Connecting Troutdale: Options for Future Transportation Choices

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Troutdale

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PPPM 399 Urban Transportation

UNIVERSITY OF OREGON
THE CITY OF TROUTDALE OREGON
SCI Sustainable Cities Institute
SCYP Sustainable City Year Program

Connecting Troutdale: Options for Future Transportation Choices

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Acknowledgments

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About SCI

The Sustainable Cities Institute (SCI) is an applied think tank focusing on sustainability and cities through applied research, teaching, and community partnerships. We work across disciplines that match the complexity of cities to address sustainability challenges, from regional planning to building design and from enhancing engagement of diverse communities to understanding the impacts on municipal budgets from disruptive technologies and many issues in between.

SCI focuses on sustainability-based research and teaching opportunities through two primary efforts:

1. Our Sustainable City Year Program (SCYP), a massively scaled university-community partnership program that matches the resources of the University with one Oregon community each year to help advance that community's sustainability goals; and

2. Our Urbanism Next Center, which focuses on how autonomous vehicles, e-commerce, and the sharing economy will impact the form and function of cities.

In all cases, we share our expertise and experiences with scholars, policymakers, community leaders, and project partners. We further extend our impact via an annual Expert-in-Residence Program, SCI China visiting scholars program, study abroad course on redesigning cities for people on bicycle, and through our co-leadership of the Educational Partnerships for Innovation in Communities Network (EPIC-N), which is transferring SCYP to universities and communities across the globe. Our work connects student passion, faculty experience, and community needs to produce innovative, tangible solutions for the creation of a sustainable society.

About SCYP

The Sustainable City Year Program (SCYP) is a year-long partnership between SCI and a partner in Oregon, in which students and faculty in courses from across the university collaborate with a public entity on sustainability and livability projects. SCYP faculty and students work in collaboration with staff from the partner agency through a variety of studio projects and service-learning courses to provide students with real-world projects to investigate. Students bring energy, enthusiasm, and innovative approaches to difficult, persistent problems. SCYP's primary value derives from collaborations that result in on-the-ground impact and expanded conversations for a community ready to transition to a more sustainable and livable future.

About City of Troutdale

Troutdale is a dynamic suburban community in Multnomah County, situated on the eastern edge of the Portland metropolitan region and the western edge of the Columbia River Gorge. Settled in the late 1800s and incorporated in 1907, this "Gateway to the Gorge" is approximately six square miles in size with a population of nearly 17,000 residents. Almost 75% of that population is aged 18-64.

Troutdale's median household income of $72,188 exceeds the State of Oregon's $59,393. Troutdale's neighbors include Wood Village and Fairview to the west, Gresham to the south, and unincorporated areas of Multnomah County to the east.

For the first part of the 20th century, the city remained a small village serving area farmers and company workers at nearby industrial facilities. Starting around 1970, Troutdale became a bedroom community in the region, with subdivisions and spurts of multi-family residential housing occurring. In the 1990s, efforts were made to improve the aesthetics of the community's original core, contributing to an award-winning "Main Street" infill project that helped with placemaking. In the 2010s, the City positioned itself as a jobs center as it worked with stakeholders to transform a large superfund area to one of the region's most attractive industrial centers – the Troutdale-Reynolds Industrial Park.

The principal transportation link between Troutdale and Portland is Interstate 84. The Union Pacific Railroad main line runs just north of Troutdale's city center. The Troutdale area is the gateway to the famous Columbia River Gorge Scenic Area and Sandy River recreational areas, and its outdoor pursuits. Troutdale's appealing and beautiful natural setting, miles of trails, and parkland and conservation areas draw residents and visitors alike. The City's pride in place is manifested through its monthly gatherings and annual events, ranging from "First Friday" art walks to the city's long-standing Summerfest celebration each July. A dedicated art scene and an exciting culinary mix have made Troutdale an enviable destination and underscore the community's quality of life. Troutdale is home to McMenamins Edgefield, one of Portland's beloved venues for entertainment and hospitality.

In recent years, Troutdale has developed a robust economic development program. The City's largest employers are Amazon and FedEx Ground, although the City also has numerous local and regional businesses that highlight unique assets within the area. Troutdale's recent business-related efforts have focused on the City's Town Center, where 12 "opportunity sites" have been identified for infill development that respects the small-town feel while offering support to the existing retail environment. The next 20 years promise to be an exciting time for a mature community to protect what's loved and expand opportunities that contribute to Troutdale's pride in place.

Course Participants

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Executive Summary

Sustained population and employment growth in the City of Troutdale have benefited the city in a variety of ways. However, this growth has amplified demand on the city's transportation system and impacted people's ability to get around. The class proposed several possible solutions to address these issues. For example, the City could paint crosswalks more clearly, stripe bike lanes, and ensure that sidewalks are continuous in their construction. This provides pedestrians and bicyclists with more certainty and comfort as they navigate the city. In addition, the class recommended different ways to connect downtown to the rest of the City via a shuttle or trolley. After assessing both options, it was concluded that a shuttle could provide a better replacement for personal vehicle trips to the downtown area. The class also recommended a golf cart zone be added to augment the shuttle in low speed zones and offer even greater flexibility in transportation choices. An additional system of electric bicycles and scooters throughout the City could also offer new and exciting methods of transportation for many residents, tourists, and commuters. These scooters could be paired with a multi-use path near a bus stop to transport workers to and from the Amazon and FedEx facilities in the Troutdale Reynolds Industrial Park. Finally, in order to facilitate the movement of goods and people in the City center, a system of three different loading/unloading zones could be implemented during certain hours of the day to maintain space for deliveries and drop offs without obstructing the flow of traffic. These recommendations offer diverse alternatives to help improve and increase opportunities to get around within the City of Troutdale.

Introduction

Troutdale is located east of Portland on the shores of the Columbia River. While the city's prime location and natural assets have brought economic development, including large employers such as Amazon and FedEx, to the area, it has also brought challenges associated with growth. Such challenges include increasing population size outside of the city center and an influx of commuters to employment sites.

The winter 2021 Urban Transportation class addressed Troutdale's requests for several projects such as: improving Troutdale's bicycle and pedestrian infrastructure, implementing a golf cart zone, establishing a downtown connector trolley, creating a downtown connector microshuttle, planning for growth in electric micromobility in the town center, bridging a first mile/last mile gap to the Troutdale Reynolds Industrial Park, and establishing loading/unloading zones in downtown Troutdale.

The class researched solutions through a variety of methods, such as government reports, academic research, inspections of the areas through satellite photos, and use of geographic information systems to evaluate tax lot ownership and speed limits.

Bike And Pedestrian Infrastructure

Within the city of Troutdale, certain bicycle and pedestrian areas were deemed as unsafe, unappealing, and/or lacked bicycle and pedestrian infrastructure, such as incomplete sidewalks, disappearing bike lanes at intersections, and lack of bike parking. Cycling infrastructure is one factor that can contribute to robust use. For example, the City of Portand's investment in cycling is reflected in its share of workers that commute by bicycle. This high rate can be seen in Figure 1 below. In order to improve the safety and usability of its streets, the City could implement bike boxes and bike lanes that continue through the intersection at Columbia River Highway and SW 257th Drive. A bike box would be painted in green in front of the traffic at the intersection. Adding bike boxes would eliminate bikes need to merge into traffic, and create a buffer between pedestrians and vehicles stopped at the intersection. Additionally, Troutdale could establish bike parking, install sidewalk furniture and vegetation, and complete sidewalks where there are gaps. This could be especially useful downtown.

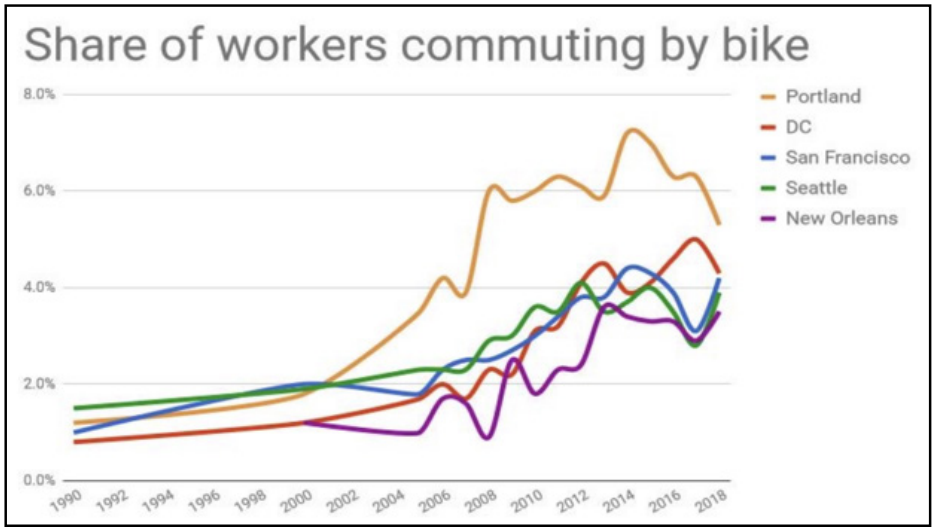


FIG. 1
Rate of bike commuting in U.S. cities

These recommendations could offer the city of Troutdale a number of benefits. It would improve multi-modal transportation options, promote safety, and create a more pleasant experience for pedestrians and bicyclists. Additionally, this new infrastructure could connect McMenamin's Edgefield to the downtown core.

There are some challenges with implementing the recommendation. For example, proposals could reduce available on-street car parking. Furthermore, bike racks require enough space so that they do not obstruct accessibility in public spaces. Striping and re-striping also comes with a financial cost and could draw public opposition; however, with the appropriate public engagement process, these concerns could be overcome and the City could move forward. This could include public meetings where City residents and business leaders make comments on the different proposals, and surveys asking which areas of Troutdale need improvements. See Apendix A and B for more information.

Connecting Downtown To The City

MICROSHUTTLE

Microshuttle buses are an alternative to personal vehicles, utilizing a ride-share format aimed at increasing efficiency of public transport and connectivity to downtown areas. The class analyzed two different cities with shuttle systems. Columbus, Ohio is a city of 895,877 people of which 60% are 18-64 years old (Data USA n.d.). The shuttle only operates near peak commuting hours, and is autonomous. Furthermore, this shuttle is limited 10 people at any time and drives around a 2.9 mile loop (Blanco 2020). Another example from a city smaller than Columbus is from Antioch, CA. This program offers personalized stops through a smart phone app, charges a low fee for transport, and runs from 8 AM to 5 PM on the weekdays (Korbay 2019). The shuttle in this case offers transit to a larger portion of the city than the one in Columbus.

After analyzing other areas, the class recommended a shuttle to connect downtown to other areas of the City. The shuttle would operate as a rideshare-typet style program that serves roughly one square mile. The full area served is shown in Figure 2. This shuttle could be hailed using an app anywhere in the area. This includes two major health facilities, access to Reynolds High School, and both residential and commercial zones. This could offer flexibility for those using the programs and reduce the need to make trips via personal vehicle. Additionally, a sharing feature could be implemented in order to encourage carpooling within the area. Possible barriers for this method of connection to downtown is the potentially high startup cost, the geographic scope, and the limited hours of the shuttle. The shuttle would operate differently than the proposed

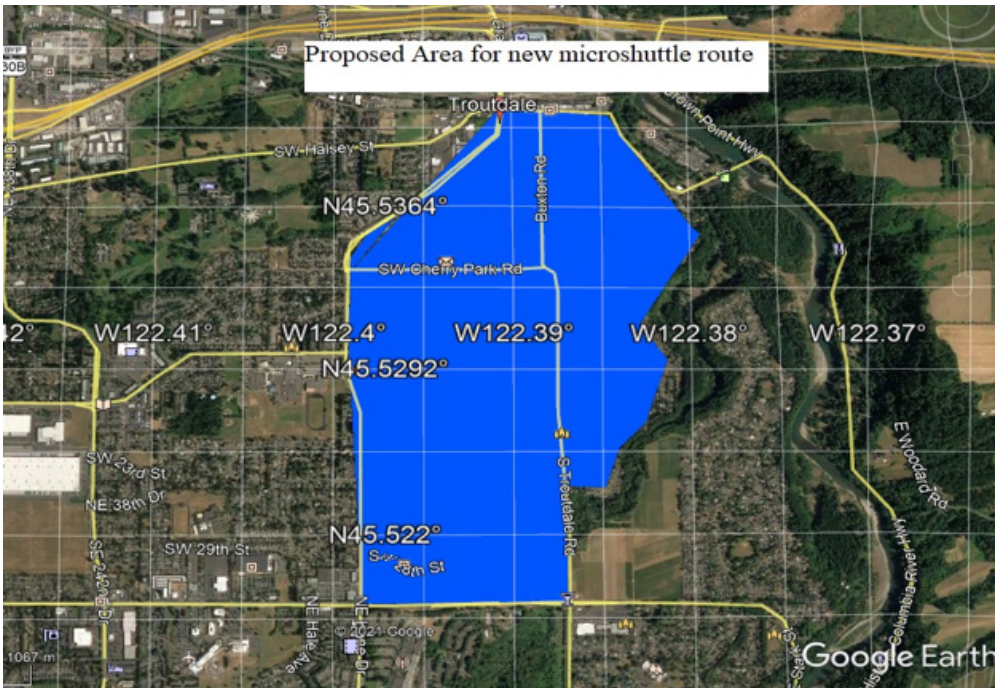


FIG. 2
Proposed microshuttle route

golf cart zone that follows due to its need for an operator. Because the shuttle requires an operator, its hours of operation would be limited, however it remains a viable option for alternative transit. Refer to Appendix C for further details.

GOLF CARTS

Another proposal is the creation of a golf cart zone. Golf carts are a mode of personal and ride-share transit that could be expanded upon in Troutdale via slow corridors and designated paths in a special zone. To determine the feasibility and design of a golf cart zone, the class analyzed two different cities that currently have golf carts. Peachtree, GA has roughly 34,000 people and has long allowed golf carts on their streets. It is estimated that nearly every household in the City has a golf cart, with 90 miles of paths (Associated Press 2011). An even smaller town with similar climate and a golf cart zone is Ridgefield, Washington. Ridgefield is located on I-5 on the banks of the Columbia River and boasts a population of approximately 9,000 (Ridgefield 2021). In 2015 they voted to

FIG. 3
Golf cart exclusion zone in Ridgefield, WA

allow golf carts on most streets except major arterials shown in Figure 3.

The review of these programs led to the recommendation of a golf cart zone that would allow golf carts on the road alongside cars in a small test area depicted in Figure 4. Within the zone, golf carts would have access to downtown and designated residential areas. This area could be marked with signage to make the purpose of the zone clear, and alert other vehicles about the potential for carts on the road. The City could also create "golf cart only" parking near downtown to encourage this transition. A golf cart zone would result in slower streets and fewer CO2 emissions as many are electric. It is widely accepted that such emissions are responsible for climate change (Kramer, et. Al 2021), therefore transitioning to zero emission vehicles is an opportunity for Troutdale to mitigate such effects. Possible barriers to this method are the expenses for signage and marking, less parking for cars, possible safety hazards with golf carts and cars in the same lanes, and wind and rain in the colder months of the year. This environmental difficulty can be mitigated with screened-in golf carts currently on the market. Residents of Troutdale with existing golf carts can also purchase screens that cover the golf cart to convert it into a screened cart. The multitude of options and low cost of implementation to the City could make this an achievable program. See Appendix E and F for more information.

FIG. 4
Proposed golf cart zone

FIG. 5
Covered golf cart

TROLLEY

Another proposal to connect the downtown area to other areas of the city wwas a trolley system. Trolley systems are a form of rail transit that require a fixed track and typically operate more slowly than other alternatives. After extensive examination of the costs of trolley cars in other cities, the historic use of trolleys in the United States, and the lack of flexibility it was determined that the trolley may not be the most effective use of resources. Figure 6 below shows the total expenditures on a small trolley system in Tucson. In addition to high ongoing costs, it is also a substantial initial investment and the fixed routes may fail to adapt in an ever growing city. Funding could be used in other areas for more substantial investments in bus infrastructure or similar projects. Refer to Appendix D for further insight on this topic.

	Actual FY 17/18	Adopted FY 18/19	Estimated FY 18/19	Adopted FY 19/20
Character of Expenditures				
Services	$2,034,745	$1,816,180	$1,906,800	$1,859,700
Supplies	$185,209	$497,400	$411,300	$506,020
Contracted Labor	$1,871,739	$2,111,010	$2,165,710	$2,220,100
Program Total	**$4,091,693**	**$4,424,590**	**$4,483,810**	**$4,585,820**

FIG. 6

City of Tucson trolley expenditures by year

(City of Tucson 2019)

Electric Micromobility And Bridging The First Mile/Last Mile Gap

In order to assess the usefulness of micromobility the class looked at several bikeshare programs in cities - PeaceHealth Rides in Eugene, Oregon, and the Aspen, CO micromobility share with WE-cycle. Eugene, OR currently has over 300 bikes across 41 stations and riders pay for the service per minute (PeaceHealth 2019). In Colorado, including Aspen, which is smaller than Troutdale, the nonprofit WEcycle provides the service with support from local municipalities to provide partially free service. This nonprofit boasts a total of 113 bikes at 21 docks around Aspen (WEcycle 2021). An example dock can be seen in Figure 7 below.

FIG. 7
WeCycle bike dock

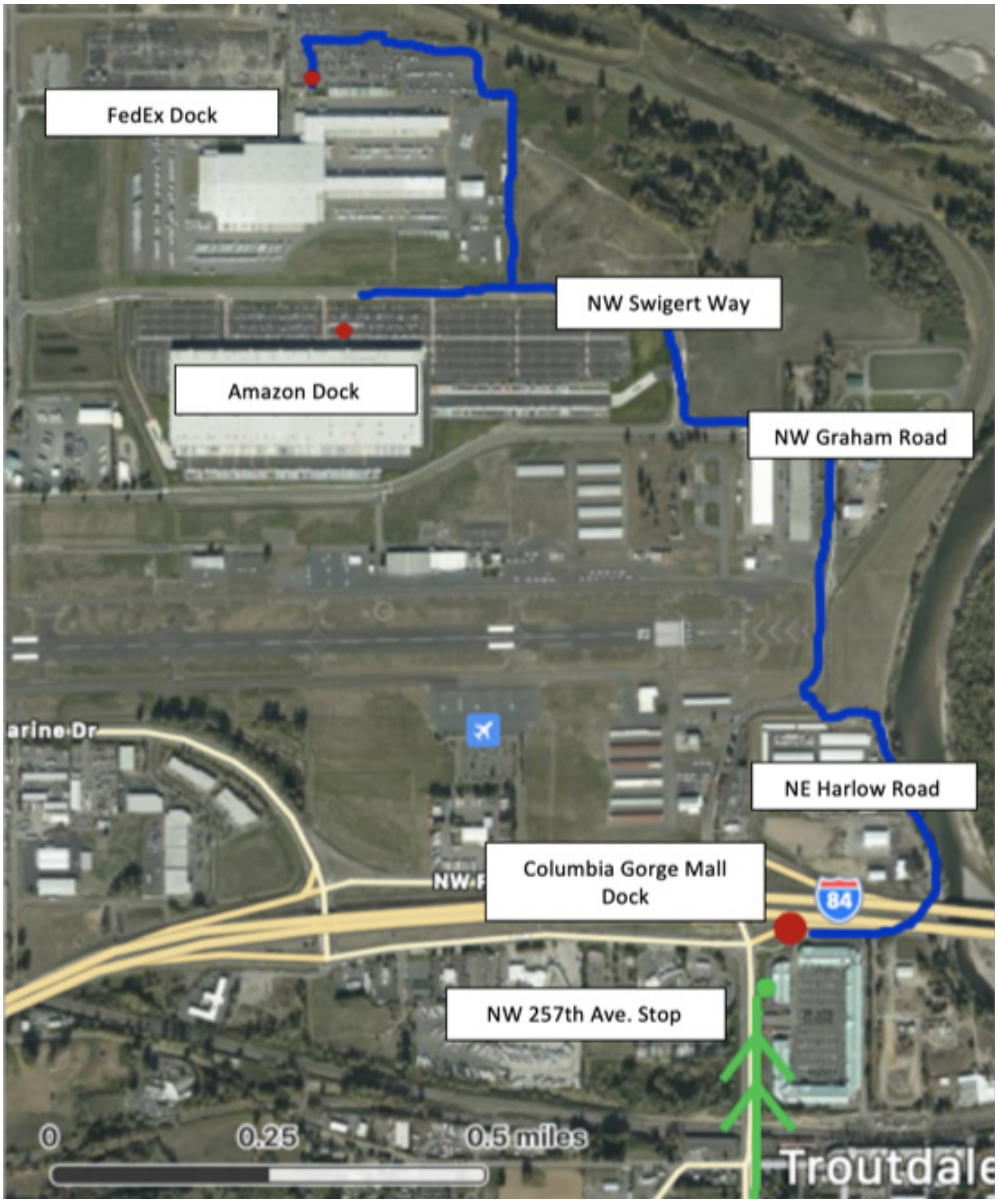
In order to expand its transportation options, Troutdale could implement a system of micromobility devices. Various cities have implemented these programs. Different devices include bicycles, electric bicycles, and electric scooters. After reviewing the bicycle infrastructure and the terrain of the City through isoline maps and satellite images, it was concluded that a split approach could be taken. For longer commutes electric bicycles could be used to avoid making a trip by car. The docks for these bicycles could be located at points further from the City center, in addition to the docks in the centralized area. In the downtown area, electric scooters could serve as an additional mode of transport to electric assisted bicycles. These scooters would assist in shorter trips instead of the longer trips that the bicycles are focused on. Additionally, the City could own the micromobility devices in order to generate revenue to upkeep the devices.

The scooters in the micromobility program could also be combined with a multi-use path in order to address the first mile/last mile problem between the TriMet bus stops and the Amazon and FedEx facilities. The proposed route for this multiuse path can be found in Figure 8. This path would accommodate bicycles used by bus riders, and scooters from a scooter share station located near the stop. Corresponding stations could be placed near Amazon and FedEx for convenient work access. See Appendix I for more information.

