North Central Texas Council of Governments

KITTELSON & ASSOCIATES

AV2.1 FINANCIAL REPORT

AV2.1: Conduct a Planning Process to help the North Texas Region Prepare for Automated Vehicles and Related Technologies

August 2, 2022

AV2.1 Financial Report

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EXECUTIVE SUMMARY

Technology impacts all aspects of transportation, and these technologies are ever evolving. North Central Texas communities will need to incorporate emerging technologies into the planning process because 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. These changes to travel patterns and behaviors can lead to changes in land use patterns (such as where people live or work). Emerging technologies include:

- **Automated** cars, trucks, shuttles, or sidewalk delivery robots (partly or fully self-driving)
- **Connected** cars (cars that can communicate with other vehicles and infrastructure)
- **Shared** mobility services (e.g., Uber, Lyft) or car sharing services (hourly or daily car rental)
- **Electric** vehicles

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."

Why is NCTCOG completing this study?

Automated transportation solutions are part of the long-term transportation strategy for North Central Texas Council of Governments (NCTCOG).

NCTCOG is preparing for emerging transportation technologies through a three-phase Automated Vehicle 2.0 (AV2.0) program. AV2.0 will advance the North Texas region through planning, partnerships, and investment into new transportation technologies like automated vehicles (AVs).

The first phase of the AV2.0 program is *AV2.1: Conduct a Planning Process to Help the North Texas Region Prepare for Automated Transportation & Related Technologies*. This project will develop 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 funding to deploy or support new technologies.

What information does this report provide?

Local agencies need guidance on how to address uncertainties in the future of transportation. 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 costs or infrastructure, if any, is needed to support the future travel needs.

The purpose of this Financial Report is to provide a high-level assessment of how automated transportation may affect local entity finances. This report uses inputs from Task 4 (Scenario Development and Evaluation) to understand the potential impacts of automated transportation on existing funding mechanisms available to four types of Local Entities:

- Counties
- Municipalities

- Public Transit Agencies
- Airports

In general, airports have greater control over access from public and private providers, which allows them to offer up different models for how new technologies work on their facilities. They can provide an opportunity to develop a technology hub in the transportation network of a region, based on their interfaces with both public and private transportation providers.

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. This is why it is important to assess how transformational technologies such as automation further influence local financial planning.

The Financial Report provides a high-level assessment of how automated transportation may affect local entity finances. This 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.

Look for this symbol to quickly find Texas-specific deployment or application information.

Overall Project Relationship

This report summarizes the work performed under Task 5, which developed an assessment of financial impacts of emerging transportation technologies. This report builds on previous tasks, including:

- Task 3.1 Existing Conditions Report
- Task 3.2 Market Analysis Report
- Task 4.1 Scenario Development Report

Once complete, all reports for this project will be posted on the project website: https://www.connectntxfutures.org/Learn

The analyses performed under preceding tasks will serve as the basis for strategy recommendations (Task 6 AV Best Practices Handbook) in the following tasks.

Key findings

Emerging technologies – including more fuel-efficient electric vehicles (EVs), shared mobility, and AVs - threaten traditional funding streams. Rapid population growth in the region, coupled with rising construction costs, aging infrastructure, and increased congestion are already straining transportation funding. 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. Revenue for sources for all local entities – airports, transit agencies, counties, and cities – will be affected to varying degrees based on their dependence on these revenue sources.

Alternative funding streams have the 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 evaluating current revenues and identifying strategies to fill potential gaps.

Agencies need to gather political and public support for alternative funding strategies. New fees and taxes can be challenging to implement; Therefore, it will be important to garner support from policy makers and the public to demonstrate clear added value from new revenue opportunities and to explain the need for changes to funding strategies.

STATE AND FEDERAL SOURCES OF TRANSPORTATION FUNDS

This report focuses on the impact of shared, automated, and electric mobility on local entity finances. Some revenues, like local property and sales taxes, fund multiple local government functions beyond transportation. Local governments have discretion on how to allocate these funds as transportation competes with other needs. The purpose of this report is to identify potential revenue streams that may be impacted by these technologies, regardless of if those funds are solely used for transportation expenditures or help fund other local government services.

Current revenue sources include: the State Highway Fund, regional toll and managed lane revenue, the Texas Mobility Fund, and local revenue.

State Highway Fund. This fund (Figure 1) is TxDOT's primary revenue source, with the Dallas-Fort Worth region receiving about a quarter of the State's transportation funds. Funding comes to the region through TxDOT. While funds cannot be sub-allocated to cities or counties (per federal law), NCTCOG splits funds along TxDOT District lines into eastern and western subregions.

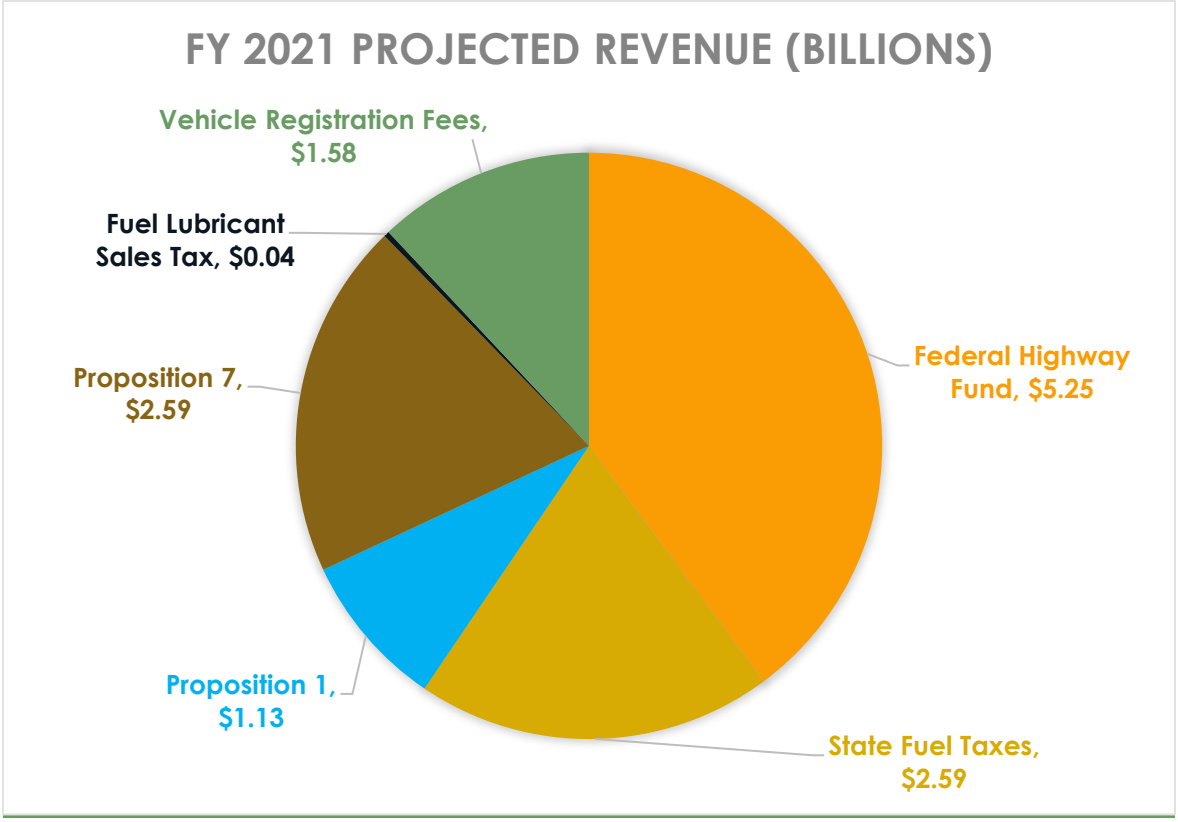

Figure 1. Texas State Highway Fund Revenue (FY 2021 projected, dollars in billions)
Source: TxDOT Long Range Revenue Forecast

- **Fuel Taxes.** Texas levies a state tax of 20 cents per gallon of gas or diesel. (The average gas tax rate in the United States was 28.09 cents per gallon in 2020.) The Texas state gas tax rate is among the lowest in the United States. State fuel taxes generate over

$3.5 billion in annual revenue.[1] In Texas, 25% of the fuel tax revenue is set aside for education funding, with the remaining put into the State Highway Fund from which TxDOT allocates funds to plan, maintain, and build transportation projects. The gas tax rate is static and not indexed to inflation, and it has been a long-term challenge for legislatures to support raising the gas tax, having not increased the state tax rate since 1991. In 2021, Texas was the only "donor state," meaning the state received less funds out of the Federal Highway Trust Fund than it puts in with fuel taxes. In 2022, with the passage of the Infrastructure Investment and Jobs Act, there will be no more donor states, including Texas.[2]

- **Federal Highway Trust Fund.** Drivers also pay a federal tax of 18.4 cents per gallon of gasoline and 24.3 per gallon of diesel fuel. The government reserves one-tenth of one cent for the Environmental Protection Agency's Leaking Underground Storage Tank (LUST) fund, 2.86 cents per gallon to the Mass Transit Account of the Highway Trust Fund and with the rest of the fuel tax revenue transferred to the Highway Trust Fund for distribution to the states for transportation projects. TxDOT projected federal reimbursements of $5.3 billion in 2021, declining to less than $3 billion by 2029.[3] Similar to the state gas tax, Congress has not increased the federal gas tax rate since 1993.

