SRTC
SPOKANE REGIONAL TRANSPORTATION COUNCIL

SMART MOBILITY PLAN

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Abstract

The intent of smart mobility planning is to determine how technology applications can help the Spokane region achieve its desired transportation and societal goals while mitigating potential negative community impacts.

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CivTech

RSG the science of insight

SRTC Smart Mobility Plan

Introduction

Spokane Regional Transportation Council is the federally designated Metropolitan Planning Organization (MPO) and Transportation Management Area (TMA) for the Spokane Metropolitan Planning Area in Washington. At the state level, SRTC is the designated Regional Transportation Planning Organization (RTPO). As the MPO and RTPO, SRTC coordinates regional transportation planning within its planning area of Spokane County. Federal legislation (23 CFR 450.306) requires MPOs to develop long-range transportation plans for their respective planning areas, known as a Metropolitan Transportation Plan (MTP). In support of the next iteration of the MTP, SRTC is exploring applications of technology to help understand needs and potential solutions for a better, smarter transportation system.

Although definitions vary, you can think of *smart mobility* as the integration of information and technology into the transportation system to improve efficiency and safety. Some technology exists today and is being deployed around the U.S. (like adaptive traffic signal systems that react in real time to traffic patterns). Other technology is being developed and tested, but the timeline for when the technology will be commercially available and widely adopted is still uncertain (like connected and automated vehicles). Some transportation technology is far off in the future, if ever (like electric automated air taxis). Finally, some technology hasn't even been thought of yet, but it will be invented and widely applied within the 25-year horizon of Spokane Regional Transportation Council's (SRTC) Metropolitan Transportation Plan (MTP) update.

The intent of smart mobility planning is to determine how technology applications can help the Spokane region achieve its desired transportation and societal goals while mitigating potential negative community impacts. Key challenges to smart mobility planning are the unknowns associated with new technologies—when will they be available, what will they cost, and what will be their real-world impacts. The Plan was developed with input from a Stakeholder Advisory Group (SAG) and the SRTC Technical Advisory Committee (TAC), Transportation Technical Committee (TAC), and Board of Directors.

The organization of the Plan is:

Appendices

Purpose

The purpose of the Smart Mobility Plan (Plan) is to understand the impacts of emerging technologies in the region and to develop a set of strategies and actions to advance transportation innovation to inform the Metropolitan Transportation Plan update and regional project development.

SMART MOBILITY GOAL

Integrate technology into the multimodal transportation network for more safe, efficient, resilient, and equitable movement of people and goods.

SMART MOBILITY OBJECTIVES

Advance regional goals by anticipating, learning from, adapting to, and utilizing new and proven technologies.

Support initiatives that offer a seamless mobility experience.

Use data to empower travelers to make travel choices and to plan, operate and manage the transportation system.

Develop proactive strategies to attract, train, and retain a skilled and qualified transportation workforce.

Use technology to reduce the transportation system's vulnerability to natural disasters, climate change, and other disruptions.

Increase access to and education on existing and emerging technologies to facilitate their successful adoption.

Promote technologies that encourage a transition to more environmentally responsible travel.

The following categories were established to help classify the key regional transportation needs:

- **Asset Management:** Keep the transportation infrastructure in as good or better condition than it is now; and integrate systems so assets are better understood, better preserved, and better utilized.
- **Safety:** Increase safety for all roadway users.
- **Travel Demand / Congestion Management:** Optimize the use of current transportation systems.
- **Accessibility and Equity:** Increase access to public transportation services and multimodal options.
- **Resiliency:** Anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from transportation disruptions.
- **Sustainability:** Minimize environmental impacts by reducing greenhouse gas emissions and the effects of climate change.

- **Smart Land Use Management:** Advocate for land use strategies the maximize the efficient use of land and infrastructure.
- **Data Management & Information Sharing:** Use data to enhance regional decision-making and coordination.

Smart Mobility in the Spokane Region

Smart mobility applications exist for many different aspects of the transportation system, including:

- **Roadways:** Roadway applications are intended to provide safer, more reliable travel for motor vehicles, including freight movement and transit.
- **Vehicle technology:** The private sector is improving technology for light and heavy vehicles to reduce the need for human intervention by autonomously adjusting the vehicle's safety, operations, maintenance, and comfort settings.
- **Public transit:** Smart mobility applications for public transit support faster, more reliable transit trips and to provide information and tools that facilitate passengers' trips.
- **Freight movement, logistics, and delivery**: Freight applications makes goods movement more efficient through improved travel planning, reduced travel times, new travel options, or shifting travel to non-peak hours.
- **Integrated multimodal travel:** Integrated multimodal information sharing makes travelers aware of mobility options for a particular trip, facilitates reserving seats or vehicles when necessary, and/or facilitates fare payment for the complete origin–destination trip.

Smart mobility applications include:

- Intelligent Transportation Systems (ITS) and Data Sharing
- Broadband
- Shared-Use Mobility
- Mobility as a Service (MaaS)
- Electric Vehicles (EVs) and Infrastructure
- Connected and Automated Vehicles (CAVs)

These applications typically do not exist on their own but require supporting resources to function, such as communication infrastructure, sensors, data storage infrastructure, data feeds, data analysis capabilities, decision-support resources, and workforce development. The following subsections provide short descriptions of the smart mobility solutions that are currently implemented in the region or that could feasibly be implemented in the next 5 to 10 years.[1]

[1] Unless otherwise noted, the technology descriptions in this section are based on: Kittelson & Associates, Inc., Bluemac Analytics, and Irwin Writing/Editing. 2019. *NCHRP Research Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation.* Transportation Research Board of the National Academies, Washington, DC.

INTELLIGENT TRANSPORTATION SYSTEMS & DATA SHARING

Intelligent Transportation Systems (ITS) integrate advanced communications technologies into vehicles and existing infrastructure to improve operations, efficiency, reliability, and safety for all modes. This information can be used to increase the efficiency and productivity of the existing roadway infrastructure. It is also critical to help manage the response to a major incident or disaster. For **freight operations**, real-time traffic information also provides valuable information about traffic conditions for route planning and logistics, system performance monitoring, and parking.

Implementing existing and new roadside transportation technologies needs to consider the regulatory environment. The Washington State Legislature has limited the use of roadside camera technology to only capturing license plates to identify vehicles, for uses such as toll enforcement, red light violations at intersections, and speed enforcement in school zones and work zones. Any expanded or different use of the technologies must be authorized in statute. This is also true for the use of application-based technology that gathers personal information. For example, using technology to detect who may be driving a vehicle or the number of occupants in a vehicle must be authorized by statute. Washington has a history of permitting technology pilot projects for use on certain transportation facilities. For example, under RCW 46.63.170, pilot projects are permitted to use automated safety cameras to detect certain traffic violations in some communities.

Existing Regional ITS Plans

The existing smart infrastructure in the Spokane region includes ITS devices, operating systems, and regional connectivity through the Spokane Regional Transportation Management Center (SRTMC). The SRTMC is mostly funded and staffed by WSDOT with other funding provided by SRTC and its member agencies. It is governed by an Executive Board and an Operations Board which is comprised of professional representatives from the City of Spokane, City of Spokane Valley, Spokane County, Spokane Transit Authority, Spokane Regional Transportation Council as an ex-officio, and WSDOT. The main purpose of the boards is to oversee the management and operation of transportation facilities within Spokane County for mutual public benefit.

The *SRTMC ITS Architecture Plan* was first developed in 2000, and was updated in 2007, 2013, and most recently in 2019. The goal of each plan has been to coordinate and prioritize ITS project planning among the six partnering agencies within the Spokane region, thereby improving the ability to leverage federal funds, fulfill federal requirements, and aid in the consideration of new and advanced technologies. **Figure 1** shows an excerpt of the 2019 plan update showing the ITS device locations throughout the region. In 2019, SRTMC completed the *Spokane Region ITS Project Implementation Plan*, outlining regional projects and investment objectives.

The SRTMC prepared a Concept of Operations (ConOps) for the advanced traffic management system (ATMS) replacement in 2015. The City of Spokane completed the ConOps prior to implementing upgrades

to the TACTICs software and has participated in each *SRTMC ITS Architecture Plan* update. The City of Spokane Valley developed an *ITS Strategic Implementation Plan* in 2011 and has made updates to the plan since, through coordination with the *SRTMC ITS Architecture Plan*. WSDOT prepared the *Eastern Washington ITS Implementation Plan* in 2007, which coincided with the *SRTMC ITS Architecture Plan* update from 2007.

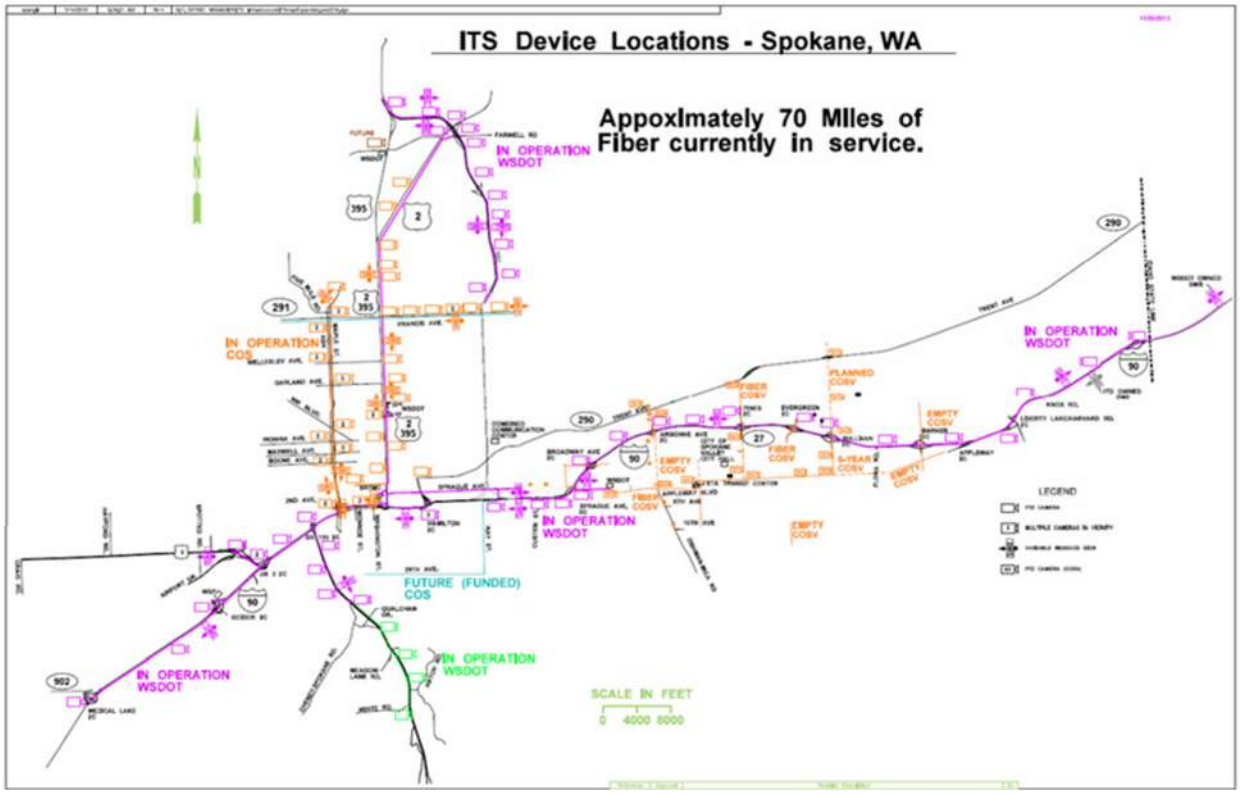

Figure 1. ITS Device Locations (Source: 2019 SRTMC ITS Architecture Plan)

Existing ITS Infrastructure

Existing ITS devices deployed within the Spokane region include advanced traffic signal equipment, closed-circuit television cameras, dynamic and variable message signs, arterial and freeway traffic measuring devices, highway advisory radios (HARs), weather stations, freeway ramp meters, and trail detection devices. The ITS devices are connected to each other, and to local agency operations centers, using fiber optic lines, copper wires, and radios. A summary of the devices by agency is provided below:

Advanced Traffic Signal Equipment – Advanced traffic signal equipment is used to improve traffic flow, reduce travel delays, and increase safety. For example, intelligent traffic signals use traffic data to create a dynamic time schedule to maximize the flow of traffic during peak hours. WSDOT and the City of Spokane Valley collaborated on a pilot project utilizing Smartlink, a MioVision device, to gather realtime data that was used to significantly reduce the number of timing plans used throughout the weekday and weekend,

adjust traffic signal offsets, and adjust the green times, Smartlink was coordinated with the MioVision devices that WSDOT installed at the Argonne/I-90 interchange and the system worked together to improve the traffic flow of Argonne Road between Trent Avenue and Mission Avenue.

The region includes over 200 connected traffic signals that house advanced traffic controllers with smart detection and are connected through traffic signal radios, fiber optic, and copper wire connections. The City of Spokane has several connected corridors, including:

- Division/Ruby Couplet
- Monroe Street
- Maple/Ash Couplet
- Hamilton Street
- Freya Street
- Sprague Avenue
- Francis Avenue
- Downtown street network

The City of Spokane Valley has coordinated corridors along:

- Appleway/Sprague Couplet
- Argonne/Mullan Couplet
- Sprague Avenue
- Sullivan Road
- Evergreen Road
- Pines Road
- Indiana Avenue
- Dishman Mica Road

The City of Millwood, who contracts with Spokane County to maintain their traffic signal system, has coordinated signals along Argonne Road. The City of Liberty Lake has a coordinated signal system along Liberty Lake Road. This is a relatively small portion of the overall number of (non-connected) signals in the region. Two (2) separate central system software platforms are used in the region, including TACTICS and MaxTime, both of which are connected to the SRTMC. **Table 1** summarizes the advanced traffic signal equipment within the region.

Table 1. Advanced Traffic Signal Equipment in Region

Regional Partner	Connected Signals	Central Signal System	Emergency Pre-emption	Transit Signal Priority	Detection Types
City of Spokane	<100	Tactics	Yes	Yes, Downtown corridor	Loops, Video, Radar
City of Spokane Valley	59	MaxTime	Yes	No	Loops, Video, Radar
WSDOT	<50	MaxTime	Yes	No	Loops, Video, Radar
Spokane County	>10	MaxTime / Kinetics	Yes	No	Loops, Radar

Closed Circuit Television Cameras – The region includes approximately 126 closed circuit television (CCTV) cameras which are connected to the SRTMC. The SRTMC hosts a webpage, open and viewable to the public, which provides access to camera images. The SRTMC operators coordinated with agency staff to develop preset camera views during hours of operation. **Table 2** summarizes the CCTV equipment.

Table 2. CCTV Equipment in Region (as of 7/29/2024)

Regional Partner	CCTV
City of Spokane	49*
City of Spokane Valley	17
WSDOT	60*
Spokane County	0

**The number of cameras have been estimated using information from publicly available information on the SRTMC website and through collaboration with local agencies.*

Additional ITS Devices – In addition to advanced traffic signal equipment and CCTV devices, the region has deployed the following ITS devices:

- Arterial and freeway traffic measuring devices
- Beacon devices – Pedestrian hybrid beacons, school zone beacons, rectangular rapid flashing beacons (RRFBs)
- Highway Advisory Radios (HARs)
- Radar speed feedback signs
- Ramp meters
- Variable Message Signs (VMS) and dynamic message boards
- Weather stations
- Trail detection devices (counters)
- Dynamic parking system (SIA and City of Spokane)

The region has communication connections with the Idaho Transportation Department (ITD) and with local and regional emergency services for incident response coordination. The SRTMC also has a key role with winter maintenance operations.

Potential Future ITS Applications

The SRTMC, ITD, and local municipalities can continue to integrate ITS into the regional traffic management and communications networks to improve travel demand management and to prepare the region for future smart mobility solutions. Key opportunities include:

- **Transit Signal Priority (TSP) Implementation** – Continue coordinating with STA and agency partners to implement TSP along priority transit routes.
- **Ramp Metering Implementation** – Continue expanding the ramp metering system along I-90 and the NSC. Install underground conduit with any new ramp construction or modification.
- **Smart Work Zones** – Implement smart work zones along high traffic corridors to alert the traveling public of delays, reducing the potential for work zone crashes.
- **Traffic Signal Coordination** – Continue expanding signal coordination along connected corridors to reduce delay, emissions, and crashes.
- **Fiber Optic Network Expansion** – Continue expanding the connectivity and redundancy of the region's fiber optic network through installation of fiber optic lines aligning with the Regional ITS Architecture Plan.
- **Regionwide Device Upgrades** – Upgrade existing CCTV cameras to internet-based IP cameras. Calibrate or replace traffic signal detectors and program signal controllers to collect high-resolution data.
- **Emergency and Event Management** – Allow for collaboration between the SRTMC and emergency operations centers to alert and guide the traveling public using ITS field devices during major events, emergencies, or weather scenarios. Create action timing plans for key corridors that can be implemented by SRTMC staff.
- **Dynamic Parking Systems** – Implement and maintain dynamic parking systems at public parking lots and garages in regional activity centers to provide real-time parking availability information. Coordinate with STA for implementation at park-and-rides.
- **Curb Management Data** – Measure curb and loading zone demand in urban areas to help agencies develop curb management strategies, such as dynamic parking fees, dynamic curb assignment, and off-peak delivery times to address the increasing demands for curb access.
- **Variable Speed Limits & Dynamic Advisory Speeds** – Implement variable and dynamic speed limit equipment along congested highway corridors and I-90. Allow for use during congested periods of the day and during weather events to reduce crashes.

BROADBAND

Communication is the backbone of smart mobility. As more transportation technologies and traffic management strategies rely on data and information sharing, building a robust communication network is critical to future-proof technology investments. The term *broadband* commonly refers to high-speed Internet access that is always on and faster than traditional access. Broadband includes high-speed transmission technologies, such as fiber, wireless, satellite, digital subscriber line, and cable. Broadband infrastructure supports the implementation of ITS, including connected and automated vehicles.

Existing Broadband Infrastructure

The region has over 70 miles of fiber optic lines with the ITS fiber backbone located along I-90.

- The City of Spokane provides an east-west redundant fiber loop along the eastern city limits through Sprague Avenue fiber and in the heart of the city through Maple Street fiber.
- WSDOT is providing a redundant north-south fiber loop along the North Spokane Corridor (NSC) with planned connection into the I-90 fiber backbone.
- The City of Spokane Valley provides an east-west redundant loop through the city using the Sullivan Road and Sprague Avenue fiber, which connects into the I-90 backbone at the respective interchanges.

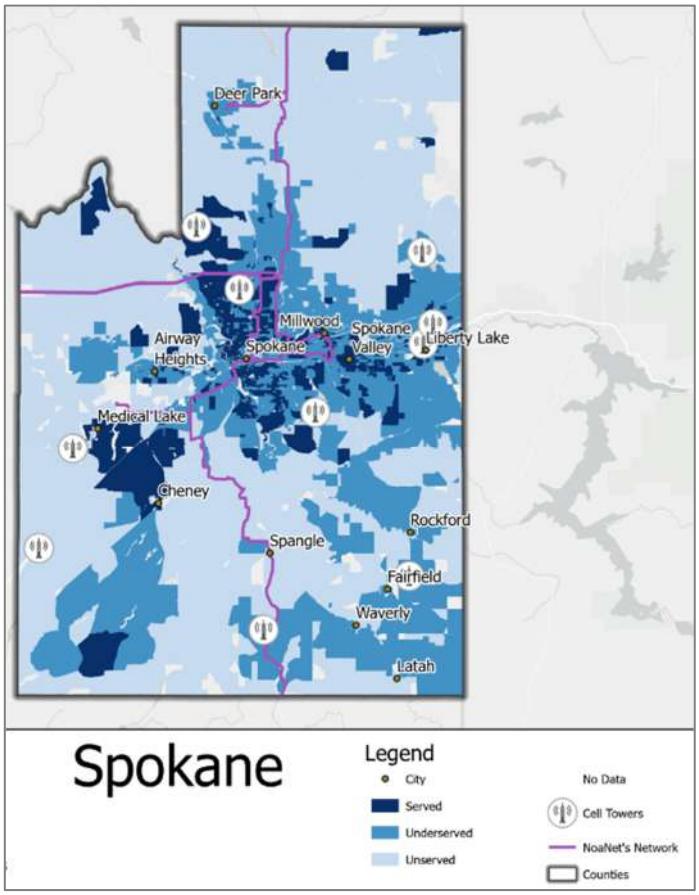

Figure 2. Broadband Hard Assets (Source: BEAD Plan)

The Washington State Department of Commerce Internet For All In Washington, Five-Year Action Plan, Broadband Equity, Access, and Deployment Plan (BEAD Plan) identified the following barriers to expanding broadband in Spokane County:

- Lack of funding to construct additional capacity.
- Low population density creates high cost per passing in rural areas, escalated cost of materials and scarcity of workforce for projects, pole contact fees/make ready fees, insurance costs, cost to complete applications, ability for public entities to have match funds, cost of tower site leases, and cost to prepare grant applications for small towns.

WSDOT has developed 'dig once' policies. Under RCW 47.44.160, WSDOT will proactively provide broadband facility owners with information about planned state highway project opportunities for the installation of broadband facilities. If no owners are ready or able to participate in coordination of the installation of broadband infrastructure concurrently with state highway projects, WSDOT can have its own contractors install broadband conduit as part of road construction projects that directly benefit the transportation system and motor vehicle users. The benefits of the 'dig once' policy include:

- Maximizing efficiencies of the highway right of way.
- Reducing costs to install conduit and fiber.
- Minimizing disruptions to the travelling public.
- Reducing the number of excavations within the highway right of way.

To preserve and expand public broadband infrastructure in Spokane County, the Spokane County Commissioners established the Spokane Regional Broadband Development Authority (Broadlinc) in 2022. Its charge is to coordinate with local governments, tribes, public and private entities, nonprofit organizations, and consumer-owned and investor-owned utilities to develop strategies and plans promoting development of broadband infrastructure and greater broadband access.

Potential Broadband Expansion

Broadband integration relies on understanding existing infrastructure and agency needs, while also forecasting future demand. Additional broadband deployment will be required to increase technological capabilities. Key opportunities include:

- **Provide access to ROW** – Allow access for broadband providers to help build the broadband backbone. Broadband is considered a utility (RCW 54.16.330) and agencies can enter into franchise agreements (RCW47.44.160 and RCW 35A.47.040) or permit the utility (RCW 35A.47.040) to be within the ROW.
- **Share resources** – Promote and expand "Dig Once" by installing conduit during transportation construction projects, share excess capacity, and expand capacity by permitting or leasing conduit and fiber.
- **Assist statewide broadband initiatives** – Support the State's effort to expand broadband infrastructure.
- **Deploy last-mile and middle-mile broadband infrastructure** – Provide "future-proofed" broadband service to support ITS applications and benefit underserved communities and rural areas.
- **Develop regional database of broadband infrastructure** – Facilitate resource sharing and deployment.

SHARED-USE MOBILITY

Shared-use mobility options provide shared vehicular opportunities that are available for reservation and use on an as-needed basis. The primary characteristic differentiating shared-use mobility options from public transportation systems is their ability to be used on-demand. Shared-use mobility provides more transportation opportunities and reduces reliance on single-occupancy vehicle use, which could reduce transportation carbon emissions. Shared-use mobility options can also help improve access to transportation disadvantaged communities by providing first-and-last mile solutions. Together, these impacts can promote a positive impact on community members through the expansion of transportation options, increasing the radius of opportunities for all.

Existing Shared-Use Mobility Applications

Spokane has active shared-use mobility providers offering scooter share, bike share, rideshare, carshare, and ridehail from transportation network companies (TNC's) like Uber and Lyft. The *Spokane Sustainability Action Plan* (SSAP) includes a goal that shared-used mobility will help reduce transportation carbon emissions. Washington law offers tax credits to employers that give employees financial incentives for using car sharing and other transportation options.

The viability of **scooter and bike share** in the City of Spokane has been affirmed through two prior short-term pilot programs.[2] The average trips per day in previous years was 1,300 with more than 1.6 million trips since 2019. On June 3rd, 2024, the City of Spokane renewed a two-year contract with Lime, a scooter and bike rental agency, to allow the use of at least 500 units (450 scooters, 50 bikes) with a maximum of 1,500 units. There are currently 1,500 units deployed. Under the contract, Lime will pay the city $17,000 per year with an additional charge of 75 cents per vehicle, per day. In 2022 and 2023, the service provided $376,000 in revenue.[3] The contract includes:

- An emphasis on proper parking.
- Phasing in camera-based sidewalk-riding detection to reduce conflicts with pedestrians.
- Improved river retrieval (The batteries used for electric bike performance are waterproof by Lime's standards, but the City of Spokane is concerned with water-induced lithium-ion battery corrosion.[4]).
- Distributing at least 10 percent of the fleet in underserved areas to address equity.
- Testing a limited number of seated scooters.

Another mode of shared-use mobility is "**Rideshare**." Previously known as "VanPool," Spokane Transit Authority (STA) operates a fleet of vehicles designated for sharing rides amongst commuters who share similar routes. Rather than paying for each individual ride, STA charges a monthly flat rate fee depending

[2] Spokane Shared Mobility Study Final Recommendations (spokanecity.org)
[3] City Council Approves Contract with Lime as Scooter Vendor - City of Spokane, Washington (spokanecity.org)
[4] Lime Scooters Returning to Spokane on Vimeo

on the area of travel.[5] The Rideshare program provides a website finder tool to coordinate commuting groups and schedules.

Carshare is also available. Different from "Rideshare," the carshare model positions car rental stations in central locations, then allows for their short-term rental like that of scooter and bike share. Users pay an hourly fee to use the rental car and drive it as needed until returning it to its "home base." A carshare model was most recently implemented on Gonzaga University's campus in June 2024. The program uses electric vehicles from ZEV Co-op; an organization committed to zero emissions and a recipient of funding from the Washington State Department of Transportation's Zero Emission Access Program (ZAP).[6] The cars were first implemented in the Puget Sound region and expanded to seven locations since 2021. Electric vehicle charging stations were installed at the parking stations on Gonzaga's campus for charging between rentals.

Shared-use mobility is also exemplified through **ridehail** service by **transportation network companies (TNCs)**, such as Uber and Lyft. Similar to a taxi service, the user virtually hails a driver from their phone. A registered driver picks up users where they are and delivers them exactly where they need to go. Rates vary depending on the length of trip and time of day. Due to the proprietary nature of TNCs, ridership and vehicle-miles-travelled data for the Spokane region are not available.

Potential Future Shared-Use Mobility Applications

- **Mobility hubs** provide neighborhood-based access to mobility services. Mobility hubs can be located at major transit stops or centers, for example, and provide access to shared mobility options that support last-mile connections from transit. They also provide a central location for accessing mobility options for people not making transit trips. Mobility hubs can also provide space for ancillary services such as storage lockers for receiving deliveries, minimarts, daycare, dry cleaners, etc. that help people perform multiple errands in one trip. **Neighborhood logistics hubs** can also be co-located with a mobility hub to provide a central location for receiving parcel deliveries that can then be distributed over the last mile using non-truck modes such as cargo e-bikes, sidewalk delivery bots, or drones.
- **Mobility as a service (MaaS)** integrates various transportation-related services into a single, comprehensive, and on-demand mobility service. MaaS offers end users the ability to access multiple mobility options through a single trip-planning application and payment method (instead of multiple ticketing and payment operations). This can come in the form of either a subscription or pay-as-you-go model. Spokane Transit Authority's (STA's) *Connect* fare system allows for contactless payment, online fare management, and fare capping for both transit and paratransit riders. Physical cards and virtual eConnect cards are available. A potential future regional MaaS application could integrate STA's *Connect* fare system with shared-use mobility applications, such as e-bike/e-scooter rentals or connections to transit via ridehail services.

