

Emerging Trends and Technology

TMP Update



1. Introduction

The Redmond 2050 Comprehensive Plan states that in 2050 Redmond's transportation system is resilient, sustainable, equitable and inclusive. The convergence of transportation technological innovations in data analysis and management, automation and electrification has the potential to make the City's transportation system not only more efficient, but also greener, safer and more inclusive. In Redmond, technology will be supporting many of the strategies defined in the City's Safer Streets Action Plan by reducing vehicle speeds, helping transportation system designers understand crash risk through data obtained from advanced cameras and software systems, and will make vehicles and interactions between vehicles and people outside of vehicles safer. Data collection and analysis using new technologies will allow planners and engineers to better monitor traffic operations; manage maintenance; and identify network deficiencies that need to be fixed. Technology will also support individuals as they plan their routes and best mode of travel, find parking, and get real-time information to help them navigate a multimodal transportation system to move throughout Redmond and connect to regional systems.

2. Advancing Redmond 2050 Guiding Principles

Redmond 2050 establishes three Guiding Principles: Resilience, Equity and Inclusion, and Sustainability. The Emerging Trends and Technology Chapter identifies strategies that support these principles, as shown below.

Resilience

- **Technology can support a resilient transportation system and safe access for all users as travel demand and patterns change over time and during major disruptions caused by natural disasters or other events. (See Redmond 2050 FW-TR-2)**
- Strategies supporting the Guiding Principle of Resilience include: Strategy 2 and Strategy 5

Equity & Inclusion

- **As new technologies are deployed in Redmond, it's essential to address the safety and accessibility of all (See Redmond 2050 TR-10).**
- Strategies supporting the Guiding Principle of Equity include: Strategy 1, Strategy 3, and Strategy 6

Sustainability

- **New technologies can be used to reduce vehicle trips, optimize traffic, and manage transportation assets, resulting in reduced greenhouse gas emissions and environmental impacts, and more efficient use of resources. (See Redmond 2050 FW-TR-4)**
- Strategies supporting the Guiding Principle of Sustainability include: Strategy 4

3. Emerging Trends in Transportation Technology

Technology is driving many of the emerging trends in transportation systems and service delivery. From autonomous vehicles to shared micromobility to artificial intelligence, new technologies are providing both opportunities and challenges for cities. In most cases, cities like Redmond have the authority to manage new technologies and ensure that technological

advancements translate into safer, more equitable and more resilient and sustainable transportation systems. However, it remains to be seen how much authority local agencies will have over where and how some technologies such as autonomous vehicles may be deployed. Technology has and will continue to offer new capabilities and approaches to transportation planning and system management in Redmond.

Current Transportation Technology Systems at the City of Redmond

The following transportation technology systems at the City of Redmond are used to manage and deliver transportation services.

Asset Management and Condition Monitoring

Technology can help Redmond manage and monitor the condition of transportation-related assets such as sidewalks, street trees, signals, and streetlights. These systems aim to optimize asset utilization, ensure proper maintenance, and track work performed in Public Works, Parks, and Facilities. Asset management plans include elements for the state of local infrastructure (inventory, valuation, age, and condition) systems levels of service, asset management strategy) practices, procedures, tools, demand supportability, and lifecycle management and risk, financing strategy, and guidance for the continued improvement and monitoring of the plan. More information on asset management can be found in Chapter 13 – Monitoring Progress.

Client Relationship Management

Client Relationship Management systems manage and enhance communication, engagement, and interactions with the public. The City uses QAlert to manage all citizen requests and inquiries – including those that are transportation-related. Requests are catalogued by the City and are then dispatched to the appropriate department depending on their context.

Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) offer a data-driven approach to improving the safety, efficiency, and sustainability of transportation networks. By integrating advanced technologies such as sensors, communication networks, data analytics, and real-time monitoring, ITS enable smarter management of transportation infrastructure and vehicles. These systems aim to optimize traffic flow, reduce congestion, enhance safety, and improve overall user experience for both drivers and pedestrians.

