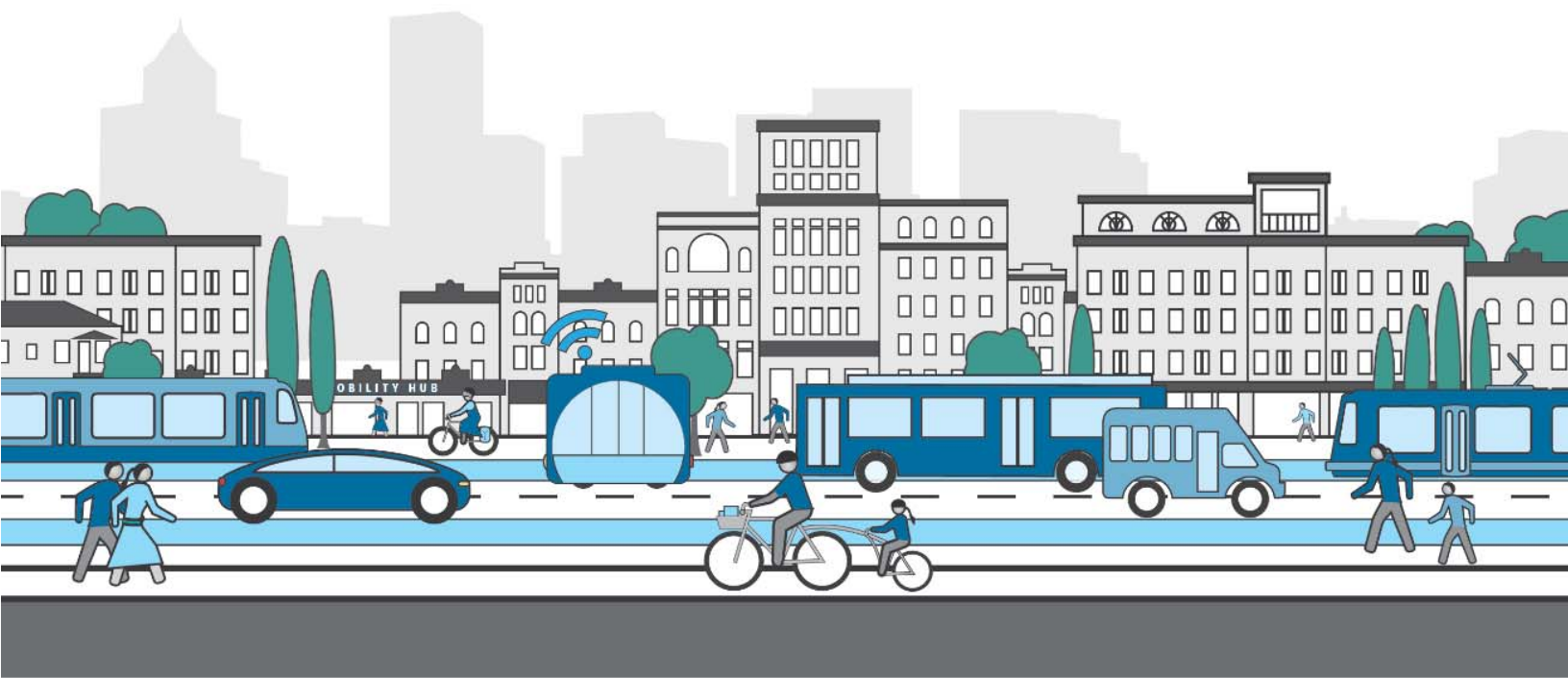




TriMet New Mobility Study

Strategic Business Review

Final Report

June 2018



In partnership with



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EXECUTIVE SUMMARY

The era of public sector transit agencies writing the rules of transit networks is over. Private mobility providers have entered urban and suburban centers and attracted droves of new users to their platforms. Not since the mid-20th century have new tools, information, and mobility options so profoundly changed the way we evaluate, plan, and build transportation infrastructure. With the growing availability of data systems, platforms, and service providers—and the associated disruption in the marketplace—transit agencies nationwide are rethinking ways to leverage these advancements to connect more riders to transit—and potentially new modes that operate in tandem with transit.

The TriMet New Mobility Strategy Assessment comes at an opportune time for the agency to look for new models that could potentially fill market gaps. This report seeks to help TriMet find ways to remain relevant to—and protect the interests of—people throughout the greater Portland region.

Central to evolving the TriMet business model is the concept of assuming the role of the region's mobility manager. The roadmap for changing TriMet's model are described herein through five key findings:

- *TriMet prides itself as a national leader in transportation innovation; redefining the agency role in an era of new mobility is central to strategic, proactive business planning.*
- *TriMet should position itself as the mobility manager for the Greater Portland Region—and is uniquely suited to do so.*
- *TriMet should seek to understand the operational specialties of new mobility service providers in order to strategically engage in project partnerships.*
- *TriMet can operationalize mobility management principles through three key efforts: Grow Services, Leverage Assets, and Influence Policy.*
- *TriMet has a small window of opportunity to retain and elevate its role in the region: iterative testing of multimodal operations will help the agency refine its business model and insulate it from risks introduced by privately-owned new mobility companies.*

Guidelines and direction for assessing pilot opportunities are described in the contents of the report; however, specific projects will be the subject of future agency efforts.

1 INTRODUCTION

TriMet prides itself as a national leader in transportation innovation; redefining the agency role in an era of new mobility is central to strategic, proactive business planning.

PROJECT PURPOSE

TriMet's Business Plan and long-term vision aims to fulfill its role of supporting the economy, easing congestion, providing mobility for those with few options, helping shape the future of the region, and supporting environmental sustainability. Technology and service models in personal and shared transportation are emerging rapidly across TriMet's service area, affecting TriMet ridership and productivity, and creating opportunities to supplement or complement the fixed route transit network. TriMet is poised to lead in delivering innovative transportation services and deliver on its mission and values.

TriMet leadership has described a vision of providing frictionless transportation experiences for its customers. In particular, TriMet identified two ways these tools will enhance services:

1. Increase effectiveness in providing and facilitating mobility around the region, whether through direct rides on TriMet, rides with partners or other service providers, slow-motor wheeled vehicles, or non-motorized modes.
2. Increase TriMet relevance to its customers for all their mobility needs. Solutions must be cost-effective and fit into the overall transit and transportation system in a coherent way that supports individual mobility and community equity.

The traditional measure of success for TriMet has been ridership. While ridership is very important metric or key performance indicator (KPI), TriMet's success today can also be judged by its ability to increase mobility and impact overall network efficiency, especially where that increased mobility reduces roadway automobile congestion and emissions.

New mobility tools and technologies can enhance TriMet's ability to make travel in the region easier and more digitally accessible. The New Mobility Plan will identify investments and strategic policies to implement the Business Plan by defining, supporting and leveraging new mobility services with solutions tailored to TriMet and the Portland context.

Additionally, this body of work seeks to identify investments and strategic policies that TriMet can offer to evolve from a traditional transit authority to one that embraces a comprehensive mobility manager model. This project and resulting documentation seeks to articulate TriMet's vision as a mobility manager for the region, and identify what resources, practices, and

partnerships the agency needs to successfully operate under this new business model. Potential projects and partnerships will consider new mobility strategies such as:

- Ride-hailing services (aka Transportation Network Companies [TNC], such as Uber and Lyft)
- Ride-sharing services (such as Car2Go and ReachNow)
- Demand-response / Microtransit providers (such as Via, Chariot, and EasyMile)
- Autonomous vehicle (AV) technology for shuttles or other vehicles
- Other shared mobility services (such as BIKETOWN bikeshare, e-scooters, and dockless bikes)

2 AGENCY ROLE IN THE ERA OF NEW MOBILITY

TriMet should position itself as the mobility manager for the Greater Portland Region – and is uniquely suited to do so.

MOBILITY MANAGER MODEL

New mobility offerings in the marketplace—and the expectations of people in the Portland Metro region—are changing at an unprecedented rate. New mobility providers are, in some cases, capturing new and existing transit riders¹ by offering faster, curb-to-curb service. These providers, especially TNCs, carry far fewer people per trip than transit, which risks increasing total vehicle miles traveled (VMT) in the Portland region. This effect could get worse once automated vehicles become a part of the transportation ecosystem.² Traffic congestion is particularly threatening to TriMet, as it compromises productivity across the fixed-route transit network. TriMet is facing these changes by rethinking how it serves people in the region, and finding ways to leverage its proven record of serving the public with high-quality travel options.

The term “mobility manager” is a way to describe the integral role TriMet can play to evolve with new product offerings and changing customer expectations. A mobility manager owns and supports the customer experience in all parts their trips, from origin to destination. With a comprehensive mobility management approach, TriMet can extend its positive impacts on the regional economy and the communities it serves.

TriMet is ready to evolve into a mobility manager role due to the agency’s unique position in the marketplace including. Trimet’s advantages include, but are not limited to:

- Multimodal operational expertise and centralized dispatch system
- Region’s mode-of-choice for job access and provider of equitable service
- Largest transit agency in region with geographic boundaries that aligns with the Portland region’s Metropolitan Planning Organization (MPO), Metro
- Demonstrated ability to collaborate with Portland Bureau of Transportation (PBOT), Metro, Oregon Department of Transportation (ODOT), as well as suburban transit providers and municipalities
- Willingness among several parties within the region to further develop dedicated right-of-way (R.O.W), and other means of protecting primary bus lines from congestion
- Owner of substantive real estate assets, including transit stations and protected rail R.O.W.
- Ability to partner with the private sector while continuing to serve the public good

¹ TCRP Report 195, Broadening Understanding of the Interplay between Public Transit, Shared Mobility, and Personal Automobiles.

² Liu, Jun et al. 2018. “Tracking a System of Shared Autonomous Vehicles Across Austin, Texas Network Using Agent-Based Simulation”. Transportation.
http://www.ce.utexas.edu/prof/kockelman/public_html/TRB17SAVs_acrossAustin.pdf

TriMet has begun exploring ways to evolve beyond the more traditional transit provider to proactively incorporate new mobility into its business model. TriMet's planning and operations will need to evolve to include strategies that "meet the marketplace" of rider needs and position TriMet as a mobility manager. This can include several roles, such as:

1. **Partner/Information Provider:** Serve as a conduit and single point-of-contact for a comprehensive variety of mobility options for trips. These may include transit as well as other modes. TriMet assets could be used as a conduit or marketing tool for riders to engage with other services (e.g. HopFastpass app, advertising for links to TNCs, microtransit, etc.).
2. **Broker:** Act as an agent with the ability to both purchase and lease mobility products (e.g. data and fare products) outside of direct TriMet ownership through public-private partnerships (P3); Concession transportation to third party and provide to TriMet riders directly.
3. **Mobility Service Provider:** Provide services directly, with limited inclusion of third-party vendors.

TriMet will benefit from exploring the broker model further in order to negotiate terms that are favorable to agency goals, support transit network efficiency, and ultimately, benefit the public good. These include options such as brokering price elasticities in vendor operations and pricing delivery models, reserving the right to adjust the volume of service, and retaining the ability to renegotiate costs should service volume deviate from forecasts.