These projects require investment, however. The initial cost of purchasing enough bicycles and scooters for an effective program could be quite high depending on the number of units required. In Eugene, Oregon where bikeshare was implemented in 2018, the initial cost was over $1.1 million (City of Eugene, n.d.). Eugene is larger than Troutdale, but assuming that cost scales by population it would still cost the City over $105,000 to invest. Furthermore, there is a concern that bike and scooter share devices will be parked in inappropriate locations; however, research suggests that actual rates of e-scooter misparking are relatively low (Brown, Klein, Thigpen, 2020). . To mitigate some of these concerns, a pilot program could be implemented that would act as a small proof of concept before transitioning into a larger program. Additionally, placing docks at FedEx and Amazon requires cooperation between the City and such businesses. Finally, the multi-use path proposed would cross multiple public property lines, which could pose a logistical hurdle when acquiring land to construct the path. See Appendix G and H for more information.

FIG. 8

Proposed multiuse path



Passenger and Goods Loading in Downtown

Downtown Troutdale is a bustling commercial zone with a multitude of businesses and offices. Throughout the day deliveries and passengers are dropped off and picked up in downtown. Currently, this activity often means obstructing a lane of travel in order to load or unload goods to local businesses. To improve traffic flow and ensure that passengers can easily and safely enter and exit vehicles, students collaborated with the city of Troutdale to design loading and unloading zones in the city center. The recommended zones would operate as loading zones from 7 AM to 7 PM. The maximum allowed time in one of these zones would be 30 minutes, and free to use. Figure 9 contains several areas that could be suitable for these zones. This aligns with other cities such as Portland where the loading zones function from 7 AM to 7 PM (Portland Bureau of Transportation 2017).

FIG. 9
Proposed loading zones shown in red

The size of these proposed zones would need to accommodate large delivery trucks like the ones shown in Figures 10 and 11.

FIG. 10
Typical delivery truck

FIG. 11
Typical delivery truck

These zones face several barriers to implementation. For example, the zones require physical space. Our recommendation would involve replacing parking within these zones, however it is acknowledged that parking is an asset that is deeply valued by the community. The total area devoted to parking in downtown Troutdale is shown in yellow in Figure 12. There also remains the cost to line out and sign these zones. These concerns could be addressed by participating in an extensive public engagement process through which the community can be consulted before a final decision is reached. This would allow the community to modify the proposal as needed to reach an acceptable decision. If concerns remain, a pilot of this idea could be conducted where the spaces are set aside temporarily for a period of six months, after which an analysis and secondary public engagement cycle could be completed to assess community attitudes and effectiveness. Reference Appendix K for further details.

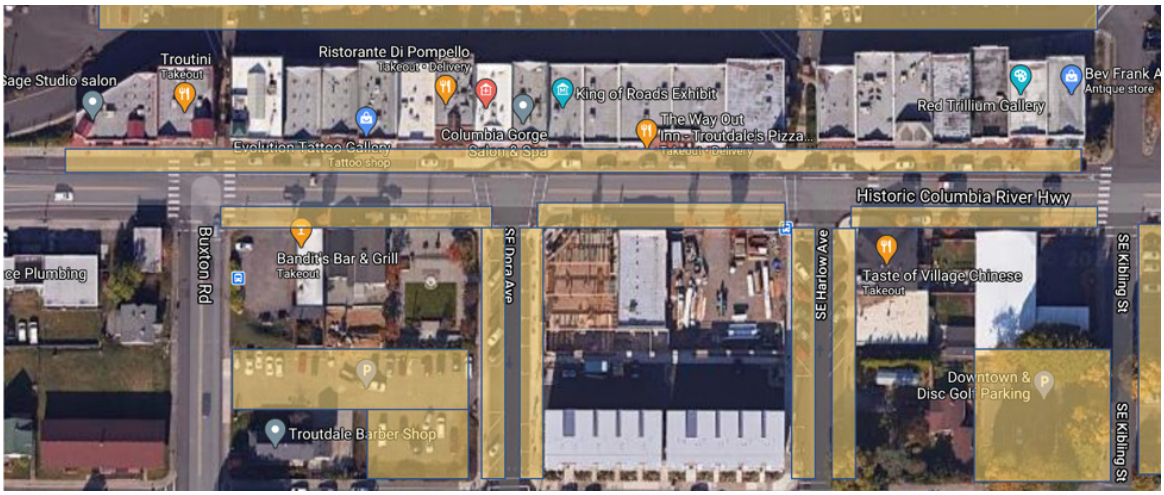


FIG. 12
Parking in downtown Troutdale shown in yellow

Conclusion

The city of Troutdale continues to grow and evolve as new residents and employers move to the area. Commuters, tourists, and residents impact the transportation system in Troutdale. Students proposed several options to address future growth, provide a variety of travel options, and improve Troutdale's transportation infrastructure. The City could:

- Improve bike and pedestrian markings to increase safety and usability for bicyclists and pedestrians, and continue the bike lane through the intersection at Columbia River Highway and SW 257th Drive.
- Implement a golf cart zone and new micromobility share to extend access to the downtown area.
- Connect a multi-use path with bus stops in north Troutdale to the industrial park.
- Add loading and unloading zones to facilitate traffic flow for personal vehicles.

The City may choose to stagger implementation of these options to individually assess public support, usage, and long-term viability.

References

Associated Press. 2011. “Electric Cars Rule Ga. Town.” Accessed May 16, 2021. https://youtu.be/C1XPWVL-nZ8

Brown, A., Klein, N. J., Thigpen, C., & Williams, N. (2020). Impeding access: The frequency and characteristics of improper scooter, bike, and car parking. Transportation research interdisciplinary perspectives, 4, 100099.

City of Eugene. N.d. “Bike Share.” Accessed May 5, 2021. https://www.eugene-or.gov/3851/Bike-Share

City of Tucson. 2019. “Adopted Annual Budget.” Accessed May 5, 2021. https://www.tucsonaz.gov/files/budget/FY_2020_Budget_Book_0.pdf

Data USA. N.d. Columbus, OH. Accessed May 16, 2021. https://datausa.io/profile/geo/columbus-oh/#:~:text=Columbus%2C%20OH%20is%20home%20to%20a%20population%20of,Columbus%2C%20OH%20than%20any%20other%20race%20or%20ethnicity.

Maria Korbay. 2019. “Tri Delta launches innovative on-demand ride sharing service.” Accessed May 16, 2021. https://trimyride.com/media/2019-Tri%20MyRide-Press-Release.pdf

PeaceHealth. 2019. “PeaceHealth Rides Bike Share System Celebrates Successful First Year.” Accessed May 16, 2021 www.peacehealth.org/news/peacehealth-rides-bike-share-system-celebrates-successful-first-year.

Portland Bureau of Transportation. 2017 “Truck Loading Zones (TLZ).” Accessed May 16, 2021. https://www.portlandoregon.gov/transportation/article/664196.

Portland Bureau of Transportation. 2019. Accessed May 16, 2021. https://www.portlandoregon.gov/transportation/article/407660

Ryan J. Kramer, Haozhe He, Brian J. Soden, Lazaros Oreopoulos, Gunnar Myhre, Piers M. Forster, Christopher J. Smith. 2021. “Observational Evidence of Increasing Global Radiative Forcing.” Geophysical Research Letters 48 no. 7. https://doi.org/10.1029/2020GL091585

Sebastian Blanco. 2020. “Columbus is first city In U.S. with autonomous shuttles in residential areas.” Accessed May 16, 2021. https://www.forbes.com/sites/sebastianblanco/2020/02/06/columbus-is-first-city-in-us-with-autonomous-shuttles-in-residential-areas/?sh=6d9af9d06d7f

WEcycle. 2021. “Cycle: Community-Supported Bike Share in Aspen & Basalt.” www.we-cycle.org/.

Appendix A

Bike & Pedestrian Planning for Troutdale Town Center

To: City of Troutdale

From: Tia Lohman, Abby Gisler, Jack Ferguson

Date: March 19th, 2021

Executive Summary:

The City of Troutdale is a growing city on the outskirts of Portland, OR, and is looking to increase its mobility options by identifying infrastructure changes for bikes and pedestrians. By increasing bike and pedestrian infrastructure, there is potential to reduce traffic, and it can also have environmental benefits such as reducing greenhouse gas emissions with less cars on the road.

Due to the COVID-19 pandemic, we used Google Maps and GIS data to find areas in Troutdale in need of bike and pedestrian improvements. Using Google Maps provided a way to see the city from a street view, and GIS data provides information from a bird's eye view. By using both of these methods, it provided a way to identify bike and pedestrian areas that were deemed as unsafe, unappealing, and didn't support bikes and pedestrians, such as incomplete sidewalks and disappearing bike lanes at intersections, and lack of bike parking. Recommendations for improvements are concluded based on research from other cities that applied different bike and pedestrian infrastructure methods.

Bike and pedestrian recommendations for the City of Troutdale include:

1. Fill in the gaps of missing sidewalks, paint the bike lanes green, and add crosswalks with signage, especially near bus stops on Halsey St.
2. Add a greenway spanning from 2nd St. to Halsey St, ending at McMenamins Edgefield.
3. Include bike parking on sidewalks or designate street spaces for bike parking at the Troutdale Town Center.
4. Add sidewalk furniture and vegetation to make the Troutdale Town Center more user friendly.
5. Redevelopment of bike lanes at Columbia River Hwy and 257th Dr, by creating through bike lanes that don't evaporate into traffic and extending bike lanes into the intersection.

Introduction:

With a population of 16,000 people, the City of Troutdale is continuously growing. With a growing city, the City of Troutdale is questioning how members of the community will travel to and from locations using different modes of travel. As of 2018, commuters in Troutdale that bicycle were at 0.32% and commuters that walked were at 1.07%.[1] Troutdale is looking to improve its bike and pedestrian environment, especially around the Troutdale Town Center. The task of this project is to identify areas in need of improvement and to provide recommendations. Specific recommendations that the city is looking for are bike/pedestrian infrastructure, infrastructure/investments that support bike/pedestrian environments, and how to support safe and comfortable walking around Troutdale.

Methods:

Google Maps
Due to the COVID-19 pandemic, it's difficult to travel to areas in Oregon such as the City of Troutdale, in which Google Maps allows us to view the city remotely. Google Maps is a tool that we are able to utilize because it gives us the ability to identify areas where bike and pedestrian infrastructure is lacking. A majority of the analysis in Google Maps is through the street view tool, where we are able to travel along the bike paths and sidewalks as if we are in the City of Troutdale ourselves.

Research from Websites and Articles
In order to make bike and pedestrian planning recommendations, outside references from various websites and research articles are used to back up our findings and recommendations. Case studies provide examples of where cities have also dealt with the lack of bike and pedestrian infrastructure, but also how those cities decided to improve their infrastructure based on their findings.

GIS Data
Using GIS data from the City of Troutdale, we created a map in order to look at the location of bike pavement markings and the location of sidewalks. By placing the shapefiles onto a basemap with streets and buildings, we were able to identify areas where there is a lack of sidewalks and where bike lanes are marked as either shoulder bike lanes or door zone bike lanes.

[1] "Troutdale, OR." *Data USA*, datausa.io/profile/geo/troutdale-or.

Findings:

There are many things that can be done to improve the streetscape even in places that originally were inhospitable to pedestrians or bikes. This was how cities in the Netherlands were before their evolution. The cities in the Netherlands, Amsterdam being a prime example, are case studies that prove that cities can be rebuilt. Even though these city's infrastructure had been focused around automobiles and their movements they were able to redefine the city. The entire culture changed and that means that cities in the United States have a chance to rebrand from cities that are built for cars to cities that are built for its communities.

Consequences of car focused cities

Cars were the transportation mode of choice because more and more people were able to afford cars. As a result of this more people end up being killed in road accidents due to there being more cars on the road. Along with more cars the infrastructure that is built is aimed towards the rapid movement of cars rather than the safe passages of cars and people. This can be seen in figure 1.

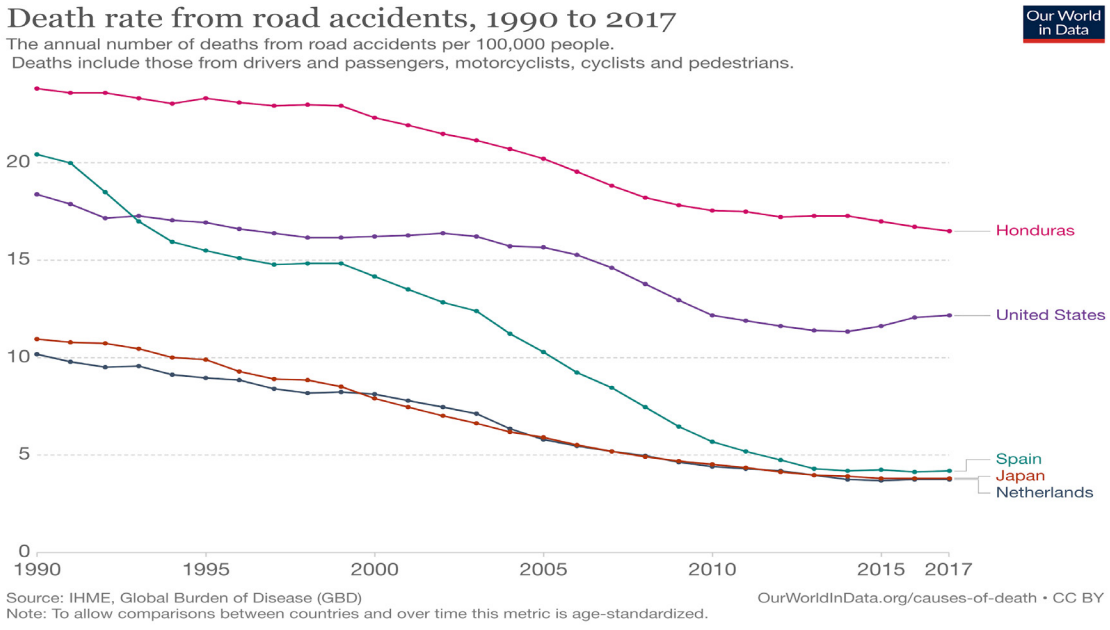


Figure 1

In 1971 traffic casualties steadily rose hitting its peak of 3,300 that year. Of those deaths 400 were children which prompted an action group, *Stop de Kindermoord* ('stop the child murder'). To push for change the *Stop de Kindermoord* group used activism, civil disobedience, and mass demonstrations. All of which aimed for a shift to bicycle

priorities and safer urban planning and it wasn't until Dutch politicians saw the advantages in bicycling that their transportation policy shifted to become more bike-friendly.[2] Stop de Kindermoord was subsidized by the Dutch government and developed safer urban planning. Specifically they developed woonerf: a people-friendly street with speed bumps and bends to force cars to drive very slowly. This type of street has been put out of fashion but is present in many Dutch cities. The result of these activist activities are more people are on bikes, 22,000 miles of bike paths, a culture around bicycling, and less deaths over time.

Deaths in road accidents are a huge issue across the world. Locally road accidents are an important issue as well. For the years 2018, 2019 and 2020 in Portland, Oregon the total deaths were 34, 51, and 59 respectively[3]. Street design is hugely important in the ability of cities to protect their pedestrians and implementing safety features are hugely important. Countries that have cities and infrastructure that are built around prioritizing automobiles over other forms of transit, unsurprisingly, have a larger number of deaths compared to countries that invest in other forms of transportation services. Which is why prioritizing cycling is important in making people safer.

Building a safer city around bicycles

In terms of infrastructure the Netherlands implemented many of the same things Oregon cities did; protected bike lanes, multi-modal roads, raised bike lanes, brightly colored bike lanes, ect. A big difference is how the planners in the Netherlands have given a speed threshold to dictate whether or not bikes share the road or if they have their own protected lane and this threshold is around 19 mph.[4] The environment that the Dutch have built has allowed bikes to interact normally not as if they are a different entity but as if they belong on the road just as cars belong and they show this by investing in bike lanes as much as they do cars. The Dutch have proved that they can reinvest and rebuild their cities from automobile dependent to multi modal roads. This means that it is possible in American cities, and especially Troutdale, Oregon.

Portland, Oregon is a city located around 20 miles from Troutdale. Portland is a city where 6.3% of commuters go by bike which is the highest percentage of bike commuters for a large American city while nationally only 0.5% of commuters bicycle. [5]

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[2] How Amsterdam became the bicycle capital of the world. (2015, May 05). Retrieved February 22, 2021, from https://www.theguardian.com/cities/2015/may/05/amsterdam-bicycle-capital-world-transport-cycling-kindermoord

[3] "Portland Traffic Fatality Tracker." *BikePortland.org*, 8 Feb. 2021, bikeportland.org/fatality-tracker.

[4] Roberts, D. (2018, August 28). No helmets, no problem: How the Dutch created a Casual biking culture. Retrieved February 22, 2021, from https://www.vox.com/science-and-health/2018/8/28/17789510/bike-cycling-netherlands-dutch-infrastructure

[5] Bicycles in Portland fact sheet. (2019, April 23). Retrieved February 22, 2021, from https://www.portlandoregon.gov/transportation/article/407660

The graph pictured, figure 2, shows the gap between bike commuters in Portland and other major metropolitan areas.[6]

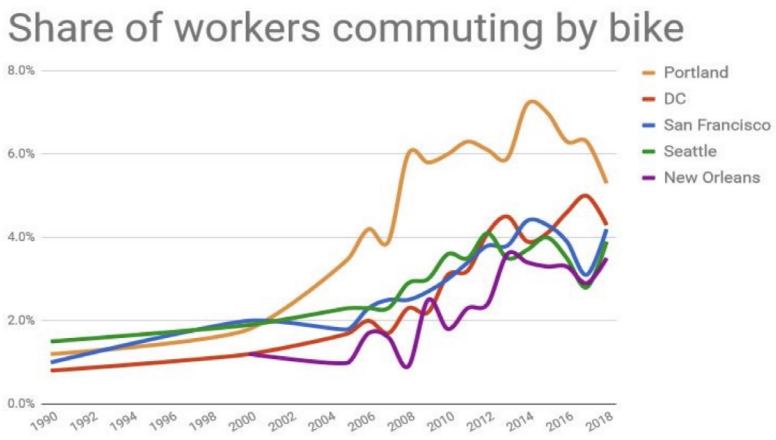


Figure 2

There are many reasons as to why Portland has become a platinum city for cyclists. Some of the reasons include: 385 miles of bikeways (35.5 of which are protected or buffered), 6500 publicly-installed bike racks, bike signals at 35 intersections and many other investments by the city of Portland. Planning through establishing policies, goals and a bikeway network is how Portland is trying to make bicycling an integral part of life. Greenaways in Portland make up 94 miles of the 385 miles of bikeways. These greenaways are focused on neighborhood streets that are implemented to prioritize walking, bicycling and rolling. The shift of focus from automobiles to pedestrians means that people feel safer to walk or ride on these roads. The components of a greenaway are simple investments that combine to be effective. Speed bumps, protected crossings at busy streets, traffic diversions, wayfinding signs and sharrow street markings are the important components that make up a greenaway[7].

In the US, larger cities are implementing ways to keep bicyclists safe when they are riding on roads that are shared by cars. A one-way protected bike lane is when curbs, posts, planters, parked cars or even just paint create a buffer between automobiles and bicyclists. These can be essential in creating bike-friendly networks across the city. As mentioned before Portland, Oregon has 7 miles of protected bike lanes and 28.5 miles of buffered bike lanes. In a neighborhood that either connects to a business district or if

[6] Death rate from road accidents. (n.d.). Retrieved February 22, 2021, from https://ourworldindata.org/grapher/death-rates-road-incidents?tab=chart&stackMode=absolute&time=earliest..latest&country=HND~USA~NLD~ESP~JPN®ion=World

[7] "What Are Neighborhood Greenways?" Portland.gov, www.portland.gov/transportation/what-are-neighborhood-greenways.

it contains businesses, implementing a protected one-way bike lane can help boost retail sales.[8] These bike lanes improve the connection between bicyclists and their intended destinations. The space between a bicyclist and the fast moving vehicles allows a sense of safety that would allow parents to bike with their children, older relatives or even allowing their children to bicycle alone[9]. A sense of safety allows for more freedom in movement.

Looking at Troutdale

As our team researched the city of Troutdale, Oregon to figure what we should do to improve the current state of the city for bicyclists and pedestrians we noticed that the sidewalks were incomplete throughout Halsey St even though there were bus stops on the side of the road. Incomplete sidewalks would make the pedestrians feel uncomfortable or unsafe when they have to walk on the side of the road to get to and from the bus stops. The incompleteness would also discourage people from walking along the road altogether because they believe it to be less safe than walking on a sidewalk[10]. We graphed the incompleteness of the sidewalk along Halsey road and noted that there are bike pavement markings, door-zone bike lanes, and bike markings within shoulder lanes. This graph is in the appendix of our paper. We deemed this streetway, Halsey St, to be important because of the bus stops along it.

Halsey St also serves as the main connection between McMenamin's Edgefield to downtown Troutdale. Mcmenamin's Edgefield has a hotel, event/concert location, golf course, and many restaurants that make it a tourist attraction. Improving upon this streetway to allow a safer and more comfortable passageway for cyclists and pedestrians would allow for a better connection to downtown Troutdale without cars congesting the roads and parking spots in the downtown area.

[8] Schlossberg, M., Fredrick, L. R., Amos, D., & Rowell, J. (2019). *Rethinking streets for bikes: An evidence-based guide to 25 bike-focused street transformations*. Eugene, OR: University of Oregon.

[9] Ink, Social. "Buffered Bike Lanes." *National Association of City Transportation Officials*, 19 July 2019, nacto.org/publication/urban-bikeway-design-guide/bike-lanes/buffered-bike-lanes/.

[10] "Pedestrian Safety." *NHTSA*, 30 Sept. 2020, www.nhtsa.gov/road-safety/pedestrian-safety.

Looking at the downtown area it is clear that pedestrians would be comfortable with walking around the area. Wide sidewalks, street lights and decent parking attract

Image 1

Image 2

people to the area who own cars. The attractive storefronts and lighting make the downtown area appealing to pedestrians, which can be seen in Image 1 and 2. However, we want people to want to be able to bike to the area and have a place to park and lock up their bike. There was a lack of bike racks which is something that can easily be added to encourage bicyclists instead of cars to the area[11].

