

Subtask 3.1

Air Quality Implications and Assessment Needs for Texas DOT in the Context of Transportation Electrification

FINAL MEMORANDUM

Prepared for the Texas Department of Transportation

August 2022

Texas A&M Transportation Institute



TECHNICAL MEMORANDUM – FINAL

Interagency Contract No: 27476
Sub-Task 3.1 – TWG Technical Issues Analysis

DATE: August 15, 2022

TO: Janie Temple
Laura Norton
Texas Department of Transportation (TxDOT)

FROM: Alice Grossman, Ph.D.
Tara Ramani, Ph.D., P.E.
Rohit Jaikumar, Ph.D.
Jason Reyes
Texas A&M Transportation Institute

FOR MORE INFORMATION:
Tara Ramani
(979) 393-0688
T-Ramani@tti.tamu.edu

TABLE OF CONTENTS

Table of Contents.....	iii
Introduction	1
Transportation Electrification Stakeholders.....	2
IIJA and Other Federal Policy.....	3
Linkages to Transportation Conformity.....	5
EV Infrastructure Planning Requirements.....	6
GHG Reduction and Climate Change Mitigation	6
Examples from Other States.....	7
Data Needs for EV Planning.....	8
EV-Air Quality Data Dashboard	10
Next Steps.....	10

INTRODUCTION

A changing landscape in the transportation and energy sectors including new federal legislation brings the emerging issues of electric vehicle infrastructure planning and related air quality considerations to the forefront for state departments of transportation (DOTs). Recent federal legislation and regulations have made it clear that the United States Department of Transportation (USDOT) is prioritizing infrastructure associated with fleet electrification and will be providing funds to support electrification efforts. States must plan for an increasing prevalence of electric vehicles amongst the general public and in both public and private fleets. For this fleet composition transition to occur in the most economically efficient and equitable manner, infrastructure needs, an understanding of vehicle operations, battery life and charging patterns, and availability of charging locations all emerge as important considerations that must be addressed.

A statewide electric vehicle plan will provide the Texas Department of Transportation (TxDOT) an accelerated start to planning for large-scale vehicle electrification and optimizing the impact of newly available federal and private investment. The proliferation of electric vehicle adoption also has implications for pollution and air quality. Mobile source emissions remain a major issue in Texas, both in the context of transportation conformity as well as public health. While electrification has the potential to reduce vehicle tailpipe emissions, a holistic picture of air quality and health impacts will need to consider the electric grid emissions and energy consumption. Transportation electrification is also related to climate change and increasing severity and frequency of extreme weather events, and the need for resiliency.

The overall goal of this activity (titled *“Electric Vehicle Infrastructure Plans and Associated Air Quality Considerations”*), conducted under the TTI-TxDOT Air Quality and Conformity Interagency Contract is to provide TxDOT with information regarding the emerging issue of electric vehicle infrastructure planning and related air quality considerations. This interim memorandum provides information on current programs and initiatives and other background information relevant to TxDOT’s efforts in planning for transportation electrification. It specifically connects electrification efforts and outcomes to air quality and attainment status and focuses within federal and state frameworks. Assessing the impacts on air quality as fleets transition will allow the state and regional transportation authorities to estimate air quality conformity levels in the future and plan for conformity

levels as well as charging infrastructure to support equitable access to both mobility, access, cleaner air, and improved public health.

TRANSPORTATION ELECTRIFICATION STAKEHOLDERS

Government agencies at the local, regional, state, and federal levels have identified communication and collaboration between transportation, energy, land use, and charging infrastructure actors as a developing need. Figure 1 shows the basic “ecosystem” of stakeholders that must collaborate for efficient and equitable electric vehicle and infrastructure deployments.