- **Vehicle Registration Fees.** The State Highway Fund receives approximately $1.6 billion annually from the Texas Department of Motor Vehicles for certificate of title fees and motor vehicle registration fees.[4] The standard Texas registration fee of $50.75 for passenger vehicles less than 6,000 pounds goes directly to the State Highway Fund. In addition, counties may charge a fee of up to $10.00 for deposit into their county road and bridge fund and $1.50 child safety fee. Some counties (Bexar, Cameron, El Paso, Hidalgo, and Webb) are permitted to assess an additional fee for transportation not to exceed $20.00 to fund long-term transportation projects in the county. County Commissioner's Courts establish local registration fees, which vary from county to county. All local registration fees in the North Central Texas region are between $10.00 and $11.50.

- **Proposition 1.** Proposition 1 transfers funds collected from Texas oil and gas production taxes to the State Highway Fund. Once oil and gas taxes surpass an established threshold, the state transfers one quarter of the funds to the State's General Revenue fund, with the remaining 75% divided evenly between the State Highway Fund and Economic Stabilization Fund. Proposition 1 funds vary annually based on oil production with $1.13 billion deposited into the SHF 2021.[5]

- **Proposition 7.** Proposition 7 (Figure 2) requires the state to deposit $2.5 billion of net revenue from the state sales and use tax into the State Highway Fund when these revenues exceed $28 billion. Beginning in FY20, if revenue from vehicle sales and rental tax exceeds $5 billion, the state will transfer 35% of the amount over the threshold to the State Highway Fund.[6] TxDOT projected $2.7 billion of revenues in 2021.

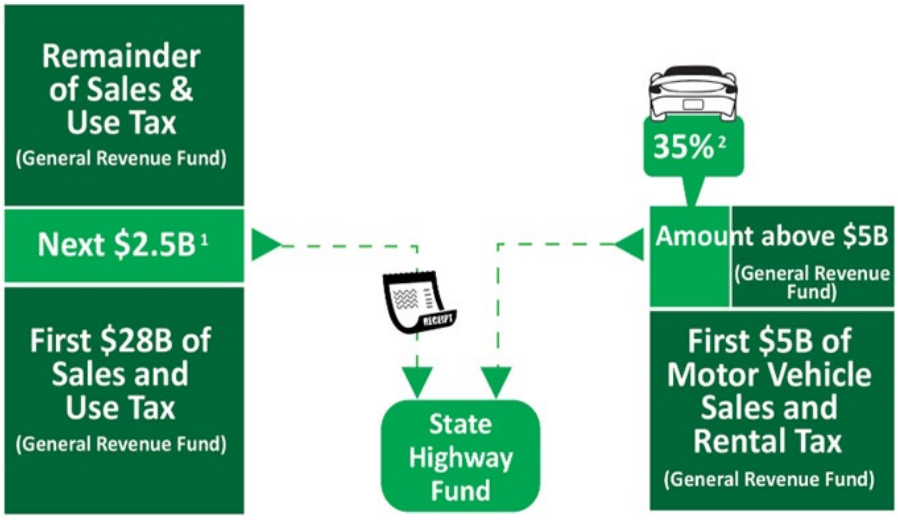

Figure 2. Proposition 7 Funding (Source: TxDOT)

- **Lubrication Sales Tax.** The State Highway Fund receives tax revenue from motor fuel lubricant purchases. TxDOT projected $37 million in revenue in 2021.

Regional Toll and Managed Lane Revenue. The North Texas Tollway Authority operates and maintains toll roads in the North Texas region. Toll revenue is the Authority's major source of revenue, totaling about 95% ($954.2 million) in the Authority's FY2022 budget.[7]

Texas Mobility Fund. The Texas Mobility Fund provides financing for construction, acquisition, and expansion of state highways. This fund includes $546 million in annual revenue, shown in Figure 3.[8]

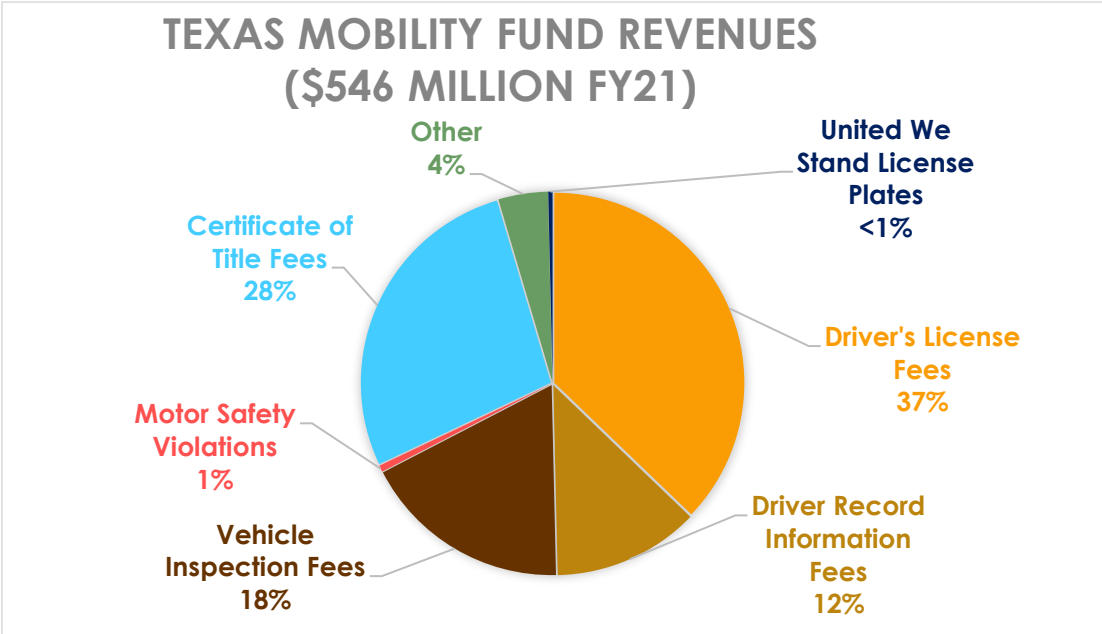

Figure 3. Texas Mobility Fund Revenues (Source: TxDOT)

Local Revenue. In general, the largest source of revenue for counties and municipalities are property taxes and sales taxes. Other sources of revenue include parking revenues (lots and meters), fines and forfeitures (including parking and traffic citations), and local vehicle registration fees. These sources are discussed in the following section.

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[1] Land Line Media. Texas state lawmaker wants to increase fuel tax
[2] Eno Center for Transportation. Highway "Donor States" R.I.P.
[3] TxDOT. TxDOT Long Range Revenue Forecast
[4] TxDOT. Annal Financial Report
[5] TxDOT. Proposition 1 Funding
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[7] North Texas Tollway Authority. Final Budget FY2021
[8] TxDOT. TxDOT Long Range Revenue Forecast

LOCAL ENTITY SOURCES OF TRANSPORTATION FUNDS

This section examines the existing funding mechanisms specifically available to four types of Local Entities:

- Airports
- Public Transit Agencies
- Counties
- Municipalities

Local entities should evaluate their current revenue sources and assess their vulnerabilities in the context of emerging technologies. Moving forward, NCTCOG could support local entities by developing specific tools and processes for conducting this analysis. They should seek to identify significant traditional revenue streams dependent on personal internal combustion engine (ICE) vehicles. The revenue sources from private vehicle parking, sales, and registration, vehicle rentals, fuel taxes, and potentially passenger fares are most at risk of changing traveler behavior due to shared, electric, and automated transportation options.