Recommendations:

The City of Troutdale, Oregon can do many things to improve traffic, especially with pedestrians and bike riders. We have gotten together to figure out ways we can improve the city. The city has a good foundation to be attractive to pedestrians and bicyclists because it has a fairly flat downtown area, has a good tourist attraction in McMenanmin's Edgefield, as well as 4 parks. Our recommendations include additional paint to discern the bike paths, a greenway system for better and more comfortable travel for cyclists and pedestrians, bike parking options, beautification of the downtown

[11] Blue, Elly. "The Best Way to Promote City Riding? Bike Racks." *Bicycling*, Bicycling, 20 Sept. 2020, www.bicycling.com/news/a20024191/the-best-way-to-promote-city-riding-bike-racks/.

area combined with environmental benefits and safety improvements for bicyclists on the road.

Sidewalk Connections, Bike Lane Paint & Crosswalks at Halsey St.
The first recommendation is that the city fill in the gaps of missing sidewalk spaces. Throughout the city there are multiple points on busy streets in the city where the sidewalk disappears for users. Examples of this can be seen if you follow along Halsey St between SW Edgefield Pl and SW Halsey Loop. The bike lane disappearing into the door zone is circled in orange in figure 3. The sidewalk ending is circled in red in figure 3.

Figure 3

A 32 inch painted buffer is recommended for bike lanes and that the lanes be labeled with green paint or striping. It is key to label the bike lanes on Halsey St (example Image 1). Halsey St is a street that has high traffic volume and speeds as well as bikeways that are adjacent to car parking. Based on buffered bikeway recommendations from the city of Portland this is a street where a buffered bike lane with stripes to indicate the buffered zone should be implemented[12].The current width of Halsey St is 38 feet wide with 12 feet dedicated to bike lanes (6 feet on each side going E/W) and 20 feet dedicated to car lanes (10 feet for each lane). The addition of the 32 inch buffer for each bike lane would change the nature of the road because the bike lane and car lanes would be smaller which would cause more caution in both the drivers and the cyclists. The choice of 32 inches is because this is the size of the buffer that the

[12] "Bikeway Facility Design: Survey of Best Practices ." *Portland Bicycle Plan for 2030 from the City of Portland Bureau of Transportation*, p. 3.

city of Portland recommends[13]. The size recommendation is also based on London, England and Brussels, Belgium. The recommendation also includes adding crosswalks along Halsey near the bus station in Edgefield and Edgefield Meadows due to the lack of safe crossing options across this busy road. Currently Halsey St has bike lanes on each side of the road going W/E with no buffer between the bike lane and car lanes except for a simple white line. So it is in the best interest of the City of Troutdale to implement this buffer for the bike lanes as well as provide the crosswalk labeling to ensure the safety of pedestrian and cyclist users.

2nd St. to Halsey Greenway

The second recommendation is for the city to add a greenway spanning from 2nd street, following along the north end of Halsey St and ending at Edgefield. The greenway would consist of speed bumps, protected crossings at bus stops to allow a safe way for pedestrians to cross the street, including adding signs. The greenway aims to shift focus from automobiles to pedestrians and bicycles.

The new greenway is recommended to be made in the untouched rural area between NE 24th Ave and SW Edgefield to the north of Halsey St separate from Halsey St. This could serve as a replacement of the previous recommendation above over this section of Halsey street. The bike lanes along Halsey can merge into this greenway instead of following Halsey the entirety of the way. At this portion of Halsey the speed of traffic is very high so having this greenway separate from the main road for cyclists and pedestrians ensures the safety from the dangers of the main road. It will also provide a more calming and relaxing experience for those traveling along it because there is no longer the concern of the road in this section. Riders will also be exposed to a more open and natural setting in the untouched urban area as compared to the modernism of the rest of the city.

Bike Parking

The third recommendation is the inclusion of bicycle parking within the city. Particularly along Columbia River Highway between Kibling St and Buxton St. These bike parking options should be implemented on the sidewalks and be set in designated street spaces that would typically be street car parking. The selection of these spaces would be designed to offer the maximum amount of bike parking while still maintaining adequate street parking for cars. An ideal example of possible locations of choice for this would be the street car parking spaces located at the northern end of the two intersections;

[13] "Bikeway Facility Design: Survey of Best Practices ." *Portland Bicycle Plan for 2030 from the City of Portland Bureau of Transportation*, p. 3.

Historic Columbia River Hwy + Dora Ave and Historic Columbia River Hwy + Harlow Ave. These spots are circled in red in images 3. In actuality it is not legal to have cars parked at these locations, so these are ideal spaces for on street bike parking without taking away from street car parking or taking away from the limited sidewalk space. These spots can be repurposed temporarily to be on street bike parking to test if these bike racks would be used by the general public. The way this can be done is by painting the pavement in a bright color, to discern from the other parking spots, and adding temporary bike racks as can be seen in image 7.

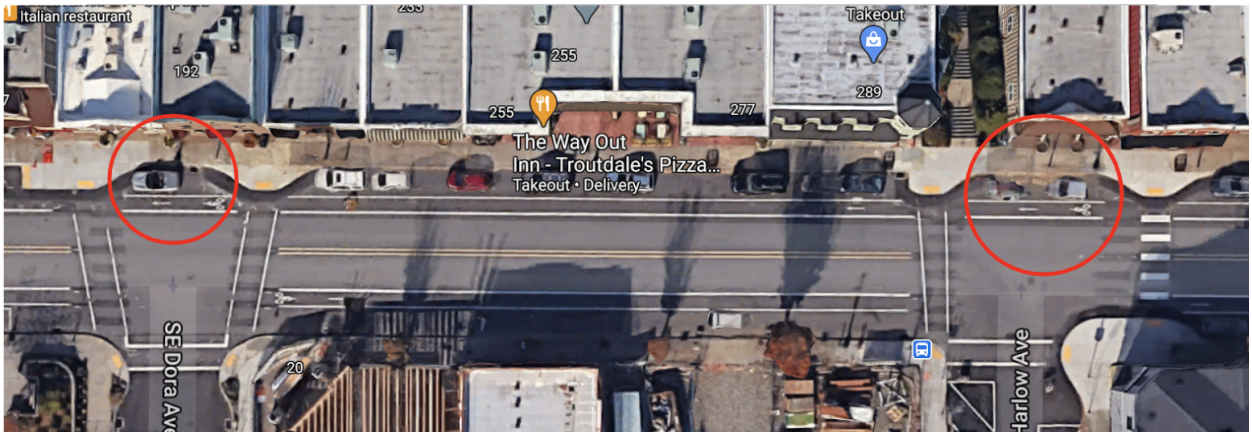


Image 3

Bike racks are important because it encourages people to bike to the downtown area and proceed to walk around the area. The city can implement something simple such as improved aesthetics and installment of a simple horseshoe rack (Image 4) or some more artsy bike racks (images 5 and 6). A more artsy bike rack would brighten up the downtown area and it can be inclusive of the community by asking community artists to design something indicative of Troutdale or Oregon. Some artsy bike racks can be difficult to lock up a bike to so it is recommended to keep the design simple.

Image 4[14]

Image 5 [15]

Image 6[16]

Image 7[17]

Sidewalk Furniture & Vegetation

The fourth recommendation is to add sidewalk furniture along the mixed use developed areas. More pedestrian friendly features along the heavily used sidewalks will help users enjoy the experiences they have with the sidewalks. In addition to the furniture, an increase in trees and vegetation is important along the sidewalks. Vegetation elements are lacking in multiple places within the city and the inclusion of more street trees offers multiple benefits. It offers a more pleasant natural experience for users traveling through the modern city space, reduces air and noise pollution, provides shade for those traveling along the sidewalks, and probably providing the greatest benefit is the fact that it helps reduce the urban heat island effect. The urban heat island effect

[14] "Bike Parking." *Bike Parking | Eugene, OR Website*, www.eugene-or.gov/2355/Bike-Parking.

[15] Downtown Ithaca's MAY GALLERY Night showcasing Area's new artsy bike racks. (2018, May 04). from https://downtownith.com/2018/05/03/downtown-ithacas-may-gallery-night-showcasing-areas-new-artsy-bike-racks/

[16] New artsy bike Racks installed in DOWNTOWN COVINGTON. (2016, July 11) from https://www.rcnky.com/articles/2016/07/11/new-artsy-bike-racks-installed-downtown-covington

[17] "Bike Parking: A Comprehensive Guide." *Magento Commerce*, www.madrax.com/bike-parking-guide.

can be a very serious health issue for city areas and particularly for low income communities.

Bike Boxes, Buffered & Through Bike Lanes

The fifth recommendation is the redevelopment of bike lanes at certain intersections. Some intersections in the city have the bike lanes evaporate. It is recommended to reinclude the bike lanes into the intersection for cyclists' safety. A further barrier system is recommended leading up to intersections in which cars need to cross bike lanes to reach designated turning lanes. The barriers will ensure cars do not cross the lane early where not designated and risk the safety of bike lane users (photo B). A gap between the cars and the crosswalk is recommended to be designated for the creation of bike boxes to be placed. The bike boxes will be painted green similarly to the bike lanes to indicate its designated user (Photo C). The intersection that we recommended for these improvements is the intersection of Columbia River Highway and SW 257th Dr pictured in image 8.

Image 8

Adding the bike boxes accomplishes two goals. First, it eliminates the need for bikes to merge into car lanes with moving traffic, allowing a much safer way for bikes to use the turn lanes of intersections. Second, it creates an additional safety buffer between the car lanes and the crosswalks when at a stop as well as prevents cars from blocking the crosswalk for pedestrians or being too close to them. This will increase the feeling of safety for pedestrians using the crosswalk and make cyclists feel better in how they will have first priority in the intersection versus needing to fight with cars to get where they want.

Photo A

Photo B

Photo C

Conclusion

The combination of all or some of the implementations will add up to make the city of Troutdale more appealing to pedestrians and cyclists. Improving the experience that pedestrians and bicyclists have in the city of Troutdale will shift the way that people commute within the city as well as to other neighboring cities. Encouraging people to bike or walk around the city will lower the air pollution and noise pollution that cars emit.

Appendix

Sources:

Bicycles in Portland fact sheet. (2019, April 23). Retrieved February 22, 2021, from https://www.portlandoregon.gov/transportation/article/407660

“Bike Parking: A Comprehensive Guide.” *Magento Commerce*, www.madrax.com/bike-parking-guide.

“Bike Parking.” *Bike Parking | Eugene, OR Website*, www.eugene-or.gov/2355/Bike-Parking.

“Bikeway Facility Design: Survey of Best Practices .” *Portland Bicycle Plan for 2030 from the City of Portland Bureau of Transportation*, p. 3

Blue, Elly. “The Best Way to Promote City Riding? Bike Racks.” *Bicycling*, Bicycling, 20 Sept. 2020, www.bicycling.com/news/a20024191/the-best-way-to-promote-city-riding-bike-racks/.

Death rate from road accidents. (n.d.). Retrieved February 22, 2021, from https://ourworldindata.org/grapher/death-rates-road-incidents?tab=chart&stackMode=absolute&time=earliest..latest&country=HND~USA~NLD~ESP~JPN®ion=World

Downtown Ithaca's MAY GALLERY Night showcasing Area's new artsy bike racks. (2018, May 04). from https://downtownith.com/2018/05/03/downtown-ithacas-may-gallery-night-showcasing-areas-new-artsy-bike-racks/

How Amsterdam became the bicycle capital of the world. (2015, May 05). Retrieved February 22, 2021, from https://www.theguardian.com/cities/2015/may/05/amsterdam-bicycle-capital-world-transport-cycling-kindermoord

Ink, Social. “Buffered Bike Lanes.” *National Association of City Transportation Officials*, 19 July 2019, nacto.org/publication/urban-bikeway-design-guide/bike-lanes/buffered-bike-lanes/.

New artsy bike Racks installed in DOWNTOWN COVINGTON. (2016, July 11) from https://www.rcnky.com/articles/2016/07/11/new-artsy-bike-racks-installed-downtown-covington

“Pedestrian Safety.” *NHTSA*, 30 Sept. 2020, www.nhtsa.gov/road-safety/pedestrian-safety.

“Portland Traffic Fatality Tracker.” *BikePortland.org*, 8 Feb. 2021, bikeportland.org/fatality-tracker.

Roberts, D. (2018, August 28). No helmets, no problem: How the Dutch created a Casual biking culture. Retrieved February 22, 2021, from https://www.vox.com/science-and-health/2018/8/28/17789510/bike-cycling-netherlands-dutch-infrastructure

Schlossberg, M., Fredrick, L. R., Amos, D., & Rowell, J. (2019). *Rethinking streets for bikes: An evidence-based guide to 25 bike-focused street transformations*. Eugene, OR: University of Oregon.

“Troutdale, OR.” *Data USA*, datausa.io/profile/geo/troutdale-or.

“What Are Neighborhood Greenways?” Portland.gov, www.portland.gov/transportation/what-are-neighborhood-greenways.

Group Members contribution statement:

Our group consisted of Tia Lohman, Abby Gisler, Jack Ferguson. Tia wrote the summary, introduction, and methods sections. Within the findings section she made a GIS map and analysed data to allow us to gather more accurate information about Troutdale. She also made the “*Sidewalks & Bike Lane Pavement Markings Along Halsey St in Troutdale*” map that we used in our findings section. Abby worked on the findings section where she gathered data and connected the research we did together to then apply it to the city of Troutdale. Jack wrote the recommendation section and included specific examples of the type of changes we are recommending be made to the City of Troutdale. He also came up with the idea of the focus of the greenway multi use path in the untouched urban land above Halsey St. Abby included more information for the bike rack section and Tia added her own information throughout as well but Jack did the most of the work on it. We met up a few times to talk about the research that we

made. We also talked out what we should implement in the city of Troutdale to improve it for pedestrians and cyclists as well as began discussing how to decide to implement these changes in different locations in the city. We did not have a chance to visit Troutdale because of the pandemic as well as the ice/snow storm that has hit the Portland area this past week. In terms of the presentation to the City of Troutdale and the Winter of 2021 PPPM 399 class, Abby created the slides that were included in the presentation with minor edits from Tia and Jack, and then Tia and Jack were the ones to speak during the presentation.

Appendix B

SCYP –City of Troutdale, Oregon

Xingchen Guo
University of Oregon
PPPM 399
Professor Brown
3-17-2021

Executive Summary

During the current decade, there has been an increase in the population of urban areas globally. However, one of the major challenges that towns and cities face is traffic congestion and gas emission, which mainly occurs due to the high population numbers within the urban areas. To ensure sustainability of transportation systems and decrease traffic congestion, efficient means of transportation should be adopted in urban areas. As a fast-growing city in Oregon, Troutdale has had significant improvements in its infrastructure as well as transportation systems. Nevertheless, the city needs to improve its current biking and pedestrian infrastructure system to achieve its future transport goals and growing transportation demand due to a steady increase in population. In order to determine the existing infrastructure for cyclists and pedestrians within the city, I visited the city and collected data through observations in order to collected data. Furthermore, I used using phone call interviews to get the information from the residents of the city. The data was then analyzed using Statistical Packages for Social Sciences (SPSS) before being interpreted. Based on the interpretation of the collected information, Troutdale should develop traffic light signaling that prioritizes pedestrians and cyclists, increase the number of its on-street bike lanes, widen some of its on-street bike lanes and pedestrian sidewalks, plant street trees, as well as put up side-walk furniture to improve its current biking and pedestrian infrastructure system.

SCYP – Troutdale City, Oregon

Although urbanization has been essential in improving global economies, it is associated with a significant number of challenges. Crowding in cities and towns significantly leads to poor health outcomes and social challenges, such as crimes. Poor transportation systems are undoubtedly one of the most significant problems faced by urban centers. Since a significant number of people is migrating to the cities during the current century, cities would be more populated within the next few decades (Dosdall & Kienitz, 2021). Hence, it is crucial to think not only about the ways of accommodating modern means of transportation, but also cycling and walking. The expansion and improvement of bicycle and pedestrian infrastructure have been ongoing in a number of urban centers globally and have significantly reduced overcrowding of vehicles that is inevitable in cities and towns. By putting a network of infrastructure to ensure the reduction of cycling and walking as viable modes of transport by city and town residents, it is possible to decrease the prevalence of traffic congestions, overcrowding, and criminal activities (Koska & Rudolph, 2016). However, before putting in place bicycling and walking infrastructure within a town or city, it is important to consider significant factors that relate to the development as well as the social and health benefits of such project. As one of the fastest-growing urban centers in Multnomah County in Oregon, Troutdale has been focusing on the improvement of its biking and pedestrian infrastructure during the past few years. Hence, by conducting a research on the city's current infrastructure system, it is possible to provide recommendations on the improvement its biking and pedestrian systems to achieve the efficiency of transportation plans.

One of the major hindrances to a transportation plan of an urban center is an increase in population due to rural-urban migration. Troutdale would have to improve the efficiency of its transportation system to ensure that it meets future transportation demands because of an increase in population ("City of Troutdale"). For that reason, the purpose of the current research is to determine the strategies that can be used within Troutdale to improve the current cycling and pedestrian infrastructure as well as meet the future transportation demands and goals of the city. Hence, the current research is significant for determining the strategies to improve the cycling and pedestrian infrastructure to enhance the efficiency of a city's transportation system

by decreasing congestion as well as emissions from modern means of transport, which is essential in reaping more social and economic benefits from urbanization in the future.

Problem under Discussion

As a growing urban center, Troutdale has two main goals to enhance the efficiency of its transportation plan. First, the city requires its transportation facilities to be designed and constructed in a manner that not only restores but also enhances its livability ("City of Troutdale"). Secondly, the city requires its transportation system to be considered safe and essential in reducing congestion within the town center ("City of Troutdale"). Based on the two goals of the city's transportation plan, there is no doubt that an initiative to improve its current cycling and pedestrian infrastructure is needed ("City of Troutdale").

Research Question

- What are the biking and pedestrian infrastructure investments that the city government of Troutdale should consider to achieve the city's transportation demands and goals in the future?

Hypothesis

- The existing biking and pedestrian infrastructure within Troutdale cannot be relied on fully to meet the growing transportation demands and goals of the city in the future due to its steady growth in population.

Objectives

There are two main objectives of the current research paper:

- To determine the existing biking and pedestrian infrastructure within Troutdale.
- To determine the strategies that can be used to improve the city's biking and pedestrian infrastructure system.

Thesis Presenting the Structure of the Paper

With regard to the formulated research question, hypothesis, and research objectives, the thesis presenting the structure of the paper is "establishing the current biking and pedestrian infrastructure system within Troutdale is essential in determining the strategies that can be used to improve the efficiency of such system to meet the city's future transportation demands and goals."

Methods

By using efficient data collection methods, it is possible to gather the credible data to reveal the detailed facts regarding the research question at hand (Paradis et al., 2016). Nevertheless, the interpretation of the collected data using specific data collection methods also depends on the ability of a researcher to analyze such information properly. On that account, it was important to use observation and interviews to collect data regarding the research question above and analyze such data using Statistical Packages for Social Sciences (SPSS).

Data Collection Procedures

Observations and interviews were the only data collection procedures that were used to collect enough data on the research question. Observations involved visiting Troutdale to assess the existing pedestrian and biking infrastructure systems and determine limitations and benefits. Through observations, it was possible to make recommendations on how the city can improve the infrastructure based solely on the limitation that the existing system had. There are two main reasons why it was important to visit Troutdale and conduct a direct observation of its existing pedestrian and biking infrastructure system. It was not only a simple and unobtrusive task but also essential for gathering first-hand data for more accuracy and credibility in answering the

research question (Paradis et al., 2016). In addition, observation as a method of data collection was straightforward and efficient, as no extensive training was required on the part of the data collection (Paradis et al., 2016). In this way, observation was a cheap and reliable way of obtaining accurate data on the biking and pedestrian infrastructure system of Troutdale.

Interviews were also essential in collecting data regarding the existing biking and pedestrian infrastructure system that Troutdale has. Four participants were chosen for the interview and they are residents of the city. However, due to the ongoing health pandemic, COVID-19, all four interviews were conducted through phone calls. A structured interview was used, in which the participants were asked to answer the predetermined questions that were related to the city's biking and pedestrian infrastructure system. The questions were also created and planned in advance before the consent of participants was obtained from the four interviewees. To a significant extent, the collection of data related to the research question through interviews was effective in answering it. Not only did the structured interviews enabled a better understanding of the city's infrastructure system but also the subject's opinions on the strategies that should be used to improve it. Thus, the accuracy and reliability of the data collected using observation were enhanced through structured interviews.

Data Analysis

In order to interpret the collected data and make meaningful recommendations on how to improve the biking and pedestrian infrastructure system within Troutdale, data analysis was important. The collected data was analyzed using SPSS version 26.0, which is the latest version of the statistical software (Ali & Bhaskar, 2016). SPSS was mainly used to conduct a correlation analysis of the collected data. The interviewees also provided data on the estimated number of city residents who mainly walk within the town center on a daily basis and those who use bicycles. Through the correlation analysis, it was possible to understand whether the investments made by the city government in improving the biking and pedestrian infrastructure system are sufficient in meeting the growing transport demand in the next few years.

Findings

Based on the observation conducted within the town center of Troutdale, the urban area has a relatively good pedestrian and biking infrastructure system that has been developed over the years. The city has continuous pedestrian sidewalks on at least one side of each street within the town center ("City of Troutdale"). The town center of Troutdale also has two regional multi-use paths that can be used by pedestrians to avoid traffic congestions during peak hours ("City of Troutdale"). One of the regional multi-use paths travels from Blue Lake Park through the south side of Marine Drive ("City of Troutdale"). It ends on the east side of Sundial Road as shown by Appendix A ("City of Troutdale"). The other regional multi-use paths for pedestrians go to Troutdale Airport and can be used by visitors and tourists who want to walk into the town center ("City of Troutdale"). It ends at Graham Road within the town center ("City of Troutdale").

The interview findings indicate that there has been an increase in the number of pedestrians using the city's street sidewalks and multi-use paths within the town center. On the other hand, the interview revealed that the town center has many signed and striped crosswalks that are being used by pedestrians to safely cross the streets. Most of the signed and striped crosswalks exist within two or more legs of intersections of streets within the town center ("City of Troutdale"). Appendix B illustrates the average number of pedestrians within various walks and multi-use paths in Troutdale during peak hours.