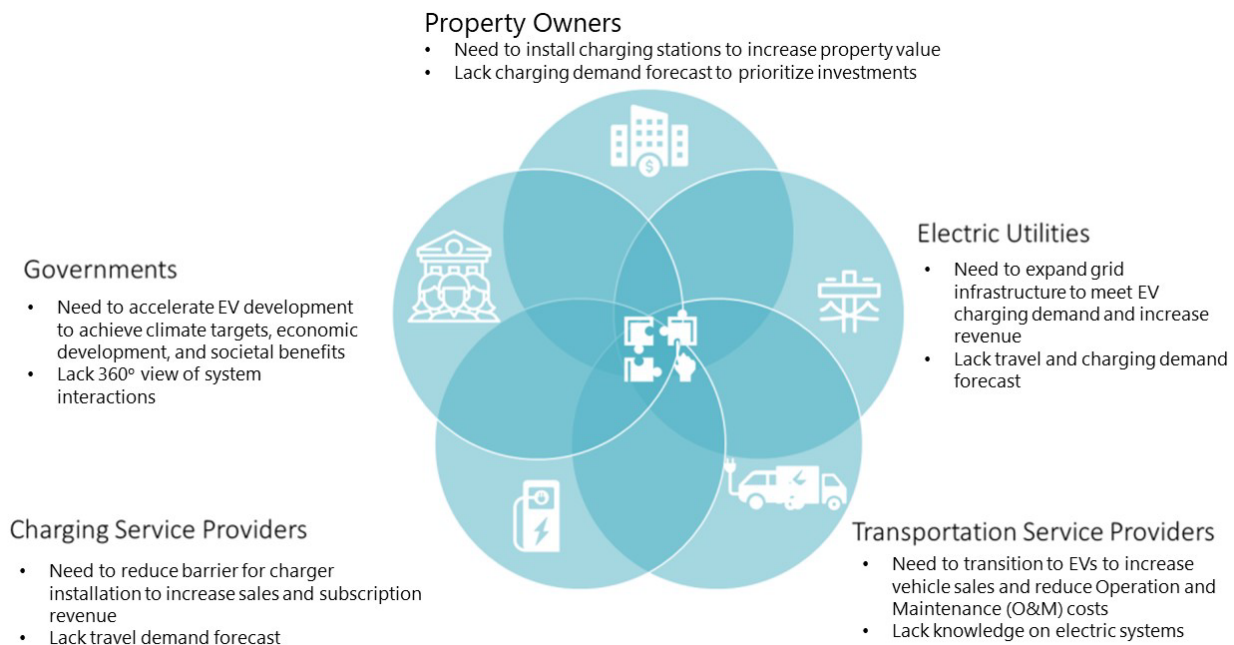


Figure 1. The e-mobility ecosystem.

Figure 1. The E-Mobility Ecosystem


























Source: CARTEEH, 2021. Technology Landscape and Future Direction for Transportation Emissions, Energy and Health


Estimating charging demand, identifying potential charger locations, and ensuring grid capacity while addressing equity concerns are the main steps involved in provision of electric vehicle infrastructure. While convening diverse stakeholders is a challenge, their input can help decision-makers reach transportation electrification goals in a more economic and timely manner with strong support and approval.

IIJA AND OTHER FEDERAL POLICY

The 2021 Infrastructure Investment and Jobs Act (IIJA) (which included a reauthorization of the Fixing America's Surface Transportation (FAST) Act) opened up billions of dollars of investment for transportation electrification and with it, federal guidance and requirements for planning and installation of charging infrastructure. Earlier laws such as the American Recovery and Reinvestment Act of 2009, and all the way back to the Clean Air Act of 1990 (CAA), remain influential in how states are required and incentivized to use their transportation dollars. Figure 2 shows the existing programs prior to the passage of IIJA that provided the opportunity to fund electric vehicles and electric charging. Although Figure 2 shows a variety of programs and millions of dollars of funding, it is important to note that most of the programs listed are habitually oversubscribed and there are many types of projects, besides electrification ones, that are eligible and receive most of the funds.

However, the IIJA both reauthorized the programs in Figure 2 (with some changes) and established new programs focusing on electric vehicles and electric vehicle charging. Table 1 shows the IIJA programs most related to transportation electrification efforts.

	FY 2021 AMOUNT		
FORMULA PROGRAMS			
National Highway Performance Program (NHPP)	\$23.1 B		
Surface Transportation Block Grant Program (STBG)	\$10.2 B		
Congestion Mitigation & Air Quality Improvement Program (CMAQ)	\$2.4 B		
National Highway Freight Program (NHFP)	\$1.5 B		
DISCRETIONARY PROGRAMS			
Rebuilding American Infrastructure with Sustainability and Equity (RAISE) (formerly known as BUILD)	\$1.0 B		
Infrastructure for Rebuilding America (INFRA) Grant Program	\$889.0 M		
Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD)	\$53.3 M		
OTHER ALLOCATED PROGRAMS			
Federal Lands and Tribal Transportation Program (FLTTP)	\$1.0 B		
Highway Infrastructure Program (HIP) (other than for bridges)	\$644.0 M		
Puerto Rico Highway Program (PRHP)	\$74.9 M		
Territorial Highway Program (THP)	\$37.3 M		
INNOVATIVE FINANCE PROGRAMS			
State Infrastructure Banks (SIBs)	Varies		
Transportation Infrastructure Financing and Innovation Act (TIFIA)	Varies		


 Construction and installation of EV charging infrastructure including parking facilities and utilities.