The main source of transportation funding in the state – the State Highway Fund – comes from State and Federal fuel tax revenues. Revenues from other state and local revenue sources, including parking, passenger fares, vehicle licensing and registrations, and traffic citations vary by local entity.

AIRPORTS

Table 1 provides a summary of revenues from the region's two major airports. Parking is the largest source of non-airline revenue for both airports, representing 40% and 42% of total non-airline revenue for DFW and Love Field, respectively. For DFW, the parking revenue includes all public parking and $17.5 million from airline employee transportation fees to and from parking lots. This cost is typically covered by airlines on behalf of employees.

Table 2 includes non-airline revenue only. Airports also receive landing fees and terminal rental revenue from airlines to cover the cost of operating and maintaining the airfield and terminal. For comparison, these airline fees were budgeted at $469.5 million for DFW Airport in 2022.

Table 1. Airport Non-Airline Revenue

Airports	Car Parking (Passengers and Employees)	Rental Cars and Ground Transportation	Food and Beverage Concessions	Advertising, Commercial Development, and Other Revenue	Total
Dallas-Fort Worth (DFW) Airport (FY19 actuals, in millions)[9]	$165.3	$33.5 (rental car) $30.2 (TNCs and Taxi/Limos)	$80.0	$89.7	$399
% Of Total Revenue	**42%**	**16%**	**20%**	**22%**	**100%**
Dallas Love Field (2015 Airport Master Plan Update, FY19 projected, in millions)[10]	$23.9	$10.8	$6.5	$16	$59.1
% Of Total Revenue	**41%**	**19%**	**11%**	**29%**	**100%**

PUBLIC TRANSIT AGENCIES

Table 2 provides a summary of the three major transit providers in the region. Passenger fares represent a relatively small portion of the transit provider revenue, compared to sales taxes and FTA, state, and local funds. Sales tax revenue made up 69% of DART and 52% of DCTA revenues in 2019. Not including capital grant reimbursements and contributions from partners, sales tax and operating grant revenues are also Trinity Metro's main sources of operating revenues and represent approximately 69.7% and 9.13%, respectively. Passenger fares make up about 7% for DART, 4% for Trinity Metro, and 3% for DCTA of total revenues. Capital contributions from federal, state, local, and other contributions make up most of the rest of the revenues.

Table 2. Transit Agency Revenue

Transit Agencies	Sales Taxes	FTA, State, and Local Funds	Passenger Fares	Other	Total
Dallas Area Rapid Transit (2019, dollars in thousands)[11]	$621,129	$136,957*	$63,941	$77,498†	$899,525
% Of Total Revenue	**69%**	**15%**	**7%**	**9%**	**100%**
Trinity Metro (2019 Budget, dollars in thousands)[12]	$81,352	$235,193‡	$13,587	$3,467	$333,598
% Of Total Revenue	**24%**	**71%**	**4%**	**1%**	**100%**
Denton County Transportation Authority (2019, dollars in thousands)[13]	$28,735	10,853	$1,358	$5,027§	45,973
% Of Total Revenue	62%	24%	3%	11%	100%

* Includes federal grant and capital contributions. Capital contributions include federal, state, and local grants, and contributions. Federal grant revenue in 2019 was lower due to a delay in approval of grant agreements. In 2018, federal grants provided $69,445 (in thousands) and $294,136 (in thousands) in 2020 due to a significant increase in assistance in response to the COVID-19 pandemic.

† Includes revenues from advertising, rent, investments, Build America bonds tax credits, and other sources.

‡ Includes operating grants, contributions from local partners, and a capital grant reimbursement. The large capital grant reimbursement was due to the Trail project completed in 2019. These funds represented 71% of the total revenue of $333,598 (in thousands).

§ Includes contract service revenue, investment incomes, and other miscellaneous revenues.

COUNTIES

Table 3 provides a summary of local county revenue for four of the largest counties in the region. It is expected that other counties would follow similar trends and patterns of revenue sources. Property taxes are the largest revenue source, representing about 75% of total revenues. County vehicle licensing and registration fees generally represent less than 5% of total revenues.

Dallas and Tarrant Counties collect between $950,000 and $3,000,000 from county-owned parking garages, representing relatively small revenue streams compared to other sources. Dallas and Tarrant Counties are the most populated counties in the region. Other less populated counties may not have the density to charge parking fees. If they do, it is likely similarly a small share of overall revenues.

Note: Table 3 provides revenues specifically collected by counties. Counties may receive support from TxDOT to assist in building and maintaining roads.

Table 3. Local Revenue - Counties

Local Entity	Property Taxes	Vehicle Licensing and Registration	Parking	Traffic Citations	Other	Total
Dallas County[14,15] (2022 estimate)	$476,437,078	$25,700,000*	$3,000,000	$4,974,336	216,680,187	$726,791,601
% Of Total Revenue	**65%**	**4%**	**<1%**	**<1%**	**30%**	**100%**
Tarrant County[16] (2022 budgeted)	$463,728,186	$5,907,500†	$950,000	$533,000‡	$103,803,959	$574,922,645
% Of Total Revenue	**81%**	**1%**	**<1%**	**<1%**	**18%**	**100%**
Denton County (2022 budgeted)	$262,801,524	$13,300,000	--	$2,350,000§	$58,495,979	$336,907,503
% Of Total Revenue	**78%**	**4%**	**--**	**<1%**	**17%**	**100%**
Collin County (2022 budgeted)	$191,278,330	$21,000,000	--	$1,080,000	$24,630,392	$237,346,435
% Of Total Revenue	**81%**	**9%**	**--**	**<1%**	**10%**	**100%**

*Includes certificate of title fees and auto license fees. Total does not include an additional $25 million for special vehicle registration fees.

†Includes fees for motor vehicle collection commission, certificate of title, motor vehicle title service, and other motor vehicle fees.

‡Includes total Justice of the Peace funds. The proposed FY22 budget does not differentiate between types of fines, such as traffic citations versus other misdemeanor fines.

§ This includes all fines received from Justice of the Peace, County, Criminal Courts, and District courts. The budget does not differentiate between different types of fines, such as traffic citations versus other misdemeanor fines.

MUNICIPALITIES

Table 4 provides a summary of local revenue from the two largest cities in the region, Dallas, and Fort Worth. Property and sales taxes make up the largest percentages of total revenue, with revenue from traffic citations and parking representing relatively small percentages of total revenues. While comparable data from other municipalities in the region were not readily available, we anticipate that property taxes would constitute the largest portion of local revenues in most municipalities, and that traffic citations, parking meters, and sales taxes would represent less than 10% of total revenues.

Table 4. Local Revenue – Cities (dollars in thousands)

Local Entity	Property Taxes	Sales Tax	Franchise Fees & Other Taxes	Charges for Service	Parking Meters/ Lots	Traffic Citations	Other	Total
City of Dallas[17, 18]	$906,904	$355,282	$116,570	$108,681	$6,800	$10,800	$85,210	1,590,248
% Of Total Revenue (General Fund)	**57%**	**22%**	**7%**	**7%**	**<1%**	**<1%**	**5%**	**100%**
City of Fort Worth[19, 20]	$602,793	$270,880	$82,639	$688,225*	$7,800	$21,400	$422,912	2,067,451
% Of Total Revenue (General Fund)	**29%**	**13%**	**4%**	**33%**	**<1%**	**1%**	**20%**	**100%**

*Service charges are mainly made up of administrative charges, fees for court services, plan review fees, gas well annual fees, registration fees, site reservations, planning commission fees, mowing fees, and fire inspection fees.