Other findings indicate that Troutdale also has a good biking infrastructure that consists of on-street bike lanes and shoulder bikeways. The on-street bike lane and shoulder bikeways exist beside pedestrian side-walks and regional multi-use paths ("City of Troutdale"). However, there have been no cases of accidents involving pedestrians and cyclists despite their close proximity during the past few years. In addition to the on-street bike lanes and shoulder bikeways, Troutdale has off-street bike facilities, such as parking and way finding signs, that can be used by cyclists to quickly locate their parked bicycles ("City of Troutdale"). Despite the fact that Troutdale has made enough investments in improving its bicycle infrastructure system within the town center, there are relatively few cyclists within the city ("City of Troutdale"). Appendix C illustrates the number of cyclists within various on-street bike lanes and shoulder bikeways within the city during peak hours.

Recommendations

Despite the fact that Troutdale has invested in its biking and pedestrian infrastructure system, the city still needs to improve its existing infrastructure. One of the strategies to ensure safe walking and cycling within the city is to develop a traffic light signaling that prioritizes pedestrians and cyclists (Aziz et al., 2018). Despite the fact that streets within the town center have signed and stripped crosswalks that can be used by pedestrians and cyclists, there are few traffic light stops within various streets ("City of Troutdale"). Therefore, the pedestrians may be endangered by drivers who may violate the traffic rules by not stopping at signed and stripped crosswalks (Aziz et al., 2018). By developing a traffic light signaling within most streets of the city, it would be possible for pedestrians to push a detector button that enables them to safely cross the streets without being endangered by ignorant drivers.

Although there are very few cyclists within the town center, Troutdale should increase the number of on-street bike lanes within certain parts of the town center. The introduction of a designated 2nd Street as bike greenway that would enable cyclists to connect to Fairwood or Wood Village corridor would decrease traffic congestions realized within the Main Street of the city, especially during peak hours ("City of Troutdale"). In addition, the on-street bike lanes of streets with more cyclists should be made wider (Aziz et al., 2018). It will prevent congestion, increase safety, and encourage more people to cycle. From the findings above, there are more cyclists on Stark and Graham Road. Consequently, it would be important for the city council of Troutdale to widen the on-street bike lanes within such streets since they have more cyclists (Aziz et al., 2018). However, more focus should be on Stark Road, which also has the highest number of pedestrians during peak hours. Consequently, since Stark Road is mainly used by pedestrians and cyclists during peak hours, increasing the widening of the pedestrian sidewalks and on-street bike lanes within the road would be essential in improving the safety of both sides.

As indicated above, one of the major goals of improving the transportation system of Troutdale is to maintain its livability. Thus, the city's management should focus on the planting trees and putting up the sidewalk furniture (Aziz et al., 2018). Planting trees would not only improve the livability of the city by making its streets look beautiful but also make it attractive to pedestrians and cyclists (Aziz et al., 2018). Sidewalk furniture, especially on streets, such as Stark and Graham Road, would enable pedestrians and cyclists to take short rests ("City of Troutdale"). For that reason, it would be possible to ease the congestion that may occur on the on-street bike lanes and pedestrian sidewalks that exist within such roads. In addition, there will be increased safety for cyclists and significant disease in emissions released in the atmosphere. Finally, it will contribute to the livability of the city.

Conclusion

Thus, the research has addressed the question of the biking and pedestrian infrastructure investments that the government of Troutdale make to achieve the goals and transportation demands of the city in the future through determining the current biking and pedestrian infrastructure in Troutdale. In addition, the study has determined the strategies that help improve the infrastructure system. The research findings indicate that the town center has a relatively good pedestrian and biking infrastructure system. In addition, the town has experienced an increase in the number of pedestrians who use street sidewalks and multi-use paths. However, cyclist and pedestrians are in close proximity. Therefore, it is recommended to ensure safe waling and cycling within the city through developing a special traffic light, increase the number of on-street bile lanes, widen the on-street bike lanes, maintaining pedestrians' safety and the livability of Troutdale.

References

Ali, Z., & Bhaskar, S. B. (2016). Basic statistical tools in research and data analysis. *Indian Journal of Anaesthesia*, *60*(9), 662. DOI: 10.4103/0019-5049.190623

Aziz, H. A., Nagle, N. N., Morton, A. M., Hilliard, M. R., White, D. A., & Stewart, R. N. (2018). Exploring the impact of walk–bike infrastructure, safety perception, and built-environment on active transportation mode choice: A random parameter model using New York City commuter data. *Transportation*, *45*(5), 1207-1229.

City of Troutdale. https://www.troutdaleoregon.gov/sites/default/files/fileattachments/community_development/page/8451/final_tsp_03-04-2014.pdf

Dosdall, N., & Kienitz, H. (2021). Why your community should invest in bicycle and pedestrian infrastructure. *SEH*®. https://www.sehinc.com/news/why-your-community-should-invest-bicycle-and-pedestrian-infrastructure.

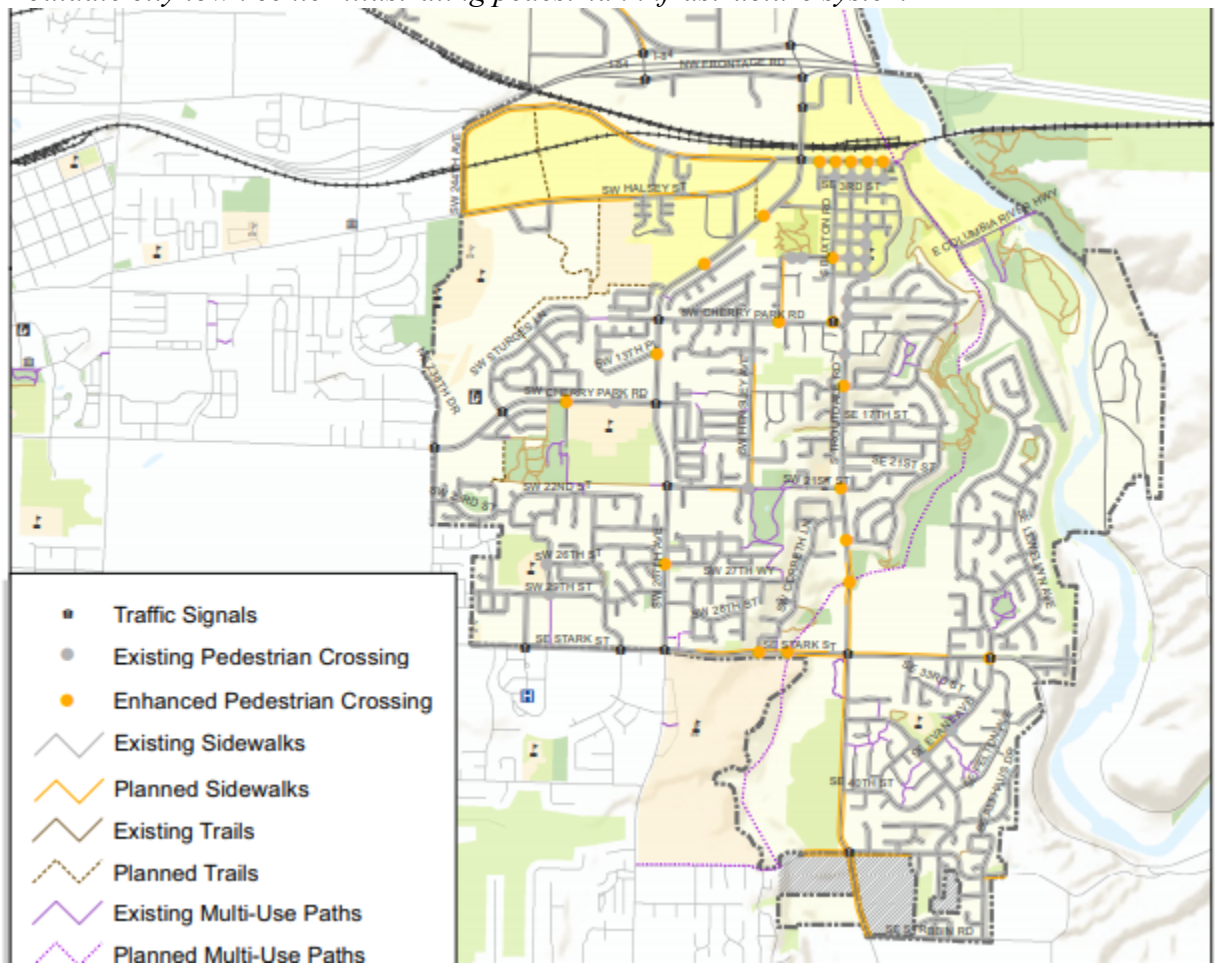
Koska, T., & Rudolph, F. (2016). The role of waling and cycling in reducing congestion: A portfolio of measures. Brussels. http://h2020-flow.eu/uploads/tx_news/FLOW_REPORT_-_Portfolio_of_Measures_v_06_web.pdf

Paradis, E., O'Brien, B., Nimmon, L., Bandiera, G., & Martimianakis, M. A. T. (2016). Design: Selection of data collection methods. *Journal of Graduate Medical Education*, *8*(2), 263. DOI: 10.4300/JGME-D-16-00098.1

Appendices

Appendix A

Troutdale city town center illustrating pedestrian infrastructure system



(Source: "City of Troutdale")

Appendix B

Average number of pedestrians within various street walks and multi-use paths in Troutdale during peak hours

Intersection	Pedestrian PM Peak Hour Volume	Intersection	Pedestrian PM Peak Hour Volume
Buxton Road/Historic Columbia River Highway	38	I-84 eastbound ramps/Marine Road	0
Marine Drive/Sundial Road	0	I-84 eastbound ramps/Graham Road	0
257th Drive/Cherry Park Road (south)	22	I-84 westbound ramps/Graham Road	2
257th Drive/Historic Columbia River Highway	19	Troutdale Road/Stark Street	44
Cherry Park Road/Buxton Street	2	Troutdale Road/Cochran Road	0
I-84 westbound ramps/Marine Road	2		

(Source: "City of Troutdale")

Appendix 3

The number of cyclists within various on-street bike lanes and shoulder bikeways within the city during peak hours

Intersection	Bike PM Peak Hour Volume	Intersection	Bike PM Peak Hour Volume
Buxton Road/Historic Columbia River Highway	0	I-84 eastbound ramps/Marine Road	0
Marine Drive/Sundial Road	0	I-84 eastbound ramps/Graham Road	6
257th Drive/Cherry Park Road (south)	0	I-84 westbound ramps/Graham Road	0
257th Drive/Historic Columbia River Highway	0	Troutdale Road/Stark Street	7
Cherry Park Road/Buxton Street	0	Troutdale Road/Cochran Road	2
I-84 westbound ramps/Marine Road	0		

(Source: “City of Troutdale”)

Appendix C

SCYP Final Paper
Naomi C, Bowei L, Lesley V

Microshuttles

Executive Summary:

The city of Troutdale, Oregon is a developing community that continues innovating while not losing the importance of the neighborhoods from which it was built. Based upon the locality needs demonstrated in the Comprehensive Land Use Plan, and the subsequent Transportation System Plan, the policies best suited for addressing community needs should include integrating a new microshuttle program. Microshuttle programs utilize different vehicles that transport passengers along personalized or shared routes based upon a more focused, efficient system for transportation. The vehicles help address many of the common issues facing any developing city, and specifically address the current issues addressed in the Transportation System Plan (TSP). Microshuttle programs enhance livability by increasing access to areas of the city without increasing the dependence on individual vehicles that are costly both financially and environmentally.

Reducing traffic and congestion are also benefits of implementing the new microshuttle plan, as these systems minimize travel hours and miles necessary for the individual drivers. Many growing cities turn to large parking structures when traffic issues are increasing, but these structures often visually pollute the community. Implementing ride-sharing mitigates parking needs for growing communities, such as Troutdale. Shared systems combine the benefits of mass public transport without increasing the inefficiencies in drive time that would otherwise incentivize private driving use. Mass transit, such as bus lines, often increase wait and travel times for individual users, which then incentivizes private vehicle driving. By implementing microshuttles, Troutdale can increase access to public transportation systems without increasing these inefficiencies that drive private use. Furthermore, the plans discussed within this report explore how other cities were able to balance the needs of the community and the changes to the systems as the microshuttle programs were implemented. The recommendation of this project is a riding-sharing program with microshuttle buses in a 1.3 square mile area of Troutdale, connecting residential, medical, and commercial centers for increased access. By utilizing the information gathered in these other cases, the report presented here provides clear guidance for developing an effective and efficient system that continues developing Troutdale as a destination city, without disrupting the business and local systems upon which the community finds pride.

Introduction :

Due to the growth of cities and the knowledge of climate change, many locations are trying to find ways in which they can help their cities reduce their carbon emissions. Cities have

developed plans to which they hope to achieve in the next years. The city of Troutdale in response to climate change and a more effective city environment decided to look into their transportation system. As is the knowledge of many, cars are the number one way in which people in cities get around but also a large portion of where the carbon emissions in cities come from as well. In many cities as well as in troutdale, looking into public transportation is one of the big steps in changing the city's carbon emission. Troutdale is taking many options to extend public transportation in mind including microshuttles. In this paper we will be conducting some research in order to advocate or refute troutdale from taking action in the microshuttle scheme. This paper will look into some of the different cities that have placed microshuttles into their cities and how the microshuttles have both succeeded and failed in creating an easy alternative to car use.

Method:

In order to analyze the benefits and cons of microshuttles the use of case studies from other cities will be analyzed. In addition to analyzing the microshuttles that are already in place we are also going to analyze the comparison between microshuttles and any related transit that can be in place instead of microshuttles. The use of case studies will allow us to distinguish what has been useful and what has not been useful when it comes to placing microshuttle in place. These case studies will not only let us see what does and doesn't work but will give an idea of what can be done to overcome any negative feedback to make the use of microshuttle possible in the city of troutdale. While the use of comparing other forms of transportation to microhuttles would also help give troutdale an idea as to where certain transportation systems have been used and where they worked as well as what transportation is easier for what population or community.

Benefits:

In order to proficiently assess the success of microshuttle implementation it is important to analyze both the benefits and negatives from multiple cities in order to have multiple viewpoints rather than one. In terms of benefits, they can be placed in categories of sustainability, and inclusivity. Specifically within the category of sustainability, microshuttles create a path for energy efficient vehicles that can potentially reduce emissions[1]. This means that there would be a positive impact on the environment because “the U.S. The Environmental Defense Fund (EDF) estimates that on-road vehicles cause one-third of the air pollution that produces smog in the U.S., and transportation causes 27 percent of greenhouse gas emissions”[2].

[1] DJ. Fagnant, K., Nieuwenhuijsen, J., J. Piao, M., J. Petit, S., Z. Kan, Z., Sheffi, Y., . . . Schellekens, M. (1970, January 01). Autonomous vehicles: Challenges, opportunities, and future implications for transportation policies. Retrieved March 14, 2021, from https://link.springer.com/article/10.1007/s40534-016-0117-3

[2] Brinson, L. (2012, August 29). How much air pollution comes from cars? Retrieved March 14, 2021, from https://auto.howstuffworks.com/air-pollution-from-cars.htm#:~:text=The%20Environmental%20Defense%20Fund%20%28EDF%29%20estimates%20that%20on-road,about%20half%20of%20the%20world%27s%20emissions%20from%20cars.

The fueling is not the only factor in potentially reducing emissions; a "focus towards optimization of car-pooling and ride-sharing services"[3] could create a pathway to reduction in pollution and traffic by reducing the number of vehicles on the road. With less vehicles on the road, it can also reduce congestion as in the case of Ann Arbor where the "case study shows that community-based carpooling can decrease daily vehicle usage by up to 57%"[4] which may also reduce the frequency or number of accidents (there are no statistics yet). Another benefit to the microshuttles is that in areas with more traffic such as downtown areas, the pressure to look for parking or pay for parking can be relieved for those commuting via the microshuttle. Last but not least, the implementation of microshuttles would allow those unable to drive such as people who may not be able to afford a car, youth, people without license, and those with medical conditions and disabilities another option to getting to where they need to go. This factor is not to be overlooked with the fact that according to a "2009 National Household Travel Survey, about 9 million non-drivers have a medical condition that affects their mobility and of these, about 8 million have reduced their daily travel"[5] which shows that there is a huge market for microshuttles in the U.S. in general.

Limitations:

Although there were little limitations found after researching, they are significant in determining if microshuttles are *actually* beneficial. The main source of limitations stems from money. Not only is there money required to even initiate and start up a program and design to have a microshuttle, even if that is successful there is going to be ongoing money put in for maintenance costs and parts[6]. From the example of the University of Connecticut, to just start up

[3] Hasan, M. H., & Hentenryck, P. V. (2021, January 20). The benefits of autonomous vehicles for community-based trip sharing. Retrieved March 19, 2021, from https://reader.elsevier.com/reader/sd/pii/S0968090X20308287?token=6F4CA4ED65EDE42824EE41088E4BE784816E3F8A812F147FCB812401228C273943648390938ADBE8E9E1D0373AE2A6BD

[4] Hasan, M. H., & Hentenryck, P. V. (2021, January 20). The benefits of autonomous vehicles for community-based trip sharing. Retrieved March 19, 2021, from https://reader.elsevier.com/reader/sd/pii/S0968090X20308287?token=6F4CA4ED65EDE42824EE41088E4BE784816E3F8A812F147FCB812401228C273943648390938ADBE8E9E1D0373AE2A6BD

[5] Montgomery, D. W. (2018, June). Public and Private Benefits of Autonomous Vehicles. Retrieved March, 2020, from https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/W.-David-Montgomery-Report-June-2018.pdf

[6] Anderson, J. M., Nihdi, K., Stanley, K. D., Sorenson, P., Saranson, C., & Oluwatola, O. A. (2014, January 10). Autonomous vehicle technology. Retrieved March 15, 2021, from https://books.google.com/books?hl=en&lr=&id=y0WrAgAAQBAJ&oi=fnd&pg=PP1&dq=disadvantage%2Bof%2Bautonomous%2Bvehicles&ots=-8Fae0FEQN&sig=6hBpXRNhWWRznVXXEgR4_N91RBs#v=onepage&q=disadvantage%20of%20autonomous%20vehicles&f=false

a program for the micro shuttle cost roughly eight million dollars[7]. Another significant limitation would be limited hours of service or mileage that the microshuttle could perform which might be cause inconvenience for those who might need a ride in the times it is not operating. The other limitations that were researched affected those that would be in competition such as parking services, insurance services, and other ride sharing services[8]. All of these limitations are important to know in order to understand what to look for and expect if Troutdale plans on implementing a microshuttle.

Columbus, Ohio:

In order to analyze what it could look like to have a fully operating shuttle, three cities were chosen to analyze and research how they operate the shuttle that could potentially be useful to the city of Troutdale. In Columbus, Ohio there is a total population of 895,877 people and included in that total there are" 7.3% people under 5 years , 22.5% People under 18 years , 60% people between 18-64 and 10.2% people 65 years and over"[9]. Those residents can use the shuttle with no cost to them and "kids as young as 12 can ride on their own"[10]. The shuttle has a capacity limit of 10 people, is driven along a route of 2.9 miles and only is running in the morning and afternoon (not a 24 hour service). The shuttle allows for those in the community to get to and from work, grocery stores, markets, and to connect people to where they need to go. The shuttle is autonomous which means there is no need to pay for a driver or worry about

[7] Jackson, E. (2019, September 1). CONNECTICUT AUTONOMOUS MICROSHUTTLE DEMONSTRATION INITIATIVE. Retrieved 2021, from https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/351196/11-university-connecticut.pdf#:~:text=Demonstration%20Autonomous%20Microshuttles%20Proposed%20Duration%20of%20the%20Demonstration,Share%20Amount%20Proposed%20%241%2C087%2C439%20Total%20Project%20Cost%20%248%2C324%2C445

[8] Anderson, J. M., Nihdi, K., Stanley, K. D., Sorenson, P., Saranson, C., & Oluwatola, O. A. (2014, January 10). Autonomous vehicle technology. Retrieved March 15, 2021, from https://books.google.com/books?hl=en&lr=&id=y0WrAgAAQBAJ&oi=fnd&pg=PP1&dq=disadvantage%2Bof%2Bautonomous%2Bvehicles&ots=-8Fae0FEQN&sig=6hBpXRNhWWRznVXXEgR4_N91RBs#v=onepage&q=disadvantage%20of%20autonomous%20vehicles&f=false

[9] Data USA. Columbus, oh. Retrieved March 19, 2021, from https://datausa.io/profile/geo/columbus-oh/#:~:text=Columbus%2C%20OH%20is%20home%20to%20a%20population%20of,Columbus%2C%20OH%20than%20any%20other%20race%20or%20ethnicity.

[10] Blanco, S. (2020, February 06). Columbus is first city In U.S. with autonomous shuttles in residential areas. Retrieved March 19, 2021, from https://www.forbes.com/sites/sebastianblanco/2020/02/06/columbus-is-first-city-in-us-with-autonomous-shuttles-in-residential-areas/?sh=6d9af9d06d7f

breaks and shifts, however with the advanced technology it costs about $40 million dollars which they obtained through a grant[11].

Antioch, California:

Antioch, California provides an example of the microshuttle system established within a regional transport system, adapting to individual needs and therefore addressing more personalized service. The pilot program, established in summer 2019, allows riders the opportunity to have personalized stops with a designated service area[12]. The program, Tri MyRide uses familiar ride-sharing technology, as smartphone apps are available to all users that can then schedule an individual ride with pickup and drop off locations anywhere within the designated area. Tri MyRide offers users a low $2 fee for transport and uses small buses that are better capable of maneuvering within residential areas where larger buses are incapable of navigating. Furthermore, the program allows users to determine the exact location for pickup and drop-off, overcoming challenges facing other mass transit systems that have designated travel paths and isolated stops that may be challenging for mobility device users, such as wheelchair or walkers. The resulting personalization and the low price allow users within two four-square mile sections of the city to access direct travel between pickup and destination from 8am to 5pm five days a week[13]. The program therefore allows typical regional bus users, and others, access to resources that would otherwise require specific stops and other common barriers to access for those within underserved communities.