TriMet also has a head start with mobility management and a role as a mobility broker through existing initiatives such as:

- **NextGen Transit Signal Prioritization (TSP):** Connected vehicle technology will allow information from vehicles to inform roadway operations by communicating traffic signals and increasing TSP effectiveness. Buses will share data about each route's schedule and passenger load with the goal of improving transit travel time reliability.
- **Rail Operations Optimization Technology (ROOT):** Along with TSP improvements, ROOT communicates vehicle schedule, customer information, maintenance, safety and security, and infotainment.
- **Mobility on Demand Sandbox OpenTripPlanner Shared-Use Mobility (MOD Sandbox OTP SUM):** An open platform will integrate trip planning and fare payment for transit and shared use mobility options.
- **Hop Fastpass:** Hop allows customers to purchase fares for TriMet, Portland Streetcar, and C-TRAN services in one card, and stores value off the card for added security. TriMet is developing a data collection and reporting system to integrate the boarding data into operations and planning.
- **Electric vehicle bus testing:** TriMet is scheduled to put five electric buses into operation this year. The pilot will provide information about vehicle charging and customer satisfaction with new technology.

These initiatives, together with other ongoing capital and service planning projects, will help TriMet develop technologies that align the high-productivity fixed route network with customer expectations and offer a platform for mobility service providers to integrate their services.

INCORPORATING NEW MOBILITY IN THE BUSINESS PLAN

There are many innovative opportunities in new mobility technology and tools that transit agencies are or could consider pursuing. TriMet should consider these new opportunities through its vision, mission, and values statements, and through the primary regional roles as reported in TriMet's Business Plan.

TriMet's vision, mission, and values guide many decisions and project prioritization within the agency. From the 2018 Business Plan, they are:

- **Vision:** Do our part in making our community the best place to live in the country
- **Mission:** Provide valued transit that is safe, dependable, and easy to use
- **Values:** Do the right thing, by being responsive, inclusive, and accountable

TriMet pursues these through primary roles of providing service and capital projects that:

- **Support our economy:** Get employees to work and customers to businesses
- **Ease congestion:** Attract many riders during peak periods and provide the kinds of service and capital projects that lead to development and lifestyles that rely less on peak-period driving
- **Provide mobility for those with few options:** Provide a critical service for seniors, people with disabilities, school kids, low-income households without cars and others who have few mobility options by getting them to work, school and other destinations by transit
- **Help shape the future of our region:** Deliver service and capital projects that help attract residents, businesses, and development to centers, main streets, and corridors that communities have identified as future growth areas
- **Reduce emissions and support environmental sustainability:** Operate service and support development that provides options other than driving, thereby reducing resource use, greenhouse gases and emissions in neighborhoods

TriMet is most effective at supporting the economy, easing congestion, shaping regional growth, and reducing emissions through its high ridership, high-productivity fixed route services. Universally in transit, the most frequent bus service in busy corridors and all-day rail service (like MAX) yield the most mobility for people in the most cost-effective way. To continue to strengthen its vision, mission, and values, TriMet should focus on new mobility tools that yield significant ridership returns in a cost-effective manner.

This focus is tempered by the need to improve mobility for those with the fewest options. The recommendations in this report represent a focus on cost-effective efforts that will generate significant improvement in key metrics, supplemented by targeted implementation of new mobility tools meant to address substantial unmet mobility needs and create opportunities to provide more cost-effective mobility services. Pilots are a great way to help TriMet understand how to extend the agency's reach without committing to longer-term service changes traditionally associated with fixed route comprehensive operational analyses.

New mobility tools and techniques also offer a unique opportunity to broaden TriMet's ability to deliver on its vision, mission, and values in ways beyond simply providing direct bus and light rail service. As TriMet shifts from being a transit agency to assuming a broader role in mobility management, it can more effectively provide benefits to the region.

Other Key Performance Indicators to incorporate as TriMet evolves to a Mobility Manager model*

The norms of the transit agency business model include tracking key metrics or key performance indicators (KPIs) of operations such as ridership, revenue, and network travel trends. These are largely based on standards set by the Federal Transit Administration National Transit Database and trade groups such as American Public Transportation Association. However, becoming a mobility manager will require reexamining established KPIs and defining new ones to gauge success, such as:

- Real Estate asset utilization
- Technology aptitude
- Speed + Reliability measures
- Provision of equitable service

**As discussed during TriMet Executive Session on 19 June 2018*

3 THE NEW MOBILITY MARKETPLACE

TriMet should seek to understand the operational specialties of new mobility service providers in order to strategically engage in project partnerships.

In understanding its role in the era of new mobility, TriMet must first understand the new mobility service providers and business marketplace within Portland, the United States, and abroad. Findings detailed in this chapter reflect market information available as of 2018. A more thorough scan of industry case studies is available within the Task 3 memo of this scope of work.

The U.S. Department of Transportation published an initial report outlining trends that are likely to shape the needs of the United States' transportation system over the next three decades and identified several common mobility challenges shared among transportation agencies nationwide³:

- Providing first-mile and last-mile service to connect underserved communities to jobs
- Facilitating goods movement into and within a city
- Reducing inefficient parking systems and payment, and
- Managing data collection and analysis across systems and sectors

However, the mobility marketplace is changing so rapidly that even these trend factors continue to evolve. Converging revolutions in transportation—shared, autonomous, and electric mobility—present an opportunity to dramatically increase the efficiency, safety, and environmental benefits of the transportation system.

The following sections describe how the marketplace of new mobility services relates to the development of pilot projects at TriMet, how transit centers, Park & Rides, and other TriMet assets can support services through mobility hubs, and how digital jurisdictions affect service development.

³ Transportation Research Board (2017). US DOT's Smart City Challenge and FTA's MOD Sandbox: Advancing Multimodal Mobility and Best Practices. Retrieved from: <http://onlinepubs.trb.org/onlinepubs/webinars/170213.pdf>

MOBILITY-AS-A-SERVICE (MAAS)

MaaS is the use of technology to provide individuals control over their mobility—including access to goods, services, and other needs—without requiring ownership of a personal vehicle to travel, in an effort to expand transportation options and make it easier for people to shift away from driving alone.

MaaS tools seek to reduce drive-alone trips and expand mobility options by using technology to increase high-occupancy and non-driving trips, increase the efficiency of transportation infrastructure, simplify multimodal linked trips, streamline payment processes, and provide real-time information. The goal is to provide travelers with access to the optimal travel option for their needs based on real-time conditions and context, by integrating public and private transportation service providers, reservations and payments, and real-time data and information.

Figure 1 At-a-Glance Overview of MaaS Platforms

Tool		Description
	Transportation Management Platforms	Transportation management platforms are subscription-based or publicly available software products that offer comprehensive commute tracking tools for individuals, and serve as a one-stop-shop for mobility options and incentives. Many include customization, games or promotions to encourage commute behaviors that align with the defined program goals.
	Multimodal Trip Planners/ Aggregators	Multimodal trip planners/ aggregators are online or mobile phone references to help users decide between routes and modal options for trips between specific origins and destinations. These tools typically customize options based on the user's preferences (e.g. cost, travel time, greenhouse gas (GHG) emissions). Some aggregator platforms enable users to plan trips in real-time, or in advance. Trip planners that aggregate multiple modes often include real-time transit arrival information (as applicable) and information on the availability of other mobility services (e.g. bike share, car share, ride-hail, intercity bus, etc.).
	Smart Mobility Kiosks	Smart mobility kiosks that typically provide a range of wayfinding and trip-planning information, including information on real-time transit availability, nearby shared mobility services, community attractions and services, and auxiliary public amenities like phone-charging ports and public Wi-Fi.
	Transit Mobile Ticketing	Ticketing apps offered by transit authorities offer riders a smartphone ticket payment option and can offer other features such as transit and multimodal trip planning, account management, real-time arrivals information, and bundled parking payment options.

MOBILITY SERVICE PROVIDERS

Mobility-as-a-Service vendors are often referred to as Mobility Service Providers (MSPs). MSPs offer transportation services through a mobility manager and/or the rider or customer. This can simplify service delivery, but can also cause agencies to lose their relationship with the customer. Agencies can be both a mobility manager and a mobility service provider, but this section specifically defines the operational nuances of private vendors that might partner with TriMet or vendors that provide examples of business models for TriMet to follow in the future.

Figure 2 At-a-Glance Overview of Mobility Service Providers

Vendor Type		Description
	Transportation Network Companies (TNCs)/Ride-hailing/Ride sourcing	Ride-hailing services match riders with drivers with riders in real-time through mobile apps that also accept payment via credit card or voucher. These platforms typically operate through a network of third-party contractor drivers using non-commercial vehicles. Ride-hailing drivers are not themselves travelers and do not share a destination with their fare-paying passengers. Ride-hailing companies are distinguished from taxi services by the inability to street hail (ride-hailing companies can only pick up prearranged rides). They typically offer several ride types, such as private ride (along the lines of a traditional taxi), and pooled-ride/fare splitting (in which multiple users with origins and destinations along a similar route can hail the same driver in real time). Ride splitting is the assigning of fares traveling along similar routes to one car, and enabling the splitting of the fare; their rides are typically 60% less than regular service rides.
	Microtransit	Microtransit is a shuttle service that can be on-demand in real-time or fixed route service updated frequently to meet market needs. The shuttles often operate in areas during peak-period commute hours where public transit is reaching capacity or may be unavailable. Companies can vary by fleet type (buses or vans), route structure (fixed or dynamic), and, more recently, fleet ownership. Microtransit is distinguished from private shuttles because, in addition to being available to the public, of its ability to automate routing, billing, customer feedback and reservations.
	Autonomous Vehicle Shuttles (AV Shuttles)	AV shuttles operate on pre-defined, fixed routes in controlled environments, thus minimizing many remaining technical and operational challenges and enabling the vehicles to operate with minimal human intervention.
	Car Share	Car Sharing programs allow people to access a shared fleet of vehicles on as-needed, per-hour or per-mile basis for point-to-point or round-trip trips. Car Sharing programs reduce the need for businesses or households to own vehicles, and they also reduce personal transportation costs and vehicle miles traveled (VMT).
	Bike share	Bike sharing is a system of bicycles that is available to users to access as needed for point-to-point or round-trip trips, traditionally to station kiosks in dense urban areas. Docked bikeshare systems are generally unattended and offered through public-private partnership. Advances in bikes have locking technology have allowed for dockless, free-floating bikes, lockable anywhere within a geographic region. This model is becoming increasingly popular; vendor companies are often fully privately owned and operated.
	Scooter share/ eScooters	Scooter share is a system of electric scooters whereby users use an app to rent and ride to their destination and then park the scooter in a similar fashion to parking a bike.