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[9] Dallas Fort Worth International Airport. FY 2022 Adopted Budget
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[11] Dallas Area Rapid Transit. Annual Comprehensive Financial Report (2020)
[12] Trinity Metro. Business Plan Annual Budget FY 2019
[13] Denton County Transportation Authority. Operating & Capital Budget 2022
[14] Dallas County. Fiscal Year 2021-2022 Budget
[15] Dallas County. Judicial Management Report
[16] Tarrant County. FY2022 Budget Hearings
[17] Governing. Special Report: How Autonomous Vehicles Could Constrain City Budgets
[18] Governing. Special Report: How Autonomous Vehicles Could Constrain City Budgets
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[20] Governing. Special Report: How Autonomous Vehicles Could Constrain City Budgets

ASSESS VULNERABILITIES & POTENTIAL FINANCIAL IMPACT OF EMERGING TRANSPORTATION TECHNOLOGY

Land use patterns incentivizing sprawl and dependence on automobile infrastructure continue to put pressure on existing transportation and infrastructure funding to address the increased demand. As population growth, economic development, and construction costs increase continue, the region's existing funding sources could be significantly stressed.

Emerging technologies—including more fuel-efficient EVs, shared mobility, and AVs— will likely have significant impacts on travel costs, mobility, land-use, safety, equity, environmental sustainability, and the labor force. The focus of this report is on how these technologies could threaten traditional funding streams for local governments and entities. There could also be impacts to private business revenue, such as fewer auto mechanics as EV ownership or shared AVs usage increases, but this report focuses on direct impacts on public funding streams. Electric and more fuel-efficient vehicles will further reduce revenue from fuel and motor oil lubrication taxes. Shared, automated mobility services may incentivize residents and visitors to forgo car purchases and rentals in some areas with less car-oriented land uses, leading to potential declines in parking revenues, vehicles sales, and registration fees. Shared mobility service integration with public transit service will determine impacts on transit fares. Shared mobility could connect to, supplement, or extend the reach of public transit service, and thus have potential to increase ridership revenue. Alternatively, automated transportation could compete with public transit, luring public transit riders to other modes. AVs could further reduce parking and traffic enforcement fine revenue, assuming manufacturers program vehicles to obey speed limits and other traffic laws.

Funding challenges may arise for agencies that depend on transportation-related funding streams based on personally owned, gas-powered cars. Researchers have estimated revenue impacts of the convergence of shared, electric, and automated transportation and some local agencies are already reckoning with declines in fuel tax revenue. The fiscal impact of these technologies will likely increase depending on how shared, electric, and automated technologies converge with each other. For example, AVs that are also shared and electric will have greater financial impacts than if AVs tend to be owned, rather than shared.

Curbspace Reallocation and Parking Revenues. Shared mobility and AVs may lead to a reduction in parking demands, a change in parking usage patterns, an increase in demand for curbside drop-off space, or all three of these outcomes. If the vehicles are shared, AVs could drop-off passengers and then move to pick up the next passenger or to another off-site designated area if the vehicle is privately owned (Figure 4). Emerging modes have already led cities to reimagine how curbspace can be reallocated for other uses such as delivery zones, transit passenger pick-up/drop-off zones, and shared mobility pick-up/drop-off zones. Reallocation of curbspace to accommodate shared mobility and AVs increases the curb's functionality, safety, and access for users, but will likely disrupt traditional parking revenues. If vehicles do not need to park for as long or at all, revenues from parking meters and parking tickets may decline, unless parking fees and metering are designed to accommodate shorter dwell times at the curb.

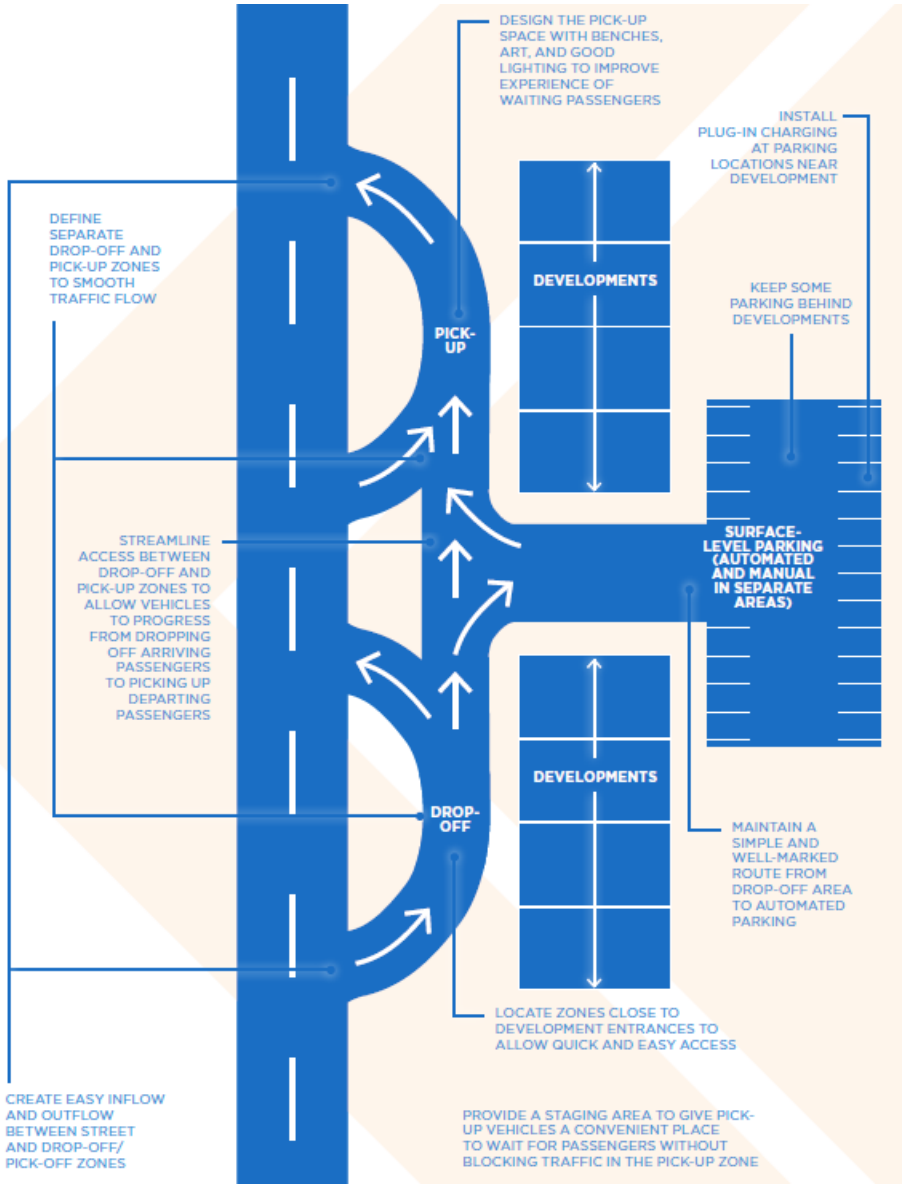

Figure 4. Drop-Off and Pick Up Zone Design Considerations (*Graphic created by Kittelson & Associates, Inc.*)

At airports, passengers may increasingly opt not to drive and park their personal vehicle at the terminal. Transportation Network Companies (TNCs) like Uber and Lyft, often used as a proxy to predict impacts of AVs, have led to a 5-10% reduction in parking revenue for airports and 13% decline for car rentals.[21] Bornstein, et al. (2018) estimates a 65% reduction in parking revenue between 2016 and 2040.[22] In North Central Texas, vehicle parking declines could be somewhat less in the near to midterm due to car-oriented land use and traveler preferences for personal vehicle.[23] Lewis and Clark (2021) also found parking revenues among the most at risk, depending on various scenarios and combinations of shared, electric, and automation. In an automated, electric, and shared future, parking fees, airport parking, and parking fines were estimated to be 40% of current revenue levels.[24] Counties, cities, and airports relying most heavily on parking revenues will likely see the greatest impacts on revenue streams.

Dallas Fort Worth International Airport budgeted for a 35% increase in parking for 2022 compared to 2021, as travel recovers from the COVID-19 impact, but revenues are still 20% below 2019 levels (as of the writing of this report in April 2022). The growth of AVs and shared mobility could continue to impact airport parking revenues. Airports across the U.S. (Figure 5), including DFW, have used parking rate increases and fees for TNC pick-ups and drop offs to make up for reduced traditional passenger parking and ground transportation revenues.