Detroit, Michigan:

Detroit, Michigan established an autonomous microshuttle pilot program beginning in late summer of 2020[14]. The partnership is a private collaboration between autonomous vehicle manufacturer Navya and regional business partners seeking to increase access for underserved communities. Specifically, the pilot program, which connects two senior-living facilities and the Detroit Medical Center. The program began after an awarded $85,000 grant from PlanetM, a regional development corporation focused on economic projects[15]. The autonomous driving

[11] Blanco, S. (2020, February 06). Columbus is first city In U.S. with autonomous shuttles in residential areas. Retrieved March 19, 2021, from https://www.forbes.com/sites/sebastianblanco/2020/02/06/columbus-is-first-city-in-us-with-autonomous-shuttles-in-residential-areas/?sh=6d9af9d06d7f

[12] Korbay, M. (2019, June 17). Tri Delta launches innovative on-demand ride sharing service. *Tri MyRide,* trimyride.com/media/2019-Tri%20MyRide-Press-Release.pdf

[13] Korbay, M. (2019, June 17). Tri Delta launches innovative on-demand ride sharing service.

[14] King, R.J. (2020, Aug. 20). New autonomous shuttle connects Detroit seniors with local hospital. *DBusiness,* www.dbusiness.com/daily-news/new-autonomous-shuttle-connects-detroit-seniors-with-local-hospital/

[15] Achtenberg, K. (2019, May 13). Five startups launching pilots, addressing mobility challenges in Michigan; PlanetM adds testing facility partners. *Michigan Economic Development Corporation.* www.planetm.com/press-releases/2019/05/five-startups-launching-pilots-addressing-mobility-challenges-in-michigan-planetm-adds-testing-facility-partners/

program has a 1.31 mile total trip, which therefore allows the passengers of the two senior facilities access to necessary travel mechanisms for meeting medical needs. As the project is currently in the pilot stages, the program is not fully available to the public, but it still increases access for those lacking proper transportation sources. Specifically, the stated goal of the project is increasing access for groups otherwise lacking that support, "namely, senior citizens, the disabled, and those who do not own traditional transport or can't afford the costs associated with traditional transport"[12]. As a result, the established program is currently in its earliest stages, running for a three month trial period. Nevertheless, the program demonstrates the short range capabilities for autonomous microshuttles, currently serving underserved communities providing both direct access for riders and assistance for riders that may otherwise need help entering and exiting the vehicles for their trips.

Compare and contrast of the microshuttles:

Within the information between the shuttles of the three cities, one can start to notice some similarities and differences between the way they are used and who uses the shuttles. One of the most notable similarities is the capacity of the shuttles which typically carry between 8-10 passengers. This structure for the microshuttle could be varied in size depending on the location of where the route is placed, what I mean by this is in downtown areas where there might be a higher population the shuttle could be created to fit 10-12 whereas in residential areas (with lower populations) the shuttle could be created to fit 6-8. Another similarity is that the shuttles have little to no cost for the people living in the actual city which creates more of an incentive to use the shuttle so that it is effective. In efficiency, the routes and stops are planned out well so that passengers know where they are going and what stops there are. Passengers can also easily access the shuttles online, through an app, or by simply showing up to the stop which makes it so people who may or may not have access to the internet or a mobile device can still ride the shuttle but for people who do it creates convenience.

Despite these similarities, there are also notable differences such as the way that the shuttles are used. For example, in Ohio the shuttle is set in the downtown area and in Antioch the shuttle is used in a residential area. Another difference, related to the settings, is where the stops are placed and how far the routes go. The importance in the differences is that shuttles can be adapted to the size of the city and where the shuttle is placed (downtown or residential).

Recommendations:

Troutdale's unique and inviting city space is a perfect example of the Pacific Northwest lifestyle and has opportunity for immense growth in sustainable ways through implementation of new technologies for public transportation. The existing case studies of variable microshuttle systems demonstrate the potential for innovation and adaptation that could benefit the city and help create a more livable community into the future. Additionally, the

possibilities for these programs allow many approaches for implementation, from a phased approached to a complete movement toward the new practices. Specifically, case studies in other cities have demonstrated the potential hazards that can now be avoided given the information provided and the opportunity for implementing a new system for meeting future transportation needs.

Since 1990, the city of Troutdale has grown almost 300%, meaning the potential for growth along with other regional centers is likely to continue into the future.[16] The population, according to the United States Census, is approximately 25% under 18 years old and another 10% 65 years or older. Therefore, over one-third of the city population consists of demographics more likely to need access to public transportation. With the continued growth of Portland and the surrounding cities, Troutdale provides opportunity for those seeking a new home without moving too far from the economic and social centers of Oregon's largest city. Nevertheless, current residents have limited access to public transportation that is run through municipal systems from Portland and run along traditional single line systems with isolated stops. Consequently, microshuttles provide the exact resolution for a neighborhood focused project that increases access for average users while equally mitigating traffic and parking issues of a growing city.

City planning surrounding public transportation must address issues of access, price, and cost for the community. Given these challenges the information gathered here presents a possible new system for developing a future stabilize public system that grants higher access for those communities that are most often neglected, and still meets the reasonable costs that must meet needs of any modern city. Looking at examples from all over the United States, there are clear benefits for the microshuttle programs as these systems of transportation address more personalized, ride systems, adopting services mirroring those of Antioch, California. As Troutdale continues developing as a community, the benefits for all members gained through an advanced transportation system are not only in-line with the stated TSP goals and policies, but they also advance goals for the comprehensive land use plan by acknowledging the benefits for economic development, recreational needs, energy conservation, and many other features[17].

Stated goals in the Troutdale TSP include areas in which the Antioch model of ride-sharing with individualized stops could provide the most benefit. Specifically, goal three of the Transportation System Plan is, "Provide a balanced, multi-modal transportation system and reduce the number of trips by single occupant vehicles."[18] The model developed in Antioch would work well in Troutdale, and the city size, only six square miles in total, mirrors the conditions in those regional travel systems for Antioch. The Antioch plan gives users the ability to choose specific locations for pickup, including at home, within a scheduled time and drop off at specific locations[19]. The recommendation of this plan is to establish a pilot system as indicated

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[16] Troutdale, Oregon. (2021). *United States Census Bureau. www.census.gov/quickfacts/troutdalecityoregon*

[17] Hughart, M and Vandehey, P.E. (2014, March). Troutdale transportation system plan. *Kittelson and Associates.* www.troutdaleoregon.gov/sites/default/files/fileattachments/community_development/page/8451/final_tsp_03-04-2014.pdf

[18] Hughart, M and Vandehey, P.E. (2014, March). Troutdale transportation system plan.

[19] Korbay, M. (2019, June 17). Tri Delta launches innovative on-demand ride sharing service

in Appendix A. The total area of this proposed project is only one square mile, but within this area are two major health facilities, easy access to Reynolds High School, and a combined area that includes residential and commercial zoning providing diverse access for underserved communities.

One of the current challenges facing all developing communities is the need for reducing single-use vehicle traffic, and the subsequent needs for parking associated with vehicle movement. Additionally, the city of Troutdale clearly values the historic elements of the city and maintains the feeling of community that has grown in its over 100-year history. As a result, the best solutions moving into the future continue building the community environment, reduce the need for single vehicle travel, and address the access for all members of the community without increasing the land use allocations for inefficient systems such as large parking environments. Therefore, the recommendation of this report is to implement a new microshuttle program utilizing existing technologies while also providing for future innovations that will increase the potential for new systems upgrading the newly formed public transportation access.

A secondary option for the program could include autonomous vehicles, but this recommendation depends upon the needs for the community and the viability of the new technology at this time. The case studies in Ann Arbor indicate the potential for autonomous vehicles and ride sharing that would increase the potential for new systems that benefit the entire community. Providing autonomous vehicles reduces much of the traffic when combined with the ride sharing of a microshuttle, while also reducing the need for parking within the valuable community space as these vehicles do not require the same parking systems as traditional single-occupant vehicles. Therefore, the benefits of this program are varied and can meet many needs. Nevertheless, it must be recognized that the technology for implementation of this system is not necessarily to the level all members of the community would feel safe which would inhibit the benefit of the transportation system. However, a phased program over ten or fifteen years could allow the city to integrate the effective new microshuttle program using traditional drivers and then, over time, replace the human-driven machines with the autonomous vehicles as the new programs are developed further. Therefore, the programs could address the many needs of the city while still working toward more livability in the future.

Conclusion:

Troutdale, Oregon is an amazing city along the Sandy River that provides a great opportunity for growth and innovation in public transport. The current city needs are going unfilled by traditional public transportation, as the major roadway bus lines fail to bring access to the entire community. Provided in this report are clear representations of alternative systems that increase access through microshuttle services. Increasing access to different communities in a city where one-third of the population may not have the necessary support needed is an important step, and the demonstrated plan would align with currently stated city goals. Furthermore, the potential for adaptation along with developing technologies means the plans are built for future needs. The growth potential for Troutdale means possible parking and traffic concerns will continue into the future, but developing a strong public transportation infrastructure not only mitigates these concerns it also provides incentives for new residents. Overall, the city of Troutdale has an amazing opportunity to continue growing and developing

and with that potential the needs for the city can be addressed through implementing a user-selected microshuttle bus program within areas of local need.

References

-, R., By, King, R., & -. (2020, August 20). New autonomous Shuttle CONNECTS DETROIT seniors with local hospital. Retrieved March 20, 2021, from https://www.dbusiness.com/daily-news/new-autonomous-shuttle-connects-detroit-seniors-with-local-hospital/

Anderson, J. M., Nihdi, K., Stanley, K. D., Sorenson, P., Saranson, C., & Oluwatola, O. A. (2014, January 10). Autonomous vehicle technology. Retrieved March 15, 2021, from https://books.google.com/books?hl=en&lr=&id=y0WrAgAAQBAJ&oi=fnd&pg=PP1&dq=disadvantage%2Bof%2Bautonomous%2Bvehicles&ots=-8Fae0FEQN&sig=6hBpXRNhWWRznVXXEgR4_N91RBs#v=onepage&q=disadvantage%20of%20autonomous%20vehicles&f=false

Blanco, S. (2020, February 06). Columbus is first city In U.S. with autonomous shuttles in residential areas. Retrieved March 19, 2021, from https://www.forbes.com/sites/sebastianblanco/2020/02/06/columbus-is-first-city-in-us-with-autonomous-shuttles-in-residential-areas/?sh=6d9af9d06d7f

Brinson, L. (2012, August 29). How much air pollution comes from cars? Retrieved March 14, 2021, from https://auto.howstuffworks.com/air-pollution-from-cars.htm#:~:text=The%20Environmental%20Defense%20Fund%20%28EDF%29%20estimates%20that%20on-road,about%20half%20of%20the%20world%27s%20emissions%20from%20cars.

DJ. Fagnant, K., Nieuwenhuijsen, J., J. Piao, M., J. Petit, S., Z. Kan, Z., Sheffi, Y., . . . Schellekens, M. (1970, January 01). Autonomous vehicles: Challenges, opportunities, and future implications for transportation policies. Retrieved March 14, 2021, from https://link.springer.com/article/10.1007/s40534-016-0117-3

Hasan, M. H., & Hentenryck, P. V. (2021, January 20). The benefits of autonomous vehicles for community-based trip sharing. Retrieved March 19, 2021, from https://reader.elsevier.com/reader/sd/pii/S0968090X20308287?token=6F4CA4ED65EDE42824EE41088E4BE784816E3F8A812F147FCB812401228C273943648390938ADBE8E9E1D0373AE2A6BD

Hughart, M and Vandehey, P.E. (2014, March). Troutdale transportation system plan. *Kittelson and Associates.* www.troutdaleoregon.gov/sites/default/files/fileattachments/community_development/page/8451/final_tsp_03-04-2014.pdf

Jackson, E. (2019, September 1). CONNECTICUT AUTONOMOUS MICROSHUTTLE DEMONSTRATION INITIATIVE. Retrieved 2021, from https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/351196/11-university-connecticut.pdf#:~:text=Demonstration%20Autonomous%20Microshuttles%20Proposed%20Duration%20of%20the%20Demonstration,Share%20Amount%20Proposed%20%241%2C087%2C439%20Total%20Project%20Cost%20%248%2C324%2C445

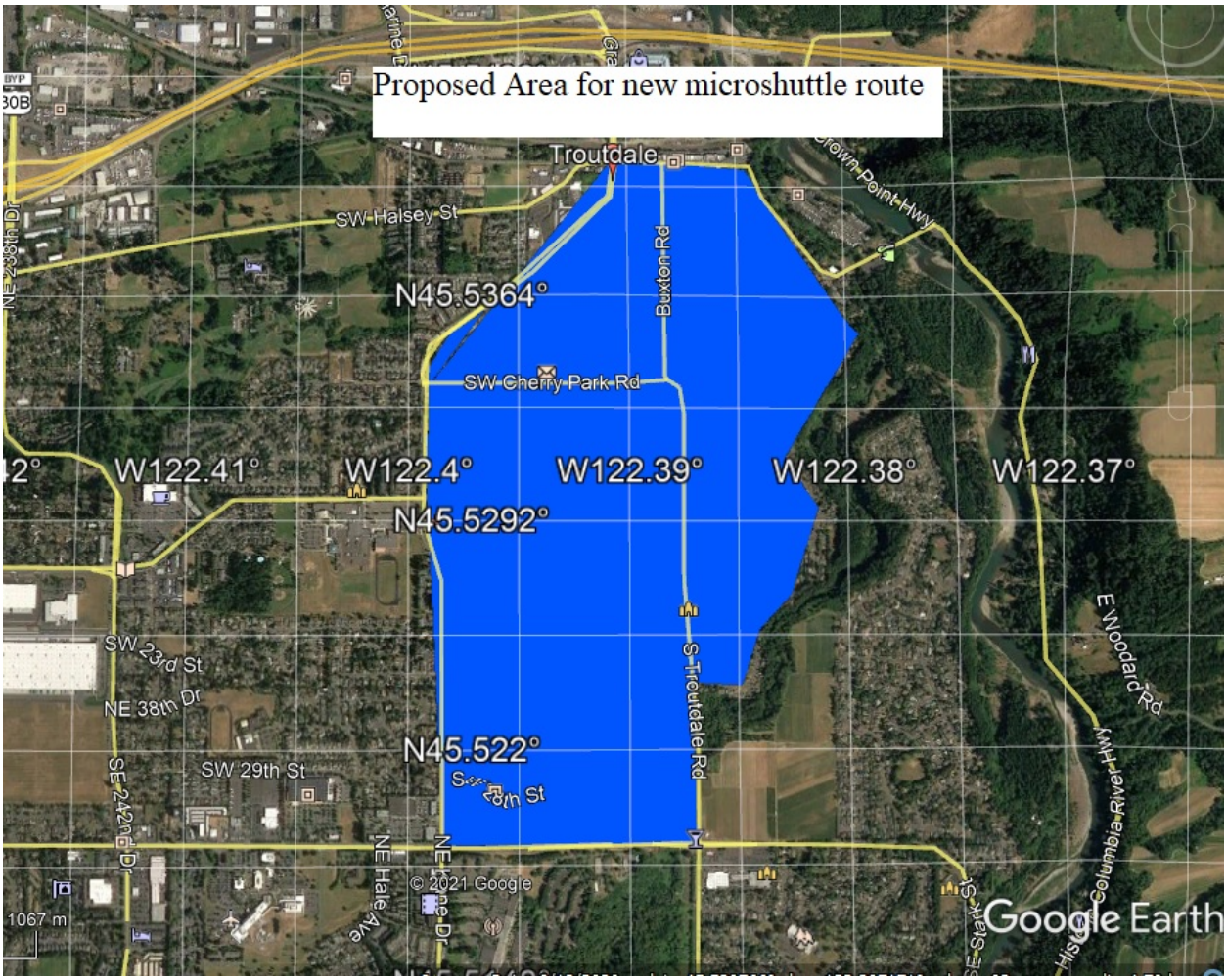
Korbay, M. (2017, June 17). Tri Delta Transit Launches Innovative On-Demand Ride Share Service. Retrieved 2021, from https://trimyride.com/media/2019-Tri%20MyRide-Press-Release.pdf

Montgomery, D. W. (2018, June). Public and Private Benefits of Autonomous Vehicles. Retrieved March, 2020, from https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/W.-David-Montgomery-Report-June-2018.pdf

Troutdale, Oregon. (2021). United States Census Bureau. www.census.gov/quickfacts/troutdalecityoregon

USA, D. (n.d.). Columbus, oh. Retrieved March 19, 2021, from https://datausa.io/profile/geo/columbus-oh/#:~:text=Columbus%2C%20OH%20is%20home%20to%20a%20population%20of,Columbus%2C%20OH%20than%20any%20other%20race%20or%20ethnicity.

Appendix A


Proposed Area for new microshuttle route
Troutdale
SW Halsey St
N45.5364°
Buxton Rd
SW Cherry Park Rd
W122.41°
W122.4°
W122.39°
W122.38°
W122.37°
N45.5292°
SW 23rd St
NE 38th Dr
SW 29th St
N45.522°
S Troutdale Rd
E Woodard Rd
SE 242nd Dr
NE Hale Ave
© 2021 Google
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Google Earth

Appendix D

Armon Ashoubi, Eva Bailey, Laura Scully
PPPM 399
Professor Brown
19 March 2021

SCYP: Trolley Group

Executive Summary

This project was done by three University of Oregon students. Our paper is a response to the following research questions: would a single streetcar or streetcar system be an efficient use of resources and a useful addition to the existing transit system of Troutdale? How would a streetcar system benefit the people of Troutdale, its tourism, and the character of the town? Are the costs of a streetcar system worth the added benefits to Troutdale?

We read various news articles and papers about trolleys in America, their history and their modern resurgence. To clarify, trolleys are also commonly referred to as streetcars, which is the term we use most often throughout this paper. After gaining an overall understanding of the subject we divided up the topics so that we could do more focused research. Our research is broken up into three sections: a section on the history and current status of streetcars in America, a section on the costs and funding of streetcar projects, and a section on Troutdale, its population, and its transit needs/goals.

We determined that streetcars were too costly, worked only in cities larger than Troutdale, and would not fulfill the town's transportation needs. Streetcars have many advantages, but they also have serious disadvantages. They require a significant financial commitment, they cannot run very quickly, and the routes are difficult to change once constructed. They do work in many cities, like Portland and Tucson, but those cities are much larger than Troutdale. In all of our research we did not see a trolley system implemented in any town as small as Troutdale. Alongside doing research we also took into consideration our own experiences taking streetcars and factored that into our recommendation to Troutdale.

We recommend that Troutdale work to expand their current transit options, namely their bus system, and focus on improving streets and walking paths. These options are cheaper, more flexible, and would be more appropriate for addressing the town's needs.

Introduction

We researched the historical use of streetcars in the United States, examined Troutdale's landscape and current transit options, and researched the costs associated with modern streetcars. Through our research, we assessed the costs and benefits of a project such as this in various scenarios. We want to clarify that, in the United States, there are several terms used when discussing trolleys. They are referred to as trolleys, trams, and streetcars, but they are all essentially the same thing. Throughout this paper we will typically call them streetcars because that has been the most common term we saw throughout or research. Streetcars are similar to light rail trains, but they do not have their own designated lanes the way that light rail cars typically do. The best general description we found is, "Streetcars are rail transit vehicles designed for local transportation, powered by electricity received from an overhead wire" (*What Is a Streetcar?*).

Streetcars were popular in the early 20th century but were phased out with automobile production in the 50s and 60s. However, they have been making a comeback in larger cities across the country. Proponents of streetcars have argued that streetcars promote economic

development (although that is a topic worthy of debate), are more durable than buses, and are environmentally friendly as they run on electricity.

Our suggestions will be based on other streetcar systems, their costs, and the context that makes them work. To clarify, we are focused on examining modern streetcars, not heritage trolleys, as they are not primarily used for transportation. They certainly can be used for transportation, and in some cities, they are, but heritage trolleys function primarily as tourist attractions.

Methods

Methods Used to Research Streetcar Background Information

In order to determine the historical and current status of streetcars in the US, we had to primarily draw from reports by the Transportation Research Board (TRB). These documents provide a historic understanding of streetcar systems, their emergence as a mode of transportation, and how these systems have developed in the US. By closely analyzing the presence of streetcars in Portland, OR, we were able to understand how their systems have manifested over time, and the various elements that have both harmed and contributed to their development. We chose to research the systems in these cities due to their extensive history of streetcars as a form of transportation. From examining these cities, we were also able to understand the implications of incorporating streetcar systems in locations with lower population density, such as Troutdale.

Methods Used to Research Costs

In order to understand the costs of creating a streetcar program we researched the initial costs, the annual maintenance and upkeep costs, and any other costs associated with having a modern streetcar system. We looked at reports from the Federal Department of Transportation, peer-reviewed reports and studies, and published records from several states. We decided to focus the bulk of our research on findings from before the COVID-19 pandemic because we felt that the pandemic was an anomaly and would not make sense to factor into an overall conclusion about the costs of these programs.

In looking at the expenses and funding of these programs we decided to do an in-depth examination of two existing programs (Portland, OR and Tucson, AZ) because we felt that it would be the best way to get a complete understanding of the entire funding and spending process for streetcar systems. We picked these two cities because the Portland streetcar program is considered to be the first of the second wave of streetcars in the US, and Tucson's was built fairly recently (opened in 2018). Ideally, we would have done an expenses breakdown/analysis of all the programs in the United States, but we felt that that was too ambitious for a project of this size, so we opted to just examine the two programs. Portland and Tucson have both published many detailed reports about their programs which allowed us to see a complete breakdown of the ways that their projects were funded.

Methods to Research Troutdale

To better understand Troutdale and its atmosphere, culture, and demographics, we needed to conduct research through the Census Bureau. We researched existing travel patterns, city attractions, main activities, and age groups living in Troutdale. We found most of this information through the Census and Troutdale's city website. We also researched Troutdale's

available Comprehensive Transportation Plan from 2014 to better understand the travel goals and specific needs for this community.

Findings

Findings from Research on Streetcar Background Information

From researching the historic and current status of streetcar systems in the US, we were able to thoroughly analyze their development as a mode of transportation. We took a close look at modern streetcar systems in Portland; where they are operating, what they are being used for, different forms of streetcars, and usage over time.