 Construction and installation of EV charging infrastructure to support operational, resiliency, national energy security, environmental, and community goals for freight transportation.

Figure 2. Programs for which electrification projects are eligible Pre-2021 Infrastructure Investment and Jobs Act

Source: FHWA, 2021. E-Funding Report (https://www.fhwa.dot.gov/cfo/fhwa-fy-2021_budget_508.pdf)

Table 1. List of Transportation Programs in the IJA Related to Electric Vehicles

Program	Program basics
National Electric Vehicle Infrastructure	Formula funds up to \$5B for electric vehicle charging infrastructure
Charging and Fueling Infrastructure	Competitive grants for up to \$2.5B for publicly accessible alternative fuel charging/fueling stations. Includes the Corridor Charging Grant Program and the Community Charging Grant Program
Carbon Reduction	\$6.4B in formula funds to reduce CO2 emissions from transportation.
Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT)	\$8.7 billion over five years (\$1.4 billion competitive) in formula and competitive funds to increase resilience
Electric or Low Emitting Ferry	Competitive grants for cleaner ferries
Clean School Bus Program	\$5 B in formula funds to states supporting reductions in transportation emissions

The major programs of note in Table 1 are the National Electric Vehicle Infrastructure (NEVI) formula funds and the competitive Charging and Fueling Infrastructure grants. The NEVI program supports the Administration’s goal of funding a national network of up to 500,000 publicly accessible electric vehicle (EV) chargers by 2030. States will have access to the funds once their EV Infrastructure Deployment Plan is submitted to and approved by the Federal Highway Administration. Fulfilling this stipulation will help states efficiently use NEVI funds, but can also help them plan for other federal requirements and programs, such as planning for strategies to meet CAA air quality attainment goals.

LINKAGES TO TRANSPORTATION CONFORMITY

The Federal Government uses funds tied to air quality conformity as a means to further their goals of cleaner air to improve public health and mitigate the acceleration of climate change. The program ensures that federal funding and approval goes to the transportation projects that support the air quality goals put forth by the CAA. Supporting the acceleration of electric vehicle adoption is one way to reduce vehicle emissions and reach CAA goals. However, the implications of EVs for transportation conformity (which only considers mobile source emissions) and for overall air quality impacts (which would include/consider emissions from electricity) are different. And while EVs reduce tailpipe emissions, they still have emissions associated with brake and tire wear (with tire wear emissions likely higher due to higher vehicle weights and brake

friction likely decreased due to regenerative braking). The actual accounting for EV emissions in a nonattainment area will also depend on assumptions in the State Implementation Plan and potentially in the modeling processes used to establish a Motor Vehicle Emissions Budget. However, the increasing proliferation of EVs necessitates the more explicit consideration of EVs in regional air quality modeling conducted as part of the transportation conformity process.

EV INFRASTRUCTURE PLANNING REQUIREMENTS

As of May 2022, guidance for the NEVI program and the Carbon Reduction Program have been released, whereas the Charging and Fueling Infrastructure Program and PROTECT Program are still pending rulemaking and guidance. The Administration has also stood up the new Joint Office of Energy and Transportation (JOET), as mandated in the IIJA, to accelerate communication and collaboration between Energy and Transportation and provide technical assistance to states for their alternative fuel plans and implementation. According to guidance from JOET, NEVI formula funds will be awarded on a rolling basis as long as state plans for electric vehicle charging infrastructure meet the federal requirements. TxDOT is working on plan development adhering to these requirements, and these plans are due August 1, 2022. Plans to lower CO₂ emissions for the PROTECT formula funds can include a multitude of strategies and are due November 15, 2023.

GHG REDUCTION AND CLIMATE CHANGE MITIGATION

EV emissions and energy are part of an entire cradle to grave lifecycle that has implications for public health at all stages. Comparing EV lifecycle costs, emissions, and impacts on the economy and quality of life to that of internal combustion engines will give a holistic sense of the savings and improvements as well as tradeoffs associated with transition on-road fleets. There are also multiple sources of funding and technical assistance associated with greenhouse gases (GHG) reduction and climate change mitigation, such as through all of the federal programs listed in Table 1. Of the programs in Table 1, the Carbon Reduction Program (CRP) is most aligned with GHG reduction, with a focus on CO₂ reduction, providing states with available funds for projects to reach CO₂ reduction goals. Supporting EV adoption could help reach those goals and provide benefits to TxDOT by allowing for more flexible use of CRP funds in the future. Further analysis on this connection is being conducted under a separate activity under this interagency contract.