[5] Rideshare - Spokane Transit Authority
[6] Sustainability Office Partners on Electric Car Sharing Program | Gonzaga University

- **Robotaxi or driverless ridehail services** are a new shared-use application being tested in a few markets across the US. Companies like Waymo and Cruise are currently testing in San Francisco, Los Angeles, Phoenix, and Austin. May Mobility, Zoox, Volkswagen, and Tesla are also developing robotaxi models. The robotaxi companies are focusing their initial deployments on cities that have large market demand for ridehail and states that have welcoming legislation. It is unlikely that robotaxis will be widely available in the Spokane region within the 25-year SRTC MTP planning horizon. However, SRTC should monitor this rapidly evolving technology. New service models and new service providers could change the likelihood of robotaxi service coming to the region. A later section discusses more general connected and automated vehicle applications.

ELECTRIC VEHICLES & INFRASTRUCTURE

Electric vehicles (EVs) offer the potential to greatly reduce the amount of greenhouse gases and other pollutants produced by the transportation system. Expanding charging infrastructure is essential for fostering widespread EV adoption and addressing the charging needs of diverse demographics, including those without access to home charging options. There are a variety of federal and state laws as well as incentive programs related to electric vehicles and electric charging infrastructure.[7] Key initiatives include:

- In 2020, the Washington state legislature passed the *Motor Vehicle Emission Standards – Zero Emission Vehicles* law. The law requires the state to adopt California's vehicle emission standards, including requirements to gradually increase the sale of new zero-emission vehicles (ZEVs) and phase out sale of non-ZEVs by 2035.[8]
- A Transportation Electrification Strategy was adopted by the state in November 2023 which identifies strategies to meet established targets, ensure market and infrastructure readiness, and decarbonize the majority of the transportation system including setting a target for all new passenger vehicle sales to be electric by the year 2030.
- The *Washington State Plan for Electric Vehicle Infrastructure Deployment* (July 2023) is a blueprint for the planning and implementation of a network of charging stations along state highways.
- The 2021 State energy code that went into effect on March 15, 2024, requires that new dwelling units with attached private garages or attached private carports have a dedicated circuit for EV charging that terminates in a junction box, outlet, or charging station.[9] This level of installation is often referred to as "EV ready." State building code defines dwelling unit as "a single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation."[10] Additionally, the Revised Code of Washington (RCW) 19.27.540(2) (a) requires EV charging capability at all new buildings that provide on-site parking at a rate of at least one parking space or 10% of required parking spaces, with wiring or raceway sized to accommodate 208/240 V, 40-amp or equivalent EV charging.

[7] Alternative Fuels Data Center, U.S. Department of Energy.
[8] Zero-Emission Vehicles, Washington Department of Ecology.
[9] https://app.leg.wa.gov/WAc/default.aspx?cite=51-51-0309
[10] https://up.codes/viewer/washington/wa-building-code-2021/chapter/2/definitions#2

- Electrical rooms must be sized to accommodate the potential for electrical equipment/distribution to serve a minimum of 20% of the total parking spaces with 208/240 V 40-amp or equivalent.
- The greater of one parking space or 10% of accessible parking spaces must be provided with Electric Vehicle Charging Infrastructure (may also serve adjacent parking spaces not designated as accessible parking).

Existing EV Applications

- Gonzaga's ZEV Co-op carshare service is a great example of electric smart mobility in the region today. Charging stations were installed on the university's campus to serve the charging needs of these shared EVs.
- SRTC in partnership with Avista and local jurisdictions in Spokane County received a $2,500,000 grant from the Washington State Department of Commerce to install EVSE around the region. SRTC, Avista, and WSDOT worked with local stakeholders and community partners to develop a strategic buildout plan for over 100 charging sites by 2025 to establish a backbone of charging infrastructure along major travel corridors and within higher population centers. The strategic buildout plan is being updated as part of this effort and is included in Appendix D.
- For more than a decade, STA has been working toward transitioning to a battery electric bus (BEB) fleet, while continuing to monitor emerging technologies. STA acquired approximately ten BEBs in 2020 and 2021 and now has 40 BEBs in the STA fleet. STA outfitted its Boone Northwest Garage for BEB overnight charging and has placed on-route charging equipment at Moran Station and SCC Transit Center to recharge buses while they are in operation.[11] STA has hit a ceiling of electric grid capacity at its garage facilities, limiting the ability to further electrify its fleet. Grid capacity must be addressed within its current facilities before STA can see growth in its share of BEBs. STA adopted a Zero-Emission Bus Fleet Transition Plan in June 2024. Zero-emission technologies considered include both BEBs and hydrogen fuel cell-electric buses (FCEBs).
- The City of Spokane has a fleet transition plan, the *Spokane Green Fleet Playbook* (2022), that serves as a guide for investments in zero emission vehicles and charging stations.
- The US Postal Service is working to transition its fleet to battery electric and is expected to become one of the largest EV fleets in the nation by 2028. In addition, the state has authorized support for the replacement of diesel school buses with electric buses.

Potential EV Applications

Demand for shared electric vehicles is expected to increase as rideshare, carshare, rental car, and ridehail service models adopt more EVs. Jurisdictions should plan for the charging needs of automobiles and trucks as well as for micromobility devices, such as e-bikes and e-scooters. **Freight electrification** is closer to full

[11] https://www.spokanetransit.com/wp-content/uploads/2023/05/20230508-STA-Electric-Buses-Fact-Sheet.pdf

deployment than automation's pilot testing, but freight electrification still faces significant barriers. Fleets like Amazon are purchasing and deploying smaller electric vehicles for their goods delivery services in urban areas. Battery electric truck tractor implementation has not progressed as quickly. Their adoption is limited by lack of charging facilities, greater up-front costs, and reduced load-carrying capacity due to greater vehicle weight. Electrification of freight vehicles is likely to support truck automation as electrification of vehicles reduces some complexities for automated steering and acceleration.

Local governments play an important role in preparing for EVs by establishing policies, regulations, and guidance for electric vehicle supply equipment to both regulate and incentivize their installation to achieve community goals. Utilities play a role in understanding and planning for increased loads on the electric grid that will come with greater adoption of EVs among individuals and fleets. The EV Charging Needs Update memo (Appendix D) provides detailed guidance on planning for the future EV charging needs in the region. Key steps to support other smart mobility technologies include:

- **Community charging hubs**. Provide high-speed Level 2 or lower speed fast charging at locations that are central to the neighborhood. The location—often referred to as a hub or depot—would have multiple charging ports so that several people can charge simultaneously. These hubs may also include solar panels and battery energy storage to minimize the demand for grid electricity. As a bonus, they can double as a community resiliency center to provide power during a long-duration outage.
- **Curbside charging pilot**. Consider piloting curbside charging, including chargers attached to streetlights or other poles, to address charging gaps by increasing the locations where consumers can charge. Newer applications integrate charging and parking fees into one payment.

CONNECTED AND AUTOMATED VEHICLES

Connected vehicles and automated vehicles are likely to become available within the MTP's planning horizon.

Connected vehicles (CVs) can send and receive information to and from roadside infrastructure, traffic management centers, and/or other vehicles.

- ***Vehicle-to-infrastructure (V2I)*** communication allows vehicles to wirelessly share information between themselves and connected road infrastructure to enhance safety, efficiency, and mobility.
    - Examples of this technology at work are traffic signal priority systems and connected traffic light information.
    - Traffic signal priority systems are used to reduce delays for transit, freight, and emergency vehicles. Transit signal priority (TSP) is the most widely implemented connected vehicle application. Traditionally, agencies have used older communication technologies, and some are upgrading those legacy systems to new cellular communication devices.

  - Connected traffic light information is currently available on certain car models (e.g., Audi, BMW) in certain cities along certain corridors. The vehicle will display signal information to the driver including time remaining until a red light turns green or the suggested driving speed to arrive at the next traffic signal on the green phase.[12]

- ***Vehicle-to-vehicle*** **(V2V) communication** allows vehicles to exchange data on speed, location, and direction with each other wirelessly and in real-time. This communication has the potential to allow vehicles that are both connected and automated to safely form closely spaced vehicle platoons, which could increase road capacity.

Industry is working to develop cellular communications alternatives to replace legacy CV communication systems. Some vehicles can communicate wirelessly today, such as receiving real-time navigation updates. Despite CV communications being tested since the 1980s, communication between vehicles of different makes or models is not yet common.

Automated vehicles (AVs) are capable of self-driving in specific situations (e.g., freeway driving) without any intervention from a human driver. AVs function by gathering information from a variety of sensors:

- Cameras
- RADAR (Radio detection and ranging)
- LiDAR (Light detection and ranging)
- Ultrasonic
- Infrared

Vehicles that are both connected and automated (**connected and automated vehicles, or CAVs**) could impact travel behavior, land use, and infrastructure needs, so agencies need to plan for future scenarios with multiple impacts from these systems. Researchers have postulated different future scenarios in which AV technology has been deployed, with different outcomes. For example, in one scenario, most AVs are owned by ridesharing companies, with private car ownership falling; transit usage could decrease (if ridesharing is used for both long- and short-distance trips) or increase (if ridesharing serves primarily as a first-/last-mile access mode to and from transit). In another scenario, individually owned human-driven vehicles are gradually replaced with automated vehicles. In this scenario, vehicle miles traveled (VMT) could increase because people may choose to live farther away from where they work and socialize when they can use in-vehicle time for something other than driving the vehicle. In addition, automation opens the door to zero-occupancy vehicle trips, where the vehicle returns home empty to park or to serve another family member after dropping someone else off at their destination.

Automated trucks have been involved in pilot testing projects under high levels of review (such as Aurora Innovation hauling freight on Interstate 45 between Dallas and Houston with 20 driverless trucks, and TuSimple hauling freight between freight depots in Phoenix, and Tucson). Deployment of automated vehicles outside of test projects has moved slower than predicted. While advanced driver assistance systems, such as lane keeping assist, are being introduced in new vehicles, the industry remains far from

[12] Audi. Audi brings Traffic Light Information to Los Angeles, New York, and San Francisco. 2021. https://media.audiusa.com/en-us/releases/485, accessed May 13, 2024.

introducing a fully automated truck that does not need driver support. The **freight industry** is also looking for ways to reduce costs of the complex and expensive "last-mile" of deliveries, and they are turning to automation. For example, multiple companies are testing last mile deliveries with drones and personal delivery devices or PDDs (also called sidewalk delivery robots). Some delivery service companies like UPS are pilot testing unmanned aerial vehicles (UAVs or drones) for light-weight, last-mile parcel deliveries. These delivery pilots have shown potential in rural areas with underdeveloped roadway networks like Zipline's on-demand drone delivery service in Rwanda and Ghana, which delivered plasma, vaccines, and personal protective equipment during the pandemic. In Scottsdale, Arizona, Kroger tested grocery delivery pods through a partnership with Nuro. FedEx is testing Roxo, their package carrying PDD. Delivery drones and PDDs are not expected to replace long-distance or regional truck routes, but they may become an alternative mode for last-mile deliveries. Automated parcel delivery infrastructure requirements may include vertiports, smart locker systems, or alternative delivery bins.

Existing CAV Applications, Guidance, and Legislation

Washington's Autonomous Vehicle Self-Certification Program was established in 2018 with *Executive Order 17-02* and has authority to issue licensing for the testing of AVs throughout the State. At the same time, the State Legislature passed legislation to establish an Autonomous Vehicle Working Group to develop recommendations to support the safe operation of AVs on public roadways, which released a final report in 2023.[13] Though the report included a few recommendations that specifically related to AV policy and legislation, no new legislation has been passed since 2017.[14] The Manual on Uniform Traffic Control Devices (MUTCD), 11th Edition, Part 5 addresses traffic control devices that are specifically designed to accommodate AVs.

Low levels of automation are available on some vehicles today. For example, automatic emergency braking systems apply the brakes to avoid a rear-end crash even if the driver doesn't hit the brake pedal. Lane centering systems adjust the vehicle's heading to stay in the center of the lane without the driver having to do the steering.

Higher levels of automation are being researched and tested for passenger and freight vehicles, like robotaxis and automated trucks. As of September 2024, three companies have self-certified to operate AVs in the state—NVIDIA Corporation, Waymo LLC, and Zoox, Inc.[15] There are no fully automated vehicles currently operating in the Spokane region. There are also no automated sidewalk delivery bots or aerial drones for package delivery operating in Spokane.

Agencies cannot control how fast vehicle-to-vehicle technology will develop, but they can implement vehicle-to-infrastructure systems. CV systems rely on a robust communications foundation, such as a fiber optic network that connects devices to each other and to cloud-based networks. Agencies should prioritize

[13] Washington State Transportation Commission, Roadmap to the Future: Autonomous Vehicle Working Group, 2023.
[14] National Conference of State Legislatures, Autonomous Vehicles Legislation Database, May 23, 2024.
[15] https://dol.wa.gov/vehicles-and-boats/vehicle-registration/register-other-vehicles-and-other-services/registering-autonomous-vehicles

which corridors will be their "smart" corridors so they can begin building the communication backbone to support ITS, CV, and AV solutions along those corridors.

Potential Future CAV Applications

Connected or highly automated vehicles could come to the region's freeways or arterials during the MTP's planning horizon. Other potential future **freight AV applications** include automated sidewalk delivery bots and aerial drones for small package delivery.

- **Automated sidewalk delivery bots**, already in use in selected locations in the U.S., can provide last-mile home and office deliveries from neighborhood logistics hubs. They can also be used to deliver goods, such as take-out food or prescription medicine, from neighborhood businesses. Automated sidewalk delivery bots require good sidewalk infrastructure that is connected by curb cuts and ramps.
- **Uncrewed aerial vehicles (UAVs or drones)** can deliver small, lightweight (e.g., under 15 pounds) parcels within a relatively small radius (e.g., 1 mile) of their base. Systems currently being tested are operated remotely by a pilot but have the potential to be automated in the future. Drones offer the potential to reduce pressure on curbside space by moving some freight deliveries off roadways.

When AVs are tested, the local streets and surrounding land uses directly experience the impacts—which is why the region needs to proactively monitor and plan for potential impacts before they arrive. Early implementers of AVs need to address the challenges of a mixed-fleet environment and to consider the needs of both human and machine-driven road users. Fortunately, AVs need many of the same infrastructure improvements that human drivers need: clear signage and pavement markings, smooth roadways surfaces, and traffic control devices. Actions agencies should take to prepare for future CAV applications include:

- **Identify and prioritize "smart" corridors.** Determine which roadway corridors to prioritize for smart infrastructure investments (such as broadband, ITS infrastructure, etc.) consistent with SRTMC plans. Focus asset management upgrades needed to support smart mobility on these corridors, rather than taking a piecemeal approach across the region. Interagency coordination along these corridors is critical to efficiently support smart mobility.
- **Maintain your existing infrastructure.** Human drivers and AVs both benefit from clear striping and signage and smooth roadway surfaces. Ensure the roadway environment stays consistent and visible to benefit both human drivers and vehicle sensors. Develop asset management policies to build a foundation for consistency and to determine when asset maintenance or replacement is needed.
- **Upgrade traffic control devices (TCDs) and roadside infrastructure.** Continue to improve visibility of TCDs to support detection and interpretation by human drivers, CVs, and AVs. Size, color, location, orientation, refresh rate, reflectivity, and content are all factors that affect TCD recognition and processing.
- **Follow new guidance on AV implementation.** The MUTCD 11th Edition Part 5 currently provides guidance on roadway infrastructure design and maintenance to support AVs. Coordinate with

Washington State and Idaho Departments of Transportation to learn how this guidance is being implemented at the state level, as well as with SRTC member agencies at the local level.

- **Invest in ITS to support CVs and to enhance AV performance**. Implement CV technology to support enhanced decision making for human drivers and CV/AV systems. For example, sharing signal phasing and timing (SPaT) data can improve intersection crash safety by assisting vehicles in navigating the dilemma zone of a signalized intersection. Transit signal priority (TSP) can enhance mobility by keeping transit vehicles on schedule along priority routes.
- **Proactively plan for AV land use impacts.** CAVs could impact travel behavior by altering monetary and time cost of travel and by providing an additional travel mode option. These changes have the potential to both benefit and harm the transportation system. For example, people may live farther from where they work increasing vehicle miles traveled. AVs could also reduce parking demand but again increase vehicle miles traveled due to zero-occupancy trips. AVs can also reduce the distance between vehicles which increases roadway capacity. Consider these potential impacts when planning for future land use so the impacts align with the region's vision for mobility and transportation.
- **Plan for EV infrastructure to support AV deployment.** AVs might also be EVs. Provide comprehensive EV infrastructure to enhance AV operation and mobility.
- **Update a connected roadway classification system (CRCS).** Develop or implement an existing CRCS to monitor where assets may need the most work to support CVs and AVs. This information can be combined with other data points to help prioritize locations for maintenance and upgrades.
- **Monitor industry trends and deployments.** Stay up to date on lessons learned published by other agencies who have conducted CV/AV deployments. Monitor travel behavior patterns and demand for curbspace to determine if roadway, sidewalk, or loading zone design changes are needed to safely support AV operations and pick-ups/drop-offs.

Recommended Smart Mobility Applications and Strategies to Address Regional Needs

Technology is a tool that can help SRTC and its partner agencies address mobility challenges, supply new means of accessibility, improve the safety and equity of the transportation system, and support resiliency. As SRTC and local agencies consider potential innovative technology solutions, they can prioritize projects based on their effectiveness in addressing regional needs. To determine how feasible a technology is, agencies can ask these questions:

- What problem are you trying to solve? Does the technology application solve your problem?
- What are the potential benefits and limitations?
- Is it "achievable" in the short term (1 – 5 years)?
- Will it require a high level of effort and resources from staff?
- Will it be supported by the public and key decision-makers?
- Is there a sustainable funding source?
- Can this be a sustainable deployment or is it better as a pilot project?

Table 3 summarizes the recommended Smart mobility applications and the strategies and actions that can be taken to implement them. This is based on current understanding of best practices and the state of the industry. Agencies should stay active by monitoring other potential applications not listed in this table, learning from other deployments, and determining what new applications are likely to come to the region in the future.

Table 3. Recommended Smart Mobility Applications and Strategies

Application	Strategies and Actions	Implementation Time Frame
Asset Management – Applicable to All Applications	• Inventory, maintain, and upgrade existing roadway infrastructure, including roadside devices.	Ongoing

Identify "Smart" Corridors	• Identify and prioritize "smart" corridors to focus investments (such as broadband, ITS infrastructure, and Advanced Traffic Signal Equipment), and coordinate between agencies along these corridors. For consideration:
	  • U district: Dynamic parking/loading zones, EV curbside charging pilot, multi-modal smart items such as bike detection, bike boxes, and LPI at signals.
	  • North Bank Sports/Downtown: Dynamic parking/loading zones during events.
	  • Downtown: TSP (additional corridors), LPI at signals, dynamic parking/loading zones, additional green lane bike corridors and bicycle enhancements/detection at signals.
	  • I-90, from US 2 to Sprague Avenue, and North/South Corridor (when complete): Dynamic signs, variable speed limits, ramp metering, queue warning systems, high congestion monitoring/warning, shoulder running (east of Hamilton Street).
	  • US 2 from Fairchild to Sunset Highway: Variable speed limit, signal/corridor timing/enhancements, TSP, transit enhancements.
	  • Sunset Highway: Variable speed limit, signal/corridor timing/enhancements, TSP, transit enhancements.
	  • High-injury crash intersections: Near-miss analysis
		1-5

Data collection, Monitoring, and Sharing	• Collect baseline data today to monitor impacts as new smart mobility applications are implemented in the region. • Collect and share system performance data with local agencies and develop applications to monitor trends toward performance objectives. • Maintain and track progress of smart mobility infrastructure data over time, such as miles of fiber and number of connected signals.	1-5

Application	Strategies and Actions	Implementation Time Frame
Expand Broadband and Fiber Optic Network to Support ITS	• Adopt a local "Dig Once" policy. • Provide broadband providers with access to ROW. • Coordinate with WSDOT to expand the network. • Update the SRTMC ITS Architecture Plan on a regular cycle including identification of shorter and longer term ITS investment needs and objectives. • Use the expanded network to implement supporting technologies such as IP-based CCTVs, HARs, RSUs, ramp meters, radar speed feedback signs, beacon devices, cloud technology, smart work zone devices, emergency management alert systems, detection data, traffic measuring devices, and weather stations to support regional goals. • Implement a checklist review of project submittals to SRTC programs to ensure compliance with regional ITS objectives. This could be integrated with SRTC's Complete Streets review processes. • Consider SRTC Board policy to establish investment guidance to ensure supportive broadband/fiber infrastructure are integrated into SRTC-funded projects. • Ensure the network is expanded in such a way that it supports equitable access to traditionally underserved populations. • Coordinate across the region, including with Broadlinc, to develop and maintain a regional database of broadband infrastructure.	1-5
Advanced Traffic Signal Equipment	• Continue to use traffic signal radios, fiber optic, and copper wire connections to provide traffic signal connectivity. • Use the expanded connected signal network to implement advanced traffic signal strategies, such as transit signal priority (TSP). • Implement Leading Pedestrian Interval (LPI) along corridors with high pedestrian activity, including downtown corridors and event centers, to further enhance pedestrian safety.	1-5
Transit Signal Priority (TSP)	• Continue coordinating with STA and agency partners to implement TSP along priority transit routes.	1-5
Traffic Signal Coordination	• Continue identifying corridors where signal coordination is desired and focus investments to support system performance goals. • Evaluate the potential impacts of signal coordination on operations, safety, emissions, alternative travel modes, and other implemented signal strategies (like TSP).	1-5
Red Light Cameras	• Implement red light cameras at intersections along the High Injury Network to identify non-compliant vehicles and mitigate this behavior.	1-5
Connected Vehicles	• Implement a connected roadway classification system (CRCS) to monitor where infrastructure maintenance and upgrades are most needed. • Invest in and implement ITS technology to support connectivity across the network's infrastructure and V2I-capable vehicles (See: **Expand Broadband and Fiber Optic Network to Support ITS** and **Advanced Traffic Signal Equipment**). • Monitor deployments and lessons learned from other agencies.	1-5

Application	Strategies and Actions	Implementation Time Frame
Electrify Municipal Fleet, Transit, Local Developer, and Local Business Vehicles	• Support fleet transition plans to prepare for the State's 2035 ZEV mandate. • Explain EV charging opportunities and business models to local developers and businesses. • Install charging infrastructure to support the charging needs. • Support STA efforts to advance toward a zero-emission fleet, including expansion of electric charging and grid capacity at its current and future facilities.	1-5
Charging Infrastructure to Support Community Needs	• Educate residents and agency staff on EVs and EV charging infrastructure. • Coordinate with local utilities to ensure electric grid capacity, resiliency, and efficiency to meet the overall expected growth in charging demand. • Conduct an EV siting study to identify where charging stations are appropriate. • Install community charging hubs that provide equitable charging opportunities to all residents. • Regularly update zoning and building codes to address EV charging infrastructure. • Conduct a curbside charging pilot. • Evaluate the impacts and benefits of EV charging infrastructure on curbside management and parking demand.	1-5
Automated Vehicles	• Ensure the roadway environment is consistent and visible to benefit both human drivers and vehicle sensors. • Follow new AV guidance on striping, signage, and signals (MUTCD 11th Ed., Part 5). • Monitor deployments and lessons learned from other agencies. • Approach future land use planning with a balanced understanding of the region's transportation vision and impacts of AVs on travel behaviors. • Plan for charging needs of electric AVs. • Evaluate the impacts and benefits of these vehicles on curbside management and parking demand. • Conduct an AV pilot prior to implementing a full deployment.	Planning and Asset Management 1-5 Pilot 10+
Mobility and Logistics Hubs	• Conduct a study to identify where mobility hubs would be most appropriate in providing equitable transportation opportunities. • As part of the study, identify the services that would be provided at the mobility hubs (storage lockers, delivery services, etc.).	6-10
Mobility as a Service	• Identify travel modes that are available in the region and which travel modes are desired or should be expanded throughout the network. • Develop an application that provides access to a variety of travel modes. This could involve coordinating with STA to expand the *Connect* fare system with shared-use mobility applications.	6-10

The following strategies will help SRTC and local agencies support the implementation of Smart mobility applications.

General Planning Practices

- Adopt a 'monitoring mindset' and keep a pulse on emerging technologies.
- Define your agency's vision for Smart mobility relative to regional and local goals. Nominate a champion from each agency to track industry trends and learn about new technology applications.
- Plan for the *applications* of technology that best meet your local needs, rather than focusing on specific *technologies*, which may be enhanced or become obsolete soon.
- Develop technology-agnostic and performance-based policies to support the use of technology to achieve your overall transportation goals of mobility, safety, equity, and resiliency. For example:
    - *Transportation Demand Management (TDM):* Use technology to manage and reduce travel demand, especially during peak hours, to reduce congestion and SOV trips and improve travel times and travel-time reliability.
    - *Asset Management:* Maintain infrastructure in a state of good repair. Monitor infrastructure conditions and address issues with striping, signage, pavement markings, and signals that will benefit all road users, including AVs.
    - *Environmental:* Track emissions, fuel consumption, VMT, and other environmental indicators to reduce the environmental impact of transportation and to quantify the benefits of converting fleets to ZEVs.
    - *Equity in Transportation:* Use technology to provide and to monitor the availability of equal access to transportation services for all communities. For example, expanding broadband to underserved areas, optimizing transportation information for mobile phones, and expanding Mobility as a Service.
    - *Smart Parking & Event Management:* Use technology and pricing to efficiently manage parking and curbspace to reduce congestion from vehicles circling for available spaces, encourage vehicle turnover in high-demand spaces or in EV charging spaces, and encourage people to use other modes of transportation that don't require parking.
    - *Transportation Safety:* Use technology to reduce the number and severity of crashes; and use technology to monitor crash risks (like near-miss events), rather than relying on historic police-reported data to understand safety needs.
- Look for alternative revenue sources to support the deployment of emerging technologies and to provide sustainable funding as vehicle technology, travel behavior, and parking patterns change.

MTP Planning Scenarios

As SRTC updates the MTP, planners should consider three potential future technology scenarios:

- The **Business-as-Usual** scenario continues the current trends in electric vehicle (EV) adoption, automated vehicle (AV) use, teleworking, regional mobility, workforce demands, and transportation

system data collection and management. It also assumes a limited investment in a regional ITS network.

- The **Moderate Technology Transformations** scenario advances transportation system management through agency investments in ITS and data collection and monitoring. These investments boost AV and EV adoption and regional mobility. This results in increased teleworking, a shifting workforce, and more efficient passenger/goods movement.
- The **Extensive Technology Transformations** scenario has widespread investment in ITS, EVs, and AVs for passenger and freight movement, along with widespread telework, high-speed internet access, and increased industry automation leading to shifting workforce demands and economic activity.

Land Use Impacts of Technology

Land use patterns may change as smart mobility applications increase transportation system efficiency and improve mobility and accessibility. The land use considerations of emerging transportation technologies are detailed in NCHRP Report 924.[16] Potential impacts to land use densities and land values may have both negative and positive impacts depending on community goals. For example:

- Technologies that facilitate travel and reduce travel costs may result in people relocating to lower density areas that have lower land costs because they are more willing to commute longer distances. Manufacturers and shippers may also relocate facilities to areas with lower labor and land costs because the travel costs of shipping their goods are less than the higher labor costs. Both of these scenarios may lead to increased urban sprawl.
- Reducing travel costs can promote job movement from areas where travel costs are high and technology options are limited (like rural areas) to urban areas that offer superior technology options, only increasing the disparity with rural areas.
- Improving facilities in a localized area (such as investing in infrastructure improvements for a "smart" corridor) increases land values and density in that local area but might reduce land values and densities along the fringe.

