Draft Emerging Trends and Future Conditions Report

Prepared for

Washington County

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January 8, 2016

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INTRODUCTION

In the initial phase of the Washington County Futures Study ("study"), the team took a "look back" over the past 30 years to review how the county has grown and what major transportation decisions and investments were made to respond to that growth. The study is currently focused on identifying alternative transportation investments to evaluate how well they address future challenges and values important to the community. The transportation investments will be evaluated relative to two plausible land use scenarios for how the county might grow in the next 40-50 years. The future scenarios reflect advancement of adopted community plans, and differing factors, or drivers of change, that are likely to influence the amount of population and jobs growth, and land development patterns in the county.

This report includes a summary of the future conditions and potential transportation implication of the future growth scenarios. The report also examines emerging trends in mobility technology and transportation pricing which serve as critical drivers of change by first looking at current and anticipated trends from a global scale, and then addressing what these trends mean for Washington County as part of describing the purpose and objectives for testing different transportation investment concepts. Following public and other stakeholder outreach and engagement, including an online open house, this report will be refined to reflect the final transportation investments to be evaluated.

EMERGING TRENDS

As the drivers of future transportation changes that were developed earlier in 2015 for this study indicated, changing technology and pricing are worthy of particular attention considering the high level of future uncertainty combined with the potential to significantly influence the transportation system.

NEW TECHNOLOGIES

By their very nature, technological advances are disruptive. New technologies are continually being developed that impact people using different travel modes, vehicles and transportation facilities. These technologies aim to improve safety, aid in the selection of a travel mode, aid travelers in route selection, and reduce congestion. The following examples of technological "disruptors" provide a context for how developments in technology necessitate thinking differently about mobility for the near-term and longer-term future. In the near-term, technological advances are broadening transportation options. Smartphone apps have enabled users to access information in real time on available public and private transit services in their vicinity.

The change in how we define mobility in the short-term of 5-10 years, while significant, will not mean that transportation infrastructure looks very different in cities and urban areas from what we know

today. However, in the longer term future, going 15 years and beyond, the ascension of autonomous/connected vehicle technology in public, private and freight transportation will necessitate development of infrastructure which accommodates equipment, signage, sensors and signals and mobile payment systems that don't currently exist.[1] This technology represents a transformative and potentially disruptive agent of change for cities of all sizes (Driverless-future.com. *Forecasts: Driverless car market watch*, 2015).

Examples of emerging technology that are assumed to affect transportation include the following:

Adoption of Driverless and Connected Vehicles

The deployment of fully autonomous and connected vehicle systems will mean a profoundly different-looking transportation system by 2055. Autonomous vehicles rely on technology such as in-vehicle sensors as well as interoperable, networked, wireless communication among vehicles, infrastructure, and personal communication devices in order to avoid obstacles and adapt speed and route. Features of Advanced Driver Assistance Systems (ADAS) have been increasingly included in passenger vehicles. National Highway Traffic Safety Administration (NHTSA) issued a final rule on March 31, 2014 that all vehicles under 10,000 pounds must include rear visibility technology (cameras) beginning May 1, 2018 (Federal Register 2014). Pilot studies of connected vehicles are being funded by US Department of Transportation (USDOT 2015). State DOTs are expanding programs to provide in-vehicle services to reduce driver distraction and avoid collisions. (Morris 2014).

We don't exactly know what the infrastructure to accommodate these systems will look like, but we can assume there will likely be a need for new or adjusted procurement policies that account for all of the major technological shifts and the new equipment necessary to integrate new technologies and make innovations run smoothly and efficiently. Not all autonomous vehicles will require infrastructure investments. Google's current autonomous vehicle runs on LIDAR and does not need to communicate