EXAMPLES FROM OTHER STATES

Many states are increasing their attention on planning for electric vehicles. Table 2 provides resources from other others states including plans and policies for electric vehicles, electric vehicle charging infrastructure, zero emission transportation goals, and sustainable transportation.

Table 2. Selected EV Plans and Policies in other States

State	EV Planning and Policy Resource	Year Published
Alabama	Alabama Electric Vehicle Infrastructure Plan	2021
Alaska	Alaska Energy Authority Electric Vehicle Workgroup Resources	2022
Arizona	Arizona Statewide Transportation Electrification Plan: Phase II	2021
California	Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment Analyzing Charging Needs to Support ZEVs in 2030	2021
Colorado	Colorado Electric Vehicle Plan 2020	2020
Connecticut	Electric Vehicle Roadmap for Connecticut	2020
Florida	EV Infrastructure Master Plan	2021
Illinois	Reimagining Electric Vehicles in Illinois Act	2021
Iowa	Charging Forward: Iowa's Opportunities for Electric Vehicle Infrastructure Support	2019
Maryland	Maryland Zero Emission Electric Vehicle Council Annual Report 2021	2021
Massachusetts	Choices for Stewardship: Recommendations to Meet the Transportation Future. Executive Summary	2019
Illinois, Indiana, Michigan, Minnesota, and Wisconsin	Regional Electric Vehicle Midwest Coalition Memorandum of Understanding Between Illinois, Indiana, Michigan, Minnesota, and Wisconsin	2021
Minnesota	Accelerating Electric Vehicle Adoption: A Vision for Minnesota	2019
North Carolina	North Carolina ZEV Plan	2019
Oregon	Oregon Biennial Zero Emission Vehicle Report	2021
Tennessee	A Roadmap for Electric Vehicles in Tennessee	2019
District of Columbia	DC Department of Energy & Environment Electric Vehicle Resources	2020

Stakeholders have identified some states as being particularly valuable as case studies. States that have similarities in geography, demographics, or politics to Texas, such as Arizona, Colorado, Tennessee, and Iowa, that are ahead in planning for EVs could be particularly valuable case studies. California would also provide for a valuable case study

due to significant advancement of electric vehicle planning and policy with higher-than-average levels of EV fleet penetration. The map in Figure 3 shows the adoption of EVs in the overall fleet in 2019 across counties and states, in an analysis from the International Council on Clean Transportation (ICCT) with data obtained from IHS Markit.