The City of Redmond has used ITS for several years to great success, though enhancements can help to make the transportation system more efficient and effective and improving the safety and performance of the multimodal transportation system. Areas that should be considered for future investments include continued advancements in traffic signal systems, flashing crosswalk beacon and school zone technology and strategies to make the fiber optic infrastructure more efficient and effective to support traffic operations and safety systems operated by the City.

Traffic Data Management and Analysis

Traffic Analysis systems comprise analytical tools and methodologies to assess and understand traffic pattern, behaviors, and characteristics. Traffic simulation models can predict development impact on traffic and analyze signal timings at intersections. Other software can report on and analyze traffic-related statistics in Redmond, such as traffic collision data to assist in planning efforts. The City of Redmond uses a variety of these technologies to support traffic monitoring and reporting, travel demand modeling and safety analysis, among other activities.



FIGURE 1 – CITY OF REDMOND TRAFFIC OPERATIONS CENTER

City of Redmond Traffic Operations Center

The City's Traffic Operations Safety and Engineering Division staff monitor traffic conditions throughout the City from the Traffic Management Center (TMC). The TMC operates during City Hall business hours and monitors traffic and activity on public streets using traffic cameras at many of the City's traffic signal locations. Interested parties can get on-line access to still photo images from Redmond's traffic cameras at roughly 70 intersections across the City (as of December 2024), showing traffic conditions on City streets in real-time. The TMC also provides information to the traveling public via its network of overhead electronic message signs.

Transportation Modeling and Forecasting

Transportation modeling and forecasting involves the use of mathematical models and data analysis techniques to simulate and predict current and future year transportation patterns,

demand, and outcomes. Models and forecasts provide insight into traffic flows, congestion, transit ridership, travel behavior, and future transportation needs.

For many years, the City of Redmond has used the Bellevue-Kirkland-Redmond travel demand forecasting model, referred to as the BKRCast model, to conduct multimodal transportation planning studies such as Sound Transit's Sound Move plan, GMA planning requirements and other efforts. Derived from the Puget Sound Regional Council's SoundCast model, the BKR model is an activity-based travel demand model configured to depict travel behaviors that depend on the built environment and demand from other users.

While the City of Redmond has been a partner with Bellevue and Kirkland, it has wrestled with the challenge of providing staff to operate and use the model outputs to meet its planning needs. As the City moves forward to work to fulfill the planning needs called for in Redmond 2050, it will need to address these challenges to make full use of this unique and effective planning tool.

Emerging Technology Trends

Artificial Intelligence

Artificial intelligence (AI) has the potential to enhance the efficiency of transportation systems and improve data-driven decision making in transportation planning. AI can be used to analyze large amounts of data from various sources.

AI-powered algorithms will play a more prominent role in optimizing traffic flows, improving safety in the public right-of-way, predicting transportation demand, and even personalizing mobility experiences for users. Cities will increasingly deploy AI to support management of truck fleet operations, ensuring they're in the right place at the right time. Expect AI to also enhance real-time curb management, reducing congestion and enabling seamless deliveries in busy urban areas.

Big Data

Large datasets from various sources like traffic sensors, GPS tracking, and mobile phone data provide opportunities to gain insights into traffic patterns, trip length and purpose, identify congestion, optimize routes, predict future traffic conditions, and inform infrastructure development decisions. Leveraging big data may lead to more efficient and effective transportation systems.

Redmond Data Governance Strategy Project

The City of Redmond is undertaking a Data Governance and Strategy project to build a citywide framework for managing data as a strategic asset. This initiative will enhance how data is collected, classified, accessed, and used, with a strong focus on accuracy, security, and accessibility.

By establishing a Data Governance Committee, implementing data classification policies, and defining clear access protocols, the City aims to reduce inefficiencies, ensure compliance with legal and privacy standards, and improve decision-making across departments.

As the Transportation Master Plan is developed and implemented, this parallel effort in data governance will help ensure that transportation decisions and investments are guided by accurate, well-managed information.

Goods Delivery Reservations

Technology that can leverage surveillance tools, historical trends on utilization rates, dynamic pricing information and curbside reservations can support more efficient deliveries, optimize access to businesses and smooth the flow of traffic.