[1] The USDOT Intelligent Transportation Systems (ITS) Joint Program Office, Institute of Transportation Engineers, AASHTO, TRB, and ITS America are also collaborating on a task force focused on connected vehicles. Connected and Autonomous Vehicle Systems (CAVS) technology which is in the process of being deployed today includes "V2V" (Vehicle to Vehicle) and "V2I" (Vehicle to Infrastructure). V2V-equipped vehicles automatically transmit data such as speed, position, and direction, and send alerts to each other if a crash seems imminent. V2V technology is currently being piloted for light and heavy trucks as well as for applications in transit vehicles warning of approaching pedestrians. Looking farther ahead, connected vehicle systems will include "V2X" (Vehicle to Central Systems & Service Providers and Vehicle to Pedestrians/Bicyclists/Motorcyclists).

with infrastructure. However, local investments in infrastructure connectivity could increase autonomous vehicle performance.

While the implications of what driverless and connected vehicle technologies will mean in the future cannot be fully determined, the following list represents expected benefits and challenges to consider, based on research and expert opinions:

- It is anticipated that freight vehicle systems will be the first to adopt this technology and become fully autonomous.
- Increased safety: Connected vehicles can detect conditions that a human driver cannot perceive and react more quickly (USDOT 2015). However, there is potential for increased distracted driving from vehicle operators interacting with in-vehicle services and other systems (Morris 2014).
- Increased efficiency: The ability of ADAS and connected vehicles to react to real-time data could enable travelers to change their route, time, and mode of travel, based on up-to-the-minute conditions, to avoid traffic jams and allow for more efficient use of roadways.
- Higher transportation costs: While some expensive "smart" infrastructure such as embedded loop detectors and video surveillance may be replaced with mobile devices, overall, equipping vehicles and infrastructure with detection and communication devices may cost more.

Advanced Ubiquitous ITS (Intelligent Transportation Systems)

Intelligent Transportation Systems (ITS) involve the application of advanced technologies and proven management techniques to solve transportation problems, enhance safety, provide services to travelers, and assist transportation system operators in implementing suitable traffic management strategies. ITS focuses on increasing the efficiency of existing transportation infrastructure and reducing crashes by managing congestion resulting from recurring and non-recurring events, like crashes or weather.

ITS are expanding to make use of vehicle automation and advances in data collection to continue to increase safety, mobility and fuel efficiency. The influence of the "Internet of Things" – which includes connected vehicle technologies like "P2P" and "P2I", and eventually "V2X" – is expected to produce significant increases in vehicle passenger and pedestrian safety. This technology will enable real-time traffic, transit, and parking data, making it easier to manage transportation systems for maximum efficiency and minimum congestion throughout the County's network. In addition, connected vehicles could enable travelers to change their route, time, and mode of travel, based on up-to-the-minute conditions, to avoid traffic jams.

ITS is taking advantage of the proliferation of mobile devices. In 2014, 58 percent of American adults used a smartphone. In an April 2012 survey, 20 percent of respondents used their phone to retrieve public transportation or traffic information in the past 30 days. Most (74 percent) adult smartphone

users use current location information (Pew Research Center 2014). These consumer technologies will likely integrate with digitally enabled transportation infrastructure.

Ubiquitous technologies have allowed for the emergence of real-time ridesharing services, with GPS providing driver and customer locations and route navigation. The emergence of ridesharing services such as Uber and Lyft over the course of five years is an example of technology disrupting the transportation mobility industry. These entities and others like them, also known as Transportation Network Companies (TNCs), are rapidly expanding into private ridesharing, public and private transit, and freight services. The quick rise of TNCs has changed how people think of ridesharing to the point that municipalities are now beginning to account for TNCs being a significant part of their transportation networks (National League of Cities, 2015).Ridesharing has garnered support for its potential to reduce private automobile use by providing a convenient and affordable alternative to driving alone, translating to reduced roadway congestion and vehicle emissions in the short-term, and reduced automobile ownership in the longer term (Alexander and Gonzales, 2015).