One early example of an electric streetcar system in the US existed just an hour south of Troutdale. Salem adopted electric streetcars in 1890, and "by 1899, trolleys were running north to Garden Road, east to the Asylum, and south to Yew Park and Salem Heights. These destinations were two to three miles from downtown" (*Thompson 2018*). There is a correlation between early streetcar networks and suburban expansion. Early streetcars were groundbreaking for their ability to transport people with a degree of efficiency that was previously unheard of. Their rise allowed people to commute to work from greater distances and access the social benefits of downtown areas without actually living there. The use of electric streetcars expanded significantly in the early 1900s, being most extensively used in cities such as San Francisco, Seattle, and Portland. However, it was the period between 1947-1951 where the use of trolley buses surged and showed potential to become a dominant mode of transportation. Unfortunately, the streetcar system didn't ever meet its potential. Thomas Mathoff elaborates on why streetcars were nearly abandoned as a system of transportation in the US: "Only if the overall capital and operating costs are approximately equal to or lower than that of diesel operation is it likely that more transit systems in North America will feel justified in undertaking electrification projects...As UMTA's Electric Trolley Bus Feasibility Study emphasized, 'Cost is by far the most significant barrier to trolley coach expansion'" (*34*). As emphasized by Matoff, the economic downside of the trolley bus is what prevented its widespread use and continues to deter cities from incorporating them into planning discussions. This is something that we paid close attention to in our research and was ultimately a critical factor in our decision to oppose the use of a streetcar system in Troutdale.

The trolley bus system in Portland has a thorough history of success that guided the reintroduction of streetcars to the city. Eleven years following the decline of the public transit system in the late 1950s, TriMet (Tri-County Metropolitan Transportation District of Oregon) was established to govern transportation services around the Portland metropolitan area. They were able to largely increase transit patronage, and "the call was heard for the introduction of electrified service on at least some of TriMet's principal urban lines. At the same time, Tri-Met was also embarking on analyses of possible regional, light rail lines, so that, far from being contrary to the direction of system development that had been established, trolley buses were viewed as a possible complement to a light rail operation" (*Mathoff 37*). The emergence of light rail operation opened the doors to a gradual revival of the streetcar system. This is evident in a number of US cities that currently operate transit systems. While streetcars vary from light rail in technicality, neither have any defining features that can differentiate them completely. For example, light rails often have factors such as dedicated lanes, off-street tracks, bigger vehicles, and multi-car trains that streetcars only sometimes have (*Malouff, 2015*). As seen in Figure 1 and 2, Tacoma's light rail system is identical to Portland's streetcar model, representing the modern

correlation between the two transit systems. For more information on the differences between streetcars and light rail see Figure A in the appendix.

Figure 1:

Portland Streetcar (*Malouff, Dan*)

Figure 2:

Tacoma Light Rail *(Malouff, Dan*)

Figure 3:

Portland Heritage Car (*Portland, OR*)

In July 2001, Portland reintroduced the first modern streetcar to the US. Similar to historic intentions of streetcar systems, the Portland Streetcar connects the city's attractive locations to the Central Business District. There are now three lines that strategically serve Portland's population, with over 55 million riders since 2001. The City of Portland made effective investments to develop their streetcar system, especially given their large population (as compared to Troutdale), and vast number of transit networking locations.

Streetcar fare is identical to bus or light rail fare, with a cost ranging from $1-$3 for the public to access. Portland's TriMet agency has integrated various transit options under the same system of collecting fares, called Hop, which has improved accessibility for the public. TriMet allows riders three fare options, a $2.50 ticket for 2.5 hours, a $5 day pass, or a $100 monthly pass. Fares are accepted on TriMet buses, light rail, streetcar, and the commuter buses that run to Washington (*Fares*). This type of fare system allows the streetcar program to integrate well into the existing public transit system.

Streetcars, like all types of public transportation, are subjected to the American with Disabilities Act. In all modern streetcars you can see the measures taken to be accommodating of people of disabilities. For example, the Portland streetcar has wheelchair ramps on all of their cars and their program states, "To help ensure access to City programs, services, and activities, the City of Portland reasonably: provides language translation and interpretation for limited English proficiency individuals; modifies policies and procedures; and, provides auxiliary aids, services and/or alternative formats to persons with disabilities" (*Accessibility*). These features appear to be widespread throughout the industry although heritage trolleys do not have many of these same services, most notably they lack wheelchair access.

Some cities currently operate trolleys that are replicas of vintage trolleys, at times even using the original cars that were in service prior to the 1950s. San Francisco represents the most famous example of heritage trolleys, with up to 20 vintage streetcars carrying passengers on a daily basis. The city of Portland has several heritage trolleys operating during a limited number of days in the year (Figure 3). Heritage trolleys tend to operate along the sides of larger streets, making them more of a feasible transit option for cities with larger populations, and substantial tourism, to consider. After reviewing the possibility of incorporating a heritage trolley system in Troutdale, we quickly came to the conclusion that it would be a poor transit investment for the city.

Findings from Research on Costs Associated with Streetcars

The main takeaway from our research into streetcar financing is that, overall, they are expensive projects that have significant costs (both fixed and recurring) that require a serious commitment from the government and taxpayers. While advocates of streetcars like to emphasize the ways that streetcars can have a positive economic impact on the community, they must be weighed against the costs. In our research we found that the most significant costs for these projects were construction, the initial costs of purchasing the track and cars, and labor. After the initial investments, the major recurring costs are labor. In the following sections we will breakdown what some programs have cost and how they were paid for.

As with buses, light rail, and other transportation options, streetcar projects can receive funding from several different sources. From our research we found that programs receive funding from the federal, state, and local government. They also receive revenue through ads that are displayed on and inside the streetcars, and they make money from fare collection, although not all programs within the United States require fare (*Bell*). The United States Department of Transportation has funded streetcar programs through a grant making program called Better Utilizing Investments to Leverage Development program (BUILD) that was previously known as the Transportation Investment Generating Economic Recovery program (TIGER). The BUILD/TIGER program has provided $9 billion since 2009 and in 2020 they provided $1 billion for 70 projects in 44 states (*About BUILD Grants*). Federal funding for streetcars has also been made available through the Department of Housing and Urban Development.

According to a report from USDOT, the Portland streetcar program has cost $251.4 million. Since 1999, the project has received $81.95 million in federal funding, $22.10 million in state funding, and $147.37 million in local funding (*Project Profile: Portland Streetcar*). The single largest funding source came from the Federal Small Starts program (a program of the Federal Transit Authority) that gave Portland $75 million in 2007, the first-time federal funding was given to a streetcar project (*Streetcar History*).

The Portland streetcar is operated as a joint effort by the city of Portland and TriMet. TriMet publishes annual reports on their adopted budget and Figure 4 is a table we made using information from the 2020 report that lists the streetcar budget from 2017-2020.

Figure 4:

Summary	FY 2017	FY 2018	FY 2019	FY 2020 (Adopted)
Personnel Services	$7,191,046	$7,657,745	$7,744,576	$8,088,061
Materials & Services	$7,526,249	$7,675,677	$8,841,740	$8,968,620
Total	$14,717,295	$15,333,422	$16,586,316	$17,056,681

Personnel services and materials and services make up roughly equal portions of the yearly budget. Notably, the budget has grown with the adopted budget for 2020 being $2,339,386 more than the budget for 2017. It is important to note that some aspects of streetcar maintenance and support appear to fall under different budgets, namely the rail maintenance budget, but it is not specified how much of that money goes towards streetcars and how much goes towards the MAX light rail. TriMet states in their report that the expected revenue from streetcars in 2020 would be $8.99 million *(Adopted Fiscal Year 2021 Budget*). The Portland streetcar's website states that for the 2019-2020 fiscal year their cost per revenue hour was $184, which was four dollars more than the target (*Ridership + Performance*).

The Tucson streetcar project, known as the Sun Link, required $209.2 million in funding. Voters approved of a $75 million plan that was funded by the Regional Transportation Authority (RTA). The Federal Transit Authority (FTA) matched the RTA's $75 million through a combination of grants and funds. Altogether, the Sun Link received $75 million from the federal government, $91.5 from local sources, and $45.7 from other sources (*History*). Figure 5 is a table we created that states the budget for the streetcar program from 2017-2020, with info gathered from the Tucson adopted budget of 2020 (*Prior year Budgets*).

Figure 5:

	Actual FY 17/18	Adopted FY 18/19	Estimated FY 18/19	Adopted FY 19/20
Character of Expenditures				
Services	$2,034,745	$1,816,180	$1,906,800	$1,859,700
Supplies	$185,209	$497,400	$411,300	$506,020
Contracted Labor	$1,871,739	$2,111,010	$2,165,710	$2,220,100
Program Total	**$4,091,693**	**$4,424,590**	**$4,483,810**	**$4,585,820**

Like Portland, the Sun Link budget has grown over the years, and although it is considerably less than Portland's budget, their proportions of labor expenses to non-labor expenses are similar.

It is clear from looking at these budgets that these projects, even after they are built, having significant ongoing costs. Streetcars require operators, mechanics, managers, safety inspectors, and other workers to ensure that the cars are running and running safely.

In 2013 the Congressional Research Service published a report that discussed the question, "Are Streetcars Cost Effective?". They found that costs for streetcar projects can vary

widely with costs-per-mile ranging from $10 million to $80 million. In comparing streetcars with BRT (bus rapid transit) and light rail they concluded that, "Operating costs, including such things as drivers' salaries, fuel, and track and vehicle maintenance, are difficult to compare among modes because of differing service characteristics. A Government Accountability Office (GAO) analysis of operational costs, for example, showed no consistent advantage for BRT or light rail. A comparison of operating costs of streetcar and bus service in seven cities found that costs per trip were higher for streetcars in only two cities. But measured by cost per passenger mile, streetcar operating costs were significantly higher than bus operating costs" (*Federal Support for Streetcars: Frequently Asked Questions*).

In general, reports indicate streetcars are a cheaper option than light rail but are more expensive than buses or other modes of public transportation *(Bell*). They can be a great option for cities that do not want to commit to light rail but are still interested in having some type of rail system as part of their public transportation. Because they are so expensive, there needs to be significant support from taxpayers and elected officials before a streetcar system can be considered.

Finding from Research on Troutdale

We have completed some preliminary research on Troutdale and the needs and goals of the community. To better understand how streetcars wouldn't be the best option for the goals and budgets necessary, we looked into the Census and recent comprehensive transportation plans. Troutdale has a population of approximately 16,100. The demographics are majority white, with 81% of the population identifying as such. According to the Census, the mean travel time to work for community members is approximately 30 minutes per commute (*Troutdale Census, Troutdale-Housing, Employment, Education*). The draw to outsiders visiting Troutdale is mostly tourism based, being just outside of a major metropolitan area like Portland. Much of the appeal of this area comes from the many hikes, parks, waterfalls, and river views surrounding the town according to Troutdale's website. They state that "Troutdale is privileged to have a wonderful park system that features parks and greenways ranging from the famous Glenn Otto Park on the banks of the Sandy River to numerous neighborhood parks sprinkled throughout the City" (*Troutdale: Parks and Greenways)*. Many find solace in these natural areas so close to downtown work centers. Additionally, Troutdale itself has a popular restaurant stretch in the main part of town, which aids in the appeal for people living here or stopping by (*Troutdale Restaurant List*). This draw for passerby puts Troutdale on the map for tourists and travelers. But for the people living in Troutdale, the town itself - with its integrated neighborhoods, family friendly parks, recreational attractions, and close by shopping centers - makes Troutdale a wonderful place to live (*Troutdale City Website)*.

According to Troutdale's Comprehensive Transportation System Plan from 2014, there are some goals that could be achieved and aided from having a streetcar system. However, even with the potential benefits, the costs and financial needs would make this system unreasonable for Troutdale specifically. To understand what Troutdale wants and needs, it is important to look at past transportation plans. Here are some of the transportation goals that Troutdale has expressed from 2014:

> **Goal 1**. Transportation facilities shall be designed and constructed in a manner which enhances the livability of Troutdale.

Goal 2. Provide a transportation system in Troutdale which is safe, reduces length of travel and limits congestion.

Goal 3. Provide a balanced, multi-modal transportation system and reduce the number of trips by single occupant vehicles.

Goal 4. Provide for efficient movement of goods.

Goal 5. Develop transportation facilities which are accessible to all members of the community.

Goal 6. Develop a transportation system that is consistent with the City's adopted comprehensive land use plan, and with the adopted plans of state, local and regional jurisdictions.

Goal 7. Establish a clear and objective set of transportation design and development regulations that addresses all elements of the city transportation system and promote access to and utilization of a multi-modal transportation system.

Goal 8. Protect the function of the I-84 Troutdale interchange and support the recommendations of the I-84 Troutdale Interchange Area Management Plan (IAMP).

Creating multimodal and accessible transportation options are very important aspects to Troutdale's transportation plan. Increasing efficiency and ease of use are also very important aspects that we will be addressing with our recommendations *(Comprehensive Transportation System Plan)*.

Our Recommendations to the City of Troutdale

We do not recommend that Troutdale implement a streetcar system in their town. Based on the extensive costs to build tracks, buy the streetcars, and the inflexible routes, we believe there are better options to improve inner/outer city transit. Other cities that have successful streetcar systems are much larger cities with bustling downtowns.

Our suggestion is to improve upon bus transit systems to maintain route flexibility and extent of travel availability. We feel that the goals expressed by Troutdale would be better suited for improvements on other projects that are less financially unstable. To improve upon neighborhood street speeds, livability, accessibility, and community/tourist growth, pedestrian/bike only streets are recommended. Having public bikes and walking/slow streets would increase the appeal for family-friendly neighborhoods and tourists in town. To increase access to utilities like the Outlet Mall, McMenamins' Edgefield, and other industries, bus systems are a more financially stable option. The costs for implementing new bus routes are cheaper, temporary, flexible, and increases access to more areas of town. Additionally, more buses could be added, increasing the route turnaround for increased and steady access to further parts of town. Bus routes would likely need to be run by TriMet.

To elaborate on "slow" streets, we have looked at which streets in Troutdale would best benefit from walkable and pedestrian focused transportation. "Slow" streets are roads that have either limited or no car access. These streets have wider sidewalks or are completely pedestrian/bike focused. Streets that lead to parks like Helen Althaus City Park (7th St) are perfect access points from main roads to extend the functionality and safety of public space.

Increasing the tourist aspect of Troutdale is an important goal, but streetcars are not the most financially reasonable option to increase tourism. There are other ways to increase the charm of Troutdale while making money back through lower upfront building costs. Adding charming and historically relevant designs to bike and bus systems would add a small-town draw to people coming into town. We are focused on improving the functionality of already existing innovative transportation systems rather than spending millions of dollars on trolleys.

Streetcar speeds are typically slower than bus speeds, decreasing their efficiency for longer trips around town (Brown). In order to have a system that is fast and reliable, Troutdale would likely need to purchase several streetcars which would further drive up the cost of the project. As riders of the Portland streetcar system, we feel that there are often few advantages to taking the Portland streetcar compared to walking or taking the bus. One member used to travel to work in downtown Portland via streetcar and during peak travel times it was often faster to simply walk. Because streetcars are in lanes with traffic, they cannot bypass an accident or congestion the way that light rail is often able to. Furthermore, unlike buses, they cannot decide to take alternate routes because they must stay on their fixed track.

Streetcars have not been proven to be a surefire success in the United States, and in many states, they have proven to be extremely expensive. Washington, D.C. spent millions on a project that only resulted in one line being built *(Laris*). We think that it would not be wise for Troutdale to take the gamble and invest in a program that has not proven to be totally successful, especially given the hefty price tag. Buses appear to be a cheaper and more reliable option that would likely have many of the same benefits as a streetcar.

When we considered the many people that visit Troutdale, people coming to shop at the Troutdale Outlet Mall or dine at local restaurants, we thought about the fact that they would have likely driven to town. These people are not likely to use a streetcar because they would already have a car with them. Therefore, the people using the streetcar would likely be people who live in Troutdale. However, as we learned in our research, Troutdale has a relatively small population and most people commute by car to work. Streetcars, because of their speed, are not ideal for commuting long distances so it would not be helpful for people looking to take public transportation to work. In cities with successful streetcar programs the stops are located in densely populated areas, like the downtown area of Portland. Troutdale simply does not have the density, and therefore should look toward other options to improve upon their public transportation goals.

Conclusion

Through our research on Troutdale, streetcars, and their costs and benefits, and considering our research questions, we do not recommend implementing a streetcar system in Troutdale. The costs of implementation are an immediate red flag, and we think that there are better ways for Troutdale to use their resources. To encourage residents and tourists to participate in public transportation, Troutdale should expand bus routes, put in place public bike programs, and create walkable/low-density streets. These are more cost-effective and flexible

designs than streetcar systems are able to provide, and which would create long-lasting, efficient, and commuter friendly travel for all.

Appendix

Figure A: Table describing some of the differences between light rail and streetcar (Malouff)

Factor	Light rail	Streetcar
Dedicated lanes	Often	Only sometimes
Off-street tracks	Often	Only sometimes
Bigger vehicles	Often	Only sometimes
Multi-car trains	Often	Only sometimes
Station size	Often big	Usually small
Route length	Often long	Usually short
Distance between stations	Often long	Usually short

Group Member Statement

Our project was broken up into sections and each member completed an equal amount of work. We had Zoom calls together consistently to break up the work and discuss what research we still needed to complete. Laura worked on researching and writing about the financial aspects of this project Eva worked on researching and writing about Troutdale, general background information on the town, and its needs. Armon worked on researching and writing about general trolley background information. We all helped each other with all the other sections. We worked well together and supported each other's best efforts throughout this drafting process.

Works Cited

"About BUILD Grants." U.S. Department of Transportation, www.transportation.gov/BUILDgrants/about.

"Accessibility." *Portland Streetcar*, portlandstreetcar.org/ride-guide/accessibility.

"Adopted Fiscal Year 2021 Budget." TriMet, trimet.org/budget/#:~:text=The%20FY2021%20Adopted%20Budget%20totals,funding%20of%20approximately%20%24126%20million.

Bell, Rhonda. "Understanding Streetcar Costs, Funding, Operations and Partnerships." Metro Magazine, 2 Aug. 2017, www.metro-magazine.com/10002957/understanding-streetcar-costs-funding-operations-and-partnerships.

Brown, Jeffrey. "The Modern Streetcar in the U.S.: An Examination of Its Ridership, Performance, and Function as a Public Transportation Mode." *Journal of Public Transportation*, vol. 16, no. 4, 2013, pp. 43–61., doi:10.5038/2375-0901.16.4.3.

City of Troutdale Transportation System Plan. Mar. 2014, https://www.troutdaleoregon.gov/sites/default/files/fileattachments/community_development/page/8451/final_tsp_03-04-2014.pdf.

"Fares." TriMet, trimet.org/fares/.

Federal Support for Streetcars: Frequently Asked Questions (R43464), Congressional Research Service. Prepared by William J. Mallet. 3 April. 2014.

"History." Sun Link - The Tucson Streetcar, www.sunlinkstreetcar.com/history.

"Home Page." *City of Troutdale, Oregon*, www.troutdaleoregon.gov/.

Laris, Michael. "How D.C. Spent $200 Million over a Decade on a Streetcar You Still Can't Ride." The Washington Post, WP Company, 5 Dec. 2015, www.washingtonpost.com/local/trafficandcommuting/how-dc-spent-200-million-over-a-decade-on-a-streetcar-you-still-cant-ride/2015/12/05/3c8a51c6-8d48-11e5-acff-673ae92ddd2b_story.html.

Malouff, Dan. "Is That a Streetcar or Light Rail? Here's How to Tell the Difference." *Greater Greater Washington*, 31 Jan. 2019, ggwash.org/view/70749/is-that-a-streetcar-or-light-rail-heres-how-to-tell-the-difference#:~:text=Light%20rail%20typically%20has%20bigger,Charlotte%20light%20rail.

Matoff, Thomas G. "The Trolley Bus and System Design." *Transportation Research Board Special Report* 200 (1983).

"Parks and Greenways." *City of Troutdale, Oregon*, www.troutdaleoregon.gov/publicworks/page/parks-and-greenways.

"Portland, OR." *APTA Streetcar and Heritage Trolley Site*, American Public Transportation Association, www.heritagetrolley.org/existPortland.htm.

"Prior Year Budgets." Official Website of the City of Tucson, www.tucsonaz.gov/finance/budget/prior-year-budgets.

"Project Profile: Portland Streetcar." U.S. Department of Transportation/Federal Highway Administration, www.fhwa.dot.gov/ipd/project_profiles/or_portland_streetcar.aspx#:~:text=As%20part%20of%20an%20innovative,Tax%20Increment%20Financing%20(TIF).

"Ridership + Performance." Portland Streetcar, www.portlandstreetcar.org/about-us/ridership-performance.

"Streetcar History." Portland Streetcar, portlandstreetcar.org/about-us/history.

Thompson, Richard. "Salem Streetcar System." *The Oregon Encyclopedia*, 17 Mar. 2018, www.oregonencyclopedia.org/articles/salem_streetcar_system/#.YDX1zBNKg0p.

Troutdale City, Oregon - Housing, Employment, Education, More. https://www.homearea.com/place/troutdale-city-oregon/4174850/. Accessed 24 Feb. 2021.

"Troutdale Restaurant List." *City of Troutdale, Oregon*, 2020, www.troutdaleoregon.gov/executive/page/troutdale-restaurant-list.

U.S. Census Bureau QuickFacts: Troutdale City, Oregon. https://www.census.gov/quickfacts/troutdalecityoregon. Accessed 24 Feb. 2021.

Appendix E

Cooper Foushee and Sudha Basu
February 1, 2021
PPPM 399
SCYP Draft

Troutdale Downtown Golf Cart Zone

Executive Summary:

For our Sustainable City Year Project (SCYP) we studied the feasibility and efficacy of installing a Golf Cart Zone in downtown Troutdale, OR. This was a challenging project to study as most places with golf cart zones are located in cities that tend to have warmer weather. For example, Ocean Springs and Pascagoula, Mississippi, both of which have successful golf cart zones and where average winter lows are just 64 degrees compared to Troutdale's winter average of 40 degrees. Despite this reality, there are a few case studies where golf cart zones are being utilized in climates more similar to what is commonplace in Troutdale. Ridgefield, WA, approved the use of golf carts in their downtown area in 2015 with the goal of increasing mobility for all citizens. The zone has been met with positive reviews for a multitude of reasons: creating more equitable transportation options, driving up foot traffic to nearby businesses, and giving the city a forward-thinking, innovative, and creative reputation. We propose that the city of Troutdale follow suit and create a golf cart zone which would set a precedent that more Northwestern cities could copy. Troutdale should extend the zone overtime to encapsulate nearby neighborhoods as a way to facilitate and foster the continued growth of golf cart use. In the meantime, we suggest the city designate a few slow corridors into the downtown zone such as Buxton road between SW Halsey St and SW Cherry Park Rd. The route should also extend to the west via SW Cherry Park Rd into the neighborhoods surrounding it. Paths dedicated to gold cart use should be built adjacent to roads to push growth in usage. Furthermore, the city should capitalize on its golf carts and create a "ride-share" style system where people can rent golf carts through an app from the city for however long they need it. Additionally, we propose that Troutdale transform 5-10 parking spaces downtown into gold cart parking with electric charging capabilities. We have located a few spots where golf cart rentals could be set up around the city.