Dynamic Pricing

Dynamic pricing is a technology that would allow the City to adjust prices for parking, tolls, and other transportation systems in real-time based on market conditions and demand. It can help optimize capacity of the transportation system.

Drones

Drones can be used to complement or replace traditional traffic sensors, such as cameras, loops, or radars. Drone-based imaging can also be used in combination with artificial intelligence and machine learning to analyze video data and create optimal, cost-effective solutions that would support the work of transportation planners. Drones are also being used for goods delivery, especially in last mile delivery. Within the City of Redmond, the Police Department is already using drones as part of their emergency response.

Autonomous Vehicles

In research conducted by the American Planning Association, autonomous vehicles (AVs) could have a large impact on the automobile/small truck markets in the US. It is estimated that approximately 50% of cars will be AVs by the year 2040. This could cause a reduction in privately owned vehicles of over 43%.

One shared AV could replace up to 9-to-11 private

vehicles. This reduction in privately owned vehicles could have substantial benefits, including cost savings for households and allowing for the reallocation of space currently dedicated to parking and larger volumes of vehicle traffic to other uses such as greenspace and housing.

With the efforts into deploying and testing the viability of AVs in major cities around the U.S. underway, there is interest in developing policies to manage this new technology to ensure it aligns with local values and priorities around traffic safety, emergency response, and equity. The cities of Bellevue and Seattle have collaborated in the creation of an automated vehicle technology to address shared regional values and goals. From this vision a joint strategic policy and technical document has been prepared and multi-agency discussions about extending the

vision and policies to more jurisdictions, including the City of Redmond, are underway. More information on autonomous drones and personal delivery devices can be found in Chapter 7 – Freight and Goods Delivery.

Vehicles Connected to Everything (V2X)

Vehicles connected to everything (V2X) is technology that enables vehicles and wireless devices to communicate with each other, roadside infrastructure, and even nearby pedestrians and cyclists. These technologies have the potential to make a more safe, secure, and efficient transportation system.

Examples of recent deployments using V2X technology include:

- A pedestrian crossing warning system for bus operators (Cleveland OH)
- Cloud-based digital advanced hazard warning alerting system for motorists (Connecticut)
- School bus signal priority (V2I) application that detects the approaching vehicles and extends green light signal phase (Fulton Co. Georgia)
- Reduced speed school zone warning application (Columbus OH)

The USDOT has recently released its national plan to accelerate the deployment of V2X technology. The Plan is focused on road safety, mobility, and efficiency through technology that enables vehicles and wireless devices to communicate with each other and with roadside infrastructure. These technologies can enable a more safe, secure, and efficient transportation system while maintaining privacy and consumer protection. The Plan will contribute to the Safe System Approach adopted by the USDOT's National Roadway Safety Strategy, which is also the foundation for Redmond's Safer Streets Action Plan. More engagement with the community and technology partners would be needed before any V2X deployment occurs in Redmond.

Mobility as a Service

Mobility as a Service (MaaS) is a type of service that enables users to plan, book, and pay for multiple types of mobility services through an integrated platform. Transportation services from public and private providers are combined through a unified gateway, usually via an app or website, that creates and manages the trip and payments, including subscriptions, with a single account. The key concept behind MaaS is to offer travelers flexible mobility solutions based on their travel needs, thus "mobility as a service" also refers to the broader concept of a shift away from personally owned modes of transportation and towards mobility provided as a service.

Telematics

Telematics is a method of monitoring cars, trucks, equipment and their assets using GPS technology and on-board diagnostics to plot the asset movements on a computerized map. The City is using telematics to report on duration of City fleet vehicle use and diagnose technical issues for vehicle servicing needs.

Other Trends

Road User Charging

Road usage charging (RUC) applies fees to motorists based on the distance traveled. It is an alternative to a fuel tax from which revenues have steadily declined due to improved fuel efficiency and growth in the EV market. RUC can be used to fund road maintenance and construction as well as alternatives to driving alone. RUC can also be an effective tool for disincentivizing driving during certain times of day or within specific areas or corridors. Dynamic road usage charging opens new possibilities for managing automated vehicles by adjusting charges in real-time based on traffic conditions and vehicle occupancy.