Online Shopping

Although online retail sales are currently a small share of all retail sales, innovations in logistics technologies, social media (i.e. via the sharing economy), and computer proficiency gains is anticipated to greatly shift the public to engage in online shopping (TRB-1, 2014; RAND, 2013). In 2013, ecommerce accounted for almost 9% of total US retail sales. Many supporting trends, including logistics technologies, digital lifestyle preferences, demographics, and digital connectivity are pointing to a medium-term revolution in retail purchase and delivery, and analysts project it will continue to grow rapidly (Forrester, 2013). The potential transportation implications include an increase in local package delivery, and a decrease in large truck traffic. Business-to-consumer delivery typically involves vans that can travel from distribution warehouse to neighborhoods, rather than from warehouse to retail store in large trucks. This could decrease large freight traffic to retail areas, and increase neighborhood traffic via routing vans. Multiple delivery channels (different shipping companies) could increase traffic. This could reduce overall VMT as local and regional delivery services replace passenger vehicle trips (i.e., substituting passenger trips with short-haul delivery trips) (Goodchild & Wygonik, 2014). There is also the potential for increased need for storage and warehousing space to serve as regional distribution hubs with online shopping.

Telecommuting

Telecommuting is anticipated to continue to penetrate the US economy. Some estimates put the share of the population that telecommutes as high as 30 percent (Tugend, 2014). In 2010, 13.4 million people worked from home at least one day per week, an increase of 35 percent over the decade (U.S. Census, 2013). Many of these workers tend to be in highly paid technical and managerial occupations—industries slated to grow in the US economy. The potential transportation implications could include fewer work trips overall with fewer workers commuting to an office resulting in reduced congestion and VMT. However, some home-based workers, such as real-estate agents, do generate off-peak work trips.

At-home workers may reduce the need for 2- or 3-vehicle households, though the type of at-home work will matter.

Increased fuel economy and alternative fuel vehicles

Many experts think fuel economy in private vehicles will continue to rise and that dependence on fossil fuels for transportation will continue to decline. Electric cars are likely to replace hybrids as the eco-friendly transportation alternative to traditional gasoline engines, and electric assist technology will continue to make bicycle commuting more attractive and convenient for those that do not wish to use personal vehicles or public transport.

Broader adoption of alternative fuel vehicles might depend on refueling infrastructure. Car charging stations will be needed. To date, the majority of infrastructure for alternative-fuel vehicles has been financed by government programs, but in the future, these could become privately funded, similar to how gas stations are funded today.

PRICING

Traditional funding methods (such as the gas tax) for transportation infrastructure are failing to keep up with rising costs at the national, state, and local levels. As a result, governments are considering more sustainable and resilient methods to pay for transportation services and infrastructure in the future. Private companies also seek to capture unfilled demand for transportation services. Policies aimed at decreasing congestion through system user costs, private-public partnerships, and expansions of private investments are expected to have increased bearing on transportation in the future.

Increased Congestion Road Pricing and User Charges

Due to increased congestion, the awareness of climate issues, and a lack of infrastructure funding, policy interventions to manage transportation will become more widespread. Foremost among these are road congestion fees and user charges, which can manage the demand for transportation facilities by time and frequency of use. Successful programs across the world have led to pilot projects in the United States and increasing interest in local, regional, and state adoption.

Potential Transportation Implications

- Higher per mile driving cost: Policies to manage vehicle travel demand may use monetary incentives to decrease the number of drivers on the road. Similarly, a broadening of the for-profit transportation landscape with increased private investment may provide greater value to users, albeit at a higher cost.

- Increased overall funding for transportation: Public-private partnerships could fill a growing gap between demand for transportation investment and the government supply of funding. Privatization could lead to an overall increase in capital investment.
- Expansion of transportation demand management: Privatization of transportation services could increase the use of demand-management measures and greater market segmentation and targeting of transportation users—similar to the long-term impacts of airline deregulation in the 1980s.
- Fewer miles traveled: In an effort to avoid tolls and other road pricing mechanisms, more people would likely make less vehicle trips, drive fewer miles, share rides, and use other travel modes (e.g. transit and bicycles) when possible.
- Reduced congestion: Fewer cars on the road will mean less congestion than there would be without any policy disincentive. This could mean reduced peak congestion, with longer periods of moderate congestion, as pricing helps smooth out transportation usage over a given time period, especially with variable pricing.

