax revenues continue to decline. Increasing registration fees for electric vehicles could provide an alternative revenue stream since EVs do not contribute to gas tax revenues, yet use the states roadway infrastructure. It may also be appropriate to consider new registration fees for shared automated vehicles to replace revenue lost by potential declines in private vehicle registration fees.
- **Increase State and Local Taxes.** State or local entities could introduce new or increased property or fuel taxes to raise additional revenue. Another option is to index the gas tax to inflation or to fuel prices.
- **Adjust Non-Transportation Funding Sources.** The state could increase oil and natural gas production (Proposition 1) or motor vehicle sales and rental taxes (Proposition 7) or direct a larger share of revenues to the State Highway Fund.
- **Implement Usage-Based Fees.** VMT fees are road user charges based on the number of miles traveled by a vehicle. VMT fees may be applied to all vehicles or may be applied in different ways to certain vehicle types (like trucks) or to certain operating conditions (like an AV or rideshare vehicle not carrying any passengers).
- **Establish Congestion Charge for Dense Urban Centers.** The fee system would establish a central downtown core with parameters for which types of vehicles can enter the zones, with exemptions to public transit or shared rides. The congestion charge could be a flat rate based on time of day, traffic conditions, or vehicle efficiency level.
- **Leverage Public-Private Partnerships (PPPs or P3s).** For new, upgraded, or expanded transportation infrastructure, local agencies can establish public-private partnerships (PPPs or P3s) that transfer the design, build, finance, operation, and maintenance of roadways to the private sector.
- **Increase Development Impact fees.** Impact fees are used to fund transportation infrastructure expansion required to serve new developments. They may not be used to fix existing transportation system needs but offer an option to shift some transportation costs onto developers.
- **Maximize Existing Infrastructure.** There could be significant cost savings (and environmental benefits) for agencies in managing existing transportation supply and demand, rather than spending money on building new roads. Land use policies and integrated, active mobility management approaches can maximize the efficiency of the transportation system.
- **Charge for Access to Transportation Data.** Emerging transportation technologies produce large amounts of data. Public agencies could choose two potential options for granting access to this important data: Begin charging private companies for access to some data or continue to give away data for free if agencies recognize a greater public benefit in providing free access.

KEY FINDINGS FROM THE FINANCIAL REPORT

- **Emerging technologies (including more fuel-efficient electric vehicles, shared mobility, and automated vehicles) threaten traditional funding streams.** Traditional transportation-centric revenues from motor fuel taxes, parking revenues, vehicle registrations, and traffic citations are most at risk in a shift to shared, electric, and automated mobility.
- **Alternative funding streams have potential to fill gaps in transportation revenues.** Local entities should identify their current revenues; collect data to understand trends and potential vulnerabilities in a shared, electric, and automated future; and assess feasibility of implementing alternative revenue strategies.
- **Agencies need a toolkit for identifying existing funding mechanisms and assessing their vulnerabilities in the context of emerging technologies. Funding mechanisms vary widely among local entities.** A toolkit may help define a process to evaluate current revenues and identify strategies to fill potential gaps.
- **Agencies should gather political and public support for alternative funding strategies. New fees and taxes are challenging to implement.** Public engagement needs to clearly demonstrate the added value from new revenue opportunities.

HOW DO YOU HOST AN AV DEPLOYMENT?

The AV Hosting Handbook provides guidance to cities to be an active player in advancing technology to solve local transportation problems. It also provides a realistic take on where technology is today and how cities can leverage technology and supporting policies to achieve their goals.

WHO IS THE HANDBOOK FOR?

The handbook is written to help cities prepare for the arrival of AVs, to help them shape the benefits of AVs on the community, and to help them avoid undesired outcomes. Some cities are actively implementing AV pilot projects, others are partnering in various ways with AV service providers already operating in their jurisdiction, while still others are taking a wait-and-see approach. The handbook can help all of these cities.

A variety of AV types, including automobiles, trucks, passenger shuttles, sidewalk delivery robots, and unmanned aerial drones, are already being tested on public roadways and in public airspace. AVs are likely to become common within the typical planning horizon of local transportation and land use plans. Even when cities are not actively seeking AV deployments, AV pilots may come to them, as Texas and some other states preempt local jurisdictions from regulating AV vehicles and services. Therefore, it is essential that cities start planning for the arrival of AVs if they have not already started doing so.