4. Strategies and Actions

Strategy 1: Employ technology in service of citywide goals, ensuring newly adopted technologies support priorities of safety, maintenance, and multimodal travel choices for pedestrians, cyclists, and motorists.

Thriving communities rely on the effective movement of people and goods. The Redmond transportation system is evolving to meet the transportation needs of those who walk, roll, ride a bike, drive a car or truck, or take transit.

Redmond 2050 Policies Supporting Strategy 1

FW-TR-1: Plan, design, build, operate, and maintain a safe transportation system that advances an equitable, inclusive, sustainable, and resilient community by providing for the mobility and access needs of all.

- TR-3: Maintain flexibility in the face of technological innovation, changes in mobility patterns, natural disasters, and other sources of uncertainty and disruption.

Recommended Actions

- Action 1A: Develop a citywide Intelligent Transportation System plan to build upon existing ITS systems and strategically apply advanced technology to improve mobility, reduce collisions, and enhance sustainability. (Public Works)
- Action 1B: Prepare a report that evaluates V2X technology and provides an assessment of the potential benefits and costs of the technology if implemented in Redmond. (Planning)

Strategy 2: Explore new and varied data sources to support strategic decision making and improve transportation system operations.

A variety of new data sources continue to be made available to public agencies that can be used to more effectively plan and manage transportation systems. For example, “Big Data”, or large and comprehensive data sets may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions. Such data provides transportation planners with new capabilities to make more informed decisions on how to optimize the transportation system for different users and travel demands, which can reduce congestion and emissions and improve safety for all users.

Redmond 2050 Policies Supporting Strategy 2

- FW-TR-6: Identify level-of-service standards for transportation infrastructure and fund maintenance, repair, and replacement costs to meet them. Proactively manage and maintain transportation assets in a way that minimizes lifecycle costs and results in replacement or renovation in advance of need.

Recommended Actions

- Action 2A: Support evidence-based decision making by using “big data” analytics to better understand travel patterns and demand and optimize the transportation network. (Planning, TIS)

Strategy 3: Develop staff skills and knowledge of advanced analytical tools and evaluation techniques that will advance transportation options, safety, and efficiency.

The City of Redmond uses the Bellevue-Kirkland-Redmond (BKR) model to help estimate future transportation vehicle and person demand on the local city and transit highway networks. Over the years, the model has been used to evaluate the impacts of population and job growth, identify auto, transit and carpool demand, plus calculate traffic impact fees for new developments. The model has been instrumental in evaluating the impacts of a future (and now operating) Sound Transit Link light rail service on the Eastside of Lake Washington. The City will continue to use the model to forecast system performance and provide data that planners can use to target new multimodal transportation investments in areas of high growth.

Redmond 2050 Policies Supporting Strategy 3

- TR-26: Use advanced technology to improve system efficiency, disseminate traveler information, and improve data collection for system management.

- TR-11: Maintain a traffic control program based on the fundamentals of education, enforcement and engineering for evaluating and responding to traffic safety and operational concerns. Maintain standards for maximum desirable traffic speeds and volumes. Apply a hierarchy of traffic control responses based on the severity of the traffic problem.

Recommended Actions

- Action 3A: Leverage the use of the Bellevue-Kirkland-Redmond regional travel demand model to support transportation planning analysis needs. Evaluate the usefulness of the model to address the planning needs of the city and make recommendations on the role and function of the model for future use, including how it may be supported or supplanted by big data. (Planning)
- Action 3B: Promote the sharing of transportation-related data through an open data portal and APIs to allow third-party developers to create useful transportation apps and services. (TIS, Planning)

Strategy 4: Formulate public-private partnerships to implement innovative, ambitious, and scalable pilots that utilize new technologies and help meet the goals of the City of Redmond around transportation safety, efficiency, travel choices, or further citywide sustainability efforts.