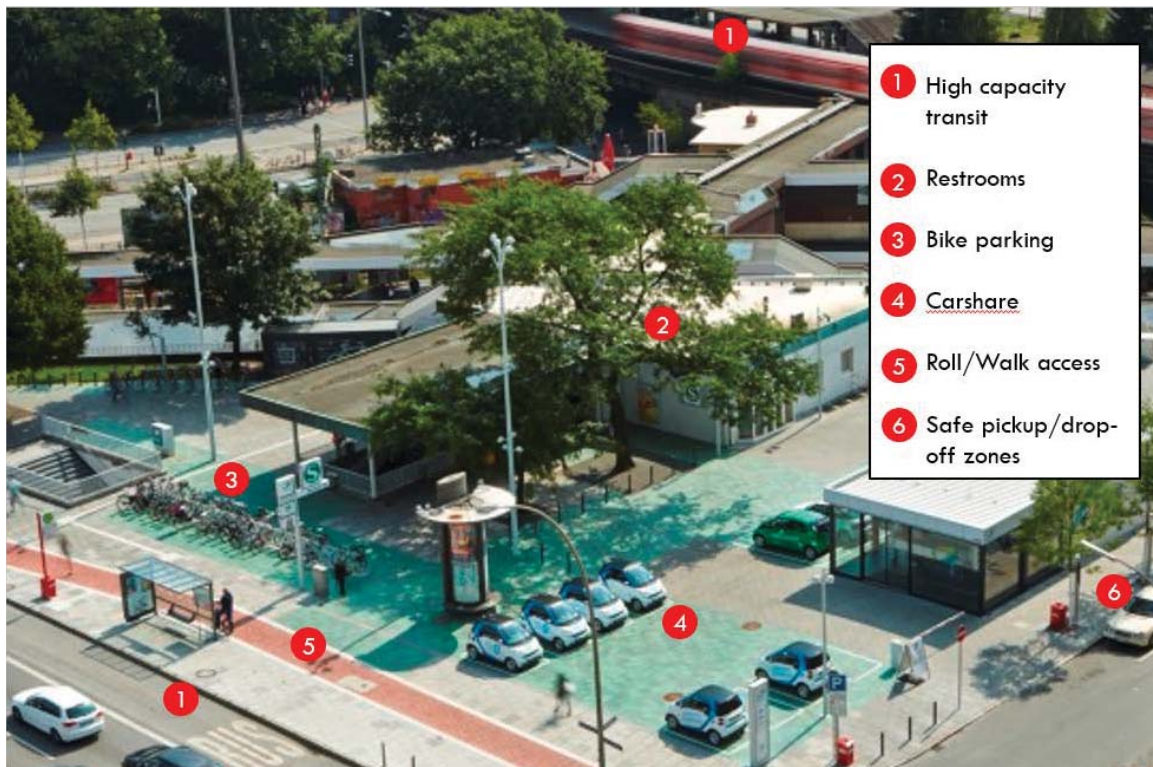
MOBILITY HUBS

The project team explored strategies to centralize pilot efforts in *places* in order to leverage existing TriMet real estate assets. One such strategy is the conversion of existing transit centers and Park & Rides to mobility hubs. Mobility hubs are places where multimodal mobility services—including public transportation—converge in a public space that is designed to facilitate convenient, safe and accessible transfer between modes. Metrolinx, the regional transportation agency in the greater Toronto area, offers a helpful definition:

“A mobility hub is more than just a transit station. Mobility hubs consist of quality transit stations and the surrounding area. They serve a critical function in the regional transportation system as the origin, destination, or transfer point for a significant portion of trips.”⁴

Figure 3 illustrates an example of a large mobility hub, with key mobility and placemaking elements.

Figure 3 Mobility Hub Example: Hamburg, Germany



Source: Hamburg Mobility Point

⁴ Metrolinx (2011). Mobility Hub Guidelines for the Greater Toronto and Hamilton Area. Retrieved from <http://www.metrolinx.com/en/regionalplanning/mobilityhubs/01SectionsI-II.pdf>

GETTING READY FOR PILOTS: THE DATA LANDSCAPE

The FTA's MOD Sandbox program, including both TriMet's OTP SUM and projects from other agencies, is providing a variety of lessons around the challenges of data sharing between public entities and private mobility service providers. The obstacles to getting the program's pilots launched have frequently been disputes about the specifics of data agreements. While the OTP SUM team can provide lessons on the specific challenges facing that project in the data sharing arena, this section provides a distillation of some of the findings that have emerged from SUMC's work on the MOD Sandbox Innovation and Knowledge Accelerator technical assistance project. This section provides prompts that can help articulate data needs surrounding particular projects or initiatives. It is intended to help outline the key questions for project-level data agreements, while framing an approach to building a data framework with other key jurisdictions in the region including PBOT, ODOT, and Metro.

Seek to understand agency information needs

TriMet must clearly understand and articulate what the agency hopes to achieve and learn from a proposed pilot project before reaching out to partner organizations and before contacting mobility service providers, either through questions or requests for proposals. Key questions to gauge success include:

- Who are the populations TriMet is trying to serve with the piloted service?
- What are the pilot project's desired outcomes?
- What operational lessons can the project provide?

Several more important considerations about understanding the agency are described below, including the kind of project, analysis types, and mobility service provider concerns.

What type of project is it?

The type of project being considered affects the data needed to implement or assess performance. For example, services that subsidize third-party, first/last mile rides require operational data for a variety of analytical applications, whereas multimodal trip-planning requires access to real-time vehicle availability and pricing, mode- or provider-specific information on customer eligibility or needs, and possibly the ability to share account credentials or payment information across entities. Regulatory or enforcement efforts, such as right-of-way protection or permit fee assessment, may require anything from individual pickup/drop-off times and locations to data aggregated at the fleet level.

What types of analysis are required, why, and what type of data would be needed?

The types of analysis or performance measurement to be performed with the data will also affect its format and how/when it is shared (e.g. real-time, trip-level availability via API vs. weekly/monthly/quarterly aggregated reporting). This also depends to some degree on the technical capacity of the entities performing the collection and analysis.

- Transportation Trends – archived, aggregated, post-processed data
- Service Planning – archived, aggregated, post-processed data
- Effectiveness, Accountability
 - o Operations – trip data, analyzed in real time or post-hoc
 - o Accounting – trip, cost, and payment/reimbursement data, analyzed post-hoc
 - o Auditing – same as operations or accounting, analyzed post-hoc

- Implementation – real-time vehicle availability and pricing data (through APIs)

Understand Private Operators' Concerns

In discussions about provision of private operators' travel data to public entities, both in the context of regulatory requirements for data disclosure and in negotiation of terms for partnerships and commercial arrangements, private mobility operators (TNCs in particular) commonly cite several areas of concern. Common Provider/TNC concerns include:

- Disclosure of proprietary information (i.e., exposure of trade secrets to competitors):
 - o Proprietary information such as algorithms, predictive features, data analytics methods, etc.
 - o Commercial information such as targeted marketing, marketing strategies, market capture, etc.
 - o Even if this information is not possessed by others in a way it can be directly disclosed, operators may fear that proprietary methods could be reverse engineered from operational or usage data.
- Rider privacy and anonymization: exposure of personally identifiable information (PII) either directly or by way of travel data that can be used to reconstruct individuals' trips
- Two major vectors of disclosure:
 - o Direct disclosure by way of freedom of information requirements or open records laws, allow competitors or others to request the information from a public agency holding it.
 - o Disclosure due to shortcomings in public agencies' data management and security capacity or protocols, with possible points of failure including collection, formatting, storage, archiving, access/authorization protocols, cybersecurity, internal and external reporting, compatibility with existing systems. This may involve either accidental disclosure (e.g. by individuals unaware of the need for security around certain data), or an intentional theft or attack (e.g. by hackers or other hostile actors).

Seek to better understand the data environment

The data needed to meet agency objectives may be complicated in its availability, its sensitivity to privacy, or competitive business interests for private partners. Some challenges related to data availability, and how TriMet may be able to receive data from mobility service providers is described below, in an effort to help staff understand relevant issues.

Data Availability

- Data does not/will not exist
- Data does not/will not exist or is sparse, but other methods such as surveys can be used (e.g., revealed preference surveys, cluster analyses, stated preference surveys) to achieve similar needs
- Data exists and is available without constraint (e.g., through public domain, NTD, transit agency database, mobility provider database)
- Project-generated data contains privacy-compromising information, and thus requires sanitization or legislative/regulatory protection from public release (e.g., removal of PII, anonymization, protection from FOIA disclosure, information clustering, aggregation, tokenization)
- Project-generated data contains proprietary information or trade secrets, thus requires policy modifications and/or industry collaboration (e.g., TNC data, origin/destination data, timestamps, app usage characteristics)

Challenges to Receiving Quality Data and Information

- Privacy concerns with location data
 - Origin/destination for point-to-point data may compromise privacy
 - Coarse aggregation may also put privacy at risk
- Public Records laws (FOIAs/FOILs)
 - Will private or sensitive data be released in a public records request?
 - Can FOIA laws/exemptions keep up with changing data landscape?
 - Non-disclosure agreement or contract between agency and provider unlikely to supersede laws regarding disclosure
 - Differences in jurisdictions—understand which laws apply in that city/county
- Differences in service type: Subsidized trips (e.g. first mile / last mile) vs general TNC operations
 - Operators may not be required to share data of existing operations
 - Data that government has collected can often be used only for project-specific purposes
- Legal differences using the same data depending on purpose (e.g. API data for internal analysis vs multimodal trip-planning apps)
- Current standards and formats for the FTA's National Transit Database (NTD) are a poor fit to counting or reporting multimodal trips, especially across a variety of public and private modes. Changing requirements and guidance may be on the horizon, and agencies can help influence this discussion by developing new, replicable measures of operational performance.

Negotiate to obtain relevant data

Based on a variety of observations from inside and outside the MOD projects, some negotiation approaches are more effective in obtaining the data needed to meet project goals. These include project-level, regulatory, and legislative approaches to overcome specific barriers.

Project-level

- Mutually agreeable aggregation levels, focused on a discussion of what's truly needed to measure project goals
- Use of FOIA exemptions to prevent disclosure of personal travel data, "trade secrets." In Oregon, both of these appear to be covered exceptions to the state's open records law:
 - Trade secrets are exempt from open-records disclosure "unless the public interest requires disclosure in the particular instance."⁵
 - Personally identifiable information "collected as part of an electronic fare collection system of a mass transit system" is similarly exempt from disclosure, except that this "does not apply to public records that have attributes of anonymity that are sufficient, or that are aggregated into groupings that are

⁵ "Trade secrets," as used in this section, may include, but are not limited to, any formula, plan, pattern, process, tool, mechanism, compound, procedure, production data, or compilation of information which is not patented, which is known only to certain individuals within an organization and which is used in a business it conducts, having actual or potential commercial value, and which gives its user an opportunity to obtain a business advantage over competitors who do not know or use it. (ORS 192.345(2))

broad enough, to ensure that persons cannot be identified by disclosure of the public records.”⁶

- Use of a trusted third-party repositories to store, manage data and/or relay information gathered by TriMet and its partner agencies in the region
- NDAs between agencies and providers (drafted with knowledge of how they function with applicable state and local open records laws)

Regulatory/legislative approaches (state and local)

- Strengthen FOIA law through legislative process to prohibit disclosure of individual travel data
- Require TNCs to provide data to operate
- Require interoperability between operators, payment systems

Examples (inside and outside Sandbox)

- Texas state FOIA laws strengthened though legislation influenced by transportation/transit agencies
- LA Metro planning to use FOIA exemptions to protect detailed MOD data (e.g. location, transaction, PII data)
- Coarser levels of aggregation in other MOD agreements (Pierce, PSTA?)
- NYC, Chicago, California, Seattle, Boston list specific data submission requirements for TNCs to operate in their jurisdiction
- Finnish Transport Code requirements for open data and interoperability

Work with the City of Portland, Metro, and ODOT towards “digital jurisdiction” that allows user information to become part of the “transit ecosystem”