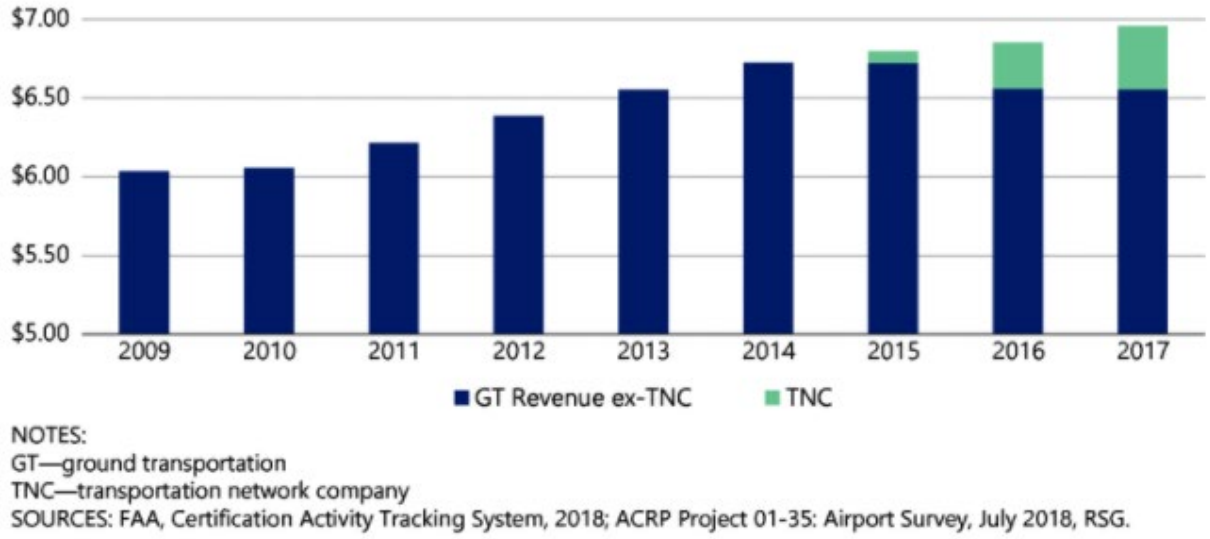

Figure 5. Total Ground Transportation Revenue Per Passenger (US Dollars) (*Source: The National Academies Press*[25])

Parking revenue impacts from TNCs have been less severe for cities – for now. Research suggests that TNC (or future AV) ridership will not cause substantial declines in parking demand until ridership triples from current levels.[26] Although ridership is getting closer to the tipping point, TNCs have not yet resulted in parking revenue losses overall for cities. Rather than TNCs reallocating a fixed number of travelers away from personal vehicles, the pie is getting bigger, meaning more people are traveling to and from destinations using both personal vehicles and TNCs.

Fuel Tax revenues. Revenue from motor fuel taxes is likely to continue to decline. Texas state and federal gas taxes are assessed on a per-gallon basis. As market share for electric vehicles grows and fuel-efficiency of internal combustion engine (ICE) vehicles continues to improve, per-gallon gas tax revenues will decrease. Figure 6 shows the Texas state fuel tax declines, adjusted for inflation, in the past 20 years.[27] Texas last increased state fuel taxes in 1991 and tax rates have not kept up with advancements in fuel efficiency or inflation. Bornstein et al. (2018) estimate gasoline demand could drop by 30% by 2040. State and local entities dependent on the State Highway Fund's fuel tax revenues will need to find alternative revenue streams in a fuel-efficient, electric, shared, and automated future. To cover shortfalls in the Federal Highway Trust Fund since 2008, Congress has shifted $153 million in general revenues to the fund, but state and local agencies will need a more permanent fix to overcome continued fuel-tax revenue declines.[28]

Texas state gas tax rate is the 44th lowest in the country. According to the Federal Highway Administration, the average Texan drives 16,172 miles per year. In 2005, with an average fuel efficiency of 19 miles per gallon, a driver would have consumed 851 gallons of fuel. With a 20 cent per gallon tax, state tax revenue would total $170. In 2020, with an average fuel efficiency of 25.4 miles per gallon, the same state tax revenue declines 25% to $127 ($93.80 in 2005 dollars).[29]

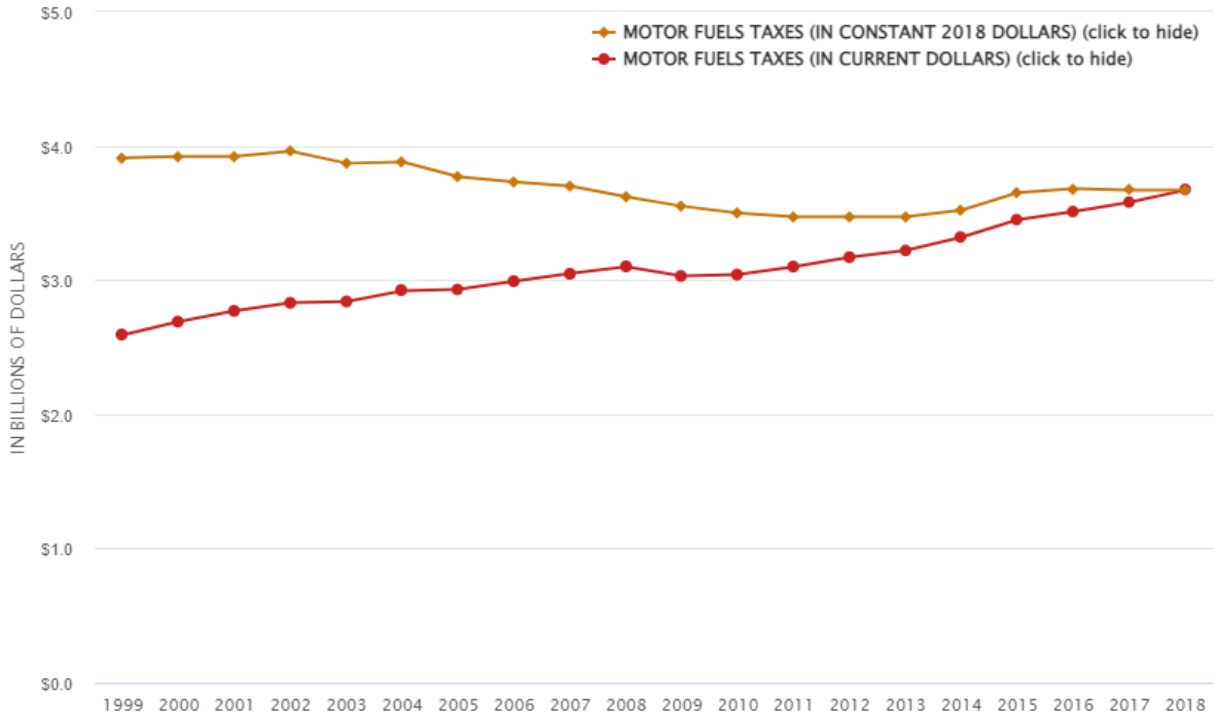

Figure 6. Texas State Motor Fuel Tax Revenue by Year (Source: Texas Comptroller)

Vehicle Registration and Licensing Fees. AVs and shared mobility may impact travelers' car ownership and driving preferences. Some research has suggested as fully automated vehicles become widely available, car ownership may decline in favor of on-demand shared AV fleets.[30] However, FHWA reported the number of licensed drivers in Texas per 1,000 people of driving age increased from 755 in 2015 to 795 in 2019 but the number of vehicles registered in Texas fell by .01 % in the past 5 years.[31] In Texas, vehicle ownership and licensing declines could be limited in the near to midterm due to car-oriented land use and traveler preferences. Litman (2022) predicts shared AVs to be cheaper than private AVs, but somewhat less convenient and comfortable, especially for suburban and rural areas where private AV ownership is likely to be greatest.[32] In this scenario, registration fees for AV ownership will still exist, but could drop by up to 30% by 2040 as travelers, especially in denser environments, ditch private vehicle ownership.[33]

There are over 22 million registered vehicles in Texas. Vehicle registration fees make up almost 10% of State Highway Funds. With the onset of shared AV fleets, if vehicle

ownership drops by 30% by 2040, registration revenue could drop to $1 billion per year.