Smart mobility applications (such as ridehail services, on-demand transit, e-commerce deliveries, micromobility, and automated vehicles) are increasing demand for curb space in urban and suburban areas. Passenger pick-ups, drop-offs, and deliveries will demand accessible and well-managed curb spaces as these services become more prevalent in the region. Agencies should engage with stakeholders (including residents, businesses, and service providers) to understand the curb-space needs and to identify curb management strategies to meet those needs. Possible strategies include allocating zones for specific uses and using technology to monitor curb-space use to inform future demand-based dynamic management strategies (like dynamic zoning or dynamic pricing). Curb management strategies might require changes to enforcement processes and staffing needs.

[16] National Academies of Sciences, Engineering, and Medicine. 2019. *Foreseeing the Impact of Transformational Technologies on Land Use and Transportation*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25580.

Planners should monitor land use patterns, jurisdictional growth, and travel behavior, and integrate smart mobility applications and impacts into the regional travel demand model and land use and transportation plans. Planners should also consider updating zoning ordinances based on changing trends. For example, consider changing parking codes to anticipate potential reductions in parking demand and increases in curbside pickup/drop-off space demand from shared-use vehicles and Avs and consider impacts of large increases in site-specific demand during events. Consider how right-of-way allocation might change if protected bike lanes and trails are needed to serve more micromobility users, or how curb space may change to provide more pick-up/drop-off loading zones for passengers using ridehail, robotaxis, or AVs and for e-commerce goods delivery needs.

Funding

Local agencies need to proactively plan for potential impacts of emerging technologies on transportation revenue, land use fees, procurement costs, operations costs, and maintenance costs to identify alternative ways to fund or finance their transportation budget. Effects on transportation funding at all levels of government, include:

- Reduced motor fuel tax revenue from more electric vehicles and fuel-efficient vehicles.
- Reduced parking revenue if parking patterns or usage change.
- Reduced transit revenue if AVs or Shared-Use mobility services compete with public transit. Alternatively, increased transit revenue if these services enhance transit connections.
- Reduced vehicle registration and sales tax revenue if vehicles become shared. Alternatively, increased revenue if new vehicle types join the market.
- Reduced traffic violation revenue if AVs are programmed to comply with traffic laws (including parking fines).

For example, an agency will need to consider the installation cost of smart traffic signals and the cost of maintaining these systems. Without advanced planning, the cost of deploying and maintaining smart infrastructure may have an impact on available funding for other important public services, such as schools and police. Future grant applications may become available, as will public-private partnerships for installation and deployment of smart infrastructure. The private sector may be more willing to invest in smart infrastructure if there is a clear return on investment, while the public sector may be more supportive of public expenditures if they believe that the community benefits of smart mobility will outweigh the costs. Local governments need to understand these expectations, encourage public dialogue, and identify alternative ways to fund or finance the transportation system.

Local agencies can prepare by taking the following actions:

- Document current local relevant sources and trends through a transportation revenue study. Assess local fuel tax revenue, parking revenue, traffic fines, vehicle registrations, and tolling (if applicable). Coordinate with regional and state organizations to identify state revenue sources and trends.

- Develop a process for local jurisdictions to monitor existing transportation-related revenues as new technologies become more widespread to understand the impact to revenue streams. For declining revenues, set dollar thresholds of when to actively seek new alternative revenue strategies.
- Explore new pricing strategies to support the maintenance and operation of the transportation system. For example, EV charging fees, local transportation district tax, usage-based fees, vehicle registration fees, public-private partnerships, development impact fees, and dynamic curbspace pricing.
- Assess infrastructure costs associated with increased adoption of smart mobility. Consider installation, operations, and maintenance. Evaluate opportunities for development fees and other fees (per bullet 3 above) to offset costs.

Potential grant programs included in the Bipartisan Infrastructure Bill (BIL or IIJA) include:

- FTA Mobility Innovation programs.
- Strengthening Mobility and Revolutionizing Transportation (SMART) Grant Program.
- Electric vehicle infrastructure.
- Broadband expansion.

To help communities understand the best ways to apply for grants and to plan for innovative projects:

- USDOT Navigator Tool is a new resource to help communities understand what resources are available at the federal level and the best ways to apply for grants, and to plan for and deliver successful projects.
- Bipartisan Infrastructure Law Overview provides key areas of funding, including details on ways to prepare, total funding amounts, contacts, and resources for each.
- Shared-Use Mobility Center Funding Strategies Learning Module.

APPENDIX A: Smart Mobility Applications

This table summarizes Smart mobility technologies that could potentially be on the region's roads within the MTP's planning horizon. Recommended applications are identified in bold. Check marks are used to identify the relevance of each application to regional transportation needs, Smart mobility technology categories, and the likelihood of near-term implementation within the next 5 years.

Application (*Applications in bold are applications with recommended actions or strategies. See* Table 3 *for more details.*)	Benefits	Limitations	Regional Transportation Needs								Priority
			Asset Management	Safety	Travel Demand / Congestion Management	Accessibility and Equity	Resiliency	Sustainability	Smart Land Use Management	Data Management & Information Sharing	Recommended Action or Strategy (See Table 3)
Roadway Applications											
Broadband	**Connects devices to enables data sharing, which could reduce congestion, increase safety, and enable connected vehicles and cities.**	**Service availability, cost to construct in rural areas.**	✓		✓		✓			✓	✓
Fiber optic networks	**Typically allows for greater amounts of information to be transferred, data is transmitted at the speed of light, typically information can be transmitted further.**	**Costly to install, especially in built-out environments; can be challenging to repair in cold weather environments; easy to damage or break.**	✓		✓		✓			✓	✓
Ramp metering	**Improve safety of freeway maneuvers, can improve flow of outer freeway lane by creating on-ramp gaps for merging/weaving, can improve air quality by reducing freeway congestion, can increase freeway speeds**	**Increases delay at on-ramps, can cause queuing/spillback to side-street and upstream signal blocking, typically requires connection into ITS backbone for improved operations and adjusting, may require separate ATMS module.**		✓	✓		✓				✓
Red light cameras	**Can reduce serious and fatal angle crashes, which can improve corridor mobility and reduce enforcement requirements (police staff) at the intersection.**	**Can increase rear-end crashes, requires additional equipment at intersection, may require City code changes to implement on a regional basis, typically requires a 3rd party vendor.**		✓							✓
Traveler information systems	**Provides information to drivers for decision making purposes, provides transparency to roadway conditions to drivers, can reduce delays and congestion thereby improving air quality.**	**Must be connected to the ITS backbone system, must have access to management center for monitoring purposes, can be costly to implement, may require separate ATMS module.**		✓	✓	✓	✓			✓	✓
Variable speed limits & dynamic advisory speeds	**Can improve traffic flow along corridor, can reduce crashes, can be used in conjunction with weather events.**	**Can be costly to implement, must be connected to the ITS backbone system, may require separate ATMS module, can have negative public reaction.**		✓	✓					✓	✓
Variable message signs	**Provides information to drivers for decision making purposes, provides transparency to roadway conditions to drivers, can reduce delays and congestion thereby improving air quality.**	**Must be connected to the ITS backbone system, must have access to management center for monitoring purposes, can be costly to implement.**		✓	✓		✓			✓	✓
Advanced traffic management systems (ATMS)	Provides a single interface to monitor, and control, a variety of traffic and ITS devices. Very advantageous for event operations, overall agency reporting, and agency monitoring.	Very costly to implement, may require several 'add-ons' to existing equipment, requires extensive training for all users and maintenance operations.			✓		✓			✓	
Dynamic lane grouping	Assists when specific turning movements are high, thereby reducing delay and congestion. Can reduce collisions due to reduced queuing.	Intersection striping, detection, and signal heads need to be properly designed and implemented. Can cause driver confusion.			✓	✓	✓		✓		
Reversible center lanes	Improves traffic flow during the peak periods without adding lanes, adds capacity to the major flow without adding lanes, can improve operations at signalized intersections by removing left-turn phasing.	Can cause an increase in crashes, can cause driver confusion, typically limits turning movements from the main road to side roads.			✓		✓		✓		

Application (*Applications in bold are applications with recommended actions or strategies. See* Table 3 *for more details.*)	Benefits	Limitations	Regional Transportation Needs								Priority
			Asset Management	Safety	Travel Demand / Congestion Management	Accessibility and Equity	Resiliency	Sustainability	Smart Land Use Management	Data Management & Information Sharing	Recommended Action or Strategy (See Table 3)
Parking monitoring systems	Provides real-time user information for decision making; can reduce congestion in parking structures/lots; can improve parking lot flow.	Can be costly to implement, hard to control parking violators			✓						
Dynamic parking system	Communicates real-time parking availability information to users. Could be implemented at park-and-rides through STA coordination.	Must be connected to the ITS backbone.			✓				✓		
Smart work zones	Can improve the safety within the work/construction zone, can reduce construction costs, can reduce collisions, can improve work productivity, can improve corridor mobility.	Requires connective devices and real time data collection (may not have service), must be monitored and adjusted with traffic conditions.		✓	✓					✓	
Traffic Signal Applications											
Advanced traffic signal equipment	**Provides connected infrastructure capabilities to support transit signal priority and other advanced traffic signal strategies to improve safety and reduce congestion.**	**Could necessitate additional space in the signal controller cabinet.**	✓	✓	✓					✓	✓
Traffic signal coordination	**Reduces the number of stops, reduces congestion and delays, reduces collisions, improving travel time, reduces speeding.**	**Must have communications to all signals, may increase side street delays, can impact transit operations negatively (TSP), can add delay to bicycles and pedestrians.**		✓	✓						✓
Adaptive traffic signal control	Continuously adjusts to maximize green times on high demand approaches thereby reducing congestion and can reduce collisions due to reduced queuing.	Requires high-resolution detection data and specific levels of congestion, can impact TSP operations negatively, can add delay to bicycles and pedestrians.			✓						
Transit signal priority (TSP)	**Keeping transit headways on-time, reducing collisions at intersections, improving intersection mobility.**	**Can impact the corridor signal timing coordination and create more delay for other vehicle types.**			✓						✓
Freight signal priority	Improves intersection safety, reduces intersection congestion, reduces emissions.	Requires higher resolution detection at the signal to depict truck traffic from standard traffic.			✓						
Alternative Transportation Mode Applications											
Mobility and logistics hubs	**Provides access to a variety of transportation modes at one location.**	**First- and last-mile connections to the hubs may present a challenge to achieve equitable access.**	✓			✓			✓		✓
Mobility as a Service (MaaS)	**Provides access to a variety of transportation modes through a single application.**	**Requires extensive interagency or public-private partnership coordination. Equitable service requires accessible mobile apps, cash payment options, and public access to the application, such as through kiosks.**				✓					✓
Computer-aided dispatch (CAD)	Allows dispatchers and responders to triage incidents for more efficient use of resources. Promotes communicate across multiple agencies and jurisdictions.	CAD operation relies on a well-maintained, connected, and sometimes complex software system.		✓	✓		✓			✓	
Real-time bus arrival information	Provides information to transit riders to improve user experience and trip-planning.	Requires automatic vehicle locator (AVL) equipment on buses and a software management system.				✓				✓	
Shared micromobility	Provides alternative travel modes for road users who do not drive or do not have vehicle access.	Requires local policies to define micromobility, allowable use areas, allowable storage areas, and allowable behavior. Could increase injuries if users are not wearing helmets. Theft and vandalism are likely to occur. Could impact ADA access due to equipment left on sidewalks.				✓	✓				

Application (*Applications in bold are applications with recommended actions or strategies. See* Table 3 *for more details.*)	Benefits	Limitations	Regional Transportation Needs								Priority
			Asset Management	Safety	Travel Demand / Congestion Management	Accessibility and Equity	Resiliency	Sustainability	Smart Land Use Management	Data Management & Information Sharing	Recommended Action or Strategy (See Table 3)
Rideshare	Reduces vehicle miles traveled through higher-occupancy vehicle trips. Provides an alternative travel mode for travelers who do not drive or do not have vehicle access.	Some additional coordination is required amongst residents to organize a rideshare route. A flat fee payment model may deter some residents with more unpredictable schedules.			✓	✓		✓			
Carshare	Provides an alternative travel mode for road users who do not have vehicle access. Can reduce emissions if using a fleet of EVs.	Users are likely operating an unfamiliar vehicle. Must supply adequate charging infrastructure if providing service through EVs. This would require educating the users on EVs and EV charging infrastructure.				✓		✓			
Ridehail (Uber, Lyft)	Provides on-demand service for users. Provides an alternative travel mode for road users who do not drive or do not have vehicle access. Can help remove impaired drivers from the road.	Service availability and response time depend on the number of drivers. Usually a less accessible option in more rural areas.				✓					
Robotaxi / driverless ridehail	Provides on-demand service for users. Provides an alternative travel mode for road users who do not drive or do not have vehicle access. Could be less expensive or safer than other travel modes (due to reduced labor costs and improved vehicle safety). Could remove impaired drivers from the road.	Could increase vehicle miles traveled due to zero-occupancy trips. Requires a well maintained, reliable, and unchanging roadway environment for vehicle sensors to perform as intended. Without education, the public may be wary of the tech. Benefits from open coordination between local agency and industry.				✓					
Vehicle Applications											
Zero-Emission Vehicles (ZEVs)	**Transitioning fleets to ZEVs provides environmental benefits through reduced emissions, complies with state mandate, and will reduce fleet operating and maintenance costs.**	**Requires charging infrastructure, including grid capacity, to support the charging demand.**	✓					✓			✓
Community Charging Hubs & Publicly Accessible Chargers	**Supports equitable adoption of EVs and reduced transportation emissions.**	**Charging infrastructure needs to meet charging demand. Sites may be constrained by utility infrastructure. Business and payment models require thoughtful consideration by agencies.**				✓		✓			✓
Connected vehicles	**Can improve safety through enhanced decision-making using information provided from the infrastructure and other vehicles. Could increase roadway capacity through platooning.**	**Must be connected to the ITS backbone. Uncertain timeframe for when CV technology will be widely deployed on production vehicles.**	✓	✓						✓	✓
Automated vehicles	**Could improve safety through enhanced decision-making and awareness. Reduces the time cost of travel if occupants can perform secondary tasks while in transit. Could improve roadway capacity if paired with CV technology.**	**Might increase vehicle miles traveled (VMT) due to longer trips or zero-occupancy trips due to decreased cost of travel. Requires a well-maintained, reliable, and unchanging roadway environment for vehicle sensors to perform as intended. Without education, the public may be wary of the technology.**	✓	✓		✓					✓

APPENDIX B: Smart Mobility Key Terms

This appendix provides short descriptions of key smart mobility applications or terms.[17]

- **Adaptive traffic signal control** adjusts signal timing in real time based on the predicted time of arrival of traffic at an intersection. It differs from traffic-responsive (actuated) operation in that actuated operation works from a preset signal timing plan with a relatively limited amount of flexibility.[18] Adaptive control offers the potential to reduce the number of stops that arterial vehicles must make, along with the extra pollution associated with stopping and starting.
- **Automated shuttles** are being tested in different locations around the U.S. and the world. At present, these shuttles mostly operate on simple routes (e.g., minimal turns required) using small vehicles operating at low speeds (typically around 15 mph). At present, pilot projects in Europe are testing higher-speed automated operation with larger vehicles.
- **Automated sidewalk delivery bots**, already in use in selected locations in the U.S., can provide last-mile home and office deliveries from neighborhood logistics hubs. They can also be used to deliver goods, such as take-out food or prescription medicine, from neighborhood businesses.
- **Automated vehicles (AVs)** are currently being developed and tested by a variety of companies. Vehicles that are capable of self-driving in specific situations (e.g., freeway driving) without any potential intervention from a human driver are not yet commercially available but are likely to become available within the MTP's planning horizon. Researchers have postulated different future scenarios in which AV technology has been deployed, with different outcomes. For example, in one scenario, most AVs are owned by ridesharing companies, with private car ownership falling; transit usage could decrease (if ridesharing is used for both long- and short-distance trips) or increase (if ridesharing serves primarily as a first-/last-mile access mode to and from transit). In another scenario, individually owned human-driven vehicles are gradually replaced with automated vehicles. In this scenario, vehicle miles traveled (VMT) could increase because people may choose to live farther away from where they work and socialize when they can use in-vehicle time for something other than driving the vehicle. In addition, automation opens the door to zero-occupancy vehicle trips, where the vehicle returns home empty to serve another family member after dropping someone else off at their destination.
- **Bike and electric scooter sharing** provide a relatively dense network of pick-up and drop-off locations that allow users to make short trips (e.g., 30 minutes or less) on demand.
- **Carsharing** allows registered users to reserve a car at a location close to them to make relatively short trips (e.g., less than a day) when they need to drive, without having to invest in a car that they may not need very often.
- **Communication infrastructure** is used to relay data collected by sensors to the places where the data will be used, such as a traffic signal controller, a traffic management center, or another vehicle. Communication infrastructure is also used to provide information to travelers and vehicles. Examples of this infrastructure include fiber, 5G wireless nodes, variable message signs, and vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications technology. Two MPOs included in the review (Appendix C) provide funding to improve high-

[17] Unless otherwise noted, the technology descriptions in this section are based on: Kittelson & Associates, Inc., Bluemac Analytics, and Irwin Writing/Editing. 2019. *NCHRP Research Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation.* Transportation Research Board of the National Academies, Washington, DC.

[18] Highway Capacity Manual, 7th edition. 2022. Chapter 37, ATDM: Supplemental. National Academies Press, Washington, DC.

speed internet connectivity in lower-income portions of their region as a means of equitably providing access to smart mobility services.

- **Computer-aided dispatch** helps transit dispatchers and supervisors monitor system operations in real time and respond promptly to incidents that may affect operations (e.g., detours, mechanical issues, security-related incidents)
- **Connected vehicles (CVs)** can send and receive information to and from roadside infrastructure, traffic management centers, and/or other vehicles. One current application is the traffic light information feature available on certain car models (e.g., Audi, BMW) in certain cities that provides a suggested driving speed to arrive at the next traffic signal as it is turning green. [19] A potential future application is vehicle-to-vehicle communication that will allow CAVs to safely form closely spaced vehicle platoons that will increase road capacity.
- **Data storage infrastructure, data feeds, and analysis capabilities** allow transportation service providers to analyze the effects of smart mobility applications, which can help them improve services in the future and communicate project outcomes to the public and funding bodies. Many smart mobility applications can generate vast amounts of data, requiring agencies to develop the ability to store and manage the data while considering data privacy and cybersecurity needs. Other applications require high-speed (up to 10 times per second) two-way communication with a potentially large number of vehicles. Transportation providers may need new staff skills, such as data scientists, to efficiently analyze data, generate performance measures, and effectively present results to others. Resources such as Automated Traffic Signal Performance Measures (ATSPMs), "a suite of performance measures, data collection and data analysis tools to support… traffic signal operations, maintenance, management, and design" can help automate evaluations of arterial performance.[20] Real-time data feeds allow private technology partners to incorporate the data into apps and services that provide useful information to travelers.
- **Decision-support resources** assist humans and/or computers in using data received from the transportation system to make decisions. These resources could be located in a traffic management center or transit agency dispatch facility. Computer-aided dispatch combines vehicle location and other information with pre-programmed decision rules to assist humans with decision-making (e.g., sending highway service patrol vehicles, notifying emergency responders, posting information on variable message signs, detouring buses). Artificial intelligence offers the potential to learn from past events to improve future responses.
- **Dynamic carpooling** matches drivers planning to make a longer-distance trip at a given time with others wishing to travel in the same direction at about the same time, a higher-tech version of ride-seeking bulletin boards. Pilot applications in Europe involve private companies providing an app on behalf of a transit agency or regional government. Riders pay a distance-based fare via the app, while drivers receive the fare payment plus a subsidy for each trip provided. [21] The service is intended for rural areas that have no or very limited transit or intercity bus service.
- **Dynamic lane grouping** changes the allowed turning movements by lane on an intersection approach to more efficiently serve traffic patterns that vary by time of day or year.
- **Electric Vehicle Supply Equipment (EVSE)**, commonly called charging stations or charging docks, refers to the wiring and electronic components that convey electricity from an external power source, such as the electric grid, to an EV's onboard battery.

[19] Audi. Audi brings Traffic Light Information to Los Angeles, New York, and San Francisco. 2021. https://media.audiusa.com/en-us/releases/485, accessed May 13, 2024.
[20] Federal Highway Administration. 2024. Automated Traffic Signal Performance Measures (website). https://ops.fhwa.dot.gov/arterial_mgmt/performance_measures.htm
[21] Nabogo. 2024. Nabogo makes it easy to drive together in daily life (website). https://nabogo.com/en/

- **Electric vehicles (EVs)** offer the potential to greatly reduce the amount of greenhouse gases and other pollutants produced by the transportation system. Potential public-sector actions to support the adoption of EVs include helping making vehicle charging convenient (which could involve changes in land use and development regulations), allowing EVs to use carpool lanes, installing solar cells within roadway right-of-way, and converting public-sector vehicle fleets to EVs. In addition to battery-electric vehicles, hydrogen fuel cell vehicles have been developed that use fuel cells to generate electricity.
- **Integrated transit trip-planning and fare-payment apps** (e.g., Vamos in San Joaquin County, California) allow travelers to plan and pay for transit trips involving multiple transit providers and may also include carshare, bikeshare, etc. as options.
- **Microtransit** is a shared-ride transit mode that operates similarly to dial-a-ride in terms of providing point-to-point service, but with shorter advance reservation times (e.g., 20 minutes or less versus a reservation the day before). It can be used to provide transit service within lower-density areas not capable of supporting fixed-route bus service and can also be used as a first-/last-mile access mode to fixed-route transit. Fare payment typically is integrated with the local transit system.
- **Mobility and logistics hubs** provide neighborhood-based access to mobility services. Mobility hubs can be located at major transit stops or centers, for example, and provide access to shared mobility options that support last-mile connections from transit. They also provide a central location for accessing mobility options for people not making transit trips. Mobility hubs can also provide space for ancillary services such as storage lockers for receiving deliveries, minimarts, daycare, dry cleaners, etc. that help people perform multiple errands in one trip. Neighborhood logistics hubs can provide a central location for receiving parcel deliveries that can then be distributed over the last mile using non-truck modes such as cargo e-bikes, sidewalk delivery bots, or drones.
- **Mobility-as-a-Service (MaaS)** apps present a full range of mobility options for a given trip and make the necessary reservations and payments for the user's selected option.
- **Multimodal trip planning services** (e.g., Google Maps) compile service and schedule information from a variety of service providers and offer them as options to travelers planning a trip. Hyperlinks may be provided to the service providers that would be used for the trip, but travelers must work with individual providers to reserve and pay for trips.
- **Parking systems** help guide motorists to available parking spaces, reducing the need for motorists to drive around searching for a parking space to become available.
- **Ramp metering** smooths the flow of traffic merging onto a freeway during high-volume periods, delaying the onset of freeway traffic jams with stop-and-go conditions.
- **Real-time bus arrival information** combines bus location information with past and present travel time data to communicate to passengers when the next bus on a route will arrive, which can reduce passengers' stress associated with not being sure when a bus will arrive. Information can be provided via displays at key bus stops, via text message, and/or via trip planning apps and websites.
- **Reversible center lanes** change the use of a roadway's center lane by time of day to better serve highly directional traffic demands—for example, as an extra inbound lane during the a.m. peak period or before a special event, as an extra outbound lane during the p.m. peak period or after a special event, and as a two-way left-turn lane the rest of the time.
- **Ridesharing** (e.g., Uber, Lyft) provides point-to-point service on request that may or may not be shared with other passengers.
- **Sensors** collect information needed to help humans and computers make decisions. Examples include video cameras to detect vehicles arriving at a traffic signal; in-vehicle sensors that determine a vehicle's location, speed, and heading; LiDAR, radar, infrared, and other sensors used by AVs to detect objects around them; and sensors to detect how many bikeshare stalls, parking spaces, or EV chargers are occupied at a given location.

- **Shared-use mobility**, also known as **mobility-on-demand (MOD)**, is defined by the Federal Highway Administration as "a safe, reliable, and carefree mobility ecosystem that supports complete trips for all, both personalized mobility and goods delivery." Shared-use mobility seeks to provide travelers with mobility choices that are user-centric, mode-neutral, technology-enabled, and partnership-driven. [22]
- **Transit signal priority** extends the green for buses arriving at an intersection late in the green phase or returns the signal to green earlier when a bus is waiting at an intersection. This technology has been available for decades, but newer implementations combine bus and bus stop location data, past and present travel time data, and communications technology to more accurately predict when a bus will arrive at the intersection. Doing so allows buses to benefit from priority more often and for extended greens to end as soon as the bus has entered the intersection, resulting in more efficient intersection operations.
- **Truck parking availability information** lets truck drivers know where space is available for them to take legally required rest breaks. The lack of sufficient parking facilities for long-distance truckers is a nationwide problem with potentially serious safety consequences (e.g., tired drivers, trucks parked on freeway shoulders near full rest areas). In addition, delivery window reservations are used today at some warehousing and distribution facilities to manage arriving truck flows, which can result in long lines of trucks parked on roadways adjacent to these facilities while the drivers wait for their allotted delivery time.
- **Truck signal priority** works similarly to transit signal priority but is used to minimize truck stopping and starting along key truck routes.
- **Unmanned aerial vehicles (drones)** can deliver small, lightweight (e.g., under 15 pounds) parcels within a relatively small radius (e.g., 1 mile) of their base. Systems currently being tested are operated remotely by a pilot but have the potential to be automated in the future. Drones offer the potential to reduce pressure on curbside space by moving some freight deliveries off roadways.
- **Variable message signs** help communicate travel information to motorists already on the road, while dedicated websites and apps can assist with travel planning prior to and potentially during a trip. The type of information provided can include travel time estimates, work zone locations and detours, crashes and other incidents, severe weather, parking availability, and more.
- **Variable speed limits and dynamic advisory speeds** help slow vehicles in advance of a traffic jam (e.g., due to a crash or road work) or in response to poor roadway conditions caused by severe weather. The intent is to smooth traffic flow and reduce crashes caused by rapid changes in speed or roadway conditions (e.g., ice, dust, smoke).
- **Workforce development** may be needed to train an adequate supply of workers to operate and maintain new mobility technologies, particularly those used by EVs and AVs.

[22] U.S. Department of Transportation. 2020. *Mobility on Demand (MOD) Program.* Publication FHWA-JPO-20-830. Intelligent Transportation Systems Joint Program Office, Washington, DC. https://www.its.dot.gov/factsheets/pdf/MobilityonDemand.pdf

APPENDIX C: Smart Mobility Implementation Review

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TECHNICAL MEMORANDUM

October 4, 2024

Project # 29835.001

To: Jason Lien, Principal Transportation Planner, SRTC

From:Wende Wilber, Abby Morgan, and Paul Ryus

RE: SRTC Smart Mobility Implementation Review

Introduction

Although definitions vary, *smart mobility* can be thought of as the integration of technology into the transportation system to improve efficiency and safety. Some technology exists today and is being deployed around the U.S., such as adaptive traffic signal systems that react in real time to traffic patterns. Other technology, such as connected and automated vehicles (CAVs), is currently being developed and tested, but the timeline for when the technology will be commercially available and widely adopted is uncertain at present. However, it is already clear that CAVs have the potential to both benefit and harm the transportation system and the broader community. Finally, some transportation technology is far off in the future, if ever (e.g., electric automated air taxis), or hasn't even been thought of yet, but will be invented and widely applied within the 25-year horizon of Spokane Regional Transportation Council's (SRTC) metropolitan transportation plan (MTP) update.

Because of the rapid changes occurring in transportation technology, a key challenge for metropolitan planning organizations (MPOs) such as SRTC is how to support emerging technologies with the potential to support regional goals and objectives while avoiding or mitigating their potential negative community impacts. This challenge is complicated by the unknowns associated with new technology, such as when they will be available, what they will cost, and what their specific benefits and disbenefits will be. The ultimate goal is not to implement new technology for technology's sake, but instead to determine how smart mobility can help the Spokane region achieve its desired transportation and societal outcomes.