TriMet should continue to cooperate with its partner agencies in the region, including PBOT and other local government units, Metro, and ODOT, to establish a unified strategy for asserting and defining “digital jurisdiction” over the user and any transportation information they gather and maintain. Data collections is set to continually increase in volume and granularity in coming years. The group should work towards common legislative and regulatory goals in the data management realm, including clarification of the open records status of transportation-related data not explicitly exempted in current legislation. This should include valuable, publicly-controlled data streams from sources (such as integrated trip planning/payment apps like the OTP SUM project and origin-destination data from HOP Fastpass) as well as future sources (such as vehicle-to-vehicle and vehicle-to-infrastructure communications, user and environmental data from shared autonomous vehicles, and other intelligent transportation system technology). The partners should work to establish regional regulatory harmony on these points in advance of industry-led efforts to define the playing field, and create management structures that protect the

⁶ (c) As used in this subsection: (A) “Electronic fare collection system” means the software and hardware used for, associated with or relating to the collection of transit fares for a mass transit system, including but not limited to computers, radio communication systems, personal mobile devices, wearable technology, fare instruments, information technology, data storage or collection equipment, or other equipment or improvements. (B) “Mass transit system” has the meaning given that term in ORS 267.010. (C) “Personally identifiable information” means all information relating to a person that acquires or uses a transit pass or other fare payment medium in connection with an electronic fare collection system, including but not limited to: (i) Customer account information, date of birth, telephone number, physical address, electronic mail address, credit or debit card information, bank account information, Social Security or taxpayer identification number or other identification number, transit pass or fare payment medium balances or history, or similar personal information; or (ii) Travel dates, travel times, frequency of use, travel locations, service types or vehicle use, or similar travel information. (ORS 192.345(38))

public interest while making the most of the complex portrait of the transit ecosystem that these rich data sources will make possible.

Seek third party repository and access mobility service providers on a common platform

A promising model for incorporating mobility service providers' data into the larger data framework while avoiding some of the private-data challenges described above is one in which TriMet or other public entities never hold private operators' disaggregated data. Instead, such data would be held by the operator or a trusted third-party repository under strong legal and technical protections and a clear access agreement, through which TriMet or other public entities would be guaranteed access to "views" of the data at the levels needed for accomplishing its work and doing appropriate performance measurement.

One form of the trusted third-party model being is currently being built out and tested at the University of Washington Transportation Data Collaborative (TDC).⁷ This model combines an understanding of how to balance the needs of public and private stakeholders with the institutional heft and technical capacity of a major research institution—capacity both in terms of technical know-how and of the sheer storage capacity and computing power needed to handle massive and ever-growing data flows.

TDC appears to be developing something of a turnkey solution for public/private data management that may appeal to agencies with less technical prowess. However, since TriMet is a leader in the world of transit and multimodal data and applications, with much longer experience and deeper understanding of the challenges, it might make more sense to work with Portland State, the University of Oregon, or a consortium of nearby research institutions to establish a similar platform specifically for the region.

Track Mobility Blockchain Progress in the Industry

Distributed ledger technologies, including blockchain models that essentially act as distributed transaction databases, hold promise for application to payment, transaction recording, and data sharing in the urban transportation arena. A number of market entrants are building (or at least envision building) transportation applications enabled by blockchain protocols. Advocates of this technology also point to its potential for creating new revenue models under which public and private entities can raise capital, enable new methods of payment (or even "micropayment") of fares, tolls, congestion or mileage fees, etc., and incentivize specific behaviors.

At this point the sector and its associated technologies appear to be almost completely speculative, with even cryptocurrencies—the most widely adopted examples of blockchain applications—still at an early stage in their evolution and general application. Since no blockchain transportation applications appear to be actually developed at this point, it's impossible to even assess the value of their boosters' claims. Still, there is huge interest in the technology and its potential applications, and considerable venture capital betting on its eventual adoption. Assuming some of this promise bears out beyond an initial hype phase, it may be worth considering ways to incorporate the technology into TriMet's data strategy. In the immediate term, however, TriMet should continue to track progress through conferences, peer information exchange, and news articles.

⁷ <https://www.uwtcd.org/>

Labor and Workforce Considerations

This section covers both the existing labor context into which new mobility projects must be integrated, as well as some forward-looking considerations about workforce impacts and labor implications of autonomous transit vehicles.

Collective bargaining and new mobility

TriMet workers are represented under a collective bargaining agreement (CBA) with Amalgamated Transit Union Local 757. The parties signed a new contract in 2017.⁸ The contract appears to be silent on the question of new mobility, but the union has made clear statements in opposition to contracting with non-union vendors and TNCs in particular. The agency's purchased transportation is also unionized. TriMet Paratransit (LIFT)—operated by First Transit—is also represented by ATU 757. The willingness to contract under a CBA was a required element of most recent (2016) LIFT procurement.⁹

A relevant labor model for fully private (i.e. not contracted, but locally regulated) transportation services is found in SFMTA's 2016 "tech shuttle" regulations, which made permanent a pilot to evaluate, permit, and regulate private shuttles' access to the public right of way and curb space in San Francisco. Among other provisions, the regulations required operators to document a "labor harmony" plan for private shuttles picking up or dropping off in the city—with the result of effectively unionizing all operators' shops (though affiliation with a particular union or local did not appear to be a factor) and helping build transit union support in a contentious process.¹⁰

Workforce Impacts of Autonomous Transit

An FTA working group, supported by the USDOT's Volpe Center, examined several scenarios and use cases for autonomous transit vehicles and related technologies, summarizing many of them in the Strategic Transit Automation Research Plan (Jan. 2018). Workforce impacts were one of the key areas of consideration and a focus of ongoing research. Regarding a timeline for the adoption of autonomous transit technologies, the report notes that product availability is a major constraint, and "although vehicle automation capabilities are growing quickly . . . full, Level 5 automation remains a decade away, if not longer." (42) In the immediate term, automation's impacts on the transit workforce are likely minimal, and within this time horizon, we might expect only marginal reductions in labor related to automation of functions related to maintenance yard and garage operations, and refueling.¹¹

⁸ ATU page: <https://www.atu757.org/>. New contract announcement: <https://trimet.org/newcontract/currentcontract.htm>.

⁹ ATU/First Transit: <https://www.atu757.org/firsttransit/>. Procurement: <https://trimet.org/pdfs/meetings/board/2016-04-27/res-16-04-23.pdf>.

¹⁰ SF: <https://www.sfmta.com/sites/default/files/projects/2017/Commuter%20Shuttle%20Policy%20and%20Program%20-%202017.pdf> and <https://www.sfmta.com/sites/default/files/projects/2016/Service%20Disruption%20Prevention%20Plan.pdf>

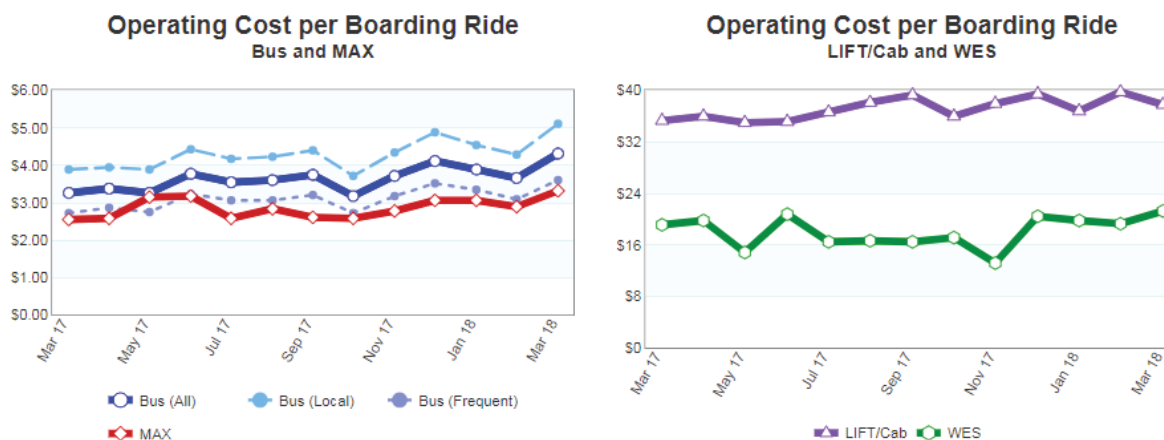
¹¹ FTA: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/114661/strategic-transit-automation-research-report-no-0116_0.pdf

- Even when full automation becomes available, line-haul transit is unlikely to be the target application, for a variety of reasons (including existing labor contracts)—circulators, demand-responsive services, etc. are more likely to be fully autonomous.
- Line-haul transit is more likely to see marginal improvements at lower levels of automation--improved collision avoidance, smoother acceleration/deceleration, precision curb alignment, automated parking and recall, etc.
- Even in use cases with higher levels of automation, the continued need for an attendant (in paratransit especially) would offset labor cost savings from possible elimination of drivers from some vehicles. However, these fully autonomous applications are likely to be the most controversial from a labor point of view.
- The need for maintenance and repair remains in all these cases, possibly increasing as more, smaller vehicles are run more frequently.
- Retraining needs will grow as technology evolves and increasingly autonomous vehicles are incorporated into the transit fleet.

ECONOMIC AND FISCAL IMPACTS

TriMet must also weight financial impact of near term and long term pilot projects in order to ultimately adopt new service types and methods of delivery. Transit agencies often look at operating cost per boarding ride to determine the cost effectiveness of the service. For much of this analysis, we used this metric in order to compare different types of pilots to one another, as well as determine if there are cost savings to be gained by TriMet.

Figure 4 TriMet Cost Analysis



Source: TriMet Performance Dashboard, updated April 2018 < <https://trimet.org/about/dashboard/index.htm> > May 2018.

In March of 2018 TriMet reported cost per boarding ride at slightly above \$3 on MAX and frequent buses, \$4 combined on frequent and local service on average, and over \$5 on local bus service. The WES costs in March of 2018 was over \$21 per trip, and LIFT/cab was \$38 per trip.

In addition to comparing projects to existing operations, cost drivers and revenue implications for new mobility projects should be analyzed for the project functions (proposed functions described in Section 4). Scenarios for each service transit type are presented in detail in Appendix C – Cost Considerations.

4 FINDINGS AND PROPOSED PILOTS

TriMet can operationalize mobility management principles through three key efforts: Grow Services, Leverage Assets, and Influence Policy.

GROW SERVICES – NETWORKNEXT

TriMet is fortunate enough to have a strong, established rail and bus system that will continue to serve as the backbone of Portland's mobility network. To augment this first layer of high capacity, high frequency transit, TriMet can extend the reach of its relevancy by expanding multimodal service offerings. To begin testing the agency's comfort with new services, TriMet should conduct a series of experimental projects roughly following the below formula:

Figure 5 Pilot Parameter Recommendations



Source: Nelson\Nygaard

Function

Understanding the MSP vendors and service offerings that can provide viable strategy options for TriMet is important in assessing the new mobility market. These are service models and products that TriMet can use to serve different functions within the regional transportation network. Functions are defined by who the potential customers are, where the potential customers are, what times of day the services would operate, which places would be served, and which types of customers would benefit based on service needs and gaps in the network.