Motor Fuel Lubrication Sales Tax. Without a tax increase, revenues from the tax on the sale of motor fuel lubricants are likely to decrease. Following a similar pattern to motor fuel, consumption of motor fuel lubricants in an automated, shared, and electric mobility future is likely not a reliable source of revenue. EVs do not require conventional oil changes and tend to require less maintenance than internal combustion engine vehicles. While providing savings benefits to EV owners or fleet operators, the lubricant sales tax will likely become increasingly obsolete as EV adoption increases. Alternative funding sources, such as Proposition 1 and Proposition 7, will face increased pressure to make up the difference as auto-oriented revenue sources decline.

Sales taxes (Proposition 7) and oil and gas production taxes (Proposition 1) are becoming an increasingly larger percentage of transportation funding in Texas, due to declines in motor vehicle revenues like the lubrication tax, fuel tax, and vehicle registration fees. Alternative funding sources represented 5% of revenues in 2006, compared with 36% in 2018.[34] Texas is not alone in facing declining fuel tax revenue and increased importance of alternative revenues. Recognizing fuel taxes will not support their transportation needs, many states have implemented alternative revenues such as bonds or tax increment financing. Hawaii, Illinois, and Indiana also apply their general sales tax to gasoline in addition to motor fuel tax.[35]

Traffic Enforcement and Fines. Parking fines, speeding tickets, court fees, and traffic violations may see a decline in a shared, electric, and automated future. This scenario assumes AV 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.

The City of Fort Worth's budget projects revenues from traffic and parking fines to decrease by 3.7% from the FY21 budget, driven by a 4.4% decrease in traffic fines the past few years.

Tolling Revenue. Connected and automated vehicles could increase roadway capacity by following at shorter headways, reducing delays on green lights due to distracted driving, harmonizing speeds to reduce stop and go traffic jams, or reducing gap acceptance for left turns over human drivers. This could potentially lead to more toll revenue. Induced demand could also increase if the time cost of travel decreases either because capacity increases or as driver level of stress reduces. People may be more willing to live father away from destinations and travel further, continuing to drive automobile-centric growth. Vehicle miles traveled (VMT) could increase as demand increases or because AVs or shared-use vehicles are making empty or zero-occupancy trips. Tolls and pricing strategies on managed lanes could generate more revenue in this scenario. Borstein et al., (2018) estimates a 20% increase in tolling revenues by 2040.

The North Texas Tollway Authority (NTTA) System consists of service roads and revenue-producing toll road main lanes. Over the last five years, total lane miles

maintained by NTTA have increased by 12% from 1,069 lane miles to 1,194 lane miles.

Transit Fares. AV impacts on transit systems and passenger fares are uncertain. Private automated vehicle ownership could shift travelers away from public transit. Similarly, if TNCs switch to AVs, they may be willing to pass cost savings from reduced labor costs on to travelers, making rideshares an attractive alternative for transit riders with lower travel budgets. In both scenarios, transit agencies would become more dependent on local taxes and federal grants for funding. On the other hand, automation could provide labor cost savings for transit agencies, which could be passed on to passengers in the form of fare adjustments, or 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.

Some AV proponents claim AV fleets offer an opportunity to reduce agency operational costs (and fares) for paratransit trips for people with disabilities by removing the driver and associated labor costs. In the near-term, operational costs savings may be limited due to the need for a human be present to assist paratransit riders. However, agencies can leverage other emerging technologies to reduce costs beyond labor. Automated routing algorithms, location tracking, service planning, and on-demand mobile applications can make paratransit more convenient and reduce some operational inefficiencies.[36]

Dallas Area Rapid Transit (DART) conducted a Mobility on Demand pilot with a microtransit provider (GoLink) and TNC (Uber) to provide more transit trip choices for riders in a low-density area that was difficult to serve. A similar deployment model could be possible with fleets of AVs to extend the reach of public transit and attract new riders.

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IDENTIFY OPPORTUNITIES FOR NEW REVENUE 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. Revenue for sources for all local entities – airports, transit agencies, counties, and cities – will be affected to varying degrees based on their dependence on these revenue sources. Local entities should identify their current revenues, collect data to understand trends and potential vulnerabilities in a shared, electric, and automated future, and examine potential alternative revenue streams to fill transportation funding gaps. Emerging transportation technologies are likely to impact existing funding sources, but also provide opportunities to open new funding streams that do not currently exist.

Establish Curbspace Pricing Mechanism. There is increased demand for limited curbspace. AVs will likely compete for curbspace with a diverse range of users, including personal vehicles, public transit, ride-hailing services, commercial deliveries, and micromobility. With cameras (like tolls) and parking space sensors, cities could establish dynamic pricing mechanisms for curbspace usage to make up for some lost parking revenue. For example, a surcharge for shared AV pick-ups and drop offs at popular locations during peak hours, or fares that automatically adjust in real-time to reflect curb availability. One strategy public agencies are considering is charging for parking or curb usage in micro-increments (1-2 minutes), rather than in the more traditional 15-minute or 1-hour increments. The challenge that still needs to be solved is how to enforce these short durations without automated payment collection or enforcement. If the AV is personally owned and travels to a designated off-site area for storage, cities could collect parking revenue, even if different from the traditional parking meter revenue. Airports, including DFW, may also increase their existing TNC drop off fees to account for losses in passenger parking revenues.

DFW Airport charges Transportation Network Companies (TNCs) $5 for up to 2 hours. TNC fees represent 13.1% of DFW's total $145.1 budgeted parking revenue for FY22.

Establish Charging Fees. Automated, electric fleets of vehicles will need access to charging opportunities close to their target markets (rideshare, delivery, etc.) in order to minimize travel costs and vehicle range spent getting to and from maintenance and storage facilities. This may offer opportunities for local entities to partner with fleet operators to share the costs of installing new EV infrastructure, as well as opportunities to charge fleet operators for access to these charging locations. Charging fees could be dynamic, with higher charges during on-peak hours and lower rates during off-peak hours. Cities, large employers, and airports are considering different business models to maintain chargers past the manufacturer warranty as the number of chargers increases.

Update Registration Fees. In a shared, automated, and electric future, gas tax revenue will decline. Policy makers are often hesistant to introduce any new or increased taxes, as evidenced by the state gas tax not being increased since 1991. Increasing registration fees for electric vehicles could provide an alternative, more politically palatable, revenue stream. Electric vehicles do not contribute to gas tax revenues, yet use the states roadway infrastructure. Fees will likely need to be right-sized to local contexts so as not to disincentivize the shift to electric, but to ensure drivers are paying their fare share for utilzing the state's roads.

30 states have separate fees for electric vehicles in addition to standard motor vehicle registration fees. California, Indiana, Michigan, and Utah tie the fee structure to inflation to ensure revenues keep up with future needs.
- National Conference of State Legislatures

It may also be appropriate to consider new registration fees for fully automated vehicles to replace revenues lost by declining vehicle registration fees.

Registration fee structures could also shift away from an annual lump sum towards a usage fee to to help sell the idea to the public. These smaller payments, such as charging a credit card on file for each AV per hour of usage each month, could be more convenient and likely to get public support. The usage fees are also more likely to meet funding demand and make the revenues more comparable with actual usage. In Texas, state law (Senate Bill 2205) pre-empts local agencies from regulating AV operations, which may hinder efforts to implement local fees. Local agencies should work with state legislatures to remove and replace any policies inhibiting planning for or addressing the impacts of emerging transportation technologies.

Increase state and local taxes. Local entities rely heavily on local sales and property taxes to fund transportation. AVs could encourage people to live father away from major job centers in Dallas and Fort Worth if people are able to be productive during the commute or travel further in a similar amount of time. This sprawl could distribute the population more evenly across the region, leading to the need to change tax rates in some areas to provide supplementary revenue or support additional demand for public services (Table 5). For example, if urban areas lose population but need to maintain the same set of infrastructure (roads, utilities), they may need to raise taxes to make up for lost revenue.

Since 2013, 33 states and DC have implemented a gas tax increase. At least 10 states tie the gas tax rate to inflation and at least 12 tie the rate to the price of gasoline.
-National Conference of State Legislatures

Getting legislative support for new or increased taxes is challenging. However, 33 states have enacted legislation to increase gas taxes since 2013.[37] Although politically challenging, the state or local entities could introduce new or increased fuel taxes to raise additional revenue. Another option is to index the gas tax to inflation or to fuel prices, although revenue streams could vary year to year based on economic conditions. There are 22 states that have a variable gas tax that adjusts to inflation or prices.[38] A tax on the electrical power used at a charging station could be added as an equivalent "gas tax" for electric vehicles.