The first half of this memo provides background information that introduces and defines a wide range of smart mobility applications. The second half of the memo provides a high-level overview of ways that 17 peer MPOs have incorporated smart mobility into their MTPs and related planning efforts. Future work on this project will develop up to six case studies that take a deeper dive into how selected MPOs have addressed smart mobility. This overview and the case studies

help support future project tasks to create a smart mobility vision, goals, and performance measures for the Spokane region.

Smart Mobility Examples

Smart mobility applications exist for many different aspects of the transportation system, including:

- Roadways
- Vehicle technology
- Public transit
- Shared-use mobility
- Freight movement, logistics, and delivery
- Integrated multimodal travel

These applications typically do not exist on their own but require supporting resources to function. These resources can include:

- Sensors
- Communication infrastructure
- Decision-support resources
- Data storage infrastructure, data feeds, and analysis capabilities
- Mobility and logistics hubs
- Workforce development

The following subsections provide short descriptions of each of these applications.[1]

Roadway Applications

Roadway applications are intended to provide safer, more reliable travel for motor vehicles. Although these applications are not specifically designed for trucks and buses, these modes nevertheless can benefit from them as roadway users. Applications include the following:

- **Adaptive traffic signal control** adjusts signal timing in real time based on the predicted time of arrival of traffic at an intersection. It differs from traffic-responsive (actuated) operation in that actuated operation works from a preset signal timing plan with a relatively limited amount of flexibility.[2] Adaptive control offers the potential to reduce the number of stops

[1] Unless otherwise noted, the technology descriptions in this section are based on: Kittelson & Associates, Inc., Bluemac Analytics, and Irwin Writing/Editing. 2019. *NCHRP Research Report 924: Foreseeing the Impact of Transformational Technologies on Land Use and Transportation.* Transportation Research Board of the National Academies, Washington, DC.

[2] *Highway Capacity Manual,* 7th edition. 2022. Chapter 37, ATDM: Supplemental. National Academies Press, Washington, DC.

that arterial vehicles must make, along with the extra pollution associated with stopping and starting.

- **Dynamic lane grouping** changes the allowed turning movements by lane on an intersection approach to more efficiently serve traffic patterns that vary by time of day or year.
- **Reversible center lanes** change the use of a roadway's center lane by time of day to better serve highly directional traffic demands—for example, as an extra inbound lane during the a.m. peak period or before a special event, as an extra outbound lane during the p.m. peak period or after a special event, and as a two-way left-turn lane the rest of the time.
- **Parking systems** help guide motorists to available parking spaces, reducing the need for motorists to drive around searching for a parking space to become available.
- **Ramp metering** smooths the flow of traffic merging onto a freeway during high-volume periods, delaying the onset of freeway traffic jams with stop-and-go conditions.
- **Variable speed limits** and **dynamic advisory speeds** help slow vehicles in advance of a traffic jam (e.g., due to a crash or road work) or in response to poor roadway conditions caused by severe weather. The intent is to smooth traffic flow and reduce crashes caused by rapid changes in speed or roadway conditions (e.g., ice, dust, smoke).
- **Variable message signs** help communicate travel information to motorists already on the road, while dedicated websites and apps can assist with travel planning prior to and potentially during a trip. The type of information provided can include travel time estimates, work zone locations and detours, crashes and other incidents, severe weather, parking availability, and more.

Vehicle Technology

Improvements in vehicle technology are being led by the private sector. However, transportation planning needs to consider the effects of these technologies on the transportation system and the community, along with ways to help support desired outcomes from these technologies. Applications include:

- **Electric vehicles** offer the potential to greatly reduce the amount of greenhouse gases and other pollutants produced by the transportation system. Potential public-sector actions to support the adoption of EVs include helping making vehicle charging convenient (which could involve changes in land use and development regulations), allowing EVs to use carpool lanes, installing solar cells within roadway right-of-way, and converting public-sector vehicle fleets to EVs. In addition to battery-electric vehicles, hydrogen fuel cell vehicles have been developed that use a fuel cell to generate electricity.
- **Automated vehicles (AVs)** are currently being developed and tested by a variety of companies. Vehicles that are capable of self-driving in specific situations (e.g., freeway driving) without any potential intervention from a human driver are not yet commercially available but are likely to become available within the MTP's planning horizon. Researchers have postulated different future scenarios in which AV technology has been deployed, with

different outcomes. For example, in one scenario, most AVs are owned by ridesharing companies, with private car ownership falling; transit usage could decrease (if ridesharing is used for both long- and short-distance trips) or increase (if ridesharing serves primarily as a first-/last-mile access mode to and from transit). In another scenario, individually owned human-driven vehicles are gradually replaced with automated vehicles. In this scenario, vehicle miles traveled (VMT) could increase because people may choose to live farther away from where they work and socialize when they can use in-vehicle time for something other than driving the vehicle. In addition, automation opens the door to zero-occupancy vehicle trips, where the vehicle returns home empty to serve another family member after dropping someone else off at their destination.

- **Connected vehicles (CVs)** can send and receive information to and from roadside infrastructure, traffic management centers, and/or other vehicles. One current application is the traffic light information feature available on certain car models (e.g., Audi, BMW) in certain cities that provides a suggested driving speed to arrive at the next traffic signal as it is turning green.[3] A potential future application is vehicle-to-vehicle communication that will allow CAVs to safely form closely spaced vehicle platoons that will increase road capacity.

Public Transit

Smart mobility applications for public transit are designed to support faster, more reliable transit trips and to provide information and tools that facilitate passengers' trips. Example applications include the following:

- **Transit signal priority** extends the green for buses arriving at an intersection late in the green phase or returns the signal to green earlier when a bus is waiting at an intersection. This technology has been available for decades, but newer implementations combine bus and bus stop location data, past and present travel time data, and communications technology to more accurately predict when a bus will arrive at the intersection. Doing so allows buses to benefit from priority more often and for extended greens to end as soon as the bus has entered the intersection, resulting in more efficient intersection operations.
- **Real-time bus arrival information** combines bus location information with past and present travel time data to communicate to passengers when the next bus on a route will arrive, which can reduce passengers' stress associated with not being sure when a bus will arrive. Information can be provided via displays at key bus stops, via text message, and/or via trip planning apps and websites.

[3] Audi. Audi brings Traffic Light Information to Los Angeles, New York, and San Francisco. 2021. https://media.audiusa.com/en-us/releases/485, accessed May 13, 2024.

- **Computer-aided dispatch** helps transit dispatchers and supervisors monitor system operations in real time and respond promptly to incidents that may affect operations (e.g., detours, mechanical issues, security-related incidents)
- **Automated shuttles** are being tested in different locations around the U.S. and the world. At present, these shuttles mostly operate on simple routes (e.g., minimal turns required) using small vehicles operating at low speeds (typically around 15 mph). At present, pilot projects in Europe are testing higher-speed automated operation with larger vehicles.

Other applications related to public transit, such as microtransit and integrated trip planning and fare payment apps, are discussed below.

Shared-use Mobility

Shared-use mobility, also known as mobility-on-demand (MOD), is defined by the Federal Highway Administration as "a safe, reliable, and carefree mobility ecosystem that supports complete trips for all, both personalized mobility and goods delivery." Shared-use mobility seeks to provide travelers with mobility choices that are user-centric, mode-neutral, technology-enabled, and partnership-driven.[4] A common feature of shared-use mobility modes is the use of an app and some form of digital payment (e.g., a credit card) to reserve and pay for rides, also referred to as Mobility as a Service (MaaS). In addition, shared-use mobility is frequently, but not necessarily, provided by private service providers. These providers apply technology to operate their fleets efficiently (e.g., combining microtransit rides, redistributing shared bikes and scooters between locations). Shared-use mobility modes include:

- **Carsharing** allows registered users can reserve a car at a location close to them to make relatively short trips (e.g., less than a day) when they need to drive, without having to invest in a car that they may not need very often.
- **Bike and electric scooter sharing** provide a relatively dense network of pick-up and drop-off locations that allow users to make short trips (e.g., 30 minutes or less) on demand.
- **Microtransit** is a shared-ride transit mode that operates similarly to dial-a-ride in terms of providing point-to-point service, but with shorter advance reservation times (e.g., 20 minutes or less versus a reservation the day before). It can be used to provide transit service within lower-density areas not capable of supporting fixed-route bus service and can also be used as a first-/last-mile access mode to fixed-route transit. Fare payment typically is integrated with the local transit system.
- **Ridesharing** (e.g., Uber, Lyft) provides point-to-point service on request that may or may not be shared with other passengers.

[4] U.S. Department of Transportation. 2020. *Mobility on Demand (MOD) Program.* Publication FHWA-JPO-20-830. Intelligent Transportation Systems Joint Program Office, Washington, DC. https://www.its.dot.gov/factsheets/pdf/MobilityonDemand.pdf

- **Dynamic carpooling** matches drivers planning to make a longer-distance trip at a given time with others wishing to travel in the same direction at about the same time, a higher-tech version of ride-seeking bulletin boards. Pilot applications in Europe involve private companies providing an app on behalf of a transit agency or regional government. Riders pay a distance-based fare via the app, while drivers receive the fare payment plus a subsidy for each trip provided.[5] The service is intended in particular for rural areas that have no or very limited transit or intercity bus service.

All these modes can be provided with electric vehicles if desired and many can support future automation.

Freight

Smart mobility also offers the potential to make goods movement more efficient. Example applications include the following:

- **Truck signal priority** works similarly to transit signal priority but is used to minimize truck stopping and starting along key truck routes.
- **Truck parking availability** information lets truck drivers know where space is available for them to take legally required rest breaks. The lack of sufficient parking facilities for long-distance truckers is a nationwide problem with potential serious safety consequences (e.g., tired drivers, trucks parked on freeway shoulders near full rest areas). In addition, delivery window reservations are used today at some warehousing and distribution facilities to manage arriving truck flows, which can result in long lines of trucks parked on roadways adjacent to these facilities while the drivers wait for their allotted delivery time.
- **Automated sidewalk delivery bots,** already in use in selected locations in the U.S., can provide last-mile home and office deliveries from neighborhood logistics hubs. They can also be used to deliver goods, such as take-out food or prescription medicine, from neighborhood businesses.
- **Unmanned aerial vehicles (drones)** can deliver small, lightweight (e.g., under 15 pounds) parcels within a relatively small radius (e.g., 1 mile) of their base. Systems currently being tested are operated remotely by a pilot but have the potential to be automated in the future. Drones offer the potential to reduce pressure on curbside space by moving some freight deliveries off roadways.

Integrated Multimodal Travel

Integrated multimodal travel makes travelers aware of all their mobility options for a particular trip, facilitates reserving seats or vehicles when necessary, and/or facilitates fare payment for the complete origin–destination trip. Examples include:

[5] Nabogo. 2024. Nabogo makes it easy to drive together in daily life (website). https://nabogo.com/en/

- **Multimodal trip planning services** (e.g., Google Maps) compile service and schedule information from a variety of service providers and offer them as options to travelers planning a trip. Hyperlinks may be provided to the service providers that would be used for the trip, but travelers must work with individual providers to reserve and pay for trips.
- **Integrated transit trip-planning and fare-payment apps** (e.g., Vamos in San Joaquin County, California) allow travelers to plan and pay for transit trips involving multiple transit providers and may also include carshare, bikeshare, etc. as options.
- **Mobility-as-a-Service (MaaS) apps** present a full range of mobility options for a given trip and make the necessary reservations and payments for the user's selected option.

Supporting Infrastructure

None of the above applications works on its own without some supporting infrastructure. Beyond helping support basic mobility application functionality, supporting infrastructure also helps transportation providers make the fullest use of their investment. For example, the data used to make real-time signal timing decisions can be stored and compiled into performance measures that can be used later to document the system's benefits. Examples of supporting infrastructure include the following:

- **Sensors** collect information needed to help humans and computers make decisions. Examples include video cameras to detect vehicles arriving at a traffic signal; in-vehicle sensors that determine a vehicle's location, speed, and heading; LiDAR, radar, infrared, and other sensors used by AVs to detect objects around them; and sensors to detect how many bikeshare stalls, parking spaces, or EV chargers are occupied at a given location.
- **Communication infrastructure** is used to relay data collected by sensors to the places where the data will be used, such as a traffic signal controller, a traffic management center, or another vehicle. Communication infrastructure is also used to provide information to travelers and vehicles. Examples of this infrastructure includes fiber, 5G wireless nodes, variable message signs, and vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications technology. Two MPOs included in the review later in this memorandum provide funding to improve high-speed internet connectivity in lower-income portions of their region as a means of equitably providing access to smart mobility services.
- **Decision-support resources** assist humans and/or computers in using data received from the transportation system to make decisions. These resources could be located in a traffic management center or transit agency dispatch facility. Computer-aided dispatch combines vehicle location and other information with pre-programmed decision rules to assist humans with decision-making (e.g., sending highway service patrol vehicles, notifying emergency responders, posting information on variable message signs, detouring buses). Artificial intelligence offers the potential to learn from past events to improve future responses.

- **Data storage infrastructure, data feeds, and analysis capabilities** allow transportation service providers to analyze the effects of smart mobility applications, which can help them improve services in the future and communicate project outcomes to the public and funding bodies. Many smart mobility applications can generate vast amounts of data, requiring agencies to develop the ability to store and manage the data while considering data privacy and cybersecurity needs. Other applications require high-speed (up to 10 times per second) two-way communication with a potentially large number of vehicles. Transportation providers may need new staff skills, such as data scientists, to efficiently analyze data, generate performance measures, and effectively present results to others. Resources such as Automated Traffic Signal Performance Measures (ATSPMs), "a suite of performance measures, data collection and data analysis tools to support… traffic signal operations, maintenance, management, and design" can help automate evaluations of arterial performance.[6] Real-time data feeds allow private technology partners to incorporate the data into apps and services that provide useful information to travelers.
- **Mobility and logistics hubs** provide neighborhood-based access to mobility services. Mobility hubs can be located at major transit stops or centers, for example, and provide access to shared mobility options that support last-mile connections from transit. They also provide a central location for accessing mobility options for persons not making transit trips. Mobility hubs can also provide space for ancillary services such as storage lockers for receiving deliveries, minimarts, daycare, dry cleaners, etc. that help people perform multiple errands in one trip. Neighborhood logistics hubs can provide a central location for receiving parcel deliveries that can then be distributed over the last mile using non-truck modes such as cargo e-bikes, sidewalk delivery bots, or drones.
- **Electric Vehicle Supply Equipment (EVSE),** commonly called charging stations or charging docks, refers to the wiring and electronic components that convey electricity from an external power source, such as the electric grid, to an EV's onboard battery. To successfully integrate EVs into the transportation network, planning, policies, and support services to prepare for the growing number of EVs and charging infrastructure.
- **Workforce development** may be needed to train an adequate supply of workers to operate and maintain new mobility technologies, particularly those used by EVs and AVs.

[6] Federal Highway Administration. 2024. Automated Traffic Signal Performance Measures (website). https://ops.fhwa.dot.gov/arterial_mgmt/performance_measures.htm

MPO Review

This second half of this memorandum provides examples of how peer MPOs are currently considering and incorporating smart mobility applications in their MTPs. Topics in this review include:

- Smart mobility applications of greatest interest to peer MPOs at present
- MPO policies, objectives, goals, and strategies related to smart mobility
- Examples of smart mobility programs, supplemental plans, and projects
- Smart mobility performance measurement

MPOS Included in the Review

This review selected 16 MPOs serving regions similar in size or larger than Spokane in the western U.S. and one regional agency in Canada (Table 1). This geographic area was selected in part to support the resiliency task occurring in parallel with this smart mobility task, as the selected regions are more likely to experience natural and man-made hazards similar to those faced in the Spokane region. The North Central Texas Council of Governments (Dallas, TX) was included because of their extensive work in supporting smart mobility applications.

Table 1: Agencies Included in the Review

Agency Name	Region	Population
Central Lane MPO	Eugene, OR	381,181
COMPASS	Boise, ID	235,421
Denver Region COG (DRCOG)	Denver, CO	716,577
Maricopa AG	Phoenix, AZ	1,650,070
Metro	Portland, OR	630,598
Metropolitan Transportation Commission (MTC)	San Francisco, CA	808,988
Mid-Region COG	Albuquerque, NM	560,274
North Central Texas COG	Dallas, TX	1,302,868
Pikes Peak Area COG	Colorado Springs, CO	488,664
Pima AG	Tucson, AZ	547,239
Puget Sound Regional Commission (PSRC)	Seattle, WA	755,078
RTC of Southern Nevada	Las Vegas, NV	660,929
RTC of Washoe County	Reno, NV	274,915
Sacramento Area COG	Sacramento, CA	526,384
San Joaquin COG	Stockton, CA	319,543
TransLink	Vancouver, BC	662,248
Wasatch Front Regional Council (WFRC)	Salt Lake City, UT	209,593

Note: AG = association of governments, COG = council of governments, RTC = regional transportation commission, Population data from U.S. (2023) and Canada (2021) Census.

The review included each MPO's current MTP or regional transportation plan, along with any planning documents or program descriptions related to smart mobility available on each agency's website.

Smart Mobility Applications of Interest to MPOs

As a high-level indication of which smart mobility applications are of greatest interest to MPOs at present, each MPO's material was reviewed to identify which applications were discussed to any extent. These mentions could range from a simple description of a smart mobility application in the plan text, to specific smart mobility projects and programs, to supplemental plans focusing on a particular aspect of smart mobility. Table 2 lists these applications in order from most frequently to least frequently mentioned.

As can be seen from the table, CAVs, EVs, and shared mobility applications were included most frequently in the peer MPO material. Arterial ITS, transit signal priority, and real-time traveler information were also discussed by approximately half of the MPOs included in the review. Other applications mentioned less frequently are not necessarily unimportant but reflect each region's unique conditions and needs. All the peer MPOs included at least one smart mobility application in their MTP.

Table 2: Smart Mobility Applications Included in Reviewed MTPs and Supplemental Plans

Application	Number of Agencies (out of 17)
Connected and automated vehicles (generally)	**13**
• *Unmanned aerial systems*	5
• *Automated trucks*	4
• *Automated shuttles*	3
• *Automated delivery bots*	3
Electric vehicles and clean fuels	**11**
Shared mobility (generally)	**11**
• *Shared mobility trip planning & booking*	7
• *Microtransit*	5
• *Mobility as a Service*	4
• *Mobility hubs*	4
Arterial ITS (generally)	**9**
• *Special event applications*	4
• *Smart parking & curbside management*	3
• *Truck signal priority*	2
• *Automated data collection & performance reporting*	2
• *Work zone & construction management*	2
• *Dynamic lane control*	2
• *Emergency vehicle preemption*	1
Transit signal priority & other transit operations applications	**9**
Physical & digital infrastructure (generally)	**9**
• *Incident response detection & clearance*	3
• *Community high-speed internet investment*	3
• *Traffic management centers*	2
• *Snowplow operations*	1
Real-time traveler information	**8**
Other applications	
• *Smart mobility workforce development*	**4**
• *Automated pavement condition measurement*	**2**

Note: ITS = intelligent transportation systems

Smart Mobility Policy, Goal, Objective, and Strategy Examples

Eleven out of the 17 MPOs reviewed had specific policies, goals, objectives, and/or strategies directed at smart mobility. The other MPOs generally appeared to view smart mobility as one tool in the toolbox for achieving broad regional goals such as reducing VMT or decreasing the percentage of trips made by single-occupant vehicles and did not present goals specific to smart mobility. This section documents peer MPO policies, goals, objectives, and strategies related to smart mobility.

Central Lane MPO (Eugene, OR)

- Objectives:
  - Leverage technological advances, including intelligent transportation systems solutions, to increase efficiency of travel across all modes for all travelers, but particularly for vulnerable populations.
  - Support state efforts to transition Oregon to cleaner, low carbon fuels and increase the adoption of more fuel-efficient vehicles and alternative fuel vehicles, including electric and hydrogen vehicles.
  - Increase the number of people and businesses with easy access to travel information.
  - Reduce the impact of roadway incidents on the regional arterial roadway network and frequent transit routes.

MAG (Phoenix, AZ)

- Goal: Expand travel choices that accommodate future growth and are flexible in adapting to changing needs and innovations.

Metro (Portland, OR)

- 2023 Regional Transportation Plan emerging technology policies:
  - Make emerging technology accessible, available, and affordable to all, and use technology to create more equitable communities.
  - Use emerging technology to improve transit service, provide shared travel options throughout the region, and support transit, bicycling, and walking.
  - Use the best available data to empower travelers to make travel choices and to plan and manage the transportation system.
  - Advance the public interest by anticipating, learning from, and adapting to new developments in technology.
- 2023 Regional Transportation Plan transportation system management and operations policies:
  - Optimize operations for reliability and mobility by coordinating and advancing operator capabilities with shared tools and interoperable technologies.
  - Provide real-time traveler info data across devices and at physical locations.

- Improve incident detection and clearance times.

- 2018 Regional Travel Options Strategy objectives:
  - Encourage innovation and new technology to increase access to travel options.
    - Increase access to and awareness of new technologies.
    - Make traveler information available to encourage private companies to better integrate travel options for users.
    - Pilot applications of new technologies for modes that reduce VMT.
  - Pursue new technologies to collect better data on how funded projects perform.

MTC (San Francisco, CA)

- Strategies:
  - Invest in high-speed internet in underserved low-income communities. Provide direct subsidies and construct public infrastructure to ensure all communities have affordable access to high-speed internet.
  - Enable a seamless mobility experience. Eliminate barriers to multi-operator transit trips by streamlining fare payment and trip planning while requiring schedule coordination at timed transfer hubs.
  - Reform regional transit fare policy. Streamline fare payment and replace existing operator-specific discounted fare programs with an integrated fare structure across all transit operators.
  - Implement per-mile tolling on congested freeways with transit alternatives. Apply a per-mile charge on auto travel on select congested freeway corridors where transit alternatives exist, with discounts for carpoolers, low-income residents, and off-peak travel; and reinvest excess revenues into transit alternatives in the corridor.
  - Advance other regional programs and local priorities. Fund regional programs like motorist aid and 511 while supporting local transportation investments on arterials and local streets.
  - Expand clean vehicle initiatives. Expand investments in clean vehicles, including more fuel-efficient vehicles and electric vehicle subsidies and chargers.

North Central Texas COG (Dallas, TX)

- Policies:
  - The region will develop and implement data sharing best practices that are project- and outcome-focused, serve the public interest, and comply with privacy and cybersecurity requirements, without infringing upon private sector proprietary information requirements.
  - The region will support automated vehicle and related transportation technology deployments that advance the goals of the Mobility 2045 Update by fostering public–private partnerships among local transportation authorities, technology developers, and commercial/industrial hubs.

- The region will support consistent and high-quality maintenance and operations of its transportation system, including utilization of new technologies which offer a cost-efficient method of linking asset management to data collection.
- The region will pursue its goal of becoming a "Region of Choice" by exploring emerging mobility technologies which offer new modes of transportation and those which enhance existing modes of transportation.
- New transportation technologies must be deployed in a manner consistent with Mobility 2045 Update goals of providing the public with a transportation system that is equitable, protects the safety of all users, offers the public more travel options, is well maintained and operated, is environmentally responsible, and prepares the region for innovations in transportation and mobility infrastructure that will accelerate its future economic development.
- The region will prepare for future innovations in both transportation and infrastructure by developing analytical tools capable of assessing traditional transportation projects against alternatives such as new mobility technologies, C-V2X (connected vehicle-to-everything) innovations, more effective use of existing assets, and demand management tools.
- The region will work with educational institutions at all levels to develop workforce training solutions to prepare area residents for job opportunities in the emerging transportation technologies sector, to pursue funding opportunities, and to support deployments of automated vehicles and other emerging transportation technologies.
- The region will prioritize the safety of all transportation system users in and through the deployment of emerging modes of transportation such as e-scooters, e-bikes, automated vehicles, and delivery robots through the use of strategic technology, design, and policy solutions.

- Objective: Encourage a transition to more sustainable fuel sources for the region's vehicles.

Puget Sound Regional Council (Seattle, WA)

- Actions:
  - Support member jurisdictions in monitoring emerging ITS activities, highlighting best practices, sharing technical assistance, and providing information on ITS assets and benefits.
  - Support efforts to develop, evaluate, and implement emerging transportation technology.
  - Jurisdictions should consider a multi-pronged approach to better highlight the benefits of ITS, including exploring most cost-effective options for retrieving data, developing and building more performance measures into ITS projects, and educating different groups on the benefits of ITS.

RTC of Southern Nevada (Las Vegas, NV)

- Strategy: Use Innovative Planning to Address Emerging Technologies & Trends. Emerging technologies and their growing use will disrupt traditional transportation planning practices. To respond proactively, the RTC will develop innovative planning approaches to address these trends that change how priorities are identified and how decisions are made.
- Action: Shift to autonomous transit vehicles as technology permits (10+ years).
- Action: Monitor and incorporate emerging transportation technologies and update road designs as needed.

SACOG (Sacramento, CA)

- Policies:
  - Implement pilot projects aimed at making microtransit and micromobility (such as bike and scooter share) work for urban, suburban, rural, and low-income areas of the region.
  - Pursue flexibility in state and federal funding sources to enable testing and implementation of innovative mobility solutions that are affordable, accessible, and reduce greenhouse gas emissions.
  - Support innovative education and transportation demand management programs covering all parts of the region, to offer a variety of alternatives to driving alone.
  - Pursue new funding and planning opportunities to support electric vehicle infrastructure and programs for both private vehicles and public transit fleets.
  - Support more seamless travel through better traveler information for trip planning, reliable service and coordination between operators for transit, shared mobility, and other first/last mile connections.
- Supporting actions:
  - Continue to assist transit and local agencies in finding ways to develop, test, and pilot new mobility services such as microtransit, bike share, and micromobility. Examples include Civic Lab, bike share, and Smart Ride pilots in Citrus Heights, Franklin Blvd., and other locations.
  - Lead a collaborative effort to shape a vision of next generation transit for the region that includes strategies to integrate traditional transit services with new mobility options.
  - Actively support transit agencies in securing funding to improve transit stations and replace aging bus and light rail vehicles. Examples include changes in 2018 to the SECAT program, which in part funds zero-emission buses.
- Other statements:
  - Support growth in innovative mobility.
  - Become a test-bed for new mobility solutions and autonomous, electric vehicles.
  - Scale new programs based on successful pilots and best practices identified in the short term.

- Track, communicate, and integrate learning and best practices from within the region and beyond.
- Launch pilots with member/partner agencies, evaluate performance, and scale or evaluate lessons learned.

SJCOG (Stockton, CA)

- Strategies:
  - Promote electric power, alternative fuels, and autonomous technologies for freight and agriculture.
  - Manage the adoption of electric vehicles and private connected and autonomous vehicles.
  - Promote electric power, alternative fuels, and autonomous technologies for public transit.
  - Support workforce training across industries, particularly transportation-related industries.

TransLink (Vancouver, BC)

- Strategy: Seamlessly connect different transport services both physically and digitally.[7]
  - Transform all transit stops and stations—from neighborhood bus stops to major terminals—into multimodal **mobility hubs** that enable seamless transfers between different transportation options. Update design guidance for these mobility hubs to specify (based on the surrounding environment and transportation demand) the appropriate mix, scale, and spatial priority for each transportation option.
  - Support industry and municipalities in the development of **neighborhood logistics hubs,** where appropriate, to better enable the consolidation of parcels in central locations for pickup by customers or the use of smaller, lighter, emissions-free freight vehicles for final mile deliveries in low-speed and pedestrianized zones.
  - Enable the development of integrated **smartphone applications** that allow for trip planning, booking, payment, and customer rewards for all mobility services from a single interface.
  - Work with **digital connectivity** service providers and authorities regulating communications service providers to (a) enable Wi-Fi and cellular connectivity throughout the service area for ubiquitous internet access and communication services and (b) ensure oversight of digital assets in the region, including establishing cost-sharing agreements, ownership, and maintenance contracts to ensure long-term viability.
- Strategy: Make driving and parking more reliable.
  - Establish a comprehensive and secure **database of urban mobility data.**

[7] Many of TransLink's actions include detailed lists of subactions (not shown here) that describe how to implement the action. See Part E of the *Transport 2050 Regional Transportation Strategy* for details.