Introduction:

Our specific golf cart outline is part of the larger Sustainable Cities Year Program (SCYP), with the general initiative to address notions of transportation and mobility in Troutdale, Oregon. Troutdale is a quaint city located outside of Portland and referred to as the 'gateway to the gorge'. Its 5.9 square miles hold around 16,000 residents but is perpetually expanding, partly as a result of FedEx and Amazon, which make up a substantial portion of the local economy[1]. As the population of Troutdale develops, questions around freedom and access to travel arise. The city experimented with an electric interurban service that connected Troutdate to Greshman, but it was eventually abandoned after a mere 20 years in 1927[2]. The main bus transit service to Troutdale today is serviced through the TriMet; a public agency that operates mass transit

[1] "About Troutdale"
[2] "Troutdale Oregon" (2021)

throughout the comprehensive Portland metropolitan area[3]. The TriMet was developed to service a large city population, and therefore is wide-ranging and not always focused on transportation needs within specific suburbs like Troutdale, but rather focuses on getting people into Portland. The size and organization of Troutdale a transportation plan more specifically oriented towards the city. Therefore, the task of this project was to develop creative and distinct transportation solutions to anticipate future social and economic growth in the city of Troutdale. Our solution, laid out in the following sections, is to allocate a golf cart zone in which the use of golf carts is approved as legitimate means of transportation. As we will discuss further, the specific demographics of the population of Troutdale make this a worthwhile investment. There are potential complications, such as the weather, budget, and technology.

Methods:

To better understand how a golf cart zone could be plausible in Troutdale we employed multiple methods to gather research on the town and how similar communities have managed golf carts on their streets. Firstly we researched real-world examples of how different cities around the United States instituted their golf cart zones and how those cities compare to Troutdale. We researched cities of similar populations and sizes.

Ridgefield, Washington:

Ridgefield, Washington is a good start as the city is similar to Troutdale in size, climate, and population. Ridgefield instituted their golf cart zone in the city back in June 2015 as part of a Multimodal Transportation Plan, which was a reasonably well-liked decision and has since grown even more popular.[4] At Ridgefield, their approach was to allow golf carts on all local streets except a few major-arterial roadways with high-speed limits and multiple travel lanes. Pictured below is a map of Ridgefield's golf cart zone.

[3] "About TriMet" (2018)

[4] VanceEditor, Ken.

Fig. 1 "Transportation."

The zone excludes some major roads, but still allows for connectivity around the city. Washington state allows cities or counties to establish a Golf Cart Zone where the vehicles can drive on any public roads with speed limits below 25 MPH. In contrast, Oregon, however, does not have a similar system in place. Rather, the state allows in accordance with ORS 810.070 the use of golf carts on highways adjacent to a golf course as a link between storage facilities, real estate, and the putting greens. This would be a challenge for Troutdale because unlike Ridgefield it would be new territory in the state of Oregon, that isn't to say it cannot be done, however.

Peachtree City, Georgia:

Peachtree, Georgia, has a population of roughly 35,000 and has allowed golf carts on their streets since the 1960s. The city has become known for its extensive golf cart path network which is roughly 100 miles long. Over 11,000 households in the city own golf carts as the infrastructure is built to facilitate them.[5] It is evident that to foster the continued growth of golf cart use, Troutdale would need to build for them over time. That is because the most successful golf cart communities all design the towns with golf cart use in mind. For example, in Peachtree, many roads are bordered with paths dedicated to golf carts and with ample marked road crossings that the carts can safely utilize. Below are design guidelines used in the city of Peachtree to safely move around the many golf carts in the community.

[5] "Peachtree City, Georgia."

Fig. 2. "Fayette County Master Path Plan."

Facilitating the golf carts is a very important component of setting up a golf cart zone. Ridgefield has laid out a few examples of their ideal version of a comfortable roadway suited for golf carts and NEVs (Neighborhood Electric Vehicles). Some potential facility types include paths or trails that would grant golf carts the ability to travel further distances without needing to use major roadways. These paths typically connect destinations between local streets with special paths suitable for golf carts and other moving vehicles such as bikes/electric scooters. Another type of facility mentioned in Ridgefield's Multimodal Transportation Plan is special on-street lanes that can only be used by golf carts, bicycles, NEVs, and electric scooters. These types of lanes would provide a safe dedicated space for motorized vehicles other than cars, which can boost usage among the town similar to how bicycle infrastructure boosts bike use.[6] Wayfinding is another key component to the Golf Cart Zone as it is very important to alert cars that they will be sharing the road with golf carts, which as we have come to learn can be quite uncommon.

Good wayfinding offers golf carts and NEVs travel information with directions, distances, etc., in addition to making certain that these vehicles do not leave the designated golf cart zone. As for parking, it appears that most cities allow golf carts to park in a normal vehicle parking spot which allows for maximum flexibility.

Fig. 3. "CDD 7 Supervisor Calling for Golf-Cart Path Striping in His District."

Findings:

After an in-depth analysis of the golf cart zones in Ridgefield, Washington and Peachtree, Georgia, as well as other considerations of demographics and legal implementation, we have come to a few conclusions. Firstly, residents typically enjoy golf cart

[6] Araripe, Evelyn.

zones once they are installed[7]. One resident even explained a scenario in which his family relocated to Peachtree for work, and rented out a golf cart to transport him and his family for a week, and that the experience was very enjoyable for both him and his kids[8]. Secondly, we found that golf carts promote equity and offer accessibility. As discussed above, for residents who struggle to operate a car, whether, from old age, disability, or just preference, golf carts are often more appealing.

Additionally, good infrastructure leads to higher rates of usage. Again in Peachtree, the exclusive golf cart lanes offer an efficient and exciting opportunity for transportation. The success of the infrastructure in this city is apparent through the image of McIntosh High School displayed in our presentation[9]. Furthermore, effective infrastructure can also address safety concerns. By having a separate lane designated for golf carts, the city reduces the higher risk of crashes between cars and carts (see figure 3). From our findings, it seems that it would be a challenge to set up a golf cart zone in Troutdale, but it is certainly not impossible.

We also discovered that cities with Golf Cart Zones tend to be suburban with populations similar to that of Troutdale. This points to greater success in the case of Troutdale as it is a suburb with many low-speed roads and relatively low population density. Some cities that are also similar to Troutdale that have their Golf Cart Zones include Ocean Springs and Pascagoula Mississippi. For comparison, Ocean springs has nearly an identical population (approximately 17,000) to that of Troutdale (roughly 16,500). Pascagoula, MS also has a similar number of residents sitting at around 21,809 people. This is important to note as it appears that suburbs are better equipped to allow golf carts on their roads as they tend to have less traffic than heavier-populated cities. Ocean Springs and Pascagoula allowed golf carts on their roads in May 2018 for a mixture of reasons including environmental-friendliness and tourism.[10] Golf carts tend to cost less than a typical car and require less gasoline which helps the environment in regards to air pollution. Not to mention that in many communities with golf carts, there is an enhanced social aspect because the carts are open and slower than cars, so passengers can talk to one another as they move along. Ultimately, we believe that in many regards opening up the downtown zone of Troutdale to golf carts benefits all different types of people and creates an inviting space for the community to enjoy.

Recommendations:

As previously stated there are many components to introducing a new mode of transportation onto the local streets of Troutdale, but the challenge is nonetheless exciting and possible with the correct implementation. The first major aspect needing consideration is of course what streets could facilitate the use of golf carts in a meaningful manner. We have identified a few corridors that are potential candidates for mixed vehicle and golf cart use. Below is a highlighted zone (in red) that serves as a good starting point to trial the use of golf carts.

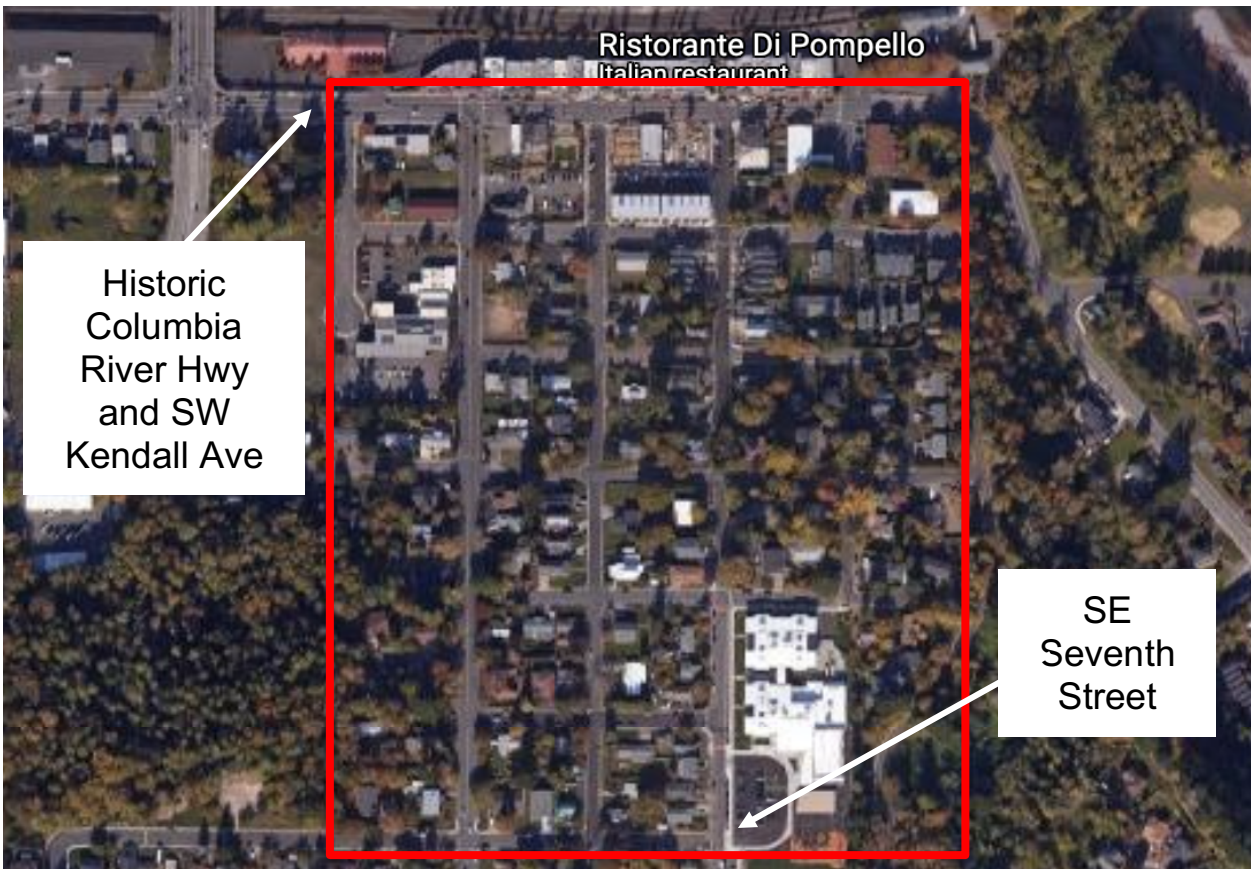
The highlighted zone stretches from the northwestern tip of W Historic Columbia River Highway where it intersects with SW Kendall Ave. To the south, it ends at SE Seventh Street.

[7] "Peachtree City Golf Carts"

[8] "Peachtree City Golf Carts"

[9] "Peachtree City Virtual Golf Cart Tour"

[10] Price, Ray.



This zone is ideal to test what works in regards to a golf cart zone as it has roads with relatively low-speed limits (about 25 MPH on nearly all of the roads) as well as direct access to the downtown central shops boarding E Historic Columbia River Highway. Research shows that the average golf cart travels at a maximum speed of just under 20 MPH[11] which poses many limitations as to where they can be used. Due to the nature of the chosen streets, however, it is feasible to allow carts on these roads. Because our selected area largely encapsulates the downtown area of Troutdale, it can be expected that many people will be utilizing many forms of transportation in addition to cars, such as walking, biking, and so on. The Troutdale 2020-2040 Town Center Plan proposes various methods by which the city can promote walking, biking and other modes of transportation in the downtown space, as well as the various benefits that these methods provide[12].

We believe that this is the best space to initially incorporate a golf cart zone, as it is one of the most welcoming spaces in the city for non-car methods of transportation. The golf carts can be used easily to maneuver from neighborhoods to the downtown area, and then either be parked or driven to the various shops that make up downtown Troutdale. The nature of golf carts would allow for this space to transform into a more resident-oriented area, and would likely be favorable to both business owners and residents. It is easier to see the spaces around while in a golf cart than in a car, which would likely increase traffic for the businesses downtown. A

[11] "Federal Motor Vehicle Safety Standards; Low Speed Vehicles." (2005)

[12] "Town Center Plan." (2021)

community in Arlington County, VA that implemented a rideshare golf cart program reported an uptick in traffic for restaurants and shops in the area as a result of the convenience of golf cart use[13]. This is also an additional benefit for demographics that struggle to travel easily, such as older people, young kids, and disabled individuals. In Oregon, anyone over 16 years old with a valid driver's license or an Oregon Department of Motor Vehicles Golf Cart Permit can drive the golf cart[14].

Troutdale must clearly mark the roads in and out of this designated zone with signage that states that golf carts will be on the roadway so that cars can be on the lookout. Furthermore, signs stating where golf carts are and are not allowed to be driving must be obvious and easy to understand. Signage can be designed in a way that makes it apparent and bright (see figure 6). Collisions are an obvious concern so delineating clear expectations and enforcement of golf cart usage is of the utmost importance. We recommend notifying residents of the plans to implement a golf cart program before its institution, as well as throughout the entire process. This will be an important aspect to encouraging usage and making the expectations clear. It will also be important to clearly demarcate the roads that golf carts are allowed and not allowed on. With the initial implementation of our golf cart program, street usage is the most ideal. For the long-term, we can

Fig. 4. Golf Cart Zone Sign from Cheap Yard Signs "Golf Cart Zone Funny novelty Xing Sign" *Amazon*

develop a plan to construct a pathway infrastructure aside from streets. This would allow for a more extensive implementation across the city, as golf carts would not be limited to areas that have slower speed limits. Additionally, it would provide infrastructure for people biking or using scooters.

Many cities that have included golf carts in their transportation plans have also implemented a rideshare program. We recommend that Troutdale also institutes a similar program to capitalize on the profitability of the development. While we recognize some households will opt towards private ownership, public ownership programs have been effective throughout the country. This has been seen most often with bicycles and e-scooters, however, we propose expanding the common usage to include golf carts. Arlington County offers its residents a rideshare program with electric golf carts made by Polaris, and we recommend implementing many similar elements[15]. Troutdale should purchase 20-30 golf carts available for public usage, and develop an app that can be used to operate them. The city could look into partnering with a company like Polaris and Yamaha that mass produce golf carts to minimize costs. For a small charge, residents can rent golf carts for a specific period of the day, we recommend no more than 6 hours and propose an additional fee beyond that to ensure they will be available to anyone who

[13] "This Luxury Golf Cart is Getting People Around Arlington for Free." (2017)

[14] Rose, Tyler (2019)

[15] "This Luxury Golf Cart is Getting People Around Arlington for Free." (2017)

is interested. The fee would go towards covering the initial cost of the vehicles. We recommend purchasing electric golf carts, as research shows gas-powered carts are

Fig. 5. "Troutdale."

generally more expensive. Additionally, gas-powered golf carts run on traditional fuel and produce carbon dioxide emissions, which somewhat minimizes the climate-conscious benefits of golf carts over cars. Electric golf carts don't produce fumes or emissions and have rechargeable batteries that don't harm the environment. Additionally, electric carts produce much less noise emission than gas-powered type, which would likely address a potential concern of residents[16]. While the city obviously can't regulate which form residents choose to purchase, by owning and offering only electric golf carts the city avoids the responsibility of providing gas and addresses many potential concerns. The application for the ride-share program can be developed in a user-friendly way to reduce stress and ensure ease of use. An interactive map in the app can detail the limits of the golf cart zone, clearly demarcate areas for driving, and include popular locations in the city. We also recommend creating a section that notifies residents of open golf carts for use, as well as available parking spaces.

Parking is one of the most important and simultaneously controversial aspects of any motorized transportation service. As explained above, cities that have implemented golf cart zones allow them to park in spaces traditionally designated for cars. To encourage usage, we also recommend allocating specific spaces for golf carts only. Similar to the strategies used for electric vehicles that have certain spaces allocated for parking and charging, designating certain spaces for golf cars will promote ridership. The city would also need to purchase charging stations, which could be put in these parking spaces. These spaces make the most sense in the downtown portion of the zone, where the community would be most likely to take the golf carts and park them. Because golf carts are smaller, downtown car spaces can easily be transformed to offer more parking spaces for golf carts. Standard parking spaces in Troutdale are 9 feet wide by 18 feet long[17] and the average golf cart is 4 feet wide by 8 feet long[18]. Therefore, four golf carts occupy the area of one standard parking space. We suggest Troutdale change 5-10 car parking spaces into golf cart parking to facilitate the 20-30 rental carts and have additional capacity for people who own a personal golf cart. This offers an opportunity for more effective land use and higher occupancy parking. Again, this benefits both the residents and business owners downtown, as residents would likely be encouraged to spend considerable time at places

[16] This section draws on Rogers, Matt (2020)

[17] "Troutdale Development Code." (2017)

[18] "How Wide is a Golf Cart for All Brands." (2019)

around the area while their cart charges. These charging stations could also be available to privately owned golf carts, however, for a nominal fee. While this is still favorable for those who have their own carts, as it provides a convenient space for charging, it still encourages participation in the public rideshare program as parking is offered for free.

Fig. 6. Golf Cart Parking from "Solar Golf Carts Charging Station." *Go Solar KB,* https://gosolarkb.com/ChargingStations.html

Challenges:

To ensure a comprehensive encapsulation of our research and proposals, we found it important to include the potential challenges to implementing a golf cart program. One of the most prominent is complications due to the weather. Oregon is renowned for its extensive rainy and wet season, and Troutdale especially is known for its windy conditions due to its proximity to the Columbia River Gorge. Golf cart usage is seen most usually in the sun-belt and areas of the country that have warmer and drier climates. For this reason, not many golf cart initiatives have been proposed in the Pacific Northwest or the east coast. This is due to the naturally open frame construction, which is not favorable to wind, rain, and cold weather. However, as discussed above, cities like Ridgefield, Washington that have comparable, if not a wetter climate, to Troutdale have implemented golf cart zones, meaning it is not unfeasible. Troutdale experiences warm and dry summers, meaning usage during those times would be very enjoyable.

Additionally, rain comes in waves and Oregon does see the occasional sunny spring or fall day. Golf carts can also be designed to withstand minimal rain (see figure 8). Most come with wipers and rain covers can be purchased for a nominal charge.

Fig. 7. "Doorworks Golf Cart Enclosures."

Another potential challenge we anticipate is creating a culture oriented towards golf-cart use. Golf cart culture is currently characterized by upper-class white populations, and usually in neighborhoods that include a golf course. An important challenge to overcome will be neutralizing criticism and achieving acceptance from the public. With the perpetually rising rate of car usage, many will likely be resistant to adding vehicles that have greatly reduced speed limits and take up parking spaces. However, we believe this can be overcome with clear and concise communication, as well as demarcated limits for golf cart use. In our proposal, we are hoping to reshape these ideals to naturalize golf carts as a daily-use vehicle. Short trips, visiting a neighbor's house, grocery trips, and going downtown can all be accomplished with golf carts. To accomplish this, we propose various methods such as public outreach, partnerships with community organizations and subsidized trips.

Conclusion:

Golf carts are a convenient method of transportation with strong social and economic implications for mobility in Troutdale. Some of the key benefits include addressing equity concerns, degradation of the climate, promoting business profitability, encouraging social interactions, and access for disabled individuals. Among our comprehensive list of recommendations, some of the most indispensable are clear signage, a rideshare program with electric-powered golf carts, and demarcated parking and charging stations downtown. Complications with the weather, budgeting, and technology among others will likely arise and provide obstacles for success, however can be resolved through strategy, planning and experience. Golf Cart Zones have a real potential for growth and we believe would be a positive development in Troutdale.

Group Member Contribution Statements:

Both of us contributed equal amounts of work to this project. Cooper did the Executive Summary, Methods, Findings, and a small portion of the Recommendations. Sudha wrote the Introduction and the majority of the Recommendations (pages 5-8). Furthermore, we both did a great amount of research on the topic and how to implement a golf cart zone logistically.

Works Cited

"About TriMet." *TriMet*, 2018, https://trimet.org/about/index.htm

"About Troutdale." *Troutdale Oregon,* https://www.troutdaleoregon.gov/about

Araripe, Evelyn. "How to Increase the Use of Bikes in Cities." Believe Earth, 9 Mar. 2018, believe.earth/en/how-to-increase-the-use-of-bikes-in-cities/.

"CDD 7 Supervisor Calling for Golf-Cart Path Striping in His District." *Villages*, 12 Jan. 2015, www.villages-news.com/2015/01/12/cdd-7-supervisor-calling-golf-cart-path-striping-district/.

"Fayette County Master Path Plan." *Fayettecountyga*, www.fayettecountyga.gov/transportation-planning/pdf/Appendix-D-Path-Design-Guidelines.pdf.

"Federal Motor Vehicle Safety Standards; Low Speed Vehicles." *Federal Register,* 17 August 2005, https://www.federalregister.gov/documents/2005/08/17/05-16323/federal-motor-vehicle-safety-standards-low-speed-vehicles

"How Wide is a Golf Cart for All Brands." *Golf Cart Report,* June 2019, https://www.golfcartreport.com/how-wide-is-a-golf-cart/#:~:text=The%20average%20golf%20cart%20is,standard%202%20seat%20golf%20cart.