FUTURE CONDITIONS

In order to test the transportation investment options, it is necessary to make credible assumptions about future population and employment growth, and spatial distribution of this growth.

This study assumes that urban Washington County and its cities will continue to grow as described in various adopted community and transportation system plans throughout the county. These plans are aspirational and visionary and anticipate that most growth will occur as infill of mixed land uses in established urban centers. This section describes the future demographic and land use assumptions along with the key elements of the future transportation system.

DEMOGRAPHIC AND LAND USE ASSUMPTIONS

Washington County's dramatic growth rate during the past 40 years is expected to slow down in the future, but continue above the national average. As it is not possible to determine the future with perfect accuracy, two plausible land use scenarios were developed. One scenario assumes a continuation of current trends in population and employment. The second scenario assumes a more robust economic growth future tied to the technology industry, which comes with more population growth in order for people to fill those jobs, and a different makeup of jobs in the region. The purpose of thinking about these alternative futures is to better understand how resilient the transportation investment options are, and how they will serve the people of Washington County in the future. The future demographics and land use assumptions forecasted to have implications on transportation are described in broad terms below:

Population

- Under Scenario 1 Washington County's population is projected to grow by 216,000 people, or an increase of 41% compared to 2015 population. This is equivalent to adding the populations of Hillsboro, Beaverton, and Tigard.
- Under Scenario 2 Washington County's population is projected to grow by 292,000 people, an increase of 55% compared to 2015 population. This is equivalent to adding the populations of Hillsboro, Beaverton, Sherwood, Tigard, Tualatin and Wilsonville.

Employment

- Scenario 1 doubles the county's current employment, from 234,000 to 475,000.
- Scenario 2 results in 144% growth in Washington County compared to 2015. Scenario 2 assumes that there will be more employment in high tech manufacturing, warehousing, and transportation than under Scenario 1. The employment in high tech manufacturing is higher wage than the average.

Travel Demand

The growth envisioned in the population and employment translates directly into transportation system needs within Washington County. As Table 1 illustrates below, population and employment growth under scenario 2 will result in significantly more trips that need to be served by the transportation system. Trips that originate and stay within Washington County are projected to be nearly double what they were in 2010. With continued growth throughout the region, including satellite cities, the number of total daily trips coming into and going out of the county grow by 58% and 38% respectively.

Table 1: Daily Trips Comparison

	2010		2055 (Scenario 2)	
	Trips	%	Trips	%
Internal	658K	**43%**	1,298K	**50%**
Trips Coming In	463K	30%	734K	28%
Trips Going Out	427K	28%	589K	22%

Age

- Demographers agree that there will be a higher percentage of older Americans in the future. The millennial generation will overtake the baby boomers as the largest generation cohort, and will be entering retirement years in the study timeline.

Household Size

- With an aging population and declining fertility rates, trends suggest that average household sizes will be smaller in the future. Smaller household sizes combined with more retirees mean that there will be a smaller number of vehicles per household in the future.

Income

- Economists generally agree that there will be less individual wealth in the future, but also that there will be a broader gap between low and high income groups. There will be a higher share of low income households in the study timeline.
- Scenario 2 assumes higher average income growth than Scenario 1, due to strong regional economic growth and more high income jobs.

Urbanization

- Downtowns, main streets and town centers are envisioned as vibrant, walkable and transit-supportive.
- Today the urbanized portion of the county, which is approximately 127 square miles, has approximately 4,150 persons per square mile. For this study it is assumed that the urban reserves in Washington County, which amounts to approximately 13 square miles, are brought into the Urban Growth Boundary and developed during the study horizon.