NCTCOG is in the forefront of preparing local jurisdictions for the arrival of AVs. The handbook is the first of its kind written by a regional agency for its member jurisdictions. In addition to providing cities with general guidance on planning for AVs, it describes specific actions that NCTCOG is taking to help the North Central Texas region prepare. While the handbook highlights the regulatory environment that local jurisdictions in Texas must work within, it also describes regulatory environments that exist elsewhere, making the guidance also useful to local jurisdictions outside the region.

HOW CAN CITIES APPLY THE HANDBOOK?

To start preparing for AVs, cities can:

- **Get (and stay) up to speed with AV technology.** The handbook introduces the technologies that make AVs possible, vehicle types, and potential AV use cases. It also presents options for building and maintaining agency staff with AV expertise and capability.
- **Develop AV goals that address local transportation problems.** Cities should use AVs as a tool to address local problems, rather than finding a technological solution and then looking for a problem. The handbook describes potential AV impacts and describes how cities can develop and update local policies to shape desired outcomes.
- **Lay the groundwork early.** The handbook describes ways to engage with stakeholders to understand common challenges, build partnerships, and establish strong relationships to deliver the transportation access needed today while preparing for future technological changes.
- **Manage the increase in the quantity of data.** AVs generate far more data than public agencies are used to dealing with, which will require new data management approaches. The handbook provides information on collecting, analyzing, managing, sharing, and utilizing AV data to understand and improve the transportation system.
- **Plan for multiple possible futures.** Until AV technologies and services move out of the testing phase and into regular real-world use by the public, their actual long-term effects will remain unknown. The handbook describes how cities can plan for multiple possible outcomes using different assumptions regarding AV deployment timelines, adoption rates, costs, and more.
- **Collect data and monitor performance.** Data from real-world deployments should be used to review the accuracy of past assumptions, incorporate findings to identify positive and negative outcomes, and adjust local policies accordingly. The handbook provides suggestions on performance measures that cities can monitor.
- **Actively engage with local communities.** Work with communities to understand their needs and to learn if AVs are helping to solve problems or if AVs are unintentionally creating new barriers. The handbook provides suggestions for promoting the equitable distribution of AV benefits and for addressing potential needs, such as workforce training to work with new technologies and retraining for those who lose their jobs to automation.

KEY FINDINGS FROM THE AV HOSTING HANDBOOK

DEVELOPING AV-RELATED POLICIES

Agencies should expect a continual process of policy evaluation and refinement as knowledge is gained through AV deployments and as technologies evolve. Nimbleness and flexibility are essential to respond to new opportunities, address negative outcomes as they are identified, support positive outcomes as they arise, and avoid unnecessary obstacles to the continued development and deployment of AV technology.

When setting AV policy, it is important to focus on the things under a local agency's control, rather than the things that are not (e.g., technology adoption timelines, vehicle licensing). There are many areas that a local agency can influence and, therefore, require policy direction. These areas include land use, curb management, equity, pricing, contracting, and data sharing. If a local agency is helping fund a pilot project or has regulatory powers, operating and safety policies that will form the basis of negotiations with an AV operator are also essential.

Technology is not a "silver bullet" to the transportation problems facing North Central Texas. The potential benefits of technology - reducing congestion, improving equity, expanding access, supplementing public transit, reducing GHG emissions, and improving safety – are not guaranteed. Today, public agencies have an opportunity to plan and proactively shape autonomous vehicle outcomes. The Urban Institute's 2022 report on **Regulations to Respond to the Potential Benefits and Perils of Self-Driving Cars** provides specific policy recommendations to limit the potential negative externalities of AVs and maximize their potential benefits.

BUILDING PARTNERSHIPS

AV technology is new and rapidly evolving, which means everyone has a lot to learn from each other. Private industry understands their technology, while agencies understand local policies and processes. Others also need to be involved, including the decision-makers, policymakers, and local communities who help shape outcomes and who are affected by policies and decisions.

Characteristics of a good partnership between an AV provider and a local agency include clear expectations, long-term perspectives, trust, nimbleness, data sharing, and project support. Other partners involved in an AV deployment (e.g., transit agency, local university, agency IT department) should contribute experience and expertise in areas where neither the local agency's planning or engineering staff nor the AV provider have expertise. Many community stakeholders will not have a broad understanding of AVs or AV technology, how they might use AVs, or how they might interact with AVs. As a result, public agencies and AV vendors need to provide community members with the information needed to make informed decisions.