- Make **parking, pickup and drop-off, and loading and unloading** more reliable for all users by [partial list follows]:
  - Deploying dynamic real-time information via digital signage and apps that communicate parking availability and help reduce unnecessary driving and circulation.
  - Deploying digital street and curb regulations to clearly communicate the rules of the road with digital mobility service providers, like app-based ride-hailing and shared micromobility today, and automated robo-taxis tomorrow.
  - Making curb zones, in areas not required for transit stops or lanes, more flexible by dynamically adjusting permitted uses based on actual real-time demand for those uses, combined with regional and locally specific policy priorities.
  - Designing streets, curbs, and loading areas to accommodate emerging freight technology, including compact human-powered and automated freight vehicles most appropriate for Urban Centres and Frequent Transit Development Areas, and larger-combination automated trucks and truck platoons most appropriate at the interface between urban areas and the highway system.
- Use intelligent transportation systems (ITS) to **dynamically manage the flow and movement of automated vehicles and other road users** on the roads for efficient movement and safety.
- Use real-time data managed in the urban data trust to enable the creation of applications that allow both shippers and the traveling public **to optimize their trip decisions.**
- Support **integrated fares pricing and loyalty programs** between different mobility providers to allow users to combine trips of different modes, and to incentivize off-peak travel.

- Strategy: As a priority, invest in the most cost-effective and most affordable modes.
  - Make **micromobility devices** such as bicycles, and mobility aids such as walkers, wheelchairs, and scooters, more widely available to more people **at low cost.**
  - Prioritize **subsidies and rebates** for electric vehicles, electric bicycles, and bicycles for those residents with the least ability to pay, particularly to those who require that transportation mode in order to conduct their jobs (e.g., gig couriers, mobile care aids).
  - Leverage the ability of **autonomous vehicles** to support the needs of people with **low incomes living in more remote locations** that are far from rapid transit service.

- Strategy: Help people and businesses connect to more economic opportunities.
  - Develop proactive strategies to **attract, train, and retain a skilled and qualified transportation workforce** that… is ready to monitor, model, analyze, plan, build, operate, and maintain the highly automated, connected, electric, and shared transportation system of tomorrow.

  - Collaborate across the transportation sector, with industry and labor partners, to proactively navigate an orderly, planned, and **gradual transition for transportation workers** whose jobs will be affected by automation and other technological changes.
  - Support a thriving **ecosystem of businesses** in Metro Vancouver and British Columbia oriented around transport automation, digitization, electrification, and shared mobility.

- Strategy: Transition to zero-emission vehicles.
  - Increase availability and access to **electric bikes, scooters, and other forms of electric micromobility,** which can make active transportation more accessible to more people.
  - Accelerate the **electrification of light-duty passenger vehicles.** This action builds on the existing momentum to transition light-duty passenger vehicle fleets to zero emissions. This category of vehicle includes commercial vehicles used for passenger movement.
  - Urgently complete a network of **EV charging infrastructure for light-duty passenger vehicles.**
  - Develop a robust network of **EV charging and zero-emission refueling infrastructure for commercial freight and work vehicles and transit buses.**
  - Address **vehicle emissions in the short- to medium-term** transition period.
  - Work with BC Hydro to ensure **sufficient and stable renewable power** to support the mass transition to electric mobility.

Wasatch Front Regional Council (Salt Lake City, UT)

- Policy: Maximize the value of emerging technologies: WFRC, along with its transportation partners, develops plans and more detailed policies to maximize the value of emerging technologies.

MTP Smart Mobility Integration Examples

Approaches to Integrating Smart Mobility

Given the rapid technological changes occurring at present; the variety of unknowns with respect to how, when, and whether certain technology may become widely adopted; and difficulties with modeling and measuring the benefits of new technologies, many peer MPOs recognized that the traditional line-item approach to identifying transportation projects in MTPs may not be appropriate for smart mobility. Metro in Portland, Oregon states this need as follows:

> "Our current planning process is designed around infrastructure projects designed to last for 50 years and an unchanging set of transportation services. It can take decades to plan and build a project, and once it is built there is little room for change. This time-intensive, risk-adverse approach continues to make sense for major infrastructure projects, but to effectively plan for emerging technology agencies need to test new services and approaches and learn from their experience. Agencies in the region have used approaches like pilot testing and phased implementation of regulations so that they can test new

> approaches to working with technology in a small-scale, low-risk manner before applying what they learn to larger-scale efforts."[8]

To address unknowns associated with smart mobility and other external factors, many larger MPOs in the review employed scenario modeling that envisioned different futures using different assumptions (e.g., how quickly CAVs would be commercially available and adopted by the public, effects of climate change on transportation services and facilities). Projects and programs that performed well in multiple scenarios were prioritized.

To reduce risk, many MPOs funded pilot projects to gain experience with different aspects of smart mobility, with the intention of scaling up successful pilots, learning from the results of less-successful pilots to improve future deployments, and walking away from unsuccessful pilots. Examples of pilot projects are provided below.

Finally, several MPOs identified the need for nimbleness when working with emerging technology and have established programs with dedicated funding to identify, fund, and support smart mobility projects. For example, MAG in Phoenix, AZ, described their Emerging Technology program as featuring "investments that will enable our region to respond to future transportation innovations. While we may not know the technology of the future today, establishing this program will ensure our region is nimble and can respond when new technology advances or innovations become reality."[9] Examples of these programs are also provided below.

The remainder of this section provides examples of how MPOs have integrated smart mobility into their regional transportation projects through dedicated programs, pilot projects, traditional line-item projects, and supplemental plans.

Programs and Pilot Projects

Several MPOs, including those serving Dallas, Denver, Phoenix, Sacramento, and Stockton, have established dedicated programs focusing on smart mobility. For example, Dallas' Innovation Grants for Local Partners and Denver's Innovative Mobility Program provide competitive grants to local jurisdictions wishing to deploy a smart mobility application. Stockton has a defined set of projects to be funded through its Stockton Mobility Collective, including community engagement, the Vamos Mobility app, carsharing in downtown Stockton, bikesharing in Stockton, workforce development, and a mobility wallet pilot program for low-income residents wanting to use new shared mobility programs. Sacramento's Innovative Mobility Program does a little of both, with $3 million set aside annually for competitive grants and $3 million set aside annually to support the MPO's smart mobility projects and subprograms.

[8] Metro. 2023. *2023 Regional Transportation Plan,* Portland, OR.
[9] Maricopa Association of Governments. 2021. *Regional Transportation Plan: Momentum 2050.* Phoenix, AZ.

Programs that partner with local universities and/or outside experts to provide research and support related to smart mobility have been established by a few peer MPOs. These include:

- North Texas Center for Mobility Technologies (Dallas): Coordinates the expertise of regional research universities to address regional, statewide, national, and global mobility technology challenges.
- Northern Nevada Intelligent Mobility Living Lab (Reno): A partnership with the University of Nevada, Reno. Projects have included university support to the MPO to learn how to use big data generated by new technologies, gather and integrate roadway data collected by instrumented buses, and use LiDAR to automate rectangular rapid flashing beacons at pedestrian crossings along an arterial.
- New Mobility Lab (Vancouver, BC): Part of the TransLink Tomorrow program, the New Mobility Lab provides "a coordinated program of applied research aimed at answering new mobility related questions of relevance to us and our regional partners…. The dialogue creates a space for researchers and TransLink to collaborate and identify new research needs, explore innovative ways to improve mobility in Metro Vancouver and advance the progress of the Regional Transportation Strategy Goals."[10] TransLink Tomorrow has also funded a microtransit pilot, a shared mobility pilot (bikeshare, carshare, and public transit options aimed at employees in one suburb), and an "open call for innovation" pilot.

NCTCOG (Dallas) funds three other smart mobility–related programs. The Transit Strategic Partnerships Program, funded by a 2% set-aside from FTA Section 5307 and 5310 grants to North Texas provides grants for eligible transit and shared mobility projects. To be more responsive to immediate needs, grant applications are accepted on a rolling basis. The Transportation Technology Innovation Program focuses on supporting AV developments, while the Freight Optimization Program is intended to support regional freight movement, starting with a pilot project to provide truck signal priority near freight hubs.

Line-Item Projects

Most, if not all, of the MPOs reviewed included arterial and freeway ITS applications as traditional line-item projects in their transportation improvement programs. DRCOG (Denver) has used line-item projects for regional mobility hubs, an autonomous circulator in Golden, and ITS/artificial intelligence equipment for a multiple-use trail. Central Lane MPO (Eugene, OR) appears to have funded all of its smart mobility projects through a traditional line-item process:

- Develop center-to-center (C2C) communications between agency traffic management centers and emergency operations centers (EOC)
- Upgrade central traffic signal system, and integrate with regional ATMS
- Upgrade legacy traffic signal controllers to ATC signal controllers. Implement advanced signal operations on select corridors

[10] TransLink. 2024. TransLink Tomorrow (website). https://www.translink.ca/plans-and-projects/programs-and-studies/translink-tomorrow#new-mobility-lab

- Implement communications to Lane County signal and Intelligent Transportation System (ITS) devices
- Implement next generation transit signal priority on EmX and major bus routes in Eugene
- Enhanced detections systems on freight corridors to provide truck priority
- Implement smart parking at major parking facilities including parking sensors, parking information message boards at key approaches
- Integrate travel information from all jurisdictions into real time (travel time/delays). Provide travel time through mobile application and dynamic signs on major arterial corridors.
- Develop automated data collection and performance reporting system, including transit performance monitoring
- Upgrade signal controllers, communication, enhance detection and cameras to collect and archive operational data for analysis tools and safety analytics
- Management of special events to include signal timing plans, portable dynamic message signs, parking management and interface with U of O operation center

Supplemental Plans

A number of MPOs have developed supplemental plans related to smart mobility that have provided vision, goals, and projects for the following MTP update. These include:

- Eugene: ITS
- Denver: Mobility Choice Blueprint, Shared Micromobility in the Denver Region
- Portland: Regional Travel Options
- Dallas: AV Hosting Handbook for North Central Texas Communities
- Sacramento: Next Generation Transit Study, Zero-Emission Vehicle Deployment Strategy, Smart Region Technology and Mobility Master Plan
- Vancouver, BC: Regional Transportation and Mobility Current Context Report, The Future of Driving

Another common approach is to develop smart mobility goals and projects through the modal plans (e.g., active transportation, transit, freight movement) that support the MTP.

Smart Mobility Performance Measurement

Of the MPOs included in the review, only those serving Dallas, Las Vegas, Sacramento and Vancouver, BC had developed performance measures specific to smart mobility. The other MPOs included the effects of smart mobility as part of broader performance measures such as VMT or mode share.

The North Central Texas COG identified the following three measures to support its objective of transitioning to more sustainable fuel sources:

- Electric vehicle registrations
- Electric vehicle charging infrastructure (number of plugs)

- Public agency fleet greenhouse gas reductions

The RTC of Southern Nevada identified three indicators to support its "Use Innovative Planning to Address Emerging Technologies and Trends" strategy and indicated that these indicators needed development:

- Autonomous vehicle travel share
- Technology impact tracking
- Transportation network company travel share

SACOG's smart mobility performance measures for Sacramento are:

- Number of successful new mobility pilot projects and programs that get expanded or extended.
- Number of new pilots launched to test additional new mobility solutions.
- Number of case studies and lessons learned from unsuccessful pilot projects.
- Number of transit fleet and facility plans to prepare for zero-emission vehicle requirements.
- Number of new and innovative transportation demand management programs including data and lessons learned from pilots.
- Implementation of new high-frequency bus service, including the region's first bus rapid transit and zero-emission bus shuttle between downtown Sacramento and Sacramento International Airport.
- Data and analysis that can be used to support regional funding programs and state and federal grant opportunities.

TransLink's smart mobility performance measures for Metro Vancouver are:

- Percentage of trips accessed through Mobility as a Service apps.
- Percentage of stations/stops with easy connection to non-transit modes, by number of modes.
- Percentage of registered light-, medium-, and heavy-duty vehicles that are zero- or near-zero emissions.
- Percentage of light-, medium-, and heavy-duty vehicle sales that are zero- or near-zero emissions.
- Number of public Level 2 (or faster) EV chargers
- Percentage of parking stalls in multi-unit buildings that have EV chargers
- Transportation fuel consumption by fuel type

Summary

This review of how selected MPOs in the western U.S. and Canada are addressing smart mobility in their MTPs found that while some MPOs are more active than others in this area, all are considering smart mobility to some degree. While a number of larger MPOs with access to more resources (e.g., Dallas, Denver, Sacramento, Vancouver, BC) have invested significant effort in

this area, so have some MPOs that are smaller than Spokane (i.e., Eugene, Reno) or not that much bigger (e.g., Stockton).

A majority of the peer MPOs have developed policies, goals, objectives, and/or strategies specific to smart mobility and this memo has documented them. In particular, Vancouver, BC has developed a comprehensive set of strategies and actions related to smart mobility.

Many peer MPOs are taking non-traditional, lower-risk, nimble approaches to developing smart mobility projects, relative to how they plan and program other transportation projects. One approach is to gain experience with specific smart mobility applications by funding pilot projects and expanding them later if they prove successful. Another complementary approach is to dedicate staff and funding to a smart mobility program that may include a combination of MPO-directed projects and competitive grant opportunities for local jurisdictions to implement smart mobility projects. A few MPOs also partner with local universities, community colleges, and trade schools to develop MPO staff expertise, investigate outcomes of smart mobility projects, and develop the local workforce needed to operate and maintain smart mobility technologies. Given the presence of Eastern Washington University, Gonzaga University, Washington State University, and the University of Idaho within 1½ hours of downtown Spokane, university collaboration may be an option that SRTC may consider pursuing.

Only four of the 17 peer MPOs have developed performance measures specific to smart mobility. For the most part, each of these MPO's measures focus on different and relatively narrow aspects of smart mobility. Dallas' measures focus on EV adoption, EV charging infrastructure, and public fleet conversion to clean fuels. Las Vegas' measures, not yet fleshed out, focus on AV and shared mobility travel share and the impact of technology. Sacramento's measures focus on smart mobility activities performed by the MPO, while Vancouver, BC's measures focus on EV adoption and access to mobility options.

APPENDIX D: Electric Vehicle Charging Needs Update

SRTC
SPOKANE REGIONAL TRANSPORTATION COUNCIL

ELECTRIC VEHICLE CHARGING NEEDS UPDATE

November 2024

Abstract

Spokane Regional Transportation Council, Avista Corporation, and Washington State Department of Transportation worked with community partners to develop a strategic buildout plan for Electric Vehicle Supply Equipment (EVSE). Since the beginning of the project, the marketplace for Electric Vehicles has shifted. This memo provides an update to previous plans and guidance for local agencies to support the installation of EVSE.

Prepared by:
KITTELSON & ASSOCIATES

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SRTC EV Charging Update

Introduction

Expanding charging infrastructure is essential for fostering widespread EV adoption and addressing the charging needs of diverse demographics, including those without access to home charging options. Local governments play an important role in preparing for EVs by establishing policies, regulations, and guidance for electric vehicle supply equipment (EVSE) to both regulate and incentivize their installation to achieve community goals. Jurisdictions should plan for the charging needs of automobiles and trucks as well as for micromobility devices, such as e-bikes and e-scooters.

Spokane Regional Transportation Council (SRTC) in partnership with Avista Corporation and local jurisdictions in Spokane County received a $2,500,000 grant from the Washington State Department of Commerce to install EVSE around the region. SRTC, Avista, and WSDOT worked with local stakeholders and community partners to develop a strategic buildout plan for over 100 charging sites by 2025 to establish a backbone of charging infrastructure along major travel corridors and within higher population centers. In 2021, more than 50 EV chargers were deployed throughout the region. It was among the first coordinated projects in the US aimed at providing a network of public chargers.

Since the beginning of the project, the marketplace for EVs shifted. Washington implemented RCW 43.392.020, which established a target for the adoption of zero emission vehicles by 2030[1] and adopted California's Advanced Clean Trucks regulation.[2] Washington is poised to adopt California's Advanced Clean Fleets regulation that will require the purchase of zero emission (ZEV) trucks.[3] Washington convened the EV Coordinating Council to create a Transportation Electrification Strategy that was presented to the State Legislature in February 2024.[4] The federal government introduced unprecedented investments in charging and hydrogen infrastructure. The federal government created the Joint Office of Energy and Transportation to administer billions of dollars in funding for charging and hydrogen infrastructure[5] and the Department of Energy issued a $7 billion opportunity for hydrogen hubs.[6] One of the regional hydrogen hubs under development is in the Pacific Northwest.

The thinking about how, when, and where people will charge their cars, trucks, and buses continues to evolve as more Zero Emission Vehicles (ZEVs) makes and models are available, and the diversity of ZEV drivers expands. It leads to the question about the role of local government in the deployment of ZEV infrastructure: is local government the lead in deploying EV charging and hydrogen stations because of the social and environmental benefits, or does local government enable economic and workforce development that encourages private industry to invest in ZEVs and ZEV fuels?

[1] https://app.leg.wa.gov/RCW/default.aspx?cite=43.392.020
[2] https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks
[3] https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets
[4] https://deptofcommerce.app.box.com/s/uphekt6rwpmtvbhojyi6eifjxdwttdvh
[5] https://driveelectric.gov/
[6] https://www.energy.gov/oced/regional-clean-hydrogen-hubs-0

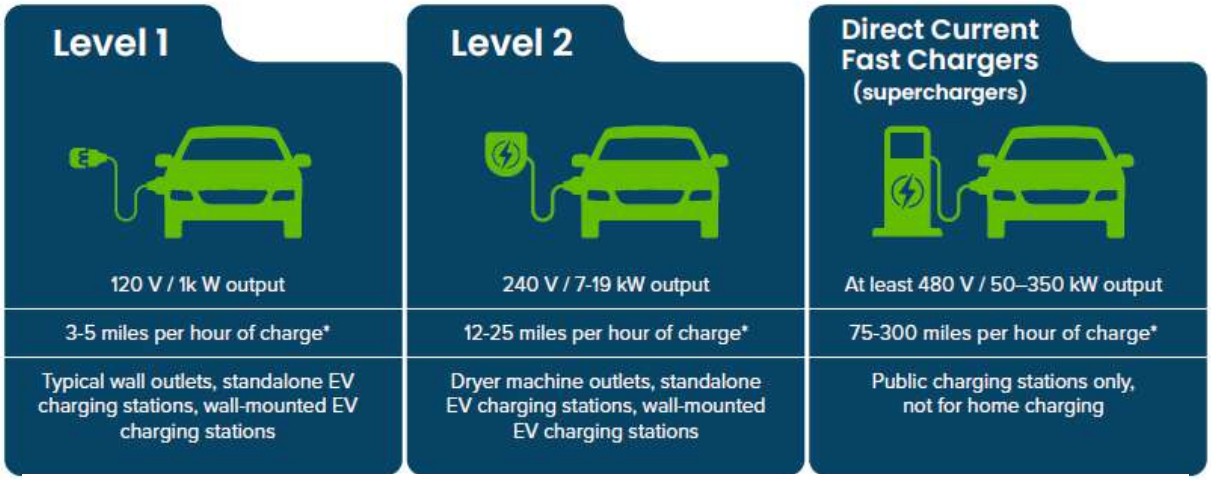
GOAL

Identify actions and activities that can help Spokane County jurisdictions meet the needs of ZEV projections modeled in the statewide Transportation Electrification Strategy.

OBJECTIVES

- Update EV adoption projections
- Identify factors that can lead to future demand shifts
- Identify priority locations for public charging for passenger vehicles
- Identify needs for zoning, policies, funding, and partnerships to implement the plan
- Identify opportunities for jurisdictions to support installation of EV chargers at residences

State of the System



*Note: The charging range for each charger type is an average and varies among vehicles. As battery technology continues to advance, the vehicle range and charging speeds will improve.

Land use plays a large role in determining which type of EV chargers should be considered. For example:

- **Residential:** Level 1 or Level 2 chargers because most EV drivers charge at home when their vehicle is parked for 8 or more hours.
- **Commercial/Retail:** Level 2 chargers to accommodate charging for a few hours where users can take advantage of spending time at adjacent land uses such as grocery stores, malls, hotels, and workplaces while the vehicle is charging.
- **Fleet:** Level 2 or Level 3 / DCFC chargers at commercial/industrial locations that support commercial vehicle fleets. These can be during overnight parking or along travel routes for higher power faster charging.
- **Transportation Corridors/Commercial:** Level 3 / DCFC chargers for land uses adjacent to major interstate highways or in areas where users need a quick charge and most likely will not be leaving their vehicles. Access to other transportation modes or land uses is less important in areas that offer Level 3 chargers with the exception of amenities like bathrooms or convenience stores that are within walking distance of the chargers, similar to gas stations.

SITING EV CHARGING STATIONS: LESSONS LEARNED

In 2018, the National Renewable Energy Laboratory (NREL) created Electric Vehicle Infrastructure – Projection (EVI-Pro) tool to help planners estimate how much EV charging infrastructure is needed in a designated area to meet a given demand. Most local governments used EVI-Pro Lite to estimate the future need for charging stations for public, workplace, and multiunit dwellings.

In 2018, most EVs had a range of 85-125 miles and EVI-Pro assumed that every driver needed 2.5 plugs: one at home and one at work, both of which the driver would use daily, and one at a retail or entertainment location that the driver would use occasionally. Modeling assumed that drivers would use 1/3-to-1/2 of the

energy in the battery on each trip and would always plug in when parked. A lot changed in a few years. In 2024, new EVs can achieve 300 miles on a charge and some luxury models claim more than 400 miles. Additionally, technology improvements mean that current model-year EVs are not experiencing battery and range degradation. As a result, many drivers don't need to charge every day.

Early deployment has also shown that the buckets of "public" and "workplace" are not absolute. Many workplaces have parking lots that are shared parking by employees and customers, clients, students, patients, residents, and other non-employees. This can make turnover at a charging station more challenging—an employee, student, or resident may be in a parking space for hours whereas a customer, client, or patient may need to park for less than 30 minutes. Similarly, multi-unit dwellings in the modal did not account for people that rent other types of residences like condominiums.

In 2024, NREL released EVI-Pro Version 3. Working with the California Energy Commission, NREL developed combined data from initial EV drivers, state and federally funded charging stations, current and future EV attributes (e.g., range, charging speeds) and included sensitivity for local policies and initiatives. The following sections identify the key behaviors that led to updates in EVI-Pro V3.

Public Charging

Initially, the thinking was that public chargers needed to be near amenities because a driver needed at least 60 minutes to charge and would want a bathroom, food, and entertainment during that time. It was also assumed that charging stations at retail stores and restaurants would be a draw for businesses. An EV driver would choose Store A over Store B because of free charging.

Data from Energetics[7] and pre-pandemic data from Atlas Public Policy[8] show that free charging is an enticement for EV drivers. If the station charges a fee, neither organization noted an increase in retail or restaurant sales. Atlas did note an increase in hotel room sales when fee-based charging stations were present.

During interviews and focus groups for similar projects in California, EV drivers and potential drivers said that they preferred to use fast charging stations at locations like dog parks, salons and day spas, playgrounds/sports facilities, and libraries. Participants stated three main barriers to charging stations at retail and entertainment locations:

1. **Traffic congestion**. Shopping centers and retail plazas are often on or near busy roads, which can include traffic signals, stop signs, crosswalks, and a line of cars entering and exiting. Interviewees said that they do not want to "fight traffic" to use a charging station.
2. **Personal safety**. In many existing charging locations, the charging station is at the rear of the parking lot or at the side of the building. It's good practice for the store or restaurant to add charging to the parking spots that are farthest from the business entrance. EV and non-EV drivers stated that the car (and driver inside) is not visible to other shoppers, which made them feel

7 https://app.fabric.microsoft.com/view?r=eyJrIjoiODBmMTY2NzAtZmUzZC00NmM0LTlhZWYtMzgyNjk3OGQ3ZDA0IiwidCI6ImM1MDVhNzQ1LTUwYzYtNDc3Zi1hMTEwLTdiZTg5YjUxM2FjYyIsImMiOjN9

8 https://atlaspolicy.com/wp-content/uploads/2020/04/Public-EV-Charging-Business-Models-for-Retail-Site-Hosts.pdf

vulnerable for theft or assault. **Figure 1** shows a DCFC hub at the rear of a parking lot and how some drivers feel too isolated, especially at night.

Figure 1: Electrify America DCFC hub at a Spokane Valley Walmart

3. **Cost of visit.** Existing EV drivers talked about the convenience of getting coffee, seeing a movie, or shopping while charging. However, most of the existing EV drivers interviewed had access to home charging and used public charging as a convenience. Non-EV drivers were concerned about added expenses of eating out or impulse spending if they needed to charge every day or every other day.

Workplace Charging

In the original EVI-Pro model, workplace charging focused on offices and commuters. Keeping in mind that most EVs had less than 125 miles of range in 2018, the thought was that an EV driver would leave home with a full battery, plug in at a Level 1 or Level 2 charging station while at their desk, and then have a full battery to run errands on the way home. Most workplace charging policies specified that a driver needed to move their EV after four hours so another EV could charge.

Then came the pandemic and many office workers stopped commuting for almost two years. Industry learned that essential workers often drive much longer than 10 or 20 miles, work 8-to-12-hour shifts, and can't leave their workstations in the middle of the day to change parking spaces. Interviews and modeling also showed that most facilities have parking for employees, customers, clients, patients, students, guests, visitors, vendors, suppliers, deliveries, and sometimes their own fleet vehicles.

Technology also evolved so that EVSE can have multiple forms of payment and tiered pricing based on the user (fleet versus customer) and time-of-day electric rates. Finally, with newer EVs having hundreds of miles of range, few EV drivers needed to top off the battery to be sure they could stop at daycare before heading home. As a result, workplace charging is still essential, but it is not the simple implementation that was envisioned pre-pandemic.

Multifamily Charging/Residential Charging

About 90% of people that buy a new car, truck, or SUV are homeowners.[9] However, to reach Washington's goal that all new sales of light-duty vehicles are electric or plug-in hybrid by model year 2035, most drivers will need access to charging at their residence or very close by. As such, EVI-Pro initially targeted multifamily properties, called multiunit dwellings or MUDs. It did not define MUD by the number of dwellings per acre, ownership, or zoning. Many of the initial outreach and incentive programs focused on apartments that had five or more units on one lot. Condos, townhouses, and duplexes fell into a grey area in incentive programs, even more so when MUDs have private garages and/or the occupant owns the unit, not rents.

Limited access to home charging also extends beyond renters. Older homes may require significant electrical upgrades that can include replacing out-of-code wires, breakers, and panels in the entire house, which can cost $10,000 or more. Manufactured houses and other homes that use "shore power," like RVs and boats, may not have an electric panel to which a dedicated breaker can be added. In some communities, all units are on a master meter and the renter pays a flat fee for energy. **Table 1** summarizes the characteristics of residences in Spokane County from the most recent Census survey.

Table 1: Physical Characteristics of Residences in Spokane County (2022 American Community survey)

Type of Residence	Number in Spokane County
Single family attached or detached home	153,879
2-9 apartments in a building or property	20,421
10 or more apartments in a building or property	36,609
Mobile home or other non-traditional housing unit	9,970
Total occupied housing units	220,879
Percent occupied by owner	64.3%

About 68,000 occupied structures (which spans all types of residences) were built before 1960.[10] Older homes, especially those that were redlined,[11] and non-traditional housing are often the homes of lower-income and underserved residents.