Some transportation agencies are actively identifying pilot projects, building partnerships with private transportation providers, and using big data analytics to identify and shape opportunities. Many, like TriMet, are taking a measured look to better understand costs, benefits, and potential

unanticipated consequences of pilots before committing scarce resources, staff time, and project development time into these efforts.

For TriMet, like other agencies, new mobility services can fulfil some functions better than others. Based on TriMet service gaps across the region, these functions include:

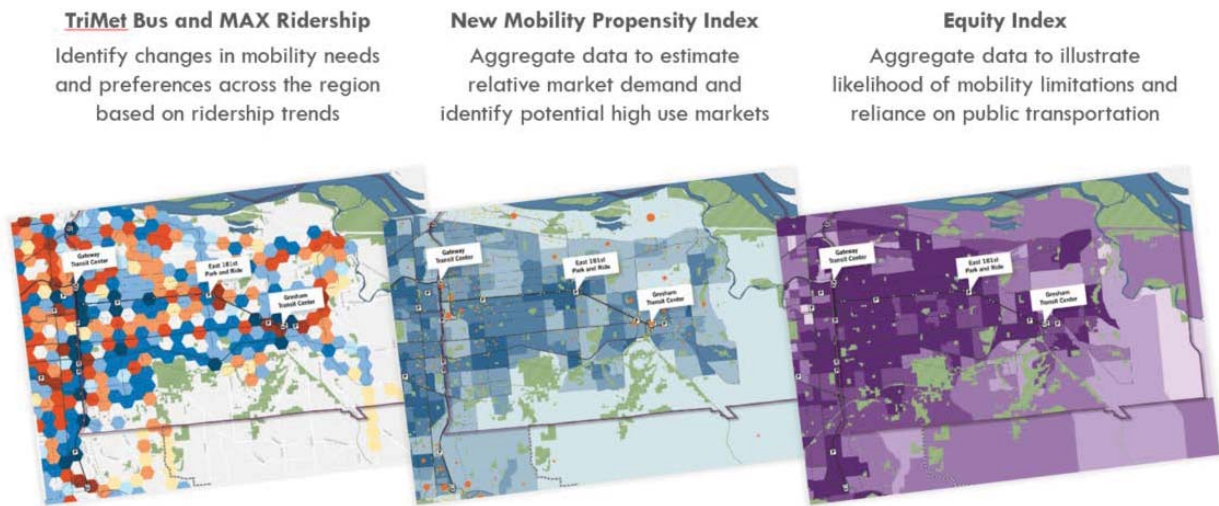
- **Late Night Service** to address transit access to for late night/very early morning times
- **Short Trips** currently not taken on transit due to perception of departure time barrier
- **Network Augmentation/ moderate transit access gaps** to address areas where lower residential density (and associated low-frequency transit service) results in unproductive transit service at a high cost per ride for traditional fixed-route transit
- **First Mile/Last Mile service** to areas where TriMet bus and rail services are too far to walk to and implementing new TriMet bus connections would not be cost-effective
- **Paratransit service** to address opportunities where new mobility services could meet the needs of customers with disabilities

Geography

The geographic market analysis can help identify where various new mobility service offerings may be most relevant to TriMet's customers. This analysis provides an illustrative view of customer travel needs in relation to TriMet's mission and values. Three layers of geographic analysis provide complementary views of the regional marketplace:

- **TriMet Ridership:** Ridership trends can indicate, in part, changes in rider needs and preferences that may not be met by TriMet's current service offerings. This analysis aggregated annual ridership data across the region to study ridership changes over time. For this study, ridership decreases between 2009 and 2016 were used as a general indicator of where TriMet customers may be switching from transit to other modes.
- **New Mobility Propensity Index:** Analyzing demographic characteristics help illustrate who might be likely to utilize new mobility services in a given area. The project team developed a new mobility index for this project to aggregate population and socioeconomic data based on published studies of new mobility service user behavior. The index uses Census data for age, family, income, education, work status, marriage status, and race.
- **Equity Index:** Social equity is a guiding priority in TriMet's business and service planning. The equity analysis can help identify opportunities to support agency mission, vision, and values with new mobility services. The project team assembled an equity index of aggregated data to illustrate areas that have a higher than average likelihood of mobility limitations and reliance on public transportation. The equity index includes Census data for age, race, vehicle ownership, and income.

Figure 6 Geographic Analysis Layers



Source: U.S. Census Bureau, Oregon Metro, Tri County Metropolitan Transportation District

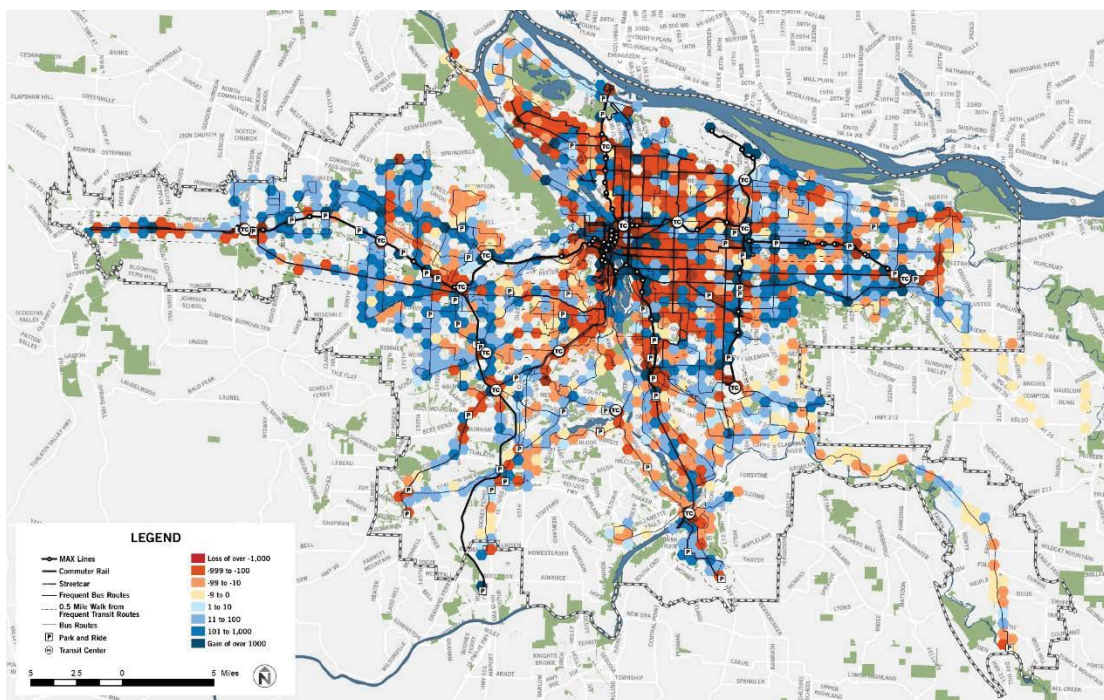
Together, these three layers of analysis articulate potential geographic markets and locations to which TriMet can match new mobility strategies. Analysis maps by region and Service Enhancement Areas are provided in Appendix A.

Regional maps illustrating ridership, the new mobility propensity index, and the equity index are illustrated in Figures 7, 8, and 9, below. The maps point to several parts of the region where people are more likely to use new mobility strategies to access public transportation to increase their use of the fixed route network. These are also areas where TriMet lost significant ridership over between 2009 and 2016, including:

- Inner Southeast Portland: this area has high transit access, rising incomes, and generally a younger demographic. The area is relatively close to downtown, making strategies like biking or short TNC trips competitors with transit. New mobility programs in this area might not support increased transit ridership, but could generate users (and compete with existing new mobility services)
- Northeast Portland: like Inner Southeast, these neighborhoods have experienced increasing incomes and a younger resident demographic profile. The northern areas are close to middle- and low-income jobs such as manufacturing and distribution north of Lombard. This area ranks higher on the equity index. This area exhibits a trends that may be conducive to new mobility programs.
- Hillsboro: Areas south of the MAX line generally have a higher likelihood to use new mobility services. Areas to the north exhibit low on the new mobility index, and high in increased transit ridership, near to several large employers. These appear to be strong areas to consider new mobility pilots.

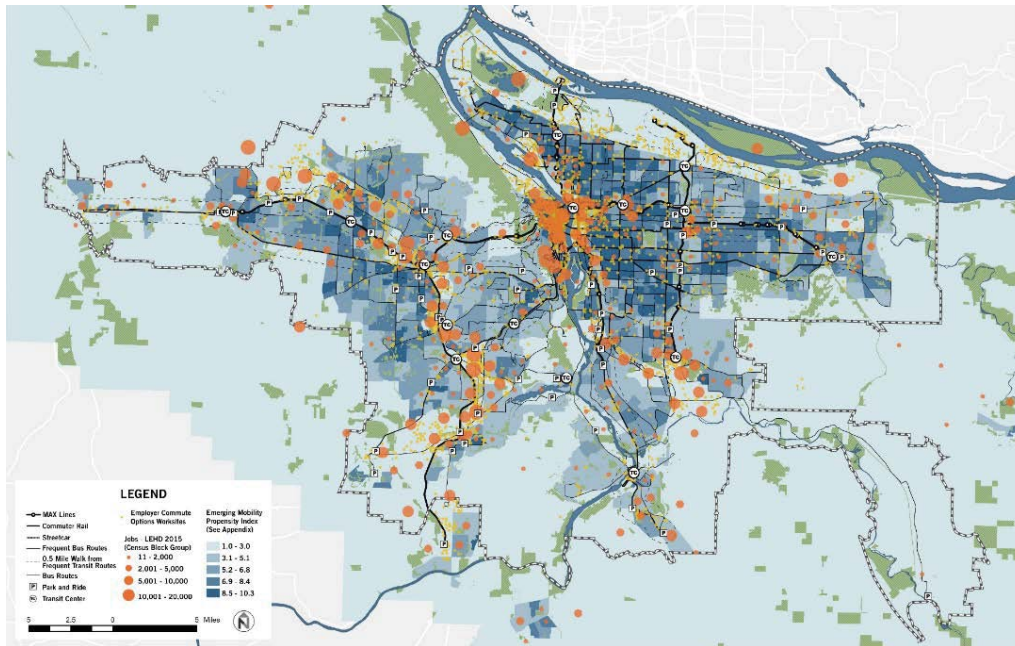
- Tigard and Southwest Portland: This area had a generally low to middle rank in new mobility index. Ridership decreases suggest the need for ways to bring more people to fixed route transit, in a generally low-density area. The equity index suggests there are a relatively high share of people who have restricted mobility options or are reliant on public transit. This area was seen as potential for some strategies suited to lower population density areas, linking to relatively strong employment centers.
- East Portland and Gresham: This area experienced increased ridership, and ranks high on the equity index, suggesting more people in this area are depending on public existing transportation services. The new mobility index is relatively high near max stations, and moderate in other areas. This area could be suitable for new mobility strategies aimed at supporting increased access to transit at affordable prices.