Agencies actively interested in hosting an AV pilot can improve their chances by:

- **Identifying high-level champions** among both agency management and elected officials.
- **Updating agency policies** to support AV testing and deployment in the community.
- **Attending trade meetings and conferences** to develop contacts.
- **Hosting workshops or roundtables** with industry representatives.
- **Participating in regional efforts** to attract AV pilots.
- **Issuing Requests for Information (RFIs)** asking AV vendors for their approaches to addressing a transportation problem of interest to the community.
- **Bringing money to the table** to help subsidize AV testing.

SHARING DATA

Data sharing between agencies and providers can be mutually beneficial. Agencies are both consumers of data for making informed transportation policy decisions, and collectors and managers of internal agency data that are potentially valuable to AV service providers and individual connected vehicles.

The volume and speed of data generated by AVs, is tremendously greater than what local agencies have historically managed. Spreadsheets and relational databases are inadequate to work with AV data; instead, big data approaches are required. These approaches not only involve new ways to address the volume of data, but also new analysis techniques, new attitudes toward breaking down data silos, and considerations of data security and personal privacy.

AV provider data useful to agencies includes:

- **Data required to monitor compliance.** This data is specified by permits, regulations, agreements, contracts, etc.
- **Data required to evaluate AV project performance.** In this case, the data should match the agency's established goals and performance metrics for the project.
- **Data that can support an agency's functions.** Data that can inform planning, operations, and decision-making.

Agency data that is potentially valuable to industry include roadway mapping and inventory data, curbside management data (e.g., parking, stopping, and loading zone locations and times), roadway characteristic changes, and real-time sensor data.

PREPARING INFRASTRUCTURE

Over the next 25 years, NCTCOG expects to see changes in vehicle automation, shared mobility, and electrification. As a result, infrastructure readiness extends beyond traditional transit and transportation system operations to EV charging infrastructure, active transportation networks, CV and AV support, data sharing and management, and resiliency.

It is not too early for agencies to start preparing infrastructure that supports the adoption of future AV technology and/or also supports current non-AV goals and applications such as communications and traffic signal systems upgrades. At the same time, Technology ages rapidly and can be expensive to install and periodically replace at a large scale. Therefore, in the absence of an actual pilot AV deployment, it is recommended that agencies wait and see what specific technologies will be needed to support AVs, once AVs have entered commercial production.

The infrastructure needs of AV pilot projects will vary by project. In general, however, one or more of the following approaches will be applicable: leave the roadway as-is, add V2I/V2X communications infrastructure, enhance the roadway for vehicle sensors (e.g., legible pavement markings, visible and consistently mounted signs), and adjusting roadway geometrics, usage, and control to simplify the road for AVs.

TRAINING AND RETRAINING TOMORROW'S WORKFORCE

Agencies need to self-assess their technology-related staff and decision-maker expertise, equipment resources, and agency capabilities. Options for building agency expertise and capability include partnering with agencies with direct experience with AVs, establishing a new advisory committee, hiring new staff and/or training existing staff, partnering with educational institutions, hiring an outside expert, partnering with AV companies, and sending staff to AV-related conferences and exhibitions.

Internally, operating a pilot project in-house requires a higher level of staff expertise than managing a project contracted to an outside vendor. However, staff expertise is still necessary when working with vendors, from designing the project parameters, to developing an RFP and making an informed selection decision, and finally to monitoring the vendor's performance, working with the vendor to address issues as they arise, and evaluating the project outcomes.

Externally, AV technology will require new skills in the workforce. Potential regional actions to develop these skills include partnering with industry, developing transferable skills such as communication and a grounding in basic subjects applicable to many types of technology jobs, demonstrating the range of job possibilities to students, starting early (e.g., K-12 students), providing workers with opportunities to upskill and reskill, and using AV pilot projects to support education.

Automation will also be disruptive, and some workers will lose their jobs to automation. Potential local agency actions that mitigate loses include: financially supporting local job retraining efforts and providing incentives to support hiring of workers displaced by AVs (including providing job preferences within the agency).

MONITORING PROGRESS

Without performance monitoring, an agency has no way to quantify the outcomes of specific AV pilots, nor the broader impacts of AV deployment on the community and region. Pilot evaluations, in particular, are helpful for communicating project outcomes to the public and to decision-makers, for identifying lessons learned, and for building support for new or expanded AV deployments in the future.