[9] https://hedgescompany.com/blog/2019/01/new-car-buyer-demographics-2019/#new_car_buyer_demographics_by_home_ownership
[10] https://data.census.gov/table/ACSST1Y2022.S2504?t=Physical%20Characteristics&g=050XX00US53063
[11] https://spokanehistorical.org/items/show/923#:~:text=From%20the%201930s%20to%20the,and%20would%20not%20be%20insured.

EVI-Pro Version 3

Table 2 compares the original EVP-Pro categories and the EVI-Prov V3 categories that Kittelson uses in this report update. Two important notes about updated definitions in EVI-Pro V3 that may be different than local zoning and building codes:

- Single-family is only detached homes rented or owner occupied.
- MUD includes all apartments, townhomes, condos, duplexes, and mobile homes that are rented or owner occupied.

Table 2: EVI-Pro V3 Categories

Original Category	Updated Category	Site Characteristics
Single family charging	Single Family Charging Ports	Residential charging at detached single-family homes.
Workplace **MUD/Multifamily**	Shared Private Charging Ports	Access controlled parking lot for company, employee, and or tenant EVs. ■ Level 1 outlets for 8+ hour dwell times ■ Dedicated or shared L2 ports for 4-to-8-hour dwell times. ■ Multifamily includes apartments, condos, townhouses, duplexes, and mobile homes
Public **Destination**	Shared Public Level 2 Charging Ports	Parking lots at community center, education, retail, grocery, healthcare, entertainment, office, and transportation facilities. ■ Shared higher-speed L2 chargers that can accept payment and manage use for 2-to-4-hour dwell times.
MUD/Multifamily	Shared Public Level 2 Charging Ports	Curbside or parking lots at public facilities "near where people live" (e.g., library, park, school)
Corridor	Shared Public DC Fast Charging Ports	Community charging ports that may be co-located with Level 2 charging or amenities that appeal to residents, commuters, and visitors. Ride-hail charging ports that are located at or near major pick-up/drop off locations (e.g., airport, train station, entertainment district)

EVI-RoadTrip

NREL created EVI-RoadTrip to estimate charging needs to enable destination and interregional travel.[12] Primarily designed to help utilities and grid operators to identify future demand for electricity, the model can also help planners identify where and how many DC Fast Charging stations might be needed to support travel between regions and for visitors.

EVI-RoadTrip is version 1 and was developed with California data. The tool provides valuable insight and guidance for NEVI stations that are being deployed along highways and interstates, and those stations will provide more behavior-based data about EV drivers and charging that will guide future EVI-RoadTrip versions.

Washington State Plan for Electric Vehicle Deployment

WSDOT submitted an updated Washington State Plan for Electric Vehicle Deployment to FHWA in July 2023[13] that was guided by a stakeholder group that included SRTC. Washington State is receiving $71 million over five years of NEVI funding.[14] The plan identifies the Electrify America station on I-90 as an existing NEVI-compliant site and identified US 395 south of Spokane as a Round 1 corridor. It also identifies US 395 north of Spokane as a Round 2 corridor. NEVI-funded stations must be along a designated Alternative Fuel Corridor (AFC) every 50 miles and within one-mile of a highway/interstate on-ramp/off-ramp with goal of creating a reliable network across the United States. **Figure 2** Washington AFCs (Source: WSDOT NEVI Plan Update) presents the Washington AFCs.

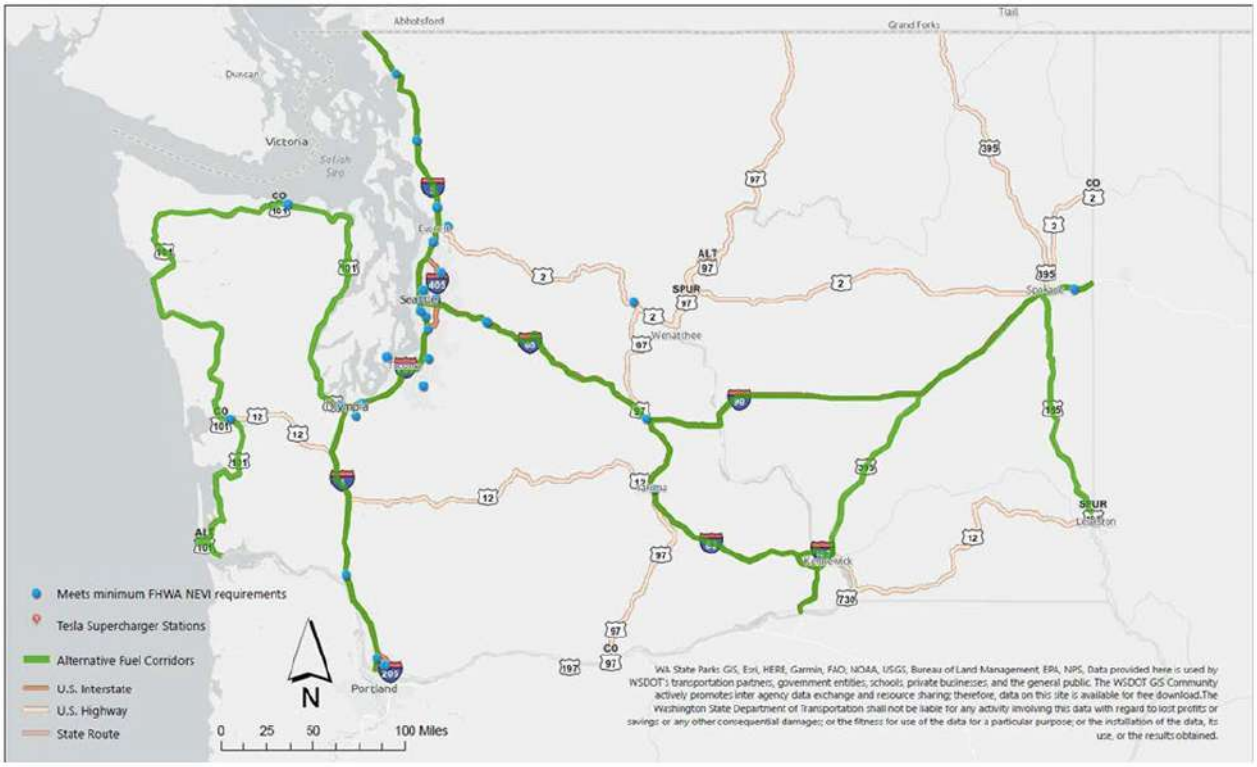
The National Electric Vehicle Infrastructure Formula Program (NEVI) is part of the Bipartisan Infrastructure Law and is managed by the Federal Highway Administration. It provides formulaic funding to each state to deploy EV charging infrastructure and additional funding through Charging and Fueling Infrastructure (CFI) competitive grants.

NEVI funding requires a minimum of four charging ports at each location, which has several benefits that SRTC and its partners can replicate for local charging stations:

- **It reduces capital expenses over time.** The per unit cost of installing two or more EVSE at once is much less than installing a second (or third) charging station later.
- **It concentrates the utility upgrades.** Installing charging stations at multiple locations on the same street, block, or in the same parking lot could require upgrades to two or more transformers and feeder lines. Concentrating the charging stations in a section of one parking lot consolidates the utility upgrades, which can reduce construction time and costs.
- **It offers redundancy.** Three or more charging stations in one place increase the drivers' odds of finding an empty (and working) plug upon arrival.
- **It creates visibility.** Several cars parked in one place at the same time help individuals to feel less isolated. Multiple charging stations are also more visible to non-EV drivers than a single charging station, which may be the encouragement that a driver needs to buy an EV.

[12] https://www.nrel.gov/transportation/evi-roadtrip.html
[13] https://wsdot.wa.gov/sites/default/files/2023-09/WSDOT-NEVI-Plan-Update.pdf
[14] https://wsdot.wa.gov/construction-planning/statewide-plans/washington-state-plan-electric-vehicle-infrastructure-deployment

Figure 2: Washington AFCs (Source: WSDOT NEVI Plan Update)



Washington Transportation Electrification Strategy

In 2022, Washington Department of Commerce organized the EV Council to lead development of a statewide strategy for transportation electrification. The Transportation Electrification Strategy (TES) was adopted at a public meeting in November 2023 and published in February 2024.[15] A consulting team led by RMI developed the analysis and projections in the TES and helped to identify priority actions. Key actions are largely focused on State programs for policies, education, incentives, energy infrastructure, and equity.

[15] https://deptofcommerce.app.box.com/s/uphekt6rwpmtvbhojyi6eifjxdwttdvh

LIGHT-DUTY EV AND EVSE PROJECTIONS IN SPOKANE COUNTY

The Washington State TES dashboard visualizes the projections for EV sales by county by year.[16] According to the dashboard, 6,675 light-duty EVs and plug-in hybrids (PHEVs) will be sold in Spokane County by the end of 2024, growing to 30,644 sold in 2035. **Figure 3** is a screenshot from the interactive dashboard that include EVs, plug-in hybrids (PHEVs), and fuel cell electric vehicles (FCEVs).

It's important to note that the projections that RMI developed are sales, do not distinguish between new and used EVs, and show an even annual increase in car sales. **Figure 4** displays historic vehicle sales data from the Federal Reserve Economic Data and shows the volatility of new and used light-duty vehicles sales on a year-to-year basis.[17]

Figure 3: Projected Sales of EVs and PHEVs in Spokane County

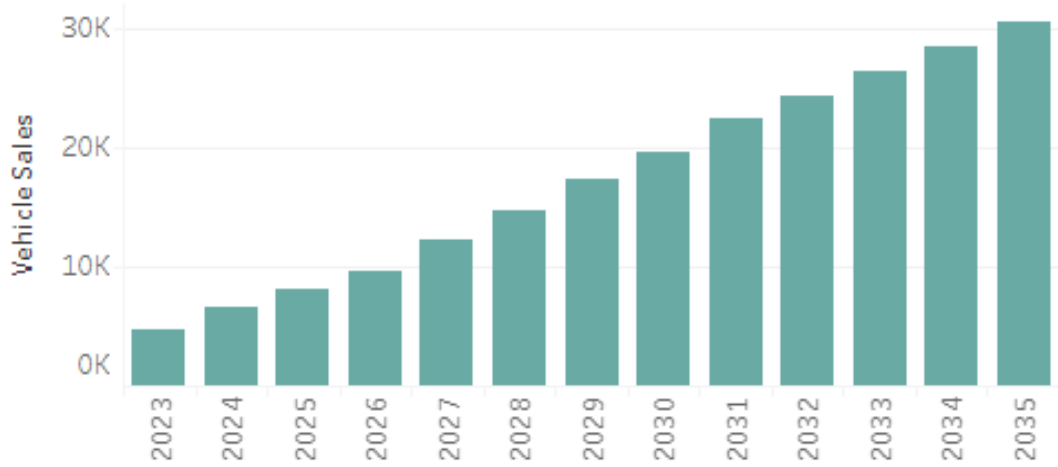
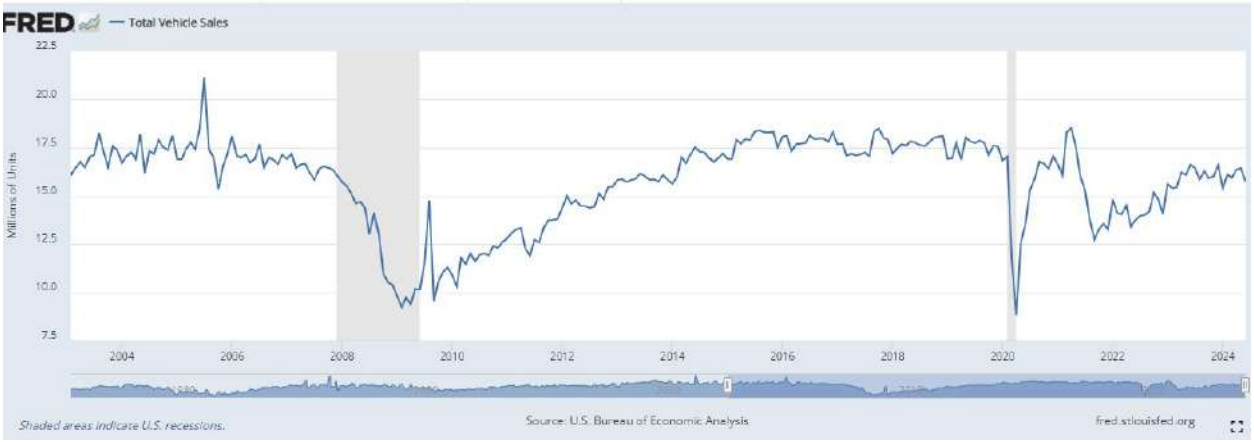


Figure 4: Volatility of national light-duty vehicle sales 2004-2024 (Source: FRED)



[16] https://public.tableau.com/app/profile/waevcouncil/viz/WashingtonTransportationElectrificationStrategy/Story_Published
[17] https://fred.stlouisfed.org/series/TOTALSA

Using the forecasts from the TES and the assumption that every ZEV sold in Spokane County remains in the county, **Table 3** shows the cumulative light-duty ZEVs in the county in 2035. Based on current numbers of registered light-duty vehicles and anticipated population growth, Kittelson finds this number of ZEVs reasonable if state and federal regulations are unchanged.

Table 3: Cumulative Light-Duty EVs in Spokane County (Source: Washington TES dashboard)

Year	New EVs	Cumulative EVs
2024	6,675	6,675
2025	8,183	14,858
2026	9,692	24,550
2027	12,380	36,930
2028	14,747	51,677
2029	17,343	69,020
2030	19,664	88,684
2031	22,541	111,225
2032	24,412	135,637
2033	26,543	162,180
2034	28,590	190,770
2035	30,664	221,434

When the TES was created, EVI-Pro V3 and EVI-RoadTrip were still in development. The TES uses the original EVI-Pro charging station definitions: single family, multifamily, public, and workplace. To support 221,434 EVs in 2035, the TES forecasts that Spokane County will need:

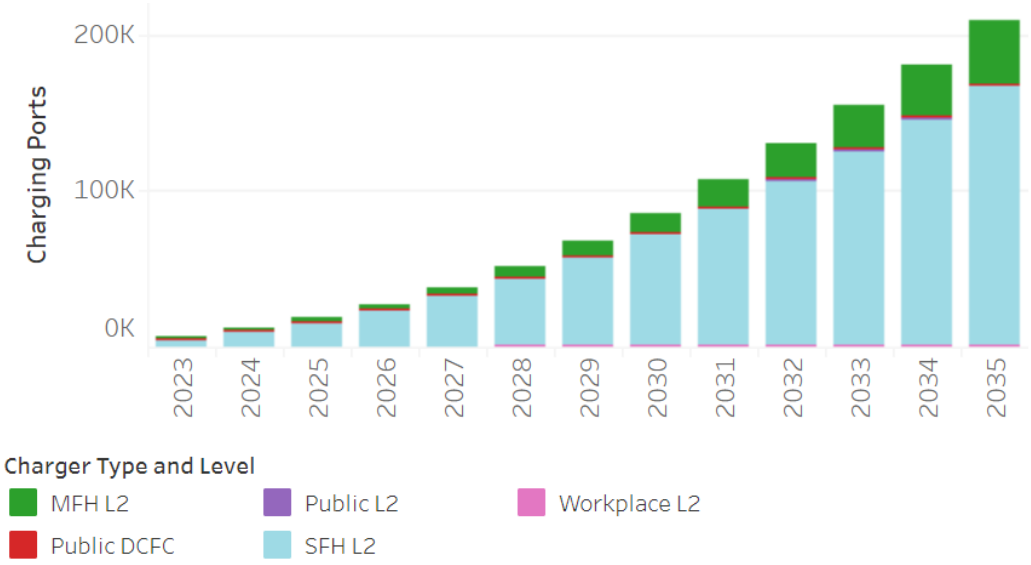
- 165,318 charging ports at single family residences
- 41,017 charging ports at multifamily housing
- 624 public DCFC ports
- 772 public Level 2 ports
- 1,623 workplace Level 2 ports

Figure 5 from the TES dashboard shows the year-by-year port count.[18]

A "port" is the connector between vehicle and charging station. Many Level 2 and DCFC have two ports per charging station, and some have as many as four ports. Ports are also referred to as plugs and connectors.

[18] https://public.tableau.com/app/profile/waevcouncil/viz/shared/3HFCJ5799

Figure 5: Light-duty EVSE needs in Spokane County by year



(Source: Washington TES dashboard)

The TES estimates that in 2024, Spokane County needs:

- 223 Level 2 ports at workplaces (Spokane has 12)
- 152 Level 2 ports in public locations (Spokane has 238)
- 123 DCFC ports in public locations (Spokane has 60)

Cross-referencing the Alternative Fuels Data Center and PlugShare databases, in September 2024 250 Level 2 ports and 60 DCFC ports were operating or planned. This number is only publicly accessible ports and excludes Tesla-only charging stations. **Table 4** shows the number of Level 2 and DCFC ports available to any driver by the type of location. Those listed as "residential" are at sales offices and visitor parking lots.

Table 4: Operational and Planned Charging Stations in Spokane County

Location Type	Number of Level 2 Ports	Number of DCFC Ports
Car Dealership	26	14
Education	24	4
Hotel	32	
Library	18	7
Medical	4	
Multifamily/Residential	4	
Parking Lot/Garage	64	2
Recreation		1
Retail/Restaurant	62	28
Street Parking	4	2
Workplace	12	2
Total	250	60

EVI-Pro V3 and EV-RoadTrip project that Spokane County will need a total of 151,980 EV charging ports by 2035 to support residents, businesses, visitors, and travelers.

- 113,358 Level 2 charging ports
- 100,478 at private residences
- 6,678 in access-controlled parking lots
- 7,461 at privately and publicly owned facilities
- 37,961 Level 1 charging ports at single-family and multifamily residences
- 663 DCFC ports at privately and publicly owned facilities

A Level 1 charging port can be as simple as a 110V outlet. It can also be a 240V outlet (like a dryer outlet.) Because Level 1 charging is a slow "trickle" charge, it doesn't require significant electrical upgrades and isn't a big impact on the grid.

This is about 50,000 fewer than the TES identified, largely due to fewer charging ports at single-family residences and the addition of community charging. **Table 5** shows the numbers of charging stations in each EVI-Pro V3 category and subcategory, and from EVI-RoadTrip by 2035.

Table 5: Charging Station Estimates for Spokane County from EVI-Pro V3 and EV-RoadTrip by 2035 (Source: NREL)

EVI-Pro 3 Category	Definition	Number of Ports
Single Family Home L2	Single family detached	100,478
Single Family Home L1	Single family detached	37,541
Shared Private Charging at Multi-Unit Dwellings L2	Condo, apartments, townhouses, duplexes, and mobile homes	1,124
Shared Private Charging at Multi-Unit Dwellings L1	Condo, apartments, townhouses, duplexes, and mobile homes	420
Shared Private Workplace L2	Exclusive to employees and fleet EVs	5,417
Public L2 at Retail	Collocated at shopping or dining	1,261
Public L2 at Recreation Center	Collocated with recreational or exercise activities (e.g., parks, beaches, gyms, movies, bars, museums)	364
Public L2 at Healthcare	Collocated with hospitals, clinics, dental, or therapy	779
Public L2 at Educational	Collocated with schools, colleges, and universities	536
Public L2 at Community Center	Collocated with religious and community gathering centers	363
Public L2 at Transportation Centers	Collocated with park-and-rides, rail stations, and airports	624
Public L2 near Neighborhoods	Curbside (and other) near where people live	1,366
Public L2 at Offices	Collocated with business parks and office buildings	2,168
Public DCFC for Community	At locations with community access	582
Public DCFC for Ride-hail (aggressive electrification scenario)	At locations that are common destinations for ride-hail drivers	54
Public DCFC for Interregional Travel (EVI-RoadTrip)	Every 10 miles along I-90, US-195, and US-395	27
	TOTAL	151,980

MEDIUM- AND HEAVY-DUTY EV AND EVSE PROJECTIONS IN SPOKANE COUNTY

The count of medium- and heavy-duty vehicles (MD/HD) has never been simple. Trucks and buses are required to obtain various permits, insurance, and registrations, but each document exempts different types of vehicles. Documentation and registration are often issued at a business address, which may be different from the domicile address. Using the Vehicle Registrations by Class and County dataset from Washington State Data Portal[19] and cross referenced with ProsperFleet,[20] a commercial fleet database, Kittelson estimates that about 152,000 medium- and heavy-duty trucks are registered and domiciled in Spokane County. **Table 6** shows Kittelson's truck census based on both data sources.

Table 6: MD/HD vehicles registered and domiciled in Spokane County (Source: Kittelson)

Primary Use Type[21]	Estimated number of vehicles
Commercial	141,211
Exempt (State/County/Local/Tribal)	2,439
Farm Use	5,614
Fixed Load Vehicle	913
For Hire	904
Government (Federal)	198
Logging	26
Tow Truck	754

Washington regulations require that 40 to 75% of medium- and heavy-duty vehicles sold in the state be ZEVs by 2035.[22] Washington expects to adopt California's Advanced Clean Fleets (ACF) regulation that will require large companies, drayage operators, and government fleets to purchase MD/HD ZEVs as they replace or add to their fleet.[23] These two regulations will create a push and pull for ZEV trucks, starting with local delivery and drayage vehicles in the nearer term and eventually extending to agriculture, logging, and other hard-to-electrify trucks.

Trucking associations have challenged the implementation of ACF and Washington and other states are waiting for a ruling (a waiver) from U.S. EPA to be able to adopt the regulation.

Table 7 shows the cumulative MD/HD ZEVs in the county in 2035 as forecasted by the TES. If Washington adopts ACF in 2025 or 2026, Kittelson believes this number may be too low. If ACF is not adopted, this number of ZEVs is reasonable.

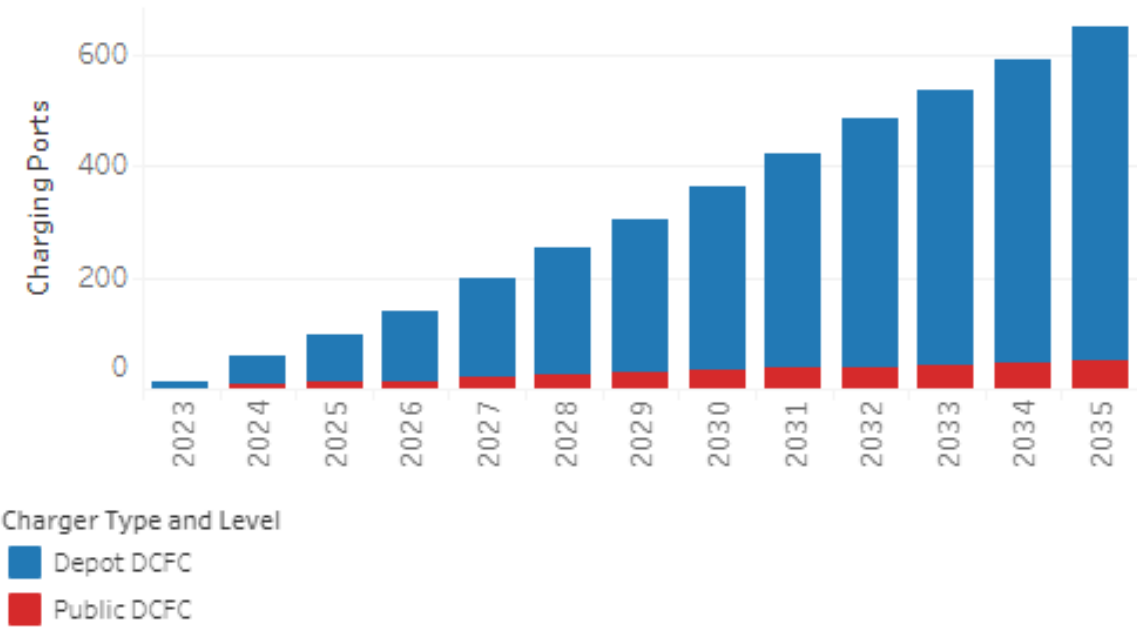
[19] https://data.wa.gov/Transportation/Vehicle-Registrations-by-Class-and-County/hmzg-s6q4/about_data
[20] https://prosperfleet.valgen.com/
[21] Defined in State code: https://app.leg.wa.gov/wac/default.aspx?cite=308-96A-099
[22] https://app.leg.wa.gov/WAC/default.aspx?cite=173-423-081
[23] https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets

Table 7: Cumulative MD/HD ZEVs in Spokane County (source: Washington TES)

Year	New MD/HD ZEVs	Cumulative MD/HD ZEVs
2024	221	252
2025	227	479
2026	225	704
2027	312	1,016
2028	306	1,322
2029	314	1,636
2030	339	1,975
2031	365	2,340
2032	391	2,731
2033	348	3,079
2034	378	3,457
2035	420	3,877
	Total	22,868

Batteries in EV trucks are 2-to-3 times larger than in light-duty EVs and, therefore, need more time, faster charging speeds, or both. Therefore, most analyses assume that all truck charging is DCFC. The number of DCFC ports needed by 2035 are shown in **Figure 6**. This number could be met by one centrally located ZEV truck stop or DCFCs added to existing truck fueling stations.[24]

Figure 6: MD/HD EVSE needs in Spokane County by year (Source: Washington TES dashboard)



[24] https://www.pfleet.com/blog/where-to-find-cfn-sites-in-washington

The TES identifies depot charging and public charging for trucks. Depot charging, shown in **Figure 7**, usually means that the charging stations are in an access-controlled parking lot and available only to the company's own vehicles. These chargers are lower-powered DCFCs and often don't accept payment.

Figure 7: Depot charging (Kirkland, WA) (Source: Chargepoly)

Public charging stations (and hydrogen stations) could be added to existing truck fueling stations or purpose-built for ZEV trucks, like the station in **Figure 8.** Some truck charging stations under development have only high-powered DCFC intended for 60-90-minute charging stops. Others have lower-powered DCFC intended for overnight charging, and still others have both.

Companies that are developing public truck charging and hydrogen stations stated that they are seeking 2-to-10 acres of vacant or underdeveloped land near major freight corridors, within a mile of a highway or interstate exit/entrance ramp, zoned for industrial or similar purpose, and near a baseload fleet, like Amazon, a local government, a transit operator, or a school district.