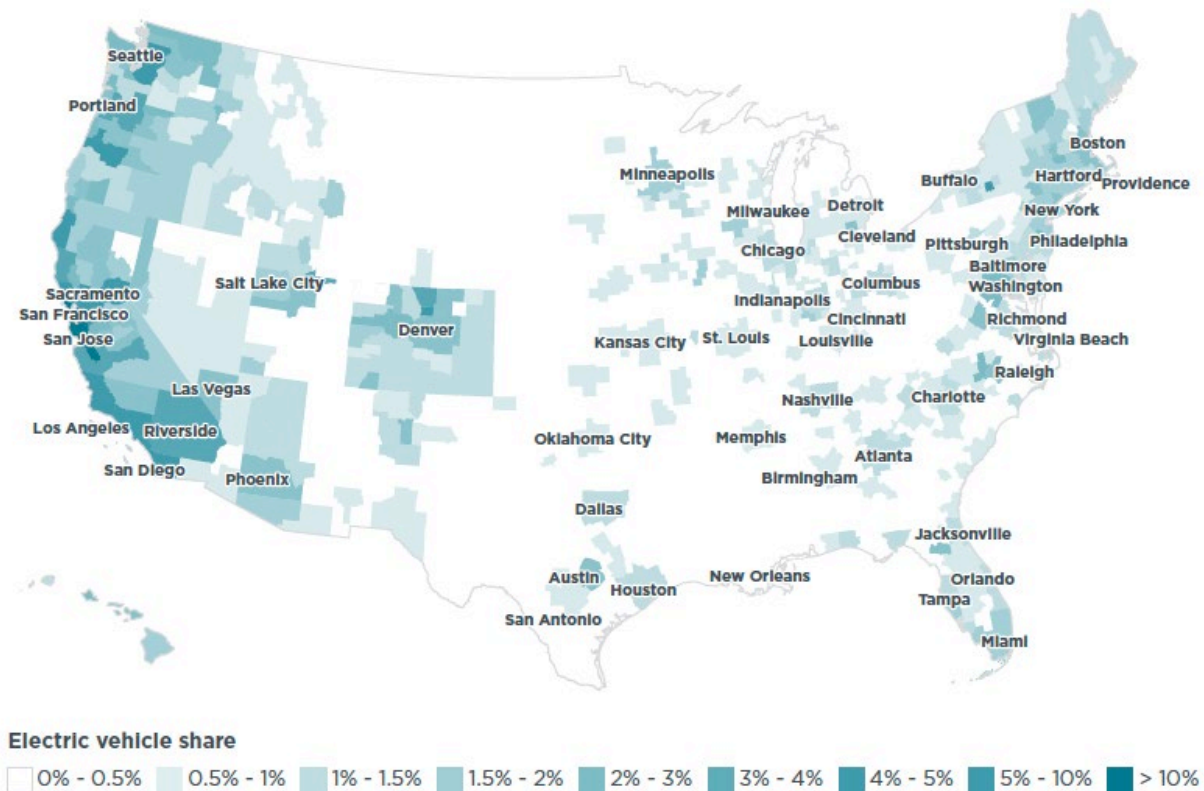


Figure 3. Electric Vehicle Shares of New 2019 Vehicle Registrations by Metropolitan Area.

Source: The International Council on Clean Transportation. Anh Bui, Peter Slowik, Nic Lutsey, 2020. Update On Electric Vehicle Adoption Across U.S. Cities (<https://theicct.org/publication/update-on-electric-vehicle-adoption-across-u-s-cities/>)

DATA NEEDS FOR EV PLANNING

In order to optimize opportunities in vehicle electrification and secure maximum federal dollars under both electrification and AQ programs, states need to continue to proceed with their EV plan development while communicating with JOET to assure that the plan meets federal criteria and access NEVI funds as soon as possible in the summer of 2022. Furthermore, connecting and communicating with stakeholders across disciplines and sectors will help set foundations for efficient EV readiness and implementation. The state

can also begin locating, collecting, and cleaning data to assist in planning and implementation for EVs on Texas roads. Table 3 shows basic data needs for the transportation, land use, energy, air quality, and social considerations necessary to include in plans. These data sets can be connected to optimize planning for economic, environmental, public health, and quality of life goals. Examining best practices from other states can also further accelerate lessons learned and positive outcomes for EV readiness.

Table 3. Data Needs for Planning of EV Infrastructure

Transportation & Land Use	Utilities	Air Quality	People
Highways	Electric Substations	Key pollutant levels (GHGs and PMs)	Travel Demand
Alternative Fuel Corridors	Electric Power Transmission Lines	Emissions from current fleets	Vehicle Purchases
Current & Planned Charging Stations	Electric Retail Utility Service Territories	Emission models for higher EV fleet penetration	Charging Patterns
Freight Developments	Pipelines		Energy Usage
Trucks Stops & Fueling Stations	Storage Facilities and Capacity		Demographics
Evacuation Routes	Grid load		
Weigh Stations			
Light and Heavy Duty Vehicle Volumes			
Rest Areas			
Major Distribution Centers			
Land Use			

EV-AIR QUALITY DATA DASHBOARD

Tools to track progress towards goals and compliance requirements can be helpful both in the planning phase and after implementation. As part of this task, TTI staff developed a [dashboard](#) that visualizes data for electric vehicle rolling stock, charging infrastructure, and air quality considerations. The dashboard is a work in progress, and currently includes pages dedicated to a deep dive into vehicles, showing adoption of types and makes over time; and a deep dive on chargers, showing charger use, levels, and operators, and big picture information into a market overview page. As remaining work on this task continues, it is envisioned that air quality related information and overlays will be added to the dashboard and ultimately integrated with the Texas Air Quality Portal.

NEXT STEPS

This interim memorandum summarizes preliminary findings with regards to EV charging infrastructure, federal programs, and air quality linkages. An updated version of this memorandum submitted at the end of the Fiscal Year will include further information and analysis related to EV charging infrastructure and air quality, covering topics such as policy guidance specifications and analysis, typical vehicle operations, charging demand estimation and location, economic/revenue impacts and considerations, environmental and air quality impacts, battery lifecycle analysis and operations, data collection, and monitoring requirements.