Performance can be evaluated in a number of areas, including:

- **Service delivery**, including service monitoring (e.g., adequate supply, usage, safety, security, customer satisfaction) and project outcomes (e.g., usage, supply, productivity, cost, safety, security, equity, environmental effects, community perception)
- **Traveler experience (quality of service)** before, during, and after an AV trip.
- **Customer experience** with AV delivery services, including ease of the ordering process, lead time to make an order, cost, and delivery reliability.
- **Community impacts**, including job access, community growth, land use, early indicators of negative effects, parking, travel demand, and safety.

WHAT SHOULD AGENCIES DO NEXT?

This AV2.1 project gives local agencies tools to proactively shape the development and adoption of emerging technologies to solve transportation challenges in the North Central Texas region.

The **AV Hosting Handbook** provides the guidance that NCTCOG and municipalities need to start planning for automation.

WHAT CAN MUNICIPALITIES DO NEXT?

To support the transition to AVs and other emerging transportation technologies, municipalities should follow the four-step process outlined in NCHRP Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation:

Prepare.

Become familiar with AV technologies and agency regulatory powers, develop the agency's vision for technology, and set technology-related goals. Some policies may be preempted by Texas state law, but local agencies do have control over land use and development policy to support emerging technology. The **Market Assessment Report**, **Engagement Report**, and **AV Hosting Handbook** provide this background information.

Self-assess.

Review the agency's staffing, resources, capabilities, organization, policies, and plans. Identify needs and courses of action. The **Existing Conditions Report** and **Financial Report** are starting points for the self-assessment.

Take Action.

Address the policy gaps identified in the self-assessment. Identify and/or develop funding sources to address resource gaps. Train or hire new staff, or partner with others with the necessary expertise, to address capability gaps. Get your feet wet by testing technology and agency readiness through pilot deployments. This final report and the **AV Hosting Handbook** provide guidance on agency and workforce development, partnerships, and local policy development.

Monitor and Adjust.

Monitor progress toward achieving the agency's technology-related goals and adjust programs, plans, and actions as necessary to meet the goals. The **Scenario Evaluation Report** predicts potential AV impacts. Agencies can monitor the model input assumption performance metrics to track trends and adjust policies as needed. NCTCOG can model additional future technology scenarios and can update model input assumptions as agencies collect more data on real-world deployments.

Read the AV Hosting Handbook.

It provides guidance on selecting performance measures to monitor impacts, evaluate deployments, and evaluate the effects of AVs on the community and region.

WHAT CAN NCTCOG DO NEXT?

NCTCOG has the stage for the region to be an active player in the deployment of emerging technologies. To continue leading the region in the adoption of automated technology, NCTCOG can:

Pursue funding opportunities.

Apply for federal, state, or local deployment funding to deploy or support new technologies.

/ Current grant programs from the Bipartisan Infrastructure Law include[4]:
Reconnecting Communities Pilot (RCP) Grant
Strengthening Mobility and Revolutionizing Transportation (SMART) Grant
Rural Opportunities to Use Transportation for Economic Success (ROUTES) Grants

/ Connect municipalities with private companies to establish Public Private Partnerships (PPPs).

Disseminate key findings.

NCTCOG and other stakeholders can keep up the momentum created from this project with continued outreach to the public, policymakers, and local agencies. NCTCOG can lead a coordinated effort to share and disseminate key findings from this project to accelerate adoption of best practices among local agencies.

Continue to monitor trends.

NCTCOG should continually monitor industry trends and the impacts on the North Central Texas region to adapt as the AV market evolves.

Develop tools to prioritize and evaluate pilot projects.

/ Develop a framework for evaluating AV2.2/2.3 pilot deployments.

/ Create a data repository for local deployments to report and share key performance metrics. The **AV Hosting Handbook** provides guidance on selecting performance measures to monitor impacts, evaluate deployments, and evaluate the effects of AVs on the community and region.

/ Develop a framework to prioritize future deployment projects and investments.[5]

Develop a financial revenue assessment toolkit.

Define a process for local agencies to evaluate current revenues and identify strategies to fill potential gaps as transportation shifts to shared, automated, and electric.

WANT TO LEARN MORE?

You can learn more about the project, guidance, and resources by visiting the project website **www.connectntxfutures.org**.

4 https://www.transportation.gov/grants

5 Florida Department of Transportation has a basic prioritization framework for project funding requests. See Table 9 in the Florida's Connected and Automated (CAV) Business Plan.