Figure 7 Change in TriMet Annual Ridership, 2009-2016



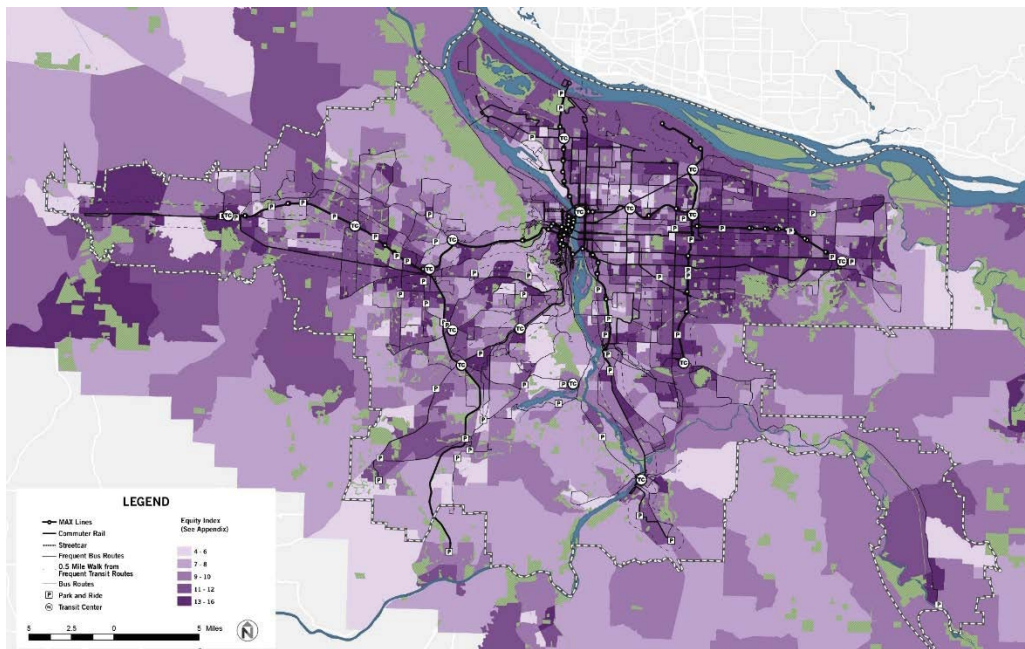
Source: U.S. Census Bureau, Oregon Metro, Tri County Metropolitan Transportation District

Figure 8 Regional New Mobility Propensity Index Map



Source: U.S. Census Bureau, Oregon Metro, Tri County Metropolitan Transportation District

Figure 9 Regional Equity Index Map



Source: U.S. Census Bureau, Oregon Metro, Tri County Metropolitan Transportation District

Modes

Microtransit

A number of private companies have started to introduce “microtransit” services. Microtransit is still an amorphous term, in some cases being applied to just about any shared ride service in vehicles larger than a sedan but smaller than a bus. Usually following a public-private partnership model with agencies, the companies tend to use passenger vans or cutaways (sometimes using existing agency vehicles) and provide hailing and trip planning technology. The case studies included in this effort either completely replace a traditional fixed-route bus in a lower ridership productivity area or, in the case of SW Prime service in the Twin Cities (see Task 3 case studies), offer service to an area previously underserved or unserved by local transit.

Microtransit providers are generally operating in only a small number of cities as they continue to experiment with how best to provide service. Scalability can be a challenge for microtransit, as companies generally start with the highest demand routes. Over the past few years, many microtransit companies have abruptly shut down due to legal and regulatory challenges and/or issues developing a sustainable business model.

Typically, microtransit providers charge a fixed fee that is known to the passenger when they book a ride. This fee may vary depending on time-of-day, distance, and current demand, and is generally higher than public transit and lower than ride-hailing (around \$3-6 per trip). Some companies, such as Via, are approved for use with commuter benefit cards. Others, such as Transdev Link, are branded and operated in partnership with existing transit services. These services may be subsidized, though most microtransit is not.

Microtransit is an unproven model with little evidence to suggest it is more useful than fixed route transit service operating in an otherwise “unproductive” area.¹² However, its passenger-carrying capacity potential is more promising than that of TNCs and its technology is more proven than that of AV Shuttles. Thus, as TriMet begins to explore different modes to augment the fixed-route network, microtransit is a mode the agency should begin to experiment with in order to customize the model to meet agency needs. Additionally, as TriMet risks losing riders to MSPs, Microtransit may help re-attracting riders into the system by providing nearly door-to-door on-demand service while offering higher capacity than TNCs.

AV Shuttles

As autonomous vehicle (AV) technologies continue to advance, many companies have begun testing, marketing, and piloting vehicles with low levels of autonomy, such as AV shuttles. AV shuttles operate on pre-defined, fixed routes in controlled environments, thus minimizing many remaining technical and operational challenges and enabling the vehicles to operate with minimal human intervention. However, in deployments to date, a human operator has still been on board to interact with passengers and step in if necessary.

AV shuttles perhaps capture an outsized level of attention compared to their current mobility impact because of the technology involved. While these projects can serve to generate excitement for transit, they also offer the opportunity to use pilot money to study a mode that has significant (though decreasing) capital costs, low to no vehicle emissions, and lower operating costs. Bishop Ranch, a large, mixed-use development that markets its sustainable transportation management

¹² Schmidt, Angie. “The Story of Micro Transit is a Consistent, Dismal Failure”. Streetsblog. 26 June 2018. Available <https://usa.streetsblog.org/2018/06/26/the-story-of-micro-transit-is-consistent-dismal-failure/>

practices, is replacing its conventional buses with electric AV shuttles. These shuttles will eventually serve as connectors to a transit center within 2 miles from the site. The city of Arlington, TX is piloting a similar AV shuttle program branded as “Milo.” Although the Milo shuttle is currently being tested in a large, off-street convention center and sports complex grounds, Arlington is eyeing eventual on-street use. As quoted on the website for the pilot, “the City is testing the driverless shuttles to explore potential uses for autonomous transportation technology in a real-world setting. This pilot program is currently expected to run through mid-2018.”

Some AV shuttle providers are exploring the potential for offering on-demand service, which is likely to be implemented in the United States sometime in 2018. In such a model, passengers would either press a button at stop locations to board the shuttle or hail a ride through their smartphone. Once on board, passengers would press a button to request to alight at the next stop.

It is likely that ride-hailing, microtransit, and AV technology will converge. For example, Navya has introduced a smaller, six-passenger vehicle advertised as a taxi to serve some use cases that their 15-passenger vehicle may not be suitable for. At the same time, some AV microtransit providers are beginning to explore using larger, full-sized buses. Larger vehicles will require more sensors to enable detection of all potential obstacles around them, but the basic principles of autonomy are the same so there should be minimal challenges applying the technology to larger vehicle types (as has been demonstrated with AV trucks).

Appendix B provides an overview of current players in the autonomous transit bus/shuttle space. While comprehensive, this list is not necessarily exhaustive, and new products could come to market at any time. Many companies are working behind closed doors to protect their intellectual property and generate a larger splash when they do launch. Some companies, such as Mercedes-Benz and Proterra, are developing full-sized autonomous buses, but these vehicles are not yet fully operational.

Most of these vendors offer their vehicles for sale or for lease, and most procurements in the United States so far have been via lease agreements. Notable exceptions include the Navya shuttle in Ann Arbor and the EasyMile shuttle in San Ramon, both of which involved a vehicle purchase to enable a long-term testing procedure rather than simply offering a transportation service. These were likely purchased rather than leased because they were intended to be used for multiple years, so the additional cost of buying over leasing became less significant. These two purchases were also early in the timeline of AV shuttles, and perhaps the business model for leasing had not yet been fully developed. Some vendors, such as May Mobility, are exploring alternate business models to purchase and lease. May Mobility's business model is to charge a per-hour operating fee to clients, and completely operate their own fleet, providing a seamless customer experience.

Vendors have often included in their RFP response a partnership with a traditional operating entity such as Transdev or Keolis to provide a turnkey solution. Leasing rather than purchasing a vehicle can also help an agency navigate AV regulations, because it may be easier to pursue an exemption. Non-American vendors have become more familiar with US transit regulations since first introducing their vehicles in the US, and have begun installing additional features (such as ramps to comply with ADA regulations and steering wheels to comply with AV regulations) in newer vehicle models. They have also begun opening manufacturing facilities in the US to comply with *Buy America* requirements.

Transportation Network Companies (TNCs)

TNC-based pilots generally serve to extend or fill gaps in fixed route service, both spatially and around the clock. Three pilots from the Pinellas Suncoast Transit Authority near Tampa, FL demonstrate a unified approach for serving a variety of users' needs at times or in locations where fixed-route transit has been unable to do so productively. The Direct Connect (a first mile/last mile service) and TD Late Shift (after hours, income-qualified workforce transportation) pilots provide general-public TNC services that make fixed route transit a useful option for more people. These two programs will soon be complemented by an on-demand service focused specifically on people with disabilities. Rather than just implementing a general TNC subsidy, these three interrelated pilots were designed with strong and explicit connections to the high frequency core of the transit system.

In the growing Toronto suburb of Innisfil, Ontario, the city opted to use TNCs to supply the entirety of their local public transportation, including connections to regional rail. As with all TNC pilots, the agency subsidizes the TNC service, generally at the individual ride level, offering the rider a fare in the same price range as fixed-route service. Programs such as this demonstrate the potential to improve response time and lower costs for some paratransit service, though results suggest that they are not a “silver bullet” solution. These pilots tend to be best-suited economically in low-density, auto-centric environments.

Several key TNC pilot design lessons can be gathered from these case studies. First, contract negotiations must include particular attention to data sharing needs and the provision of wheelchair accessible vehicles (WAVs). Second, in order to satisfy federal requirements around accessibility and driver drug and alcohol testing, it is generally necessary to offer more than one ride provider for users, to provide access for users without mobile phones, and to design service for users who prefer to use cash. Most TNC pilots have addressed these needs by including local taxi companies as service options.

Autonomous Rapid Transit

In the longer term, TriMet should also begin to pilot new technology for its rolling stock bus and train service that includes a phased autonomous component. This effort can overlap with fleet electrification testing as well as the NextGen Transit Signal Prioritization, Rail Operations Optimization Technology (ROOT) project (explores the Internet of Things (IoT) & big data analytics), and other agency fleet modernization initiatives.

Autonomous Rapid Transit (ART) is an emerging train/bus hybrid mode that operates using driverless software and follows tracks painted on the road. Currently only available in China, several U.S. cities have expressed interest in bringing the technology to American streets. At present, the electric vehicles can run up to 43 MPH and hold up to 300 passengers.¹³

Though a “mode” to seek to better understand as part of the New Mobility Strategy, ART technology is not a candidate for a near-term pilot due to procurement and technology safety barriers still under development.

¹³ Bliss, Laura. “Can We Just Call This a Bus?” City Lab. 8 November 2017. Available <https://www.citylab.com/transportation/2017/11/can-we-just-call-this-a-bus/545189/>

Figure 10 Rendering of ART or “Trackless Train”



Source: Miami/Dade County

The Go/No-Go Test for Engaging in a Pilot

Key questions to consider in determining specific pilot parameters include:

- Does this help us solve a problem?
- Will this project help us better understand ways to ultimately move people throughout the network efficiently?
- Will it help us meet one or many key performance indicators?:
 - o Increased ridership
 - o Increased revenue
 - o Utilization of real estate assets
 - o Increasing internal aptitude of technology
 - o Improved speed and reliability
 - o Provision of equitable service
 - o Does it meet vision, mission, and values?