Table 5 North Central Texas County Tax Rates

County	Total Actual Levy	Total County Tax Rates	County Adult (18+) Population	Tax Levied Per Adult
Collin	$270,963,200	$0.172531	744,736	$363.84
Dallas	$683,972,482	$0.239740	1,936,816	$353.14
Denton	$260,284,945	$0.224985	649,198	$400.93
Ellis	$68,719,520	$0.350276	131,651	$521.98
Erath	$17,156,819	$0.444400	33,475	$512.53
Hood	$35,792,923	$0.472538	47,411	$754.95
Hunt	$35,311,921	$0.467017	73,265	$481.98
Johnson	$62,193,372	$0.425000	126,911	$490.06
Kaufman	$63,900,896	$0.504957	93,649	$682.34
Navarro	$26,570,888	$0.604500	36367	$730.63
Palo Pinto	$14,311,430	$0.420000	22095	$647.72
Parker	$56,557,406	$0.358619	104,249	$542.52
Rockwall	$43,340,076	$0.313100	73,865	$586.75
Somervell	$15,161,319	$0.499586	6,959	$2,178.66
Tarrant	$514,278,641	$0.234000	1,531,028	$335.90
Wise	$24,511,999	$0.307500	51,130	$479.41

Source: Texas Association of Counties

Adjust Non-Transportation Funding Sources. Propositions 1 and 7 funds and other non-transportation funding streams will likely continue to contribute a significant portion of total transportation revenues available to local governments. The state could increase oil and natural gas production taxes (Proposition 1) or direct a larger share to the State Highway Fund (currently split between the State Highway Fund and the Economic Stabilization Fund). The state could also lower the preset collection threshold, over which funds are directed to the General Revenue, State Highway, and Economic Stabilization Funds. Similarly, Texas could raise sales taxes and motor vehicle sales and rental taxes or send a larger share of the revenues to the State Highway Fund, rather than to the General Revenue Fund. In Texas, Proposition 1 and Proposition 7 would require voter approval and legislative action to change the constitutional amendments.

Implement Usage-Based Fees. Vehicle Miles Traveled (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). VMT fees are being explored in several states to address the issue of declining revenue from fuel taxes as fuel economy increases. They are marketed as a simple switch from a "pay-per-gallon" to a "pay-per-mile" option that follows a "user pays" principle for infrastructure funding. This allows the state to receive revenue from hybrid and electric vehicles that contribute less or no gas taxes but still cause wear and tear on the road.

> *Two states – Utah and Oregon – currently charge drivers based on vehicle miles traveled. Congress and USDOT have also signaled openness to a national VMT approach.*
> *-Washington Post (2021)*

The primary motivation of VMT fees is to serve as a replacement for declining gas tax revenues. VMT fees should be coupled with land use policies that make shorter trips more feasible and are likely to be just one additional piece of the puzzle to replace declining gas tax revenue. For some, VMT charges raise privacy concerns if the government can track where the vehicle went. Instead, charging by the hour when the vehicle was used might help alleviate privacy concerns about knowing where the vehicle went. At the state level, VMT fees could also be collected annually at the time of vehicle registration by reporting odometer readings.

As an example, Oregon's OReGO program has inspired other states to explore VMT fees as a revenue-neutral substitute for the gas tax and covers electric vehicle drivers as well. In California, the Road Charge Pilot Program was launched in 2016 and ran for nine months, with over 5,000 vehicles across the state participating. The pilot program was enabled by Senate Bill 1077 passed by the California State Legislature in 2014 and administered by the California Department of Transportation (Caltrans). Like in Oregon, the fee was set at 1.8 cents per mile to be revenue neutral compared to a gas tax (the rate was established by taking a five-year average of the gas tax and dividing by average miles per gallon of the statewide fleet).

VMT fees will need to evolve as we learn more about technologies and use cases. For example, for fleets of automated vehicles, local entities could consider a fee like utility usage fees. Cities could charge fees based on the size of the fleet, or an annual fee with a partial refund for coming in with a VMT lower than a target, and an extra fee for going over to incentivize efficiency and disincentivize zero-occupancy trips. Fees could be tied to fleet sizes or vehicle weights or tiered for personal, commercial, and industrial vehicles.

Establish Congestion Charge for Dense Urban Centers. Another usage-based fee for dense urban centers is the congestion charge. 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 or vehicle efficiency level. In a connected and automated future, the congestion charge could be more dynamic, with real-time incentives (lower or higher charges) and fee structure adjustments based on traffic conditions. Land use policies and incentives might be needed to supplement congestion charging to disincentivize businesses and other destinations from choosing to leave downtown to avoid the charges and encouraging sprawl. Local agencies could also consider policies, such as adjusting fee structures for zero-occupancy AV trips. Congestion charge revenue could be a critical revenue-producing transportation demand management tool for dense urban centers in North Central Texas. Texas state law prohibits adding tolls to existing, taxpayer-funded roadways, which could impact the legal authority of local entities to impose congestion charges.[39] Proposition 1 and 7 funds are also prohibited to be used for toll roads. Public agencies can work with legislatures to remove policy barriers or to amend policies to allow some exceptions.

London's congestion charge zone applies a £15 static flat daily charge – regardless of vehicle type or emission efficiency – if driving within downtown core.

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. Agencies can encourage toll authorities to have partnerships and agreements with airports and surrounding cities to share risks, costs, revenue, and facilities. Today, DFW Airport is owned by Dallas and Fort Worth, but the property is located within the municipal boundaries of Coppell, Euless, and Irving, each of which have a revenue sharing agreement. In some PPPs, the private sector provides upfront capital to expedite a project. In others, agencies lease existing toll roads to private operators, shifting operations and maintenance responsibilities to the private sector.[40] This may be especially relevant if automated transportation systems require new investments in EV infrastructure, Vehicle-to-everything (V2X) infrastructure, or Urban Aerial Mobility aerodromes. Fleet operators who need this infrastructure may be willing to contribute to the implementation, or potentially contribute to retrofitting of existing roadways with V2X technology. Public-private partnership toll roads exist in Texas but have had mixed results. Texas has limited enabling statutes, authorizing only regional tollway authorities to use agreements with private

The North Central Texas Region has three operational PPP projects:

- *LBJ Express/IH 635 Managed Lanes*
- *North Tarrant Express I-820 and SH 121/183 (Segments 1 and 2W)*
- *North Tarrant Express 35W (Segments 3A, 3B and 3C)*

FHWA provides an overview of all state enabling legislation for PPPs.

entities to design, finance, construct, maintain, and operate roadway projects. In 2017, Texas legislature rejected a bill to allow TxDOT to use PPPs to fund several highway projects.[41]

Increase development impact fees. Impact fees are used to fund transportation infrastructure expansion needed 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. Texas state law (Local Government Code §395) requires entities to update the land use assumptions and capital improvements plan that inform the calculation of maximum allowable fees at least every 5 years. Changing land use patterns (e.g., sprawl) due to AVs could necessitate updates to local transportation impact fees.

In January 2022, the Dallas City Council approved the creation of the Dallas Economic Development Corporation (EDC). The EDC operates independently to develop city-owned property and to attract businesses to Dallas. Dallas Mayor Eric Johnson said the EDC was "a major step forward for our city as we strive to compete more aggressively at the regional, national, and international levels"[42] Local entities can engage the EDC to consider changes to development impact fees, shifting some of the burden of additional infrastructure for new development onto willing developers instead of local governments.

Maximizing existing infrastructure. In an era of rising construction costs and declining revenues, agencies will need to make the most of what they have. 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 to increase supply. Land use policies can incentivize denser development, enable shorter trips, and reduce dependence on the automobile. Agencies may also consider an integrated, active mobility management approach for supply and demand in the transportation system. Strategies can include incentives, traveler information, or Intelligent Transportation Systems (ITS) to dynamically manage transportation supply and demand. AVs will produce large amounts of data, providing an opportunity for agencies to maximize the efficiency of the transportation system.

Charge for access to transportation data. Emerging mobility technologies (including shared-use mobility, integrated mobility applications, connected and automated vehicles, and smart city technologies) are already producing large amount of data, which will likely only increase over time. The data could provide valuable insights for transportation planners and policy makers to better understand mobility patterns in the region. Private mobility providers and software developers could also use the data to shape their services. [43] Cities will need to invest in building capacity of new data management approaches to collect, analyze, manage, share, secure, and utilize data for transportation planning. Public agencies will also need to protect data to build public trust.