Under Scenario 1, Washington County's population increases to nearly 5,500 persons per square mile (33% more dense), and in Scenario 2 it increases to 6,000 persons per square mile (45% more dense). For comparison the City of Portland, without Forest Park, is nearly 137 square miles and has an estimated population (2014) of 619,360 or 4,520 persons per square mile.

Satellite Cities

- The small cities outside of the metro area but within commuting distance to Washington County are assumed to grow. With more demand for single family housing, particularly in Scenario 2, these cities see steady population increase. It is anticipated that people living in these cities will commute to jobs in Washington County and other parts of the Metro area.

TRANSPORTATION SYSTEM ASSUMPTIONS

Local and regional adopted transportation system plans address a broad range of transportation challenges and opportunities. They address a diversity of transportation needs while integrating social, economic, environmental, and livability aspirations over the next 25 years. This section describes the future conditions of the transportation system as envisioned by these plans. Although the adopted plans do not consider future growth beyond 25 years, they do provide the launching off point for this study, and the basis for the assumed transportation system.

Active Transportation Assumptions

In response to a number of factors, such as smaller households, aging population and increased urbanization, people may shift to non-auto modes, including biking or walking to work, using light rail in conjunction with "first and last mile" solutions such as ride, bike or car share and shuttle services. The relatively flat terrain of the Tualatin Valley, combined with an ever increasing mileage of "complete streets", multi-use trails and high capacity transit routes, creates a favorable environment for increased use of active transportation travel modes. Washington County has the potential to become a North American model for suburban active transportation utilization. Planned investments include a broad range of pedestrian improvements, including full-street "boulevard" retrofits, and improved street connectivity in regional and town centers, station communities and main streets.

Trends show people are less interested in cars and driving with lower vehicle miles per capita and fewer cars owned per household. For many trips, active transportation choices are the most sensible and efficient mode. For very short trips, such as a half-mile trip to a convenience store, walking can be the best choice. Trips in the one to five mile range are often ideal for bicycling. Improved efficiencies in battery technology are resulting in a wide range of application including the electrification of bicycling. With a rise in use of electric assist bicycles, we can expect that in the near future there will be demand for more dedicated "regional" bicycle facilities to complete longer trips within the County and throughout the region.

Transit Assumptions

Transit ridership is highly dependent on convenient, affordable, and frequent service. Increased frequency of transit service in combination with transit signal priority and bus lanes will make transit faster and more convenient. Safe and direct biking and walking routes and crossings that connect to stops will make transit more accessible and convenient. New community and regional transit connections will improve access to jobs and community services and make it easier to complete some trips without multiple transfers. Emerging trends like connector shuttle services like GroveLink and interconnected mobility services like ride/bike/car sharing are seen as improving neighborhood access to regional transit service, jobs and other destinations in the community.

Communities will become more connected via transit, both public and private.

In the future it is assumed that there will be increased mobility options meaning a more equitable and comprehensive transportation system that maximizes use of existing infrastructure in getting people from Point A to Point B (National League of Cities, 2015). Integration of public and private mobility options and substantial increases in transit service levels will improve first/last mile connections to new growth areas within the county (South Hillsboro, South Cooper Mountain, River Terrace, etc.), adjacent counties and satellite cities (Newberg, Scappoose, Woodburn, etc.), and employment centers in

Portland, Hillsboro, Tigard, Tualatin, and along OR 217. As Transportation Network Companies (TNCs), like Uber and Lyft, become more mainstream, they will likely coordinate with public transportation agencies (e.g. TriMet) to integrate services and consolidate payment methods. For example, where transit coverage and travel times are currently impediments to travel between North Hillsboro and Tigard could become a convenient reality in years to come.

Trip Reduction Strategy Assumptions

The demographics and preferences of the County's workforce are changing.

As with global trends, mobility is changing in Washington County. Smartphone apps and online tools for accessing public and private transportation services are already popular and will increase in use amongst residents and the workforce. As Baby Boomers continue to retire and Millennials ascend to the majority of the workforce by the 2030s, use of these apps will become ubiquitous and enable convenient, streamlined access to different modes. The single-occupant vehicle will never go away, but the increase in public and private transit, bicycle and pedestrian mode share for trips throughout the region is anticipated to be significant, even as autonomous private vehicles become more commonplace.