Sample Pilots

The New Mobility Strategy Assessment seeks to provide guidance for the agency on how planners can begin to think about pursuing new pilots. The framework described above (Pilot = Function +

Geography + Mode), along with an assessment of the Service Enhancement Plans (which note low-productivity areas well-suited to community connector services) point to opportunity areas suitable for a mix of new mobility strategies, and potential pilot projects.

Using the applied logic to test different pilots could begin by a sample set of pilots as described in Figure 11 below. These serve as starter concepts on a series of experimental outputs that should then further define how TriMet intends to test equity provision, key metrics and evaluation criteria in addition to that described in Section 2. Pilot projects should be the subject of cross-agency collaboration with PBOT, Metro, and ODOT as well as congruent with the efforts of other TriMet departments.

Figure 11 New Mobility Pilot Project Sample Set

Pilot Function	Geography		Mode	Key areas of interest
	Service Enhancement Plan Area	Zone Description		
Short Trips	Southeast	Foster/Powell	Microtransit	Short-trips to downtown and within East/Inner SE Portland. Area of strong ridership loss but suggested new mobility propensity.
Late Night Service	East Side	181 st Street P&R – Gateway TC	TNC or Microtransit	Test service for shift workers and test lower income riders' interest and utilization of new mobility.
First mile/last mile	Westside	Hillsboro TC	AV Shuttle	Ideal street network and operating conditions for AV shuttles.
First mile/last mile	Southwest	Barbur and Tigard Transit Centers	Microtransit <i>AV shuttle (longer term)</i>	Option to test service interoperability with fixed route transit and integration with mobility hubs.
Network augmentation	North Central	North Lombard/North Columbia Blvd.	Microtransit	Example of low density experiment with potential employer collaboration.
Paratransit	Any	--	TNC	Option to apply a highly-tested and quick-to-implement use case within current LIFT and paratransit operations.

Procurement Considerations

For a full list of procurement considerations, see Appendix B.

LEVERAGE ASSETS

New mobility companies have a huge first mover advantage in acquiring users. However, TriMet has a huge first mover advantage in owning and operating a system that includes:

- 16 transit centers
- 30+ owned park-n-ride locations
- 30+ leased park-n-ride locations
- 74+ miles of dedicated right-of-way

Controlling these assets gives TriMet an opportunity to shape the way users connect with new mobility services through the existing backbone of the transit network. TriMet can leverage its ownership of the physical space to anchor new mobility services to welcoming and effective facilities.

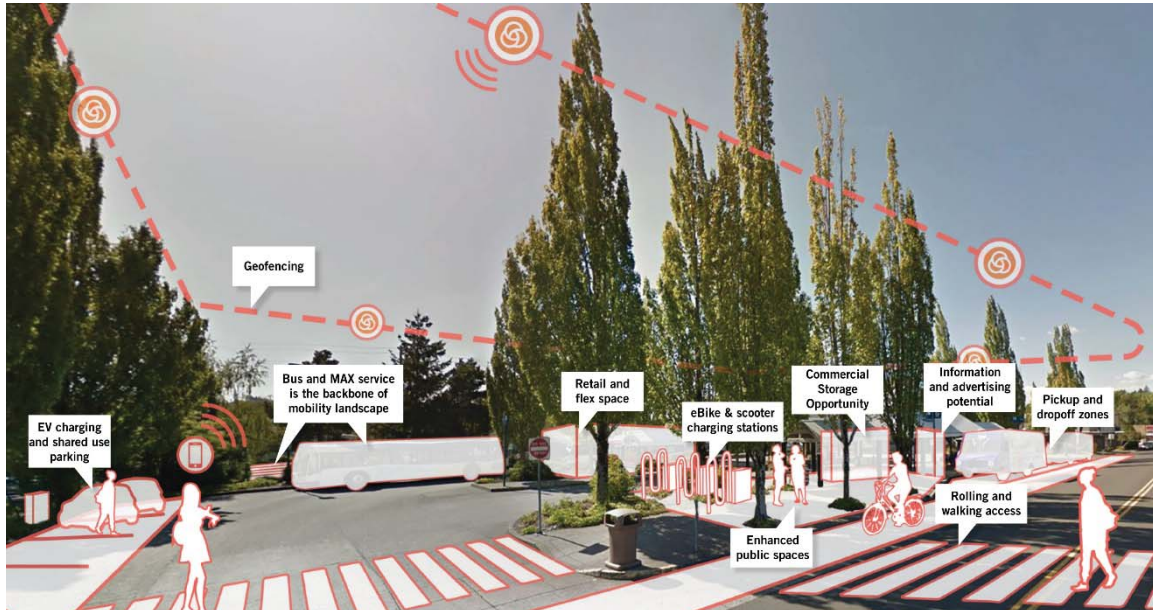
Mobility Hubs

Figure 12 illustrates a few components to the Mobility Hub strategy that can be a stand-alone pilot initiative or incorporated within the efforts of other pilots organized by mode. These and other characteristics of mobility hubs to consider include:

- **Geofencing:** Mobility hubs are natural places for TriMet to begin experimenting with the use of GPS and other technologies to create a virtual geographic boundary. Pairing geofencing with other data efforts within the HOP Fastpass or OTP SUM apps will allow TriMet to include the ability for software to trigger a response when a mobile device enters or leaves a particular area.
- **Commercial Storage Opportunities:** Provide e-commerce vendors such as Amazon a simple solution for product distribution and offer riders a place to pickup goods on their way to home or work.
- **Public space:** Design a sense of place attracts riders and facilitates an accessible hub.
- **Shared Use and private vehicle parking:** Dedicate space for carpool, carshare, bikeshare and other equipment facilitates multimodal trip-making.
- **Pickup/ drop off zones:** Offer marked curbspace for auto passengers for convenience and safety to passengers, drivers, and nearby cyclists and pedestrians.
- **Rolling and walking:** Design hubs with connections to sidewalks, bike/multi-use paths and equipment parking offer added convenience and flexibility
- **Restrooms and other facilities:** Retrofit underutilized building space can offer convenience and commercial opportunities benefitting TriMet, customers and businesses.
- **Charging stations:** Offer low-rent space to MSPs looking to charge scooters, bikes, and vehicles.

- **Community partnerships:** work with local vendors to encourage local businesses to operate at mobility hubs.

Figure 12 Tigard Transit Center Mobility Hub Example (Illustrative)



Source: Nelson\Nygaard

Effectively leveraging TriMet's assets will also depend on partnerships and relationships with other public agencies who control curb and sidewalk spaces that provide access to light rail stations, transit centers, and Park & Rides. TriMet should continue to work closely with regional jurisdictions as they develop right of way policies, regulations, and short- and long-range plans.

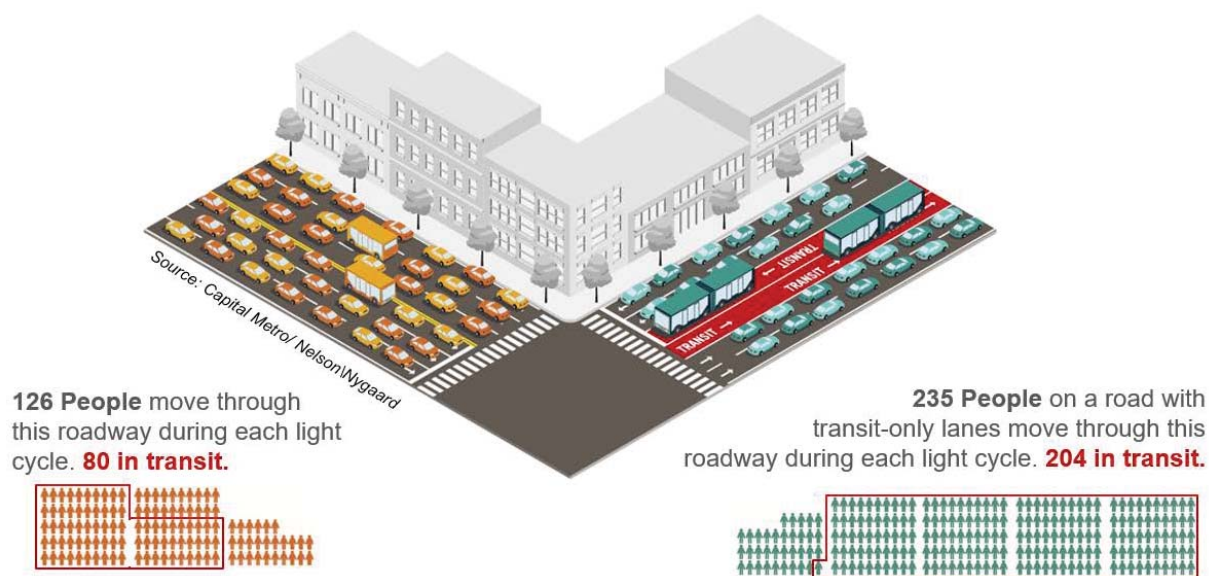
TriMet can implement mobility hub improvements in phases at existing properties. Layers of enhancements and services can be added as agency resources allow and rider needs evolve. In this way, a mobility hub initiative can complement other ongoing improvement programs as opportunities arise and agency resources allow. Improvements should be integrated into major infrastructure development and re-development projects to align the mobility hub initiative with other local and regional efforts.

Demonstrate Efficient Use of Right-of-Way

TriMet has more than 74 miles of dedicated on-street and off-street R.O.W. in its control. However, as automated vehicle operators begin operating in mixed traffic, there may be a strong pressure to "share the transit lane" with non-transit uses. Not only is this proposal inefficient, but risks TriMet's ability to meet on-time performance goals and serve obligations to the public good. Transit succeeds when given the opportunity to serve the most amount of people in the most efficient amount of space. Figure 13 below illustrates transit's inherent geometric advantage in moving people efficiently through a street cross-section.

Thus, it is important that TriMet continue to keep data and track speed, efficiency, and high operational standards within their own R.O.W. to demonstrate good baseline performance metrics.

Figure 13 Sample Illustration: Efficient use of R.O.W. with Transit



Source: Capital Metro\ Nelson\Nygaard

INFLUENCE POLICY

Legal and legislative considerations have cross-sector implications such as labor agreements, consumer and operator data protections, curb and right-of-way access, and geographic service area. Likewise, state and federal rulemaking processes could result in significant changes in the legal landscape. TriMet should address key legislative and legal questions through coordinated lobbying and information sharing efforts around new mobility services, and be prepared to react to proposed policies and legislation at the local, state and national levels.

Likewise TriMet, through pilot projects and other initiatives, can continue to build its understanding of, and relationships with, privately owned mobility service providers, to inform and create a balanced policy environment that advances efficiencies in regional mobility while allowing innovation and growth in products.

TriMet's general policy influences will be most effective in addressing three key issues, described below.

Laws to cover emerging use cases and TNC preemption. The Oregon legislature has already seen proposals to allow TNCs and AV service providers with broad rights in using the public R.O.W. These preemptive policies will limit local government's abilities to set their own transportation and land use goals, and could limit the communities' rights to establish high-capacity transit lanes. As a regional mobility manager, TriMet can build and leverage influence at

the state level, and offer another cohesive, coordinated voice on behalf of the Portland region's transportation future. For more information, see TNC Preemption Legislation, below.