There are two potential options for granting access to this important data: Begin charging for access to some data or continue to give away data for free.

In the first approach, cities may consider providing a tiered access system to public data exchanges, with free access for some users and some datasets, while charging for anything above a specified volume of data or access to specific data that private companies would use for their for-profit businesses.

Cities could consider leveraging the power of mobility data and monetizing streams such as:

- **Roadway mapping and inventory data**, such as roadway dimensions, speed limits, traffic control devices, and EV charging locations
- **Curbside management data**, including information on parking and utilization patterns
- **Roadway characteristics changes**, including information about work zones, road closures, and changes in curbside use
- **Real-time sensor data**, including counters and sensors within the roadway, parking spaces, loading zones, or charging stations.

Cities could also establish data sharing agreements where the city receives compensation (in the form of money or access to mobility provider data) in exchange for access to government data.[44] Cities could also charge for in-ride services, such as public WiFi, during trips provided by private mobility companies

This approach of charging for access has not yet been successfully implemented by any public agency. Public agencies may see greater value in giving data away for free to let private companies use the data to provide a public benefit. The approach is provided only as a potential alternative for future consideration or research.

The second approach continues the trend towards "open data" that led many cities to establish free data exchanges for users to access and download government data. Maintaining free access recognizes there are potential downsides to charging for access to transportation data. Public agencies are subject to local open data requirements, sunshine laws, and Freedom of Information Act (FOIA) requests, and stringent data privacy and security procedures. In some cases, it may be in the public entity's interest to give away data for free. For example, private sector investments in travel navigation services rely on free public data and result in benefits to the publicly maintained transportation system. Private companies could also choose to avoid operating in cities who charge for data.

> *"The democratic case is pretty solid for public data to be unconditionally free to NGOs, the press, or the casual civic hacktivist. But should it under all circumstances be free to a company looking to exploit a free—but valuable—resource like data for a profit?"*
> *-Anthony Williams, Former Mayor of Washington, DC (Bloomberg)*

Assess Potential Cost Impacts

Along with shifting revenues, automated transportation could impact operations and maintenance (O&M) costs and expenditures that local entities should plan for. Additional O&M considerations include:

- **Increased roadway maintenance costs.** more roadway maintenance may be needed if VMT increases significantly causing more wear and tear on roads. More frequent resurfacing or restriping of roadways may be needed for AV cameras and sensors to operate effectively (including in adverse weather conditions).
- **Reduced labor and fuel costs for operators.** Removing drivers from vehicles could reduce operational costs for mobility providers. In the short term, savings from reduced labor costs might be offset by more expensive initial costs of EVs and AVs. AVs may have costlier

maintenance due to longer downtime caused by added technology and specific parts needed for repairs. However, as technologies mature and achieve economies of scale, it is likely that maintenance costs for automated systems will be equal or lower than those of conventional vehicles. Some studies show, however, that an electric autonomous bus could save a transit agency $3 million over a 12-year vehicle life cycle.[45]

- **Legal liability, insurance, and cybersecurity costs.** There are likely to be costs associated with protecting AVs and data from cyberattacks. Legal liability and insurance costs for AVs are uncertain. Crashes involving fully automated vehicles may shift liability costs to the vehicle manufacturers. However, operating agencies could be held responsible if vehicle maintenance or software updates were not performed.
- **Reduced costs from crashes.** If the safety improvements of automated vehicles are realized, there may be reduced costs for emergency response to crashes and costs from accident settlements.
- **Public engagement and education costs.** Local entities will likely need to engage in significant public outreach campaigns to educate travelers on the technology and any impacts to transportation system.

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NEXT STEPS

Local agencies need guidance on how to plan for uncertainties in the future of transportation. 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, if any, is needed to support the future travel needs.

This Financial Report provides a high-level assessment of how automated transportation may affect local entity finances for four types of Local Entities:

- Counties
- Municipalities
- Public Transit Agencies
- Airports

This 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.

Step 1: Identify Existing Funding Mechanisms.

This report identifies many funding streams. Local entities should further refine and evaluate their current revenue sources before assessing their vulnerabilities in the context of emerging technologies. They should seek to identify significant traditional transportation revenue streams. These revenue sources from private vehicle parking, sales, registration, rentals, and fuel taxes are most at risk if traveler behavior changes due to shared, electric, and automated transportation options.

Step 2: Assess Vulnerabilities and Potential Impact of Emerging Technologies.

The North Central Texas transportation system is already stressed from population growth, economic development, automobile-oriented development, traffic congestion, lack of connected bicycle and pedestrian infrastructure, poor traffic safety performance, and high construction costs.

Emerging technologies—including more fuel-efficient vehicles, EVs, shared mobility, and AVs—further threaten traditional funding streams. Agencies should assess their dependence on specific revenue sources, collect data, and monitor impacts of emerging technologies to measure changes to their revenue streams over time.

To assist with this assessment, NCTCOG could support the development of a toolkit for identifying existing funding mechanisms and assessing their vulnerabilities in the context of emerging technologies. A toolkit may help define a standardized step-by-step process for different entities in the region to evaluate current revenues and identify strategies to fill potential gaps.

Electric and more fuel-efficient vehicles will reduce revenue from fuel and motor oil lubrication taxes. Shared, automated mobility services may incentivize residents and visitors to forgo car purchases and rentals, leading to potential declines in parking revenues, vehicles sales, and registration fees. AVs could further reduce parking and traffic enforcement fine revenue, assuming manufacturers program vehicles to obey speed limits and other traffic laws.

Funding challenges may arise for agencies that depend on transportation-related funding streams based on personally owned, gas powered cars. The fiscal impact of these technologies will likely increase depending on the degree of convergence of three emerging technologies – electric, shared, and automated.

Step 3: Identify Alternative Funding Streams.

Local entities should examine potential alternative revenue streams to fill transportation funding gaps, including:

- Charge for Mobility Data Access
- Establish Curbspace Pricing Mechanisms
- Update Local Registration Fees
- Establish Charging Fees for EVs
- Increase State and Local Taxes
- Adjust Non-Transportation Revenue Sources
- Implement Usage-Based Charges
- Establish Congestion Charge for Dense Urban Centers
- Leverage Public-Private Partnerships
- Increase Development Impact Fees
- Maximize Existing Infrastructure

Local entities should also plan for impacts from automated transportation on operations and maintenance (O&M) costs.

Step 4: Identify a Champion and Gather Public Support.

The alternative funding streams identified in Step 3 are only hypothetical without political and public support. Agencies need to recognize the shifting nature of transportation revenue sources and identify a champion to lead the effort to identify sustainable funding sources. One of the most important steps is to then garner support from policy makers and the public. The champion needs to understand the policy development process and be well-connected to local decision makers to help build consensus. Transportation funding policy requires local champions that can initiate change and motivate on the long-term scale, while being up to date on the latest trends in transportation technologies that could impact revenues.

Local champions can help facilitate engagement with critical stakeholders, including:

- **North Central Texas Council of Government (NCTCOG) and Regional Transportation Council**, the independent transportation policy body of the Metropolitan Planning Organization, to include in the development of transportation plans, programs, and funding decisions.
- **State and local legislatures** to remove any policy barriers to prepare for the financial impact of emerging transportation technologies or adjust funding allocations as the region continues to grow.
- **North Central Texas Innovation Alliance (NTXIA), North Texas Center for Mobility Technologies (NTCMT), Texas Research Alliance, and North Texas Tollway Authority** to conduct further research and pilot programs on the financial impacts of emerging transportation technologies.

New taxes are likely not politically palatable. Implementing new or increased fees is a challenge. Historically, efforts to increase the gas tax rate have failed and state law prohibits adding tolls to existing, taxpayer-funded roadways. It will be important to effectively market any new fees for transportation to demonstrate a public benefit, build public support, and spur policy changes.

In addition to framing the new revenue opportunities, agencies will need to engage the public and demonstrate the value of improved roads, better service, improved travel reliability, reduced overall costs, and other benefits. The public may have to vote on a referendum, similar to Proposition 1 and 7, so public engagement is critical to building support.