With the demand for mobility options increasing, we can expect the workplace itself to be transformed in the future throughout the County and region. In the cities (e.g. Beaverton, Hillsboro, Tigard, Tualatin) the ascendance of Millennials is expected to drive demand for offices to be located more in proximity to transit and non-motorized options (e.g. bicycles, multi-use paths and sidewalks for pedestrians). Office-sharing and telecommuting is also expected to increase, which will allow for County residents to have more choice in living nearer to these options.

Transit demand will increase in the cities and will also need to serve the UGB expansion areas. Experts point to the trend of public transit lines focusing on optimization to accommodate the demand in dense corridors, improving frequency and capacity. Private transit and trip consolidating services such as Waze and RideScout will become more prevalent in Washington County to aid in completing transit coverage.

The County and cities will utilize intensified Transportation Demand Management (TDM) programs.

In line with the trend of expanded transportation options, TDM programs will become more instrumental to how residents and employees plan day-to-day travel in the County. County and city governments will likely partner private entities to provide more effective programs. The increased availability of ride-sharing services such as Uber and Lyft will be instrumental in providing "first- and last-mile solutions" for people who live and work in areas underserved by public transit. These private-public partner arrangements will provide a means for locating facilities throughout the County such as "mobility hubs" where users may access transit, rental bikes, and whatever information they need for making complete trips.

Roadway Assumptions

Roadway projects will incorporate "Complete Streets" concepts

Local and regional plans call for providing an integrated multimodal network of complete streets that that improve travel options, making new connections and adding capacity to major roadways. "Complete streets" are designed to accommodate use by all travel modes, including automobiles, bicycles, freight delivery vehicles, transit vehicles, and pedestrians of all ages and abilities. Connectivity creates multiple opportunities for movement within and between neighborhoods as well as within areas of employment and other parts of the community. Having a connected system encourages local travel needs so that local trips can be made easily and efficiently, without needing to use the throughways.

There will be increased investment in ITS

An example of an ITS application is ODOT's RealTime signs on OR 217. This project has shown significant results including nearly a 21% decrease in crashes over the previous year, a 5% increase in throughput, and improved reliability with a 10% decrease in delay times.

There will be increased investment in improved connections and added capacity

The following planned investments will result in some improved connections and added capacity:

- New 5-lane roadway between I-5 and 99W
- New overcrossings on OR 217 and US 26
- Widen Tualatin Sherwood Road to 5-lanes
- Extension of 124th Avenue from Tualatin Sherwood Road to Grahams Ferry Road;
- Widen US 26 to 6 lanes from 185th Ave to Brookwood Parkway
- Extend existing I-5 auxiliary lane between Nyberg and Lower Boones Ferry Road
- Connect the Allen-Denney interchanges as a split diamond interchange on OR 217
- Construct a new I-5 Columbia River Crossing
- Safety and operational improvements on I-5 between I-405 and I-84

Even with the planned investment it is anticipated that a person traveling on an average weekday in the future will experience more congested roadway miles and the duration of congestion will be substantially longer.

Freight Assumptions

Freight moves over several different modes (truck, rail, air, and water). Current products being manufactured in Washington County are often exported by truck but get consolidated with other goods leaving the region at the air cargo facilities at Portland International Airport (PDX), or to other destinations served by Interstate 5 (I-5). The truck routes to get from or through the county to PDX are

currently congested. Furthermore, hazardous materials are prohibited from traveling through the Sylvian tunnel and limited to Hwy 217 or Cornelius Pass Road.

As a critical catalyst for a strong economy, freight movement will influence future travel patterns and transportation facilities design considerations within Washington County and between the county and other regional destinations. While the future types and mix of freight modes will change over time in response to shifting demands, policies, and advanced technologies, efficient and reliable goods movement will continue to be important.

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