Data sharing framework and guaranteed data. A key concern from MOD Sandbox and other TNC pilot projects is firms' concerns that customer data will be publicly available, creating safety and security risks for users, and liability issues for the firms. One potential solution is to employ a third-party (independent) organization to house disaggregated data in such a way that customer identities are protected and secure.

The data collection tools also create an opportunity to advance public agencies' transportation practices, by providing data for planning, accounting, operations, and auditing. Policies can advance and respond to public private partnership needs by creating a balanced data sharing rules, clarifying the scope of analysis public agencies need and should expect when providing the infrastructure in public R.O.W. that the mobility service providers depend on.

Autonomous vehicle operational framework. AV technology is advancing rapidly. TriMet is already working with ODOT and other partners to understand what widespread AV adoption will mean for our transportation network and R.O.W. sharing, and how to best preserve mobility efficiencies, R.O.W. safety, and regional and local economies. Key considerations for TriMet to consider moving forward include:

- Most productive transit areas are unlikely targets for early application, but possible
- Circulators, demand-responsive services are more common today
- Continued need for an attendant (in paratransit especially)
- The fully automated applications are likely to be the most controversial for labor
- Maintenance and repair: more, smaller vehicles are run more often, with more equipment
- Retraining: increasing as more automated vehicles incorporated into transit fleet.

More on these three issues (legislation, data sharing, and AV frameworks) are described in the sections below.

TNC Preemption Legislation

Nearly 40 states have some kind of TNC preemption law, limiting local jurisdictions' authority to regulate TNCs, including prohibitions on

- Fees or taxes on TNC drivers, vehicles, or companies
- Data collection requirements
- Business licensing to operate in a given jurisdiction
- Specific requirements relating to airport access

Among the most recent are Florida's and Texas', both passed in 2017. Similar legislation was introduced in Oregon as HB3246 during the 2017 session.¹⁴ Though the Oregon bill died in committee, the trajectory of similar legislation in other states suggests that this won't be the last time this appears. Areas of possible impact include:

¹⁴ Florida: http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0600-0699/0627/Sections/0627.748.html. Texas: <https://www.tdlr.texas.gov/tnc/tnclaw052917.pdf>. Oregon: <https://olis.leg.state.or.us/liz/2017R1/Measures/Overview/HB3246>.

- Revenue (removes ability of local jurisdictions to set rates or collect fees or taxes)
- Safety (limits ability to require greater degree of background checks, etc., to apply TNC-specific traffic regulation, and to apply taxi or other commercial transportation regulations to TNCs as they are specifically defined as a different class of service)
- Congestion (removes ability to regulate curb-use, designation of specific zones for special treatment, etc.)
- Data sharing

In short, this type of legislation removes many of the levers that might help bring TNCs to the table for mobility pilots or work around specific geographies (mobility hubs, etc.).

The state of Washington provides an example of a state law that provides a statewide authorizing framework for TNCs while preserving local regulatory prerogative. The National Employment Law Project & Partnership for Working Families has produced a useful playbook for jurisdictions facing TNC preemption efforts, as Oregon is likely to continue to see.¹⁵

Open Records Laws and Implications for Data Frameworks

In discussions about provision of private operators' travel data to public entities, both in the context of regulatory requirements for data disclosure and in negotiation of terms for partnerships and commercial arrangements, the operators (TNCs in particular) often cite freedom of information requirements and open records laws as a reason for avoiding disclosure. Two main areas of concern are generally cited by private operators: exposure of trade secrets to competitors; and exposure of personally identifiable information (PII) either directly or by way of travel data that can be used to reconstruct individuals' trips.

In Oregon, both of these appear to be covered exceptions to the state's open records law:

- Trade secrets are exempt from open-records disclosure "unless the public interest requires disclosure in the particular instance."¹⁶
- Personally identifiable information "collected as part of an electronic fare collection system of a mass transit system" is similarly exempt from disclosure, except that this "does not apply to public records that have attributes of anonymity that are sufficient, or

¹⁵ NELP and PWF:

<http://www.forworkingfamilies.org/sites/pwf/files/publications/Uber%20State%20Interference%20Jan%202018.pdf>

¹⁶ "Trade secrets," as used in this section, may include, but are not limited to, any formula, plan, pattern, process, tool, mechanism, compound, procedure, production data, or compilation of information which is not patented, which is known only to certain individuals within an organization and which is used in a business it conducts, having actual or potential commercial value, and which gives its user an opportunity to obtain a business advantage over competitors who do not know or use it. (ORS 192.345(2))

that are aggregated into groupings that are broad enough, to ensure that persons cannot be identified by disclosure of the public records.”¹⁷

Most forms of data that a transit agency might currently collect seem to be protected under these exemptions. However, there are legitimate questions as to whether the fare payment system exemption covers some new use cases in the new mobility arena:

- To what degree does this cover PII gathered by private contractors or vendors or partners? At a first glance, this seems to be covered by the definition of "mass transit system" it refers to is not explicit—that statute refers to "mass transportation for passengers" where *mass transportation* is not defined. Is exclusive-ride taxi or TNC service considered mass transportation by dint of it being subsidized by a transit agency?
- What about data collected by transit apps not part of a fare collection system—e.g., through a trip planning app that simply hands off a TNC trip to the private operator for completion of the transaction?
- Does raw, disaggregated origin/destination data, even if obvious PII data is removed, constitute PII if individuals can be identified from it? A growing body of scholarship suggests that very few data points are needed, even in aggregated datasets, to identify individuals, especially if several large datasets can be combined and cross-referenced. What is necessary level of temporal/geographic aggregation? What is a public entity's responsibility to its constituents in making this determination?¹⁸

Beyond this is the question of the volume of data that will be generated by incorporating new mobility systems into public applications, and where this data will be stored, what the ongoing technical requirements are for doing so securely, and whether this is a role public bodies have the capacity and desire to take on.

Possible approaches to the issues include:

- Lobbying to tighten statutory language to explicitly cover new use cases
- Creation of a data framework in which TriMet or other public entities never hold private operators' disaggregated data. Instead, it would be held by the operator or a trusted third-party repository under strong legal and technical protections, and the public entity would be guaranteed access to views of the data at the levels needed for accomplishing its work (planning, accounting, operations, auditing being the main areas). The trusted third-

¹⁷ (c) As used in this subsection: (A) "Electronic fare collection system" means the software and hardware used for, associated with or relating to the collection of transit fares for a mass transit system, including but not limited to computers, radio communication systems, personal mobile devices, wearable technology, fare instruments, information technology, data storage or collection equipment, or other equipment or improvements. (B) "Mass transit system" has the meaning given that term in ORS 267.010. (C) "Personally identifiable information" means all information relating to a person that acquires or uses a transit pass or other fare payment medium in connection with an electronic fare collection system, including but not limited to: (i) Customer account information, date of birth, telephone number, physical address, electronic mail address, credit or debit card information, bank account information, Social Security or taxpayer identification number or other identification number, transit pass or fare payment medium balances or history, or similar personal information; or (ii) Travel dates, travel times, frequency of use, travel locations, service types or vehicle use, or similar travel information. (ORS 192.345(38))

¹⁸ See: <https://www.wired.com/2013/03/anonymous-phone-location-data/> and <https://news.mit.edu/2015/identify-from-credit-card-metadata-0129>

party model being is currently being built out and tested at the University of Washington Transportation Data Collaborative.¹⁹

General Autonomous Vehicle Provisions

Definitions and statutes regarding autonomous vehicles are increasingly keyed to the Society of Automotive Engineers (SAE) six automation levels (from 0—no automation, with the driver performing all driving tasks—with increasingly autonomous functions up to level 5—full automation) and guidance from the National Highway Transportation Safety Administration.²⁰

Many AV statutes and executive orders simply state an intent to support or observe the development and testing of autonomous driving technologies, without providing specific regulation. The more specific laws provide statutory definitions of terms and levels of automation, and tend to center on several key areas as driving tasks are increasingly automated:

- Testing is often specifically authorized. The need for an operator to be physically present may vary.
- Operation on public roads (as opposed to closed proving grounds or test facilities), both for testing and regular use
- Permissibility of a variety of commercial applications:
 - For ride-hailing, taxi, or other use for hire
 - Larger vehicles for passenger transportation, such as shuttles and coaches
 - Cargo, freight, and delivery uses, often touching on the “platooning” of multiple vehicles on highways
- Liability, insurance, and traffic enforcement: Several statutes include designation of the “driver” to answer the question of who is responsible in case of an accident or a traffic violation. (The vehicle's owner? The individual who activated autonomous mode? The engineer sitting in the seat?)

Statutes in Michigan, Florida, Arizona, California, Nevada, Tennessee go the furthest in addressing many of these questions. The National Conference of State Legislators has produced a good rundown of various state provisions across the country. Oregon is among some 20 states who have not addressed AVs through enacted legislation or executive action but is pursuing a better understanding of public needs through the Oregon AV Taskforce.^{21, 22}

Autonomous Vehicle Preemption Legislation

Though similar in form to TNC preemption legislation, AV preemption legislation is not nearly as widespread at this point. At their most basic, these statutes simply prohibit localities from themselves prohibiting use of AVs. Others provide more regulatory detail and reserve a larger set of prerogatives to the state. Texas SB 2205 (2017) is an example of the latter. It allows fully

¹⁹ <https://www.uwtcd.org/>

²⁰ NHTSA guidance: <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>

²¹ Michigan: <https://www.recode.net/2016/12/9/13890080/michigan-dot-self-driving-cars-laws-automakers>. Tennessee: <http://www.capitol.tn.gov/Bills/110/Bill/SB0151.pdf>. NCSL:

<http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx>

²² <https://www.oregon.gov/ODOT/Get-Involved/Pages/Task-Force-on-Autonomous-Vehicles.aspx>

autonomous vehicles (including commercial vehicles) to operate on any public road in the state as long as it is 1) insured to state standards, 2) compliant with relevant federal regulations, 3) capable of operating in compliance with traffic laws, and 4) equipped with a data recorder. Local jurisdictions and state agencies are prohibited from imposing any additional regulations.²³

Nevada AB69 goes even further, prohibiting local governments from regulating, requiring permitting or certification, or imposing taxes, fees, or other requirements on AVs, their operators, or networks of AVs.²⁴

²³ Texas: <http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx>

²⁴ Nevada: https://www.leg.state.nv.us/Session/79th2017/Bills/AB/AB69_EN.pdf

5 CONCLUSIONS AND CALL TO ACTION

TriMet has a small window of opportunity to retain and elevate its role in the region. Iterative testing of multimodal operations will help the agency refine its business model and insulate it from risks introduced by privately-owned new mobility companies.

TriMet is uniquely poised to take advantage of changing forces in the era of new mobility. By positioning itself as a mobility manager and taking measures through growing services, leveraging assets, and influencing policy, the agency will be better suited to thrive for the next generation of riders.

The agency should begin by first building out program structure and priorities in the following three areas summarized in the report:

1. Grow Services
2. Leverage Assets
3. Influence Policy

TriMet should approach near-term pilots with an adapted scientific method to glean crucial information from projects such as:

- Define hypothesis of project performance
- Develop “A/B” tests to understand how different rider groups respond to new technologies.
- Pre-define how findings will mature internal understanding and further the business model.

Auxiliary and complementary efforts include continuing to empower staff to take measures to evolve the agency business model, refine KPIs and experimental parameters, and foster cross-agency collaboration.