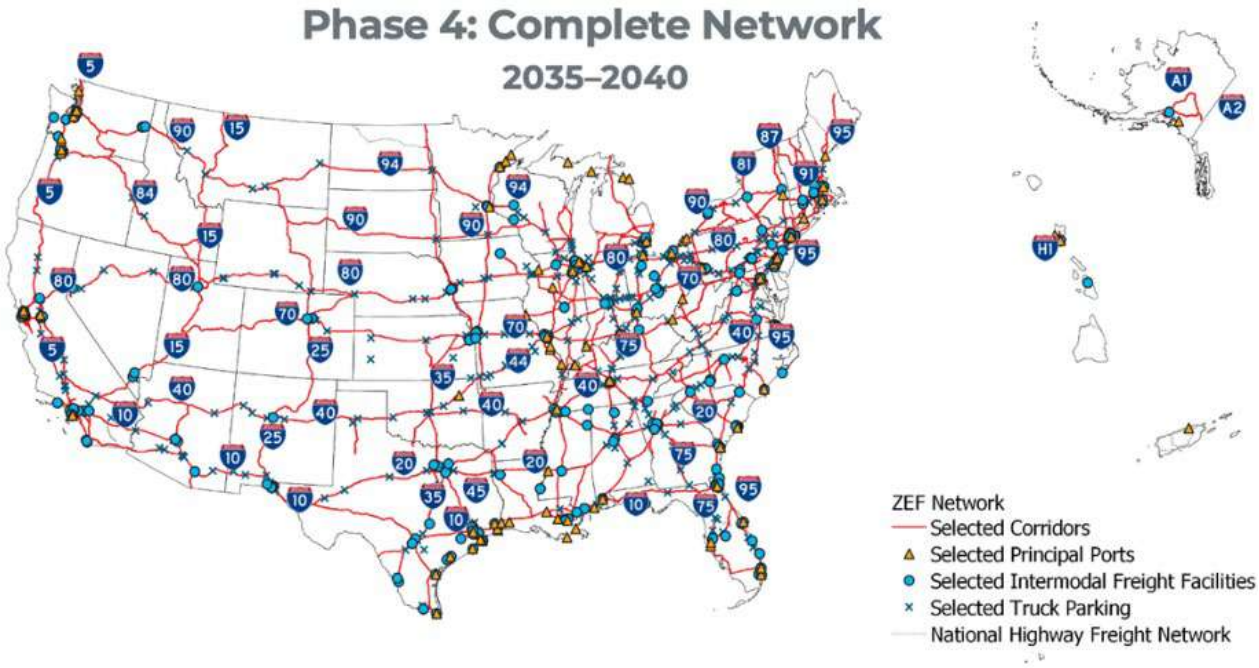
Figure 8: Rendering of public truck charging station (Source: Travel Centers of America

The National Zero Emission Freight Corridor Strategy, March 2024[25] prioritizes, sequences, and accelerates freight infrastructure buildout in four phases. It focuses on key freight routes and hubs based on freight volumes and critical corridors. The following are identified for the Spokane Region (**Figure 9**):

- Intermodal Freight – Air to Truck Hub near the airport
- Intermodal Freight Rail
- Zero Emission Freight Corridors: I-90 and US 2
- Truck Stop Parking – Petrol Spokane, 10506 West Aero Road

[25] Joint Office of Energy and Transportation. National Zero Emission Freight Corridor Study, March 2024

Figure 9: National Zero Emission Freight Corridor Strategy



Near-Term Opportunities for SRTC and its Member Agencies

State, federal, and local utility programs often focus on incentives, rebates, and credits that provide financial support to vehicle buyers and to manufacturers, developers, and dealers. Local government has played an important role in identifying and donating land for charging stations, applying for and administering local and regional grants, and coordinating with utilities.

This section highlights opportunities for SRTC and its member agencies to help create policies, guidance documents, and processes that can encourage third-party development and operation of charging stations to accelerate the adoption of EVs in an equitable manner, and to create local business opportunities that lead to economic development.

- Enable home charging
- Prepare for community charging pilots
- Leverage Commute Trip Reduction information for employee charging
- Plan for public truck charging and hydrogen stations

OPPORTUNITY: ENABLE HOME CHARGING

Permitting

The TES and many other reports call for permitting guidelines, streamlining, and cost reduction. Most recommendations are aimed at commercial charging stations so that developers understand the costs and timelines for permits. Because most people will charge their EVs at home, it's equally important to simplify permitting for residential charging stations, which individual jurisdictions can do without state approval. Examples are:

- City of Seattle EV Charger for Single-family and Multifamily Homes
- Tacoma EV Charging Station Pilot Program
- City of Ventura Residential EV Charging Station Review
- City of San Jose EV Charging Station Permitting Guide
- City of Oakland EV Charging Installation
- City of San Diego Simple Permit and Circuit Card

Recommendation: Review the TES recommendations for permit streamlining and the samples above with each member agencies' community development, building, and planning department. Identify processes that cities can implement quickly and those that take more time. If permit streamlining can be implemented soon, apply for a Paper to Digital grant.

Benefit: A simple process that doesn't require in-person trips to the permit desk and enables a skilled tradesperson to make a relatively straightforward installation can encourage homeowners and landlords to install EVSE.

Local Ordinances to the State Energy Code

The 2021 State energy code that went into effect on March 15, 2024, requires that new dwelling units with attached private garages or attached private carports have a dedicated circuit for EV charging that terminates in a junction box, outlet, or charging station.[26] This level of installation is often referred to as "EV ready." State building code defines dwelling unit as "a single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation."[27]

Additionally, the Revised Code of Washington (RCW) 19.27.540(2) (a) requires EV charging capability at all new buildings that provide on-site parking at a rate of at least one parking space or 10% of required parking spaces, with wiring or raceway sized to accommodate 208/240V, 40-amp or equivalent EV charging.

- Electrical rooms must be sized to accommodate the potential for electrical equipment/distribution to serve a minimum of 20% of the total parking spaces with 208/240V 40-amp or equivalent.
- The greater of one parking space or 10% of accessible parking spaces must be provided with EVCI (may also serve adjacent parking spaces not designated as accessible parking).

Recommendation 1: Fact Sheet. Local jurisdictions and builders will need to have a common understanding about the implementation of this new code as it applies to condos, townhouses, duplexes, and apartments and what constitutes a private garage and a private attached carport, neither of which are precisely defined in building code. A fact sheet that all SRTC member agencies distribute to planners and builders can clarify when and how this new code applies to new construction.

Recommendation 2: Reach Code. Washington State Code allows jurisdictions to pass local ordinances, also called reach codes, which exceed the requirements in state code. SRTC member agencies could adopt reach codes that:

- Require that dedicated circuits terminate in an outlet or charging station (not junction box)
- Require EV readiness compliance in shared garages and unattached carports for all or a percentage of parking spaces
- Require EV readiness compliance for private parking spaces
- Require EV readiness during major remodels that require other upgrades to the electrical system (e.g., installing rooftop solar, switching from a gas furnace to a heat pump)

Benefit: Installing the electrical infrastructure for EV charging is about 1/3 the cost of installing it later. Making homes EV ready removes a major barrier to a resident choosing to buy an EV when they replace their current car, SUV, or truck.

[26] https://app.leg.wa.gov/WAc/default.aspx?cite=51-51-0309
[27] https://up.codes/viewer/washington/wa-building-code-2021/chapter/2/definitions#2

Clear Guidelines for HOAs

On June 9, 2022, RCW 64.34.395,[28] and its counterparts, RCW 64.32.290, RCW 64.38.062, and RCW 64.90.513, were enacted to enable the installation of EV charging stations in condominiums and homeowners associations (HOAs) while protecting the associations and their members from bearing the capital and operating costs. It does not prevent the HOA from imposing restrictions that may include requiring the charging station be out of sight of the street (e.g. inside the garage) and prohibiting charging while parked in the driveway.[29] This can be a particular dilemma for people with very small garages, as illustrated in **Figure 10**.

Figure 10: Tiny garages may require driveway charging

SRTC and its members don't have the authority to change HOA covenants, codes, and restrictions (CC&R), but can create guidance for flexibility for outdoor charging station installation, driveway charging, and charging stations in common areas. Apogee Charging Solutions offers a policy that is a good starting point.[30]

OPPORTUNITY: PLAN FOR COMMUNITY AND NEIGHBORHOOD CHARGING

Recommendation: Identify three pilot programs for community and neighborhood charging that will benefit Spokane residents and result in valuable information for SRTC member agencies and might be applicable for other cities in Washington and nationwide.

Benefit: Identifying locations, proposed outcomes, potential partners and engaged community groups are vital to applying for and winning a Charging and Fueling Infrastructure Discretionary Grant.[31] Winning the grant and implementing the pilots creates a playbook for private developers to implement on a wider scale.

[28] https://app.leg.wa.gov/RCW/default.aspx?cite=64.34.395
[29] https://brandtlawgroup.com/electric-vehicle-charging-stations-in-condominiums-and-homeowners-associations/
[30] https://apogeechargingsolutions.com/does-my-hoa-need-an-electric-vehicle-charging-policy/
[31] https://www.fhwa.dot.gov/environment/cfi/

Curbside Charging

Community Charging: Emerging Multifamily, Curbside, and Multimodal Practices, a report by the Joint Office of Energy and Transportation identifies three approaches to curbside charging.[32]

1. Lower-power overnight curbside charging in medium- to high-density residential neighborhoods where residents park on-street. Pole-mounted chargers, shown in **Figure 11,** may be able to use existing curbside power (e.g., streetlights) to provide low-power charging.
2. Higher-speed level 2 charging at metered parking spaces in areas with higher traffic, visibility, and turnover such as commercial centers. **Figure 12** shows a charging station in New York City that integrates the parking meter and EVSE in one interface/payment system.
3. Level 2 or DCFC charging with an attendant, like a valet, in areas that have no or very limited parking.

Figure 11: Curbside pole charging (Portland)

Figure 12: Metered curbside charging (New York City)

The report also identifies challenges of curbside charging that include competition for the curb from loading zones, bus lanes, and bike lanes; need for ADA accessibility at the curb and the EV charging station; adhering to "no parking" times for street cleaning, snow plowing, and public works maintenance; interference with emergency services; and design standards that are trying to declutter the sidewalk. Cities that have implemented curbside charging noted additional challenges presented by infrastructure under the sidewalk and easements that water agencies, telecom providers, utilities, and other entities may have.

A final challenge with curbside is that EVs' charging ports are in different places: back right, back left, front right, front left, and center. **Figure 13** shows curbside charging in Europe where people bring their own cords (BYOC) and the combination of wrong-way parking and cords snaking through the gutter apron to reach the car.

Figure 13: European curbside charging

Curbside charging isn't appropriate for every neighborhood. Places with narrow streets, urban forests and tree shading, and rural areas without curbs will need other concepts for neighborhood charging. Other neighborhoods may require street and curb improvements to prevent hazards (e.g., tripping on uneven pavement, pools of water during a storm) or thicker asphalt to support the weight of an EV.

[32] https://driveelectric.gov/files/community-emobility-charging.pdf

To identify potential locations and partners, SRTC can:

- Review results of street and sidewalk surveys that were conducted to identify needed improvements to sidewalks, street paving, intersections, and underground utilities. Find opportunities to add curbside charging during other construction projects.
- Contact homeowners and neighborhood associations about interest in a curbside charging pilot. In Spokane County, Homeowners' Associations are often responsible for stormwater system maintenance. Public Works and the County Auditor have information about the many HOAs.[33] A short survey or a map-based community input platform like Social Pinpoint could identify locations for pilot projects for curbside charging.
- Work with the utilities and telecom providers to identify existing easements. These may be recorded in the building or community planning department; however, in some cases the easement will predate city incorporation.
- Understand barriers to "lamppost charging." Streetlights and lights in parking lots have low-voltage electricity and may be an opportunity to directly add Level 1 or low-power Level 2 charging stations. However, municipalities may have a special electricity rate for streetlights that prohibits other uses. That may include cameras, sensors, and other connected devices that enable a smart city to use all the additional electric capacity in a streetlight.

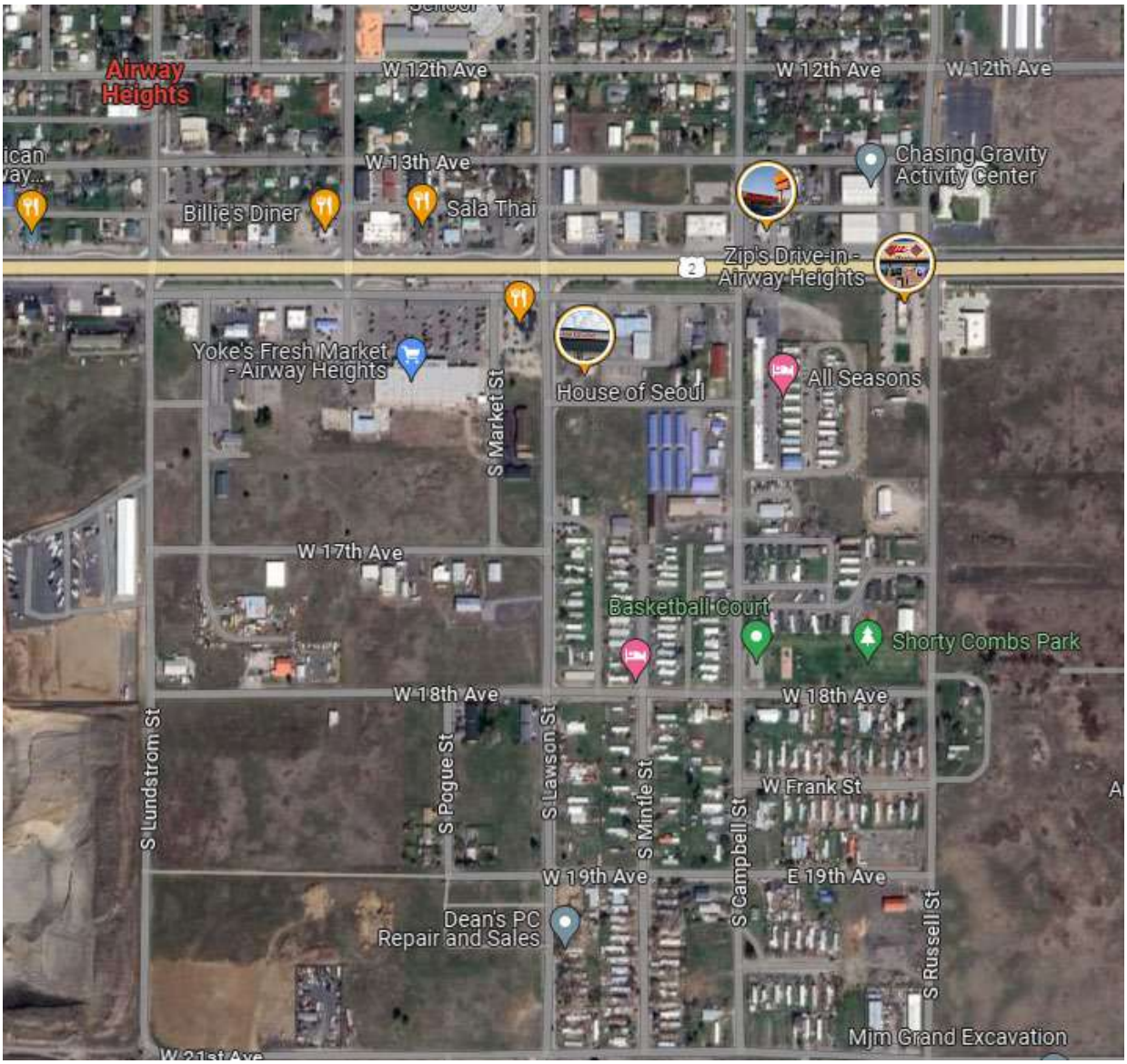
Community Charging

Community charging is an evolving concept that has several current business models and more will evolve as EV deployment accelerates. The idea is to provide high-speed Level 2 or lower speed fast charging at locations that are central to the neighborhood. The location—often referred to as a hub or depot—would have multiple charging ports so that several people can charge simultaneously. These hubs may also include solar panels and battery energy storage to minimize the demand for grid electricity. As a bonus, they can double as a community resiliency center to provide power during a long-duration outage.

Community charging is different than charging stations at businesses, including retail and dining. For example**, Figure 14** is a Google Maps view of part of Airway Heights. Public charging stations at Yoke's Market, one of the restaurants, or Chasing Gravity Activity Center would serve the community, customers, employees, and travelers. A community charging hub at Shorty Combs Park would provide neighborhood charging for the residents of the mobile home parks on the north, west, and south sides of the park.

[33] https://www.spokanecounty.org/4592/Homeowners-Associations

Figure 14: Airway Heights (source: Google Maps)



Charging hubs can be as small as two shared charging stations or include dozens—or hundreds—of ports. They can include multiple amenities and charge a variety of vehicles from e-bikes to large trucks. They may be stand-alone or added to an existing facility.

Figure 15 is a rendering of a planned charging hub in Mission Hills, CA, which includes a "robotic snack shop" and waiting room with tables and chairs. It's proposed for vacant land near a mission church and the developers are using crowdsourced funding to build the site.[34]

[34] https://issuanceexpress.com/evii-mission/

Figure 15: Rendering of an EV hub concept

Figure 16 shows the design of an EVGo charging hub at a community center in Anaheim, CA, and a photo of its implementation. Although charging stations at the entrance of a building look great, they need to be located nearest to electrical tie ins and situated so that cords won't interfere with walking and rolling. The charging hub was funded by Anaheim Municipal Utilities

Figure 16: Rendering and Implementation of an EV hub in Anaheim, CA

At its new Rainbow Park, Vancouver, Canada, installed an electrified bike-share station and DCFC and Level 2 charging stations, shown in **Figure 17**. The program strategy includes "digging once" to build a network of conduit and power connections that the film industry, food trucks, special events, and e-bike and EV charging stations can all use. The installation coincided with a complete streets project that constructed an all-ages-and-abilities protected bikeway and was funded by the City of Vancouver.

Figure 17: Multimodal EV hub in Vancouver, Canada

To identify potential sites for a community charging hub, SRTC can:

- Focus on mobile home parks, which are often affordable housing for many underserved segments of the population, where the residents often own one or more vehicles, and will benefit from lower transportation costs. Mobile homes are also very difficult to upgrade for home charging stations. Spokane County's GIS Data Catalog shows 5,741 mobile home parcels countywide.[35]
- Identify neighborhoods of homes that were built before 1960 and have had fewer-than-average permits issued or census data indicates at least 50% of residents are renters. Use GIS data or local information to identify potential hosts, which include houses of worship, recreation centers, and parks that are within a short walk of many homes.
- Engage with neighborhood associations for condos and townhomes, particularly older communities that tend to have smaller (or no) garages and common areas for parking.
- In collaboration with Avista, other utility providers, and city/county facilities staff, identify facilities that can meet the following criteria:
  - Parking lot/parking spaces that are available to the community 24/7 and that dedicated EV parking spaces will not impede use of the facility.
  - The parking lot/spaces are configured so that one EV charging port will be adjacent to a van-accessible ADA parking space.
  - The EV charging spaces would be visible so that EV drivers do not feel isolated and vulnerable while charging.
  - The electrical supply at the facility (electric panel, conduit, etc.) can accommodate the electric load of two DCFCs.
  - The utility electrical supply (transformer, feeder lines, switchgear, meter) can accommodate or be upgraded to accommodate the electric load of four cars charging simultaneously.
  - Optionally, the location could accommodate shared EVs, micromobility, and potentially mobile services that could visit the site to activate it. For example, a parking spot for an EV bookmobile or mobile vet clinic.

Recommendation: Develop guidance about zoning, planning, permitting, and assessing development fees for charging hubs. Use the above criteria to highlight viable sites.

Benefit: Creates certainty for charging station developers and helps cities and neighborhoods avoid unintended consequences.

Existing guidance from the American Planning Association, U.S. Department of Energy, and other sources is about zoning and building codes for adding EV chargers to parking spaces, like defining EV chargers as an accessory use and allowing EV charging spaces to count toward minimum parking spaces. Charging station developers are also approaching cities with plans and designs to build stand-alone charging hubs or add charging hubs to an existing parking lot.

[35] https://gisdatacatalog-spokanecounty.opendata.arcgis.com/datasets/f3c10efed2a54b4fa0d34f2fd0e5b824_0/explore?location=47.671224%2C-117.433386%2C9.81

Figure 18 and **Figure 19** show EV charging stations, which are more common in Europe. Each of the companies in the photos and several others are building hubs across the U.S. to take advantage of grants, incentives, and tax credits for EV charging and, in many cases, solar energy production and battery storage.

Figure 18: Charging hub in Sandy Springs, GA (Source: Mercedes-Benz)

Figure 19: EV charging hub in Winchester, UK (Source: InstaVolt)

City building departments, planning commissions, and economic development directors need to prepare for these "gas stations of the future." Questions to ask and answer include:

- What is the tipping point between charging stations in a parking lot (powered parking) and a "ZEV fuel station?"
  - Number of charging stations, ports, or EV parking spots?
  - Hours of operation/expected charging sessions per day?
  - Current zoning/land use of the parcel?
  - Dollar amount of site improvements?
  - Additional amenities proposed for the site?
- What are the implications to city services from the proposed ZEV fuel station?
  - Does public safety need to review the site plans to ensure that emergency vehicles have access?
  - How will the site handle refuse and run off?

  - As applicable, how will the site handle snow removal?
  - Is a business license required? If so, who is the licensee if the site owner and the charging station provider are different entities?
- What are the implications to the neighborhood?
  - Does the plan call for an increase in vehicles that will require a traffic study?
  - What is the potential for increased noise in the neighborhood (e.g., people talking, playing music)?
  - How will the site handle vandalism and unintended uses?
  - Will the jurisdiction restrict the site from other uses (e.g., truck charging, mobile food vendors, micromobility vendors)?

Review Land Use Codes: Many jurisdictions have a land use code that is specific to businesses that serve vehicles. For example, the City of Spokane has a code for Quick Vehicle Servicing and a separate code for Vehicle Repair.[36] Revising these codes and/or adding additional codes can cover a stand-alone community charging hub, adding charging to a vehicle repair business, and similar land uses.

Review Building Codes: All jurisdictions refer to national and state codes for buildings that include electrical, plumbing, fire, mechanical, and fuels. International codes provide some guidance for installation of EV charging stations but are focused on wiring and parking spaces.[37] Revised or new codes can address requirements for fire suppression systems, space needed for emergency response vehicles and snowplows, requirements for refuse containers and collection, lighting maximums and minimums, and other allowed uses of the property.

State code has requirements for service stations that might be adapted for ZEV fuel stations. Blaine, WA, has a recent municipal code for gas stations that clearly lists factors to consider for ZEV fuel stations.

Review Impact and Development Fees: Impact fees are charges that a jurisdiction assesses on development activities to recover all or part of the cost for government services, which may include, but are not limited to, emergency services, sewers, streets and streetlighting, parks and park maintenance. Jurisdictions may also charge impact fees for a change of use. For example, changing the use of a warehouse to an indoor soccer club could result in additional impacts to roads, sewers, and police and fire response. Setting development fees for ZEV stations and powered parking spaces and waiving those fees until X number of stations are operational could protect city infrastructure and encourage near-term development.

[36] https://my.spokanecity.org/smc/
[37] https://codes.iccsafe.org/content/ICCEVBCSGGR2021P1

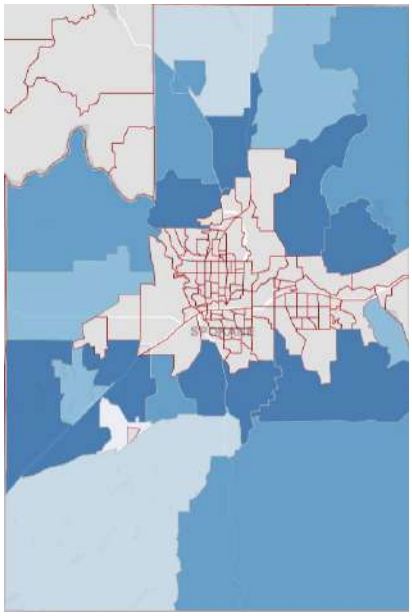
Rural Community Charging

According to the U.S Department of Transportation, rural areas are home to 20 percent of Americans and almost 70 percent of America's lane miles. Rural residents drive longer distances than their urban counterparts, spend more on vehicle fuel and maintenance, and often have fewer alternatives to driving to meet their transportation needs.

The U.S. Census Bureau defines "rural" as having fewer than 2,000 housing units and 5,000 residents.

Spokane County has 19 census tracts that meet the definition of rural, shown in shades of blue in **Figure 20.** Other census tracts include areas that are both urban and non-urban but are not strictly "rural." The shades of blue represent the percentage of residents that live in owner-occupied single-family detached homes and ranges from 95% (darkest shade of blue) to 70% (lightest shade of blue.) By comparison, about 50% of people live in owner-occupied single family homes in the urban census tracts.

Figure 20: Rural Census Tracts (Source: U.S. Census Bureau)



Although the northern and southern areas of the county are unique in many ways, data point to commonalities to consider for rural EV charging pilots:

- Most residents can add charging stations to their properties and have access to home charging.
- Data indicates that pickup trucks and SUVs are more common in the zip codes in these census tracts. Due to the number of businesses that have the words farm, ranch, seed, equestrian, RV, and excavation, Kittelson assumes that many vehicles are used for towing and work purposes.
- Residents (and businesses) will need convenient fast charging mostly for return trips.

Public DC fast charging can be a solution for residents and for visitors to some destinations, which includes the county's many equestrian centers. In cooperation with stakeholder groups that include the farm bureaus[38] in Spokane and adjacent counties, identify rural-focused retailers that include:

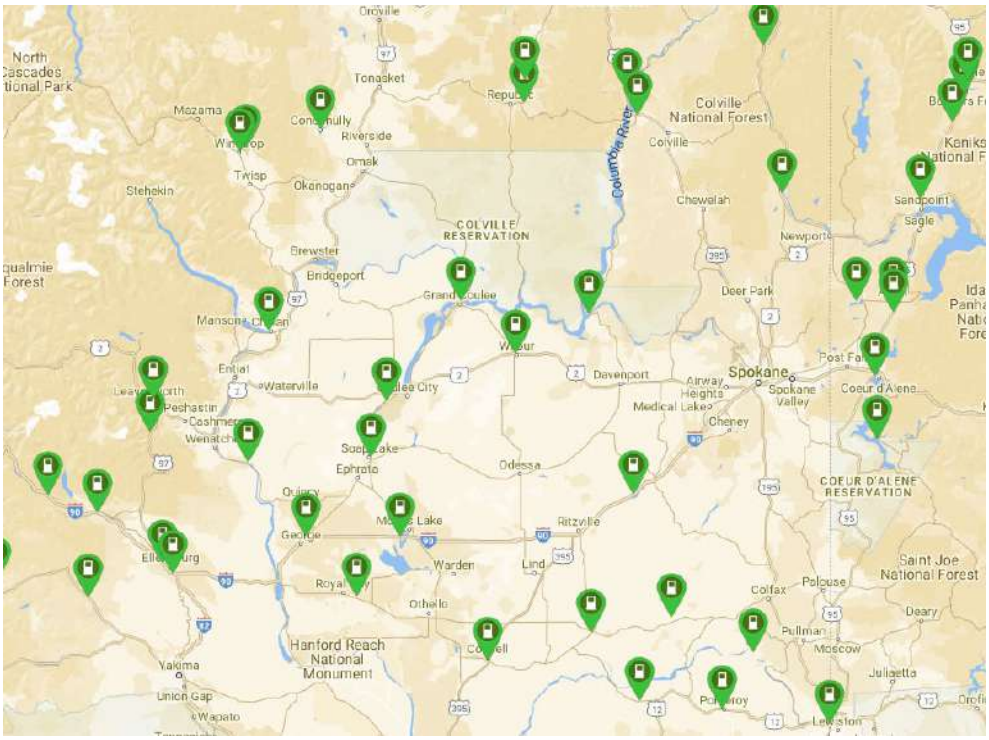
- Hardware stores
- Feed stores
- Agriculture coops
- Equipment dealerships
- Existing truck fueling stations

Campgrounds and RV parks may present an opportunity to add charging. **Figure 21** is a screenshot from PlugShare, a website and app drivers use to locate charging stations. This view shows the places in eastern Washington and western Idaho that listed NEMA charging and camping. NEMA outlets are 220-volt plugs, similar to a dryer outlet, which provide power to motorhomes and RVs when they are parked. They can also

[38] https://wsfb.com/county-bureaus#spokane-county-farm-bureau

charge EVs, although at a slower rate than a Level 2 charging station. Many RV parks have available electricity, Wi-Fi, and physical space that will allow for a Level 2 charging station, and some a DCFC, which could also create income for the business owner.

Figure 21: Campgrounds that offer NEMA charging (Source: Plugshare)



It's also important to design charging stations as islands instead of parking spaces to make sure that EVs can charge when towing a trailer. **Figure 22** is from a Car and Driver blog written by a Vermont farmer about his experience with a Ford Lightening F-150.[39] Pull-through charging stations in rural areas could also provide opportunity charging for local delivery drivers, school buses, and other large vehicles, which helps promote electric vehicle miles traveled countywide.