Public/private partnerships traditionally have proven to be a good tool to test new strategies for local governments. These partnerships can provide several benefits such as:

- Provide access to private capital, innovation, and efficiency of technology for governments.
- Provide investment opportunities for the private partner with public sector guarantees for private companies.
- Help to increase mobility, economic growth, jobs, safety, equity and environmental protection as public goals.
- Provide a reasonable return on investment, critical infrastructure, and economic growth as private goals.
- Provide access to additional capital and technical expertise for governments.

Despite the above benefits, there could be some challenges to consider before entering a public-private partnership (PPP). These may include:

- Misalignment of interests. While public entities prioritize social welfare, private firms are profit-driven, which can lead to conflicts. Transparent contracts and regulatory oversight are essential to maintain balance.
- Another significant challenge is risk distribution. If risks are not shared equitably, either party can suffer setbacks.
- Additionally, PPPs may involve complex regulatory and legal landscapes, which can delay projects. Navigating these complexities requires robust governance frameworks, clear legislative guidelines, and efficient dispute resolution mechanisms.

Redmond 2050 Policies Supporting Strategy 4

- TR-10: Implement transportation programs, projects, and services that support the independent mobility of those who cannot or choose not to drive.
- TR-12: Implement transportation programs, projects, and services that prevent and mitigate the displacement of communities that have been disproportionately harmed by past transportation siting decisions, as well as those at high risk of displacement.

Recommended Actions

- Action 4A: Form partnerships with emerging mobility services, technology services, platforms, and neighboring jurisdictions to advance safety and mobility. (Planning, Public Works, TIS)

Strategy 5: Leverage technological advancements in support of multimodal travel strategies.

The advance of technology has given travelers many opportunities to make the best choices about how to use the transportation system. However, the simple question of “How do I get from point A to point B in the shortest amount of time?” is not so simple to answer. As shown in the graphic below, people who live, work and recreate in Redmond have many things to consider when determining their best transportation choices. Tools such as Google Maps, ORCA cards, and OneBusAway, a real-time bus tracker application have made using the public bus system simple and responsive. Integrating traveler information through Mobility as a Service (MaaS) technology to support travel on other modes is still relatively new and while they will continue to get better, local governments can support these efforts by providing a regulatory regime that is flexible and making public generated data accessible to the greatest extent possible.

Redmond 2050 Policies Supporting Strategy 5

- TR-26: Use advanced technology to improve system efficiency, disseminate traveler information, and improve data collection for system management.

Recommended Actions

- Action 5A: Work with partners and vendors to implement integrated Mobility as a Service (MaaS) platforms that combine public transit, ridesharing, bike-sharing, and car-sharing services to promote multimodal transportation and reduce dependency on private vehicles. Work to ensure that these platforms align with the City’s goals and guidelines for safety and equity. (Planning)

Strategy 6: Adopt regulations for the use of new transportation-supportive technologies in Redmond.

As new technologies emerge it is critical that the City evaluate them to determine how they can advance Redmond’s transportation vision and what new regulations may need to be put in place to ensure these technologies offer a net benefit to the Redmond community and any potential negative impacts to people, property or City operations are mitigated. One such case is the

advent of managing the use of autonomous vehicles (AVs) in the City, which can include personal delivery devices and drones. Other technologies such as automated traffic enforcement and road usage charges could improve street safety and transit reliability, and create long-term sustainable transportation funding sources as gas tax revenue continues to decline, respectively.

Redmond 2050 Policies Supporting Strategy 6

- TR-10: Implement transportation programs, projects, and services that support the independent mobility of those who cannot or choose not to drive.

Recommended Actions

- Action 6A: Evaluate new technologies to understand potential positive and negative impacts on Redmond's transportation system, safety, and overall community livability and develop regulations in support of community goals. Join state and national efforts to advocate for local control and regulation of AVs, drones, and other technologies that may adversely impact transportation infrastructure, safety, and community livability. (Planning)
- Action 6B: Investigate and consider adoption of the Seattle/Bellevue Automated Vehicle Strategic Vision Plan to better prepare for the introduction of automated vehicles. (Planning)
- Action 6C: Support efforts to expand the use of automated enforcement to improve safety and transit reliability.
- Action 6D: Keep apprised of and support efforts at the State and County levels to explore road usage charges.