Figure 22: Pull-through charging can accommodate a trailer (Source: Car and Driver)

[39] https://www.caranddriver.com/features/a42298268/ford-f-150-lightning-pickup-as-a-farm-truck/

OPPORTUNITY: LEVERAGE COMMUTE TRIP REDUCTION INFORMATION

SRTC can use information from the Commute Trip Reduction Plan about how Spokane County residents travel for work. Data from the report may help to identify employers that will benefit from private or public charging stations that could be shared with employees, fleet vehicles, and potentially open to the public. Use the survey data and information from previous household travel surveys to identify employers that are:

- Unlikely to be served by regular, convenient transit routes from residences to workplace. Examples, Spokane County Wastewater Treatment Plant, Liberty School District.
- On routes that were not designed for bike and pedestrian access or become inaccessible in bad weather. Examples, National Weather Service office, resorts at Williams Lake
- Operators of light- or medium-duty fleet vehicles, like home delivery trucks and cargo vans. Examples, construction companies, plumbers, landscapers
- Have a vested interest in climate reduction initiatives. Examples, certified Green Businesses, organic food growers and packagers, recycling/reuse/refill centers.

Additionally, STA park and ride locations should continue to be evaluated for EVSE.

OPPORTUNITY: PLAN FOR TRUCK CHARGING AND FUELING

State and Federal strategies for trucks include batteries and fuel cells. Both types of ZEVs are in the early stages of development for trucks, and both will have a future role in the market. National labs and consultants like Arthur Little, RMI, and PwC project that by 2040, battery EVs will be more dominant for short-haul trucks and urban buses, and fuel cell EVs will be more dominant for long-haul trucks and regional/interregional buses.

Fuel cells convert hydrogen (stored in the vehicle's tank) and oxygen (from the air) into electricity. It takes about 20 minutes to fill a truck or bus tank with hydrogen, and fuel cell trucks typically have 500+ miles of range.

At this time, ZEV trucks are 2-to-3 times more expensive than traditional trucks. Without strong regulations that require the sale and purchase of ZEV trucks and/or incentive programs that buy down the costs of ZEV trucks, adoption will be slow. However, ZEV trucks are the future, and it is important for jurisdictions to remove barriers and create opportunities for businesses to deploy ZEV trucks and invest in infrastructure.

BARRIER: LAND USE CHANGES MAY PROHIBIT COMPANIES FROM ADDING CHARGING STATIONS

As cities look to their urban areas to simultaneously increase housing and reduce GHGs from transportation, commonly called "infill development," they are changing the zoning laws to convert industrial/heavy commercial areas to residential, mixed use, and light commercial. As a result, existing business—including fuel stations—cannot add charging stations because it is a non-conforming use. [40]

Nonconforming use refers to when local governments change zoning laws yet allow some form of exemption to existing property. Often, nonconforming property may not expand its nonconforming use in any way or change the property use at all unless it conforms with new zoning regulations.

Opportunity: Use ZEV fuels as an incentive to move

Economic development departments may closely coordinate with the affected businesses to help them move to a new location, including offering financial support like low-interest loans or city-paid infrastructure for roads, sidewalks, and utilities. If Washington adopts the Advanced Clean Fleets regulation and large businesses need to add charging stations, having properties with existing charging stations, are ready for charging station installation, or have access to a nearby charging hub could be an economic enticement to move, which also helps the city move through its infill development plans more quickly.

Collaborate with Greater Spokane, Inc./Advantage Spokane to identify areas that are targeted for economic development and redevelopment and to understand if this opportunity is applicable.

Opportunity: Exempt a few charging stations from zoning laws

Many developments will take decades to implement. In the meantime, the existing businesses could be allowed to install charging stations for their own use to help them transition to ZEVs and reduce local GHG emissions. Convene the planners in each jurisdiction to agree on the maximum number of charging stations to be installed at existing non-conforming properties.

BARRIER: AVAILABILITY FOR SUITABLE LAND FOR PUBLIC CHARGING HUBS AND HYDROGEN STATIONS

Kittelson staff interviewed developers that are building and funding truck ZEV stations across the U.S. Although the developers had a variety of business models, most station developers stated that they wanted to build ZEV stations on land that they own. They are looking for sites that:

- The developer can own; most are not interested in building a station on leased or loaned land.
- Vacant property that is undeveloped or underdeveloped or is a parking lot. They are not interested in remediating a brownfield or renovating existing buildings.
- Already zoned for industrial (or similar) use

[40] https://www.law.cornell.edu/wex/nonconforming_use

- 2-to-10 acres on a current freight corridor that will not need upgrades or changes to support additional traffic. To be eligible for federal funding, the site must be within one mile of an exit ramp from a designated Alternative Fuel Corridor (Not all developers apply for federal funding).
- Is relatively near to fleet operations that can create a baseload demand, which might include school buses, transit buses, municipal fleets, and distribution companies.
- The utility can bring in at least 4MW of electricity to the site on a reliable schedule. Most developers expect that the utility will need to scale up to maximum power over several years.
    - Hydrogen station developers do not have the same requirement for power, but desire to be close to a source of renewable hydrogen.

Most station designs do not include buildings, although some developers' plans have a small structure that could be an office or driver's lounge. Some developers expect that they will follow the gas station model in which the developer leases part of the land to other companies for a convenience store and fast food. At least two developers expect to use up to half of the property for solar panels and/or energy storage that they will use onsite and sell to a utility.

Finding land that meets all these parameters is very challenging. Undeveloped land in cities and urban areas is often zoned for residential and light commercial use. In more rural areas, land is often protected natural area, agricultural, or geologically unsuitable. LoopNet, a commercial property database, showed 14 properties in Spokane County that met the developers' criteria, with multiple properties at the Airway Heights Industrial Park and Spokane Valley Industrial Park. Prices ranged from about $1 million to more than $15 million.

Opportunity: Tax Lien Sales and Surplus Properties

In many counties, the tax collector holds a public auction, and each tax lien is sold to the highest bidder. If the property owner continues to default on property taxes, the lien holder can take title to the property and assume all the debts, fines, and other liens. Once the debts are settled and the title is "clean," the new owner can build on the property or sell it. Some cities and counties buy tax liens to acquire land for future development.

Property becomes tax-defaulted land if the property taxes remain unpaid on July 1. After several years of missing the July 1 deadline, the county tax collector can sell the property title to satisfy the defaulted taxes.

Surplus property is land that a city or county no longer needs. It may be land that a jurisdiction bought as an easement, for future potential development, or to remove a blighted or nuisance building. Justifications sell surplus land through auctions, which are usually sealed bids, or buy issuing an RFP for reuse proposals.

RCW 39.33.015 explicitly allows public agencies to transfer, lease, or dispose of surplus real property to a public, private, or nongovernmental entity at low or no cost, if such action is for a public benefit, which the state currently defines as affordable housing.[41]

A similar approach could enable the development of public ZEV stations for trucks and buses. Buying liens of industrial properties and then making them for sale to ZEV station developers. This is a long play—it will

[41] https://app.leg.wa.gov/rcw/default.aspx?cite=39.33.015

take years to establish a local policy, take title to a default property, and then prepare it for sale. It may, however, increase the likelihood of a charging hub in a high-demand area that has prohibitive land costs.

Opportunity: Add ZEV stations to future industrial developments

Industrial parks are an opportunity to add ZEV stations that multiple businesses could access, and developers are very interested in building stations in new and existing industrial parks. Developers have noted two barriers and potential solutions:

- Master plans require buildings on every parcel, and ZEV fuels stations structures don't meet the definition of a building. A categorical exemption in local code could specify that when commercial or industrial properties are used for renewable energy production, energy storage, and/or fuel dispensing, buildings are not required.
- Require that industrial park owners/developers include a ZEV station, which they can build or contract to a third-party, as part of the development. Because these parks need decades to fully build out, requiring that they plan for a ZEV station will ensure that the infrastructure is in place for future charging/hydrogen distribution.

Geographic Opportunities to Fill Charging Gaps

Spokane and Avista are placing charging stations in the urban core and to support interregional travel. Data and operational experience from the first round of charging stations will help to inform continued growth in Spokane and Spokane Valley. Specific examples are:

- The North Bank area in Spokane could benefit from charging stations to serve visitors to the Spokane Veterans Memorial Arena, The Podium, and One Spokane Stadium. These stations could be open to other visitors, area residents, and for employee charging during non-event hours.
- The "West Plains Connection" corridor study aims to reduce congestion along U.S. 2. As the roadway network is diversified and enhanced for active transportation and transit, it could also include a mobility hub that has charging for personal vehicles, vehicles for hire, transit buses, and electric micromobility.
- Cheney appears poised for growth in population, jobs, and residences and is currently underserved with charging stations. Additional charging at and near the university can encourage staff and faculty to transition to electric vehicles. Community charging hubs in the city's developing south side can support current visitors to the National Wildlife Refuge and future multifamily residents.
- Expand the availability of library charging stations to Medical Lake, Liberty Lake, Otis Orchards, Cheney, and Deer Park libraries.
- Explore opportunities for ecotourism with Visit Spokane, chambers of commerce, Spokane Winery Association, Spokane Conservation District, and property owner associations in the recreation and agriculture areas. Charging stations near boat launch ramps and trail heads can bring additional tourism to areas.

- Work with the Spokane Hotel/Motel Association and Washington Hospitality Association to encourage hotels, inns, and resorts to install Level 2 charging stations that can provide workplace and visitor charging. At least 10 Spokane area hotels and the Big Trout Lodge in Liberty Lake have installed charging stations, and others have Tesla-only charging stations.

Summary of EV Plans in Neighboring Counties

Coordinating EV charging station across jurisdictions is important to maximize investments and obtain geographic distribution. For the Spokane region, it is also important to adequately serve drivers who commute from Idaho for work and those who come from more rural parts of Washington for regional services. Below is a snapshot of EV planning in adjacent counties. Of the adjacent counties, Pend Oreille and Whitman counties had the largest relative increases in EVs from 2022 to 2023 in Washington State, with 75.0% growth (32 to 56) and 68.3% growth (183 to 308), respectively.

WHITMAN

According to the Washington State Department of Transportation, in 2023 Whitman County had 308 registered EVs—0.25% of all registered passenger vehicles.

PlugShare shows several campgrounds that offer NEMA plugs. One DCFC is at the Rosalia Visitor Center, and a DCFC and several Level 2 charging stations are at and near the WSU campus in Pullman.

LINCOLN

Compared to other eastern Washington counties, Lincoln has more registered commercial vehicles than passenger vehicles. In 2023, 45 of the of 8,000 registered passenger vehicles were EVs, about 0.7%. Kittelson did not find any mention of EVs or EV charging stations in public records from Lincoln County or Quad-County Regional Transportation Planning Organization (QUADCO.)

PlugShare shows Level 2 charging stations in several cities and towns on US 2 and US 28, DCFCs in Ritzville at the intersection of U.S. 261 and I-90 (one Tesla hub and two non-Tesla), and a Tesla charging hub at a truck stop near Sprague. PlugShare also shows several campgrounds and parking lots that offer charging via NEMA plugs.

STEVENS

In 2023, 211 EVs were registered in Stevens County, about 0.68% of all passenger vehicles. Compared to other eastern Washington counties, Stevens County has a larger number of registered off-road and recreational vehicles, which include ATVs, snowmobiles, and motorhomes. Kittelson did not find any mention of EVs or EV charging stations in public records from Stevens County. The Northeast Washington Regional Transportation Planning Organization (NEW RTPO) has a Call for Projects through September 15,

2024, for Transportation Alternatives.[42] It includes shared micromobility and electric bikes but doesn't specify EV charging stations.

PlugShare shows two locations with DCFCs along U.S. 395, Chewelah and around Colville at the junction of U.S. 395 and U.S. 20 (one Tesla hub and two non-Tesla). PlugShare also shows several campgrounds and parking lots that offer charging via NEMA plugs, and non-networked Level 2 charging stations at businesses in Colville. Fruitland Valley Vineyard recently installed two Level 2 charging stations.

PEND OREILLE

In 2023, 56 EVs were registered in Pend Oreille County, which was a 75% increase above 2022 EV sales and the greatest percentage increase statewide. Pend Oreille had 9,267 registered passenger vehicles in 2023, about 0.6% were EVs. Kittelson did not find any mention of EVs or EV charging stations in public records from Pend Oreille County. The Northeast Washington Regional Transportation Planning Organization (NEW RTPO) has a Call for Projects through September 15, 2024, for Transportation Alternatives.[43] It includes shared micro mobility and electric bikes but doesn't specify EV charging stations.

PlugShare shows one Level 2 charging station at the Metaline Falls Visitors Center and one campground with a NEMA plug.

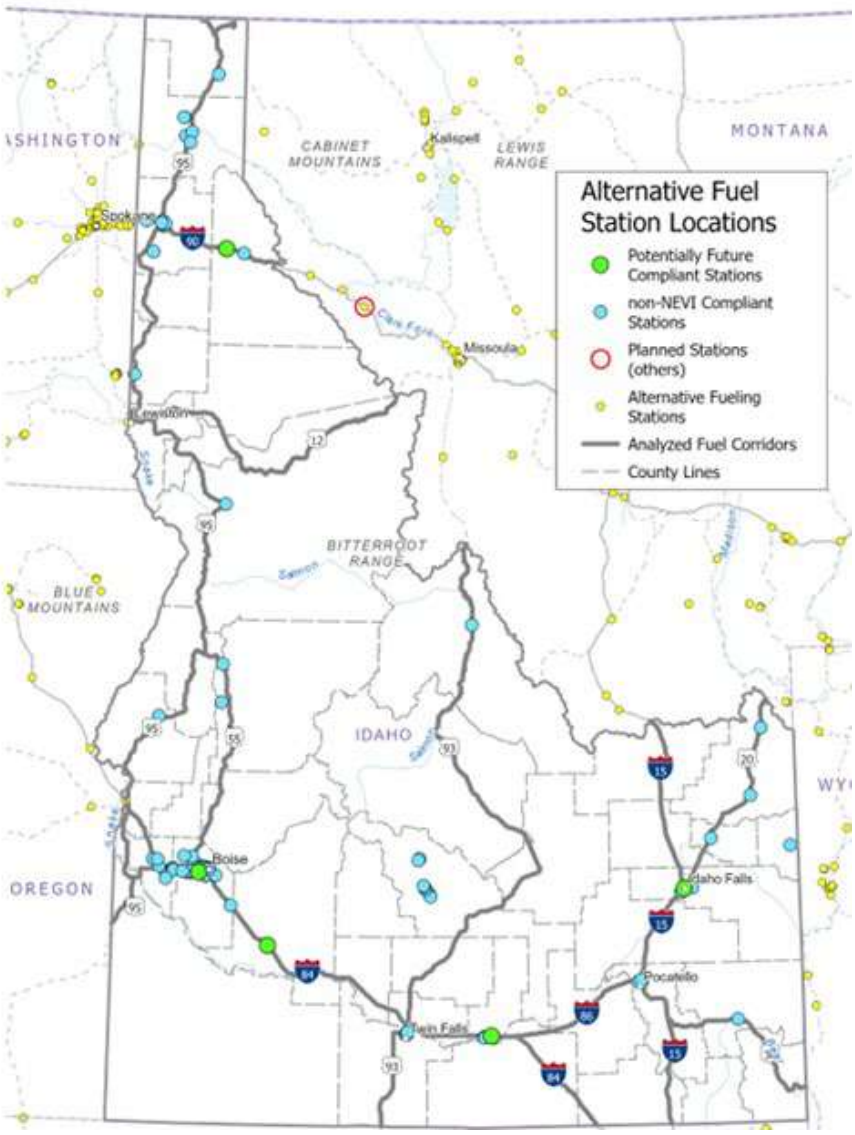
KOOTENAI

As of December 2021, Kootenai County had 290 registered EVs.[44] Idaho does not make vehicle registrations by class or type available to the public, but data from the U.S. Census states that Kootenai County had 71,309 households and an average of two vehicles per household. Idaho's NEVI Plan does not include sites in or near Kootenai County as Tier 1 locations for the first round of NEVI funding.[45] **Figure 23** shows the proposed NEVI locations in Idaho at the Washington/Idaho border. Kittelson did not find any mention of EVs or EV charging stations in public records from Kootenai County, Kootenai Metropolitan Planning Organization, City of Coeur D'Alene, or Avista.

PlugShare shows many DCFC and Level 2 charging stations in and near Coeur D'Alene, many at hotels, retail stores, and travel plazas. Several campgrounds in the northern part of the county offer NEMA plugs.

[42] https://tricountyedd.com/wp-content/uploads/2024/08/2024-2027-TA-Program-Call-for-Projects-and-Guidlines-Draft.pdf
[43] https://tricountyedd.com/wp-content/uploads/2024/08/2024-2027-TA-Program-Call-for-Projects-and-Guidlines-Draft.pdf
[44] https://static1.squarespace.com/static/646663757d1a463dc663547d/t/65270d5cf0812c09b98e59d4/1697058145903/IdahoNEVI-FY2024_Plan_Update_9-26-23_FINAL+REVISED.pdf
[45] https://storymaps.arcgis.com/stories/4aa8138dde6749d991fc3db5216cf5eb

Figure 23: Idaho NEVI plan at WA/ID border (Source: ID NEVI Plan)



Tying it All Together

Electric vehicles will continue to increase in the coming years. A combination of state and federal regulations require that an increasing percentage of vehicles manufactured and sold are electric, and state, federal, and utility funding are helping to reduce the costs of installing charging stations.

According to Washington's TES and federal modeling, about 80% of people will charge their vehicles where they live. They will need access to charging stations when they travel, and on the extraordinary days when miles driven exceeds battery range. About 20% of people will rely on public charging to fill their batteries but will likely go days between charges.

Truck charging will be more dependent on public charging and hydrogen stations. Public charging stations will require megawatts of power and both types of station will require at least one acre of property in an area zoned for industrial or highway commercial use.

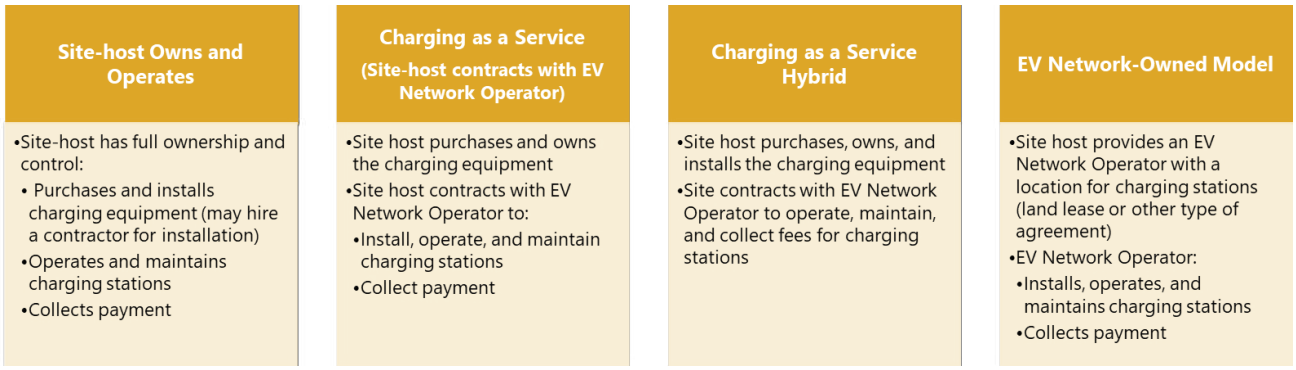
Local governments can contribute to the installation, operation, and maintenance of charging infrastructure by:

- Developing best practices and guidance to share with constituents, private developers, and other jurisdictions
- Updating local codes and design standards to incentivize the installation of EV charging infrastructure
- Transitioning municipal fleets to EVs
- Providing EV charging at public facilities
- Building public-private partnerships to develop programs that prioritize more difficult market areas, such as multi-unit dwellings
- Distributing local funding
- Coordinating with utility providers
- Engaging stakeholders in identifying charging station locations
- Expanding equitable access to electric mobility
- Facilitating the installation of EV charging stations on publicly owned lands
- Encouraging employers to provide workplace charging for fleets and for their employees, which will reduce demand for other public charging infrastructure.

Some key considerations include:

Who should install and own EV charging stations? Many of the EV charging stations installed by local jurisdictions have been publicly owned and procured using grants or other public funds. In these cases, the agency purchased, owned, operated, and maintained the stations. Most agencies have learned they do not want to be responsible for charger operations and maintenance—or the responsibility of handling customer service, payment options, and maintenance requests. Today, vendors and suppliers are typically willing to offer any solution an agency might want to have. There are four main types of EV charging business models, illustrated in **Figure 24.**

Figure 24: Typical Business Models



- **Site-Host Owns and Operates**. The site-host installs, owns, operates, and maintains the chargers. A site-host-owned model might be appropriate in one or more of the following situations:
  - The chargers will be installed in locations that are monitored (e.g., a county-owned parking garage or secured fenced area) to minimize the potential for damage.
  - The site-host wants flexibility in selecting equipment and is ready to take on the responsibility of operating and maintaining it.
  - The site-host is conducting a pilot test of providing public EV chargers and does not wish to make longer-term commitments at the present time.
  - The site-host will not be requiring a fee to use the charger.
  - The local electric utility is a county department.
  - The site-host has the ability to receive revenue and Washington State Clean Fuel standard credits.
- **Charging as a Service (CaaS)**. The site-host pays a subscription fee to an EV charging network to install, operate, and maintain the chargers. By the end of the subscription period, the site-host owns the chargers. A CaaS model might be appropriate in one or more of the following situations:
  - The site-host wants the convenience of dealing with a single entity for all aspects of its public EV charging program and/or does not want to add to staff responsibilities.
  - The site-host's budget cannot accommodate the up-front capital costs of installing charging infrastructure but could do so if the costs were structured as a series of payments over time.
  - The site-host does not want to take on the risk of maintaining and repairing EV chargers and/or wants to lower the risk that its purchased equipment will not be supported in the future.
- **CaaS Hybrid Model.** This model combines elements of the site-host-owned and CaaS models. The site-host installs and owns the chargers up-front but pays a third party to operate and maintain them. Another hybrid option is the site-host chooses not to network its chargers and instead relies on a third-party parking app to collect fees for parking in an EV charging space. A hybrid model might be appropriate when:
  - The site-host does not want the responsibility of maintaining its chargers and/or collecting payments for use, but also wants the flexibility to change network operators if desired.
  - The cost of networking the chargers would exceed the revenue obtained from charging.

- **EV Network-Owned Model**. An EV charging network installs, owns, operates, and maintains the chargers and keeps the charging and/or advertising revenue, or shares the revenue with the site host (e.g., the county, if installed on county property). The site-host can seek out network operators that may be interested in placing EV chargers on their property or the site host can act as a facilitator for the installation of EV chargers on public lands. The network-owned, site-host-as-initiator model might be appropriate in one or more of the following situations:
  - The site-host owns high-traffic sites that do not charge for parking and where people park for an hour or more at a time.
  - Curbside spots can be identified that have sufficient revenue potential and can be implemented without significantly impacting other curbside uses (e.g., bus stops, deliveries, bike lanes).
  - There is a lack of competing privately or publicly owned public EV chargers in the area.

EV charging pricing strategies should align with agency goals. Offering free charging can incentivize EV adoption; however, it is not likely sustainable in the long term. Agencies who offer free charging will need to identify revenue alternatives to cover the electricity costs associated with the charging as well as operations and maintenance costs. Strategies for pricing should be based on an agency's desire to be revenue neutral or revenue generating. To set pricing consider:

- Capital, operating, and maintenance costs
- 3rd party networking fees
- Energy rates
  - Set DCFC rates higher than Level 2 rates
  - Peak energy periods (set rates higher during peak periods to incentivize off-peak charging)
- Idling fees when a vehicle is parked but not charging to incentivize drivers to move their vehicles when they're finished charging to free the space for other vehicles to use.
- Charging for parking space use if you cannot resell electricity.

Prioritize EV charging locations. Consider land uses, how people charge and serving rural and disadvantaged populations. The Joint Office of Energy and Transportation created a Public EV Charging Station Site Selection Checklist to assist with site selection for publicly available EV charging stations.

- **Low-Density Residential**. Areas with predominantly **single-family homes, duplexes, or townhouses with driveways/off street parking** are expected to be largely supported by at-home charging (Level 1 and/or Level 2) and will not require additional charging stations.
- **Multi-Family Residential.** People living in apartments and condominiums may or may not have access to a garage or consistent parking spot and may lack the ability to charge their vehicle. Level 2 chargers are most appropriate for on-site charging. In areas of high demand, one Level 3 (DC Fast Charger) could meet the equivalent demands of several Level 2 chargers.
- **Commercial.** EV drivers can also benefit from Level 2 chargers in commercial areas where they can park their cars for a few hours and charge their vehicles while shopping.

- **Highway Corridors.** Level 3 chargers work best adjacent to major interstate highways to capture long-distance travelers. Level 3 chargers are already being prioritized along Alternative Fuel Corridors (AFC) under the National Electric Vehicle Infrastructure (NEVI) program.
- **Public Facilities.** Places like community centers, libraries, schools, and recreational destinations present opportunities for Level 2 EV infrastructure. They are often located in neighborhoods and have the potential to serve those who do not have access to charging.
- **Curbside charging**. Installation of Level 2 curbside charging in residential areas without off-street parking options.
- **Community charging hubs.** Developing community charging hubs with Level 2 charging in underserved and rural communities, near multi-family residential, at park and ride lots, and in parking lots.

Keep Codes Current. Some additional best practices that could be incorporated into future code and permitting updates are provided below.

- **EV Parking Requirements:**
  - Add requirements for EV-Capable infrastructure for new multifamily housing and for EV-Ready or EV-Installed infrastructure for commercial parking.
  - Add allowance for certain use cases which reduces the number of required Level 2 EV-Installed parking spaces if a DC Fast Charger space is installed.
- **Accessibility**: Follow the US Access Board's Design Recommendations for Accessible Electric Vehicle Charging Stations.
- **Signage and Pavement Marking**: Require that EV parking space signage and pavement markings follow the Manual of Uniform Traffic Control Devices (MUTCD) and Alternative Fuels Data Center requirements and best practices.
- **Landscaping**: Provide more guidance related to EV supply equipment (EVSE) placement and landscaping.
- **Triggers for Upgrades**: Identify a threshold (such as a dollar amount or percentage of the building area) to trigger EV upgrade requirements.
- **Site Design Guidance**: Consider publishing site design guidance for developers.
- **Permitting**: Consider streamlining, standardizing, and digitizing the permit application and review process for EV charger installation.

Enforcement will need to play a role in the efficient use of EV parking spaces. It is recommended that changes be made to allow for enforcement of:

- EV parking space restrictions.
- Reporting of unauthorized vehicle parking in EV spaces.

Continually Monitor EV Technology and Adoption. As with any new technology, EV model options, battery, and charging technology will continue to evolve. Monitoring their evolution will be paramount to meeting future demands.

- Vehicles are becoming less expensive and used models are becoming available. As EVs become more affordable, adoption rates should increase.
- Charging technology is evolving. There are now:

  - Mobile charger services that provide portable, on-demand, off-grid charging. They could serve parking garages, special events, and emergency uses. A mobile fast-charging pilot led by L-Charge is being tested in Amsterdam, Netherlands.[46]
  - Wireless charging roads are being tested using inductive charging. Examples of pilot projects include Michigan Department of Transportation's one-mile-long section of 14th Street in Detroit[47],' the Central Florida Expressway Authority's initiative on S.R 516[48], and the Pennsylvania Turnpike Commission's plan for the new Mon-Fayette Expressway Project[49].
- Federal funding initially focused on long-distance charging needs. New funding is focused on supporting residents who will have the hardest time charging at home—residents without off-street parking.
- Future federal funding is uncertain. Agencies will need to find sustainable funding sources for EV chargers.

[46] The EV Report, "L-Charge Launches World's First Mobile, Ultra-Fast Off-Grid EV Charging Service in Amsterdam." 6 February 2023.
[47] MDOT, City of Detroit and Electreon unveil the nation's first public EV-charging roadway at Michigan Central
[48] State Road 516 (Lake/Orange Expressway) from US 27 to SR 429 | Central Florida Expressway Authority (cfxway.com)
[49] 2022-ptc-sustainability-report.pdf (paturnpike.com)