"Peachtree City, Georgia." *Wikipedia*, Wikimedia Foundation, 16 Feb. 2021, en.wikipedia.org/wiki/Peachtree_City,_Georgia.

"Peachtree City Golf Carts." *Trip Advisor*, https://www.tripadvisor.com/Attraction_Review-g35179-d8428254-Reviews-or5-Peachtree_City_Golf_Cars-Peachtree_City_Georgia.html#REVIEWS

"Peachtree City Virtual Golf Cart Tour." *Peachtree City, Georgia*, 8 April 2020, https://visitpeachtreecity.com/

Price, Ray. "Ocean Springs Seeing Positive Impact of Golf Cart Ordinance." *Https://Www.wlox.com*, 15 Sept. 2019, www.wlox.com/2019/09/15/ocean-springs-golf-cart-ordinance-go/.

Rogers, Matt. "Electric Golf Cart vs. Gas Golf Cart." *RMI Golf Carts,* 4 January 2020, https://www.rmigolfcarts.com/blogs/news/electric-golf-cart-vs-gas-golf-cart

Rose, Tyler. "Oregon Golf Cart and LSV Laws." *Golf Carts,* 26 Nov 2019, https://golfcarts.org/oregon-golf-cart-and-lsv-laws/#:~:text=According%20to%20Oregon%20Golf%20Cart,Nighttime%20driving%20is%20not%20permitted.

"This Luxury Golf Cart is Getting People Around Arlington for Free." *DCist*, 11 July 2017, https://dcist.com/story/17/07/11/sprynt-launches-free-rides-in-what/

"Town Center Plan." *Troutdale Oregon,* 9 March 2021, https://www.troutdaleoregon.gov/commdev/page/town-center-plan

"Transportation." City of Ridgefield, 30 Sept. 2020, ridgefieldwa.us/government/transportation/.

"Troutdale Development Code." *Troutdale Oregon,* 11 April 2017, www.troutdale.info

"Troutdale." *Eleete Real Estate*, www.eleeterealestate.com/blog/neighborhoods/troutdale/.

"Troutdale Oregon." *Wikipedia, The Free Encyclopedia*, 23 February 2021, https://en.wikipedia.org/w/index.php?title=Special:CiteThisPage&page=Troutdale%2C_Oregon&id=1008544605&wpFormIdentifier=titleform#MLA_style

VanceEditor, Ken. "Ridgefield Establishes Golf Cart Zone." *The Reflector*, 10 June 2015, www.thereflector.com/news/article_8ac5c106-0e25-11e5-baa3-eb85df631045.html.

Appendix F

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Brown
PPPM 399
19 March 2021

SCYP Project Golf Carts - Final Draft

Executive Summary

Our main finding while conducting research for this project was the impact a golf cart implementation program would have on the environment due to reduced emissions (golf carts are often zero-emission vehicles or electric and solar-assisted). This pilot program could also save residents money, because on average, electric vehicles cost less to maintain and operate than vehicles that run on gasoline. Carts also use less energy and don't produce nearly as much greenhouse gas emissions, and therefore our group believes it is the better option for protecting the environment and more specifically the atmosphere. Additionally, our group found that successful golf cart communities already exist in cities not only in the United States but Toronto, Canada as well with similar climates to Troutdale. Our group also addresses the cost of basic golf cart models ranging to larger family models with more seats to meet the needs of different sized groups of people. Overall, our project dives into various intersections of cart operational, financial, and environmental costs as well as the possible benefits to the community.

For our project, we focused on implementing a golf cart pilot program in Troutdale, Oregon. This program would improve air quality, reduce congestion and improve parking, and bring more tourists to stimulate economic development. Our recommendations for the city are to run a large scale advertising campaign, including a promotional event at Edgefield golf course, to promote the use of golf carts, reduce speed limits to allow golf carts to drive on major roads and adjust parking regulations to allow for golf cart operation in the downtown area of the city. Part of this advertising campaign could also provide educational opportunities to the community for safe golf cart operation, proper maintenance, and driving regulations as they apply to golf carts on the road. The city could also create golf cart hubs at transit centers to reduce first and last mile problems that surround the Amazon warehouse.

Introduction

The city of Troutdale is looking to increase mobility options that are not only cost-efficient and environmentally conscious but also add to the aesthetic and uniqueness of their city's community. Our project goal includes investigating and introducing the idea of implementing golf carts to the city in a meaningful way that ultimately adds to the overall quality of resident's lives. Golf carts hold a variety of possibilities for mobility options for not only able-bodied citizens but for older residents, those with disabilities, and those engaging in short-trip travel within the local area. Additionally, another task of our project was to consider certain environmental factors that may make this project more beneficial for the community. In this

project, our group took into consideration operational costs of these carts (also sometimes categorized as lower-speed vehicles (LSV's)), whether the climate of the Pacific Northwest provides weather opportunities for carts and LSV's, and if there is a possibility for Edgefield Golf Course or local hotels to partner with the city to house and offer golf carts to their customers.

Methods

Throughout our research on the topic of golf carts, our group utilized a variety of research studies and case studies as well as government websites to create a solid baseline of general information and research on golf carts and LSV's. In addition to these research methods, our group also made use of maps and figures which help readers gain a better understanding and perspective of areas within the City of Troutdale as well as highlight the variety of differences between electric and gas golf carts. Lastly, some statistical data was employed to quantify the older demographic of residents in the city of Troutdale to analyze the benefits golf carts might provide for them specifically. Our group used these research methods in order to analyze generally how feasible it would be for the city of Troutdale to implement a golf cart service for public use. Our group analyzed our data by first defining what our goals of this project were, and then afterward we individually collected quantitative data and research before we were able to visualize the results and draw our related conclusions from the data we individually collected.

Findings

Weather

An initial concern our group had about the feasibility of a program like this stemmed from weather concerns. When most people are asked to envision a golf cart centered community, it's likely they'll imagine it is somewhere in the Sunbelt region or in other warm, dry regions such as Palm Desert, California (Grabar). Since Oregon is moderately rainy for half the year on average, we were concerned that people would not be inclined to make the investment in something they might only get regular use out of for half of the year. However, there have been a number of successful programs implemented in cities with similar climates to Oregon, such as Denver and Colorado Springs. Like Oregon, both these cities have mild summers and rainy winters. According to Active Adult Living, there are at least 35 golf cart centered communities within Colorado. These have received high scores on community ranking websites and seem to be appreciated by those who live there. They provide great access to outdoor recreation such as golfing and providing access to biking/walking trails and parks around the city. Additionally, parks could transform their parking lot structures to adapt to the change in mode of vehicle as other cities have.

Environment

One finding of this research project included the benefits to the environment and the atmosphere. In a Toronto, Canada study of whether electric and solar-assisted golf carts were

financially and environmentally beneficial, researchers state, “electric and solar-assisted electric carts have a clear advantage over gas carts when energy consumption is compared. Gas carts were found to have a daily fuel consumption of 1.13 L, which contains about 10 kWh of energy. The daily energy consumption of the electric carts was 3.3 kWh. This demonstrates the overall energy inefficiency of gas versus electric motors. The gas motor consumes about 3 times more energy than the electric motor to accomplish the same work” (Toronto and Region Conservation, 7). This reveals the immense difference between the energy usage of these various cart models. Similar to energy use, total output of emissions was also found in this study to be lower for electric, solar-assisted vehicles. The study writes, “the gas carts produced much higher emissions than either the standard electric or solar-assisted electric carts...the GHG emissions associated with operating an electric golf cart charged during off-peak hours is no more than 595 gCO2e per day...the gas carts use about 1.13L gasoline per day...daily emissions for the gas carts are approximately 2,656 gCO2e. Therefore the emissions from the gas carts are about 4.5 times higher than those of the electric carts” (Toronto and Region Conservation, 10). This finding in the study discloses that electric carts have a clear advantage over gas carts when it comes to overall emissions output.

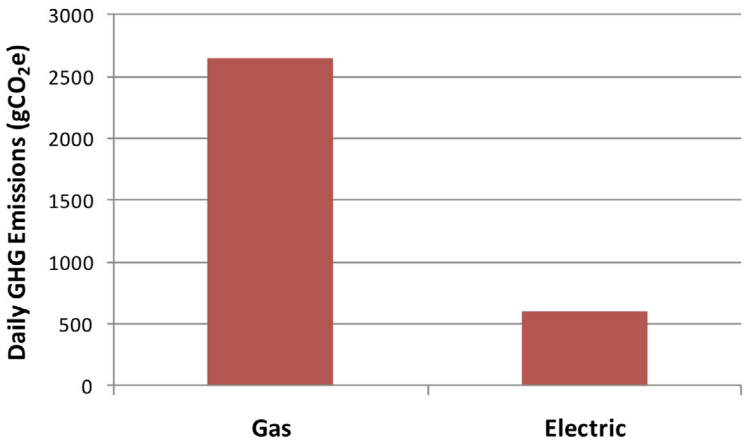


Figure 4.4: Daily green house gas emissions (gCO_2e) for gas and electric golf carts.

Figure 1 (source: Toronto Region Conservation)

As shown on **Figure 1** above from the Toronto study, gas-powered low-speed vehicles have a much higher rate of using total daily greenhouse gas emissions. As our society continues to accept and address the climate emergency facing us, it will be imperative to have cities respond in a timely manner through innovative, environmentally-conscious solutions that create accessibility and mobility for its residents without adding to the burden on our natural landscapes. In addition, another way in which the city could save in costs includes plugging the carts in to charge after off-peak hours begin (which would look like charging the carts at 9pm and by use of a timer), “plugging in the carts after off-peak begins (e.g. at 9 PM, by use of a timer) would reduce charging costs and emissions. If these lower emissions during off peak hours are taken into account, electric carts would produce even fewer emissions than the above

calculations suggest" (Toronto and Region Conservation, 11). This quote from the study reveals merely another way in which the City of Troutdale could optimize electric lower-speed vehicle batteries and reduce overall emissions. Lastly, when comparing the fuel cost between gas and electric carts, the Toronto study found that fuel costs for gas-powered carts are 6.5 times higher than the costs for electric carts (Toronto and Region Conservation, 12). Overall, this passage from the study highlights the promise of electric and solar energy in the coming decades. Our group believes that this information can additionally be used to deliberate the overall costs in comparison to gas carts (which could potentially be higher due to fuel costs and overall battery quality and maintenance).

Benefits to Older Residents

Another imperative finding within our research included the benefits of carts for the older demographic of residents within the city of Troutdale. The research states in their study on policy and design considerations of lower-speed vehicles in community transport networks, "the National Household Travel Survey reported nearly 70,000 light electric vehicles and golf carts in operation on the nation's roadways in 2009...Americans took more than 180 million trips and drove nearly 65 million miles on these vehicles that year. Forty-five percent of these trips were taken by persons age 65 and older, a surprisingly high number given that older adults comprise just 13 percent of the U.S. population and account for 12 percent of all trips in the United States" (AARP Public Policy Institute, 4). This reflects the fact that there is a large demographic of older residents in the U.S. that may require or desire alternatives in mobility options. Carts have a budding opportunity to be an innovative alternative to those engaging in local and short-trip travel. Further, 9% of Troutdale's total population are in the category of a "senior" (age 65+) who reside in the city of Troutdale (World Population Review). This leads our group to wonder how many of these residents would benefit from access to this service. Further, AARP reveals that more than three-quarters (76%) of all American vehicle trips are 10 miles or less and the utilization of LSV's for a larger majority of these shorter trips could potentially play a critical role in reducing America's greenhouse gas emissions (AARP Public Policy Institute, 4). Our group found that there is a growing demand of electric lower-speed vehicles and carts in transportation planning and sustainable development within cities.

Setbacks

While there are many promising environmental and financial benefits to potentially implementing a golf cart service in a meaningful way into the city of Troutdale, it is also important to consider the setbacks. For one, falls from golf carts and overturns were the leading cause of injury (47.2 percent) (AARP Public Policy Institute, 6). Further, another study by the Center of Injury Sciences at the University of Alabama found that "the report determined that there are approximately 1,000 golf cart injuries in the United States each month. The highest injury rates were observed in males aged 10–19 and those over 80. Head trauma and fractures were the most common injuries" (AARP Public Policy Institute, 6). Our group believes that this is critical information for the city of Troutdale to consider, since road safety should additionally

be a key priority of any city across the nation. While this may pose as a potential barrier in implementing LSV's into more mainstream use on the roads, AARP argues, "numerous states and communities are grappling with legislative proposals that aim to address the increasing use of LSVs and golf carts for everyday travel on local streets and paths. Safety considerations need to play a more central role in the design of the transportation networks that will accommodate these vehicles and in the regulation of their use" (AARP). This displays some promise in a change in legislation regarding LSV's. AARP also adds, "...AARP's Public Policy Institute provides policy makers and law enforcement officials with recommendations that address public education, licensing, registration and insurance, vehicle safety features, enforcement, and data collection. The authors offer city planners design recommendations for ways to accommodate these types of vehicles along streets and paths, and across intersections (AARP). Our group finds that these recommendations put forth by AARP Public Policy Institute are of utmost importance to examine in an effort to move forward with golf cart and LSV services within the City of Troutdale. Recommendations that our group believes should take priority in addressing are public education/data collection via trial run, vehicle safety features, and enforcement.

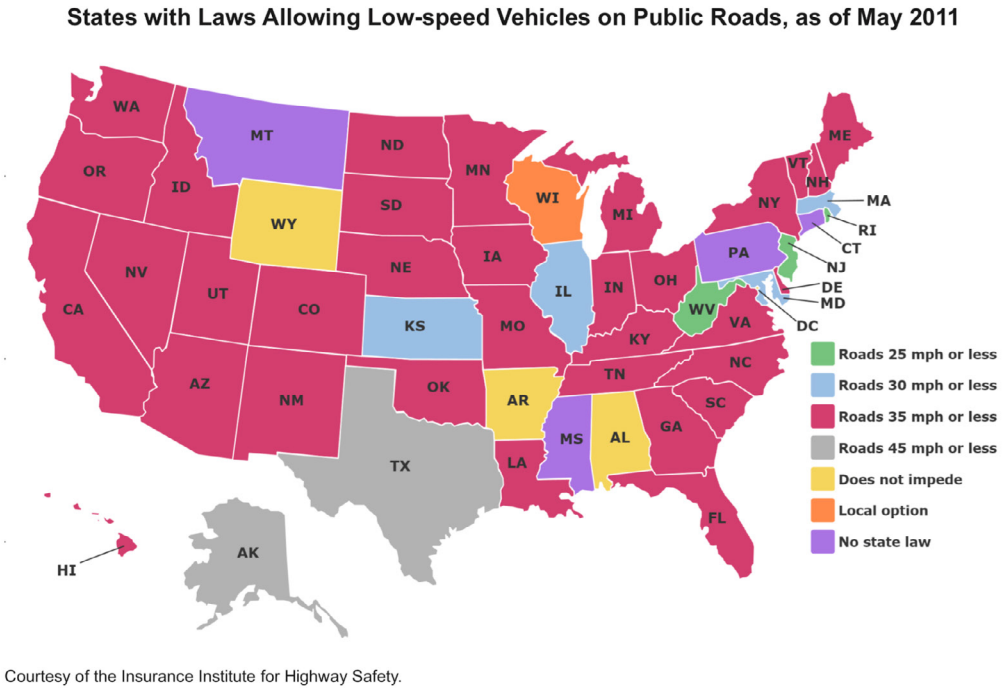


Figure 2 (Source: AARP Public Policy Institute)

Looking at **Figure 2** above, provided by the AARP Public Policy Institute, we observe the various laws across the United States regarding LSV's on public roads (as of 2011). This map reveals that across the nation there is at least a conversation happening regarding what is possible (and what the limits are) to regulating LSV's and carts on the roads. While golf carts and LSV's are not technically defined as the same vehicle in legislation, and there are some minor differences, this map offers hope that one day with proper consideration and regulation,

carts could have legislation similar to that of LSV's as displayed in this figure. Some of the main differences between LSV's and carts as described by AARP Public Policy Institute includes size, carrying capacity, speed, and suspension/maneuverability. Additionally, LSV's have more safety features such as windshields, side view mirrors, seatbelts, and lights (AARP Public Policy Institute, 2). Overall, this figure left our group wondering if there are ways to improve carts in a meaningful way that brings them closer to LSV standards to ensure the safety of the public who would choose to engage with this mode of transportation as well as increase the probability that legislation could be written to include carts in a meaningful way within our communities.

Pricing

We looked at a range of various golf carts on the market for this pilot program. Ultimately we wanted a healthy mix of golf carts in the fleet to cater to single and couple riders, as well as a small fleet of larger golf carts to accommodate families and larger groups. We recommend a pilot program of 20 golf carts. 80% of the fleet wwe are recommending the city buy will be 2 seater golf carts which is a total of (16) that average a price of $5,000 which include lights, extra road safety features, and storage baskets in the back. The remaining 20% will be 6 seater Golf carts which is a total of (4) that the average price is $11,000. This includes storage, added safety features, and to ensure it is road legal. This pilot program will come out to a cost estimated around $125,000. Other ancillary concerns and considerations include, building a protective area that is secured, maintenance and upkeep, managing expenses, employee cost, overhead cost, licensing, and fees.

Recommendations

Through our research period we came up with a number of recommendations for the city of Troutdale to implement. First and foremost, we believe that LSV and golf cart transportation is feasible in Troutdale and that it could bring a number of positive changes to the community and for the environment. We also have several ideas of how the city could introduce golf carts into the community without it being a jarring change and making it interactive.

In terms of safety, we recommend to lower the speed limit of 3-4 roads surrounding the downtown district of Troutdale such as Halsey Street, 257th Dr, and South Troutdale Road. The maximum allowed speed for a golf cart is 35 mph so we recommend lowering the speed limit below or at 35 mph to ensure proper safety for the electric golf carts. We also recommend increased signage for safety and guidance for the golf carts. Low cost or free charging is recommended. We also recommend the city set up designated areas for parking of the golf carts. This could help alleviate some of the curbside parking issues since golf carts are much more compact. We also recommend that these areas be free to park your golf carts as an incentive. We also recommend if there is road capacity in and around town drives, to designate a lane solely to golf carts such as bikes that have their own designated lane. Lastly we would recommend that these pick-up and drop off sites of the golf carts be accessible from the street. We plan on

showing this reduction in speed through signage alerting the drivers of the presence of golf carts and to share the road as well as the reduction in miles per hour.

One idea we had to introduce the golf carts into the Troutdale community was to utilize Edgefield by offering golf cart tours of the grounds and facility and piloting a rental program. This would be a popular attraction for both locals and people from out of town and would stimulate Troutdale's economy as well. Edgefield would be a good location to implement a pilot program since it's such a well-known venue and beautiful facility. Additionally, since there's a golf course on the grounds already, it's really the perfect location in Troutdale. If the pilot program is a success, this type of program could also be implemented at other neighboring golf courses as well. This would be a way for residents to try out the new form of transportation without making the considerable investment in their own golf cart. Additionally, if the pilot program is a success, it could be expanded to a rental program that allows customers to test drive golf carts for a period of time to consider if they'd like to purchase their own cart.

We'd also recommend placing golf cart rental or shuttle systems at major transit centers within Troutdale to aid in the first mile/last mile dilemma that the city is facing. This would be extremely beneficial to Amazon workers who might be commuting from nearby suburbs via a bus route. It could also attract tourists to the downtown area and serve as a means of micro-transportation for visitors and tourists. The golf cart could replace people's daily vehicle trips, such as getting groceries and shopping. Partnering with Amazon or Edgefield could also be a way for the city to reduce the initial investment cost ($125,000) if either business would be willing to partially sponsor the pilot program.

There's also an endless number of promotional events that the city could collaborate on with local organizations to introduce the change to the community. There could be a local golf tournament where the winner receives their own cart. There could be booths at farmers markets to provide information about owning golf carts, golf cart safety and maintenance from experts. Schools and community centers could host an array of golf cart centered games and activities for kids and families. This could include guided rides through the city's parks with paved paths, golf cart races, make-shift mini-golf and so on. Another idea the city could consider would be creating an advertising campaign for the golf carts and run promotional videos and commercials on local television stations. We recommend that through public education and awareness of golf carts, a promotional video would fit nicely to educate certain demographics (such as teenages who are new to the roads) of people who may need extra guidance in operating this sort of vehicle. There's really no limit to the way golf carts can be promoted and marketed to the city, the more creative the better, and the more engaging to the public, the more aware and conscious residents will be of sharing the road.

Conclusion

A golf cart pilot program would be beneficial to the city of Troutdale. There have been other successful golf cart communities established around the country that have been transformational. It would reduce pollution (noise and emissions), benefit the older population

and could elevate the first/last mile problem surrounding the Amazon Distribution Center. Although the initial investment from the city would be quite large, there's multiple potential sponsorship opportunities worth looking into. There's a number of ways to generate excitement around this potential change and answer the community's concerns.

Appendices

1. Case Study on golf carts and lower-speed vehicles in Avalon, California
https://www.fybr.com/wp-content/uploads/2016/03/Fybr_CaseStudy_Avalon_AWS_.pdf

2. Multiple case study reports on the differences between golf carts and LSV's as well as existing state and federal regulations on them (The Villages, Florida; Peachtree City, Georgia; Western Riverside County, California; and Linton, Indiana)
https://www.aarp.org/home-garden/transportation/info-09-2011/insight-54.html

3. Golf carts as alternative transport for senior citizens, persons with disabilities, and others
https://trid.trb.org/view/646978

4. Policy and design considerations for accommodating lower-speed vehicles and golf carts in community transportation networks. This pdf is full of helpful information between the differences between carts, LSV's, and NEV's (neighborhood electric vehicles) and automobiles. Additionally, the study compares the advantages and disadvantages of LSV's and carts versus automobiles and breaks it down into helpful figures (page 4).
https://assets.aarp.org/rgcenter/ppi/liv-com/insight54.pdf

5. An article discussing the relatively increasing popualarity of golf cart usage across the country from Atlanta suburbs to Palm Springs, Florida as well as some of the challenges. Additionally cart utilization is mentioned in Coachella Valley, California.
https://www.bloomberg.com/news/articles/2015-09-21/the-neighborhood-electric-vehicle-revolution
6. An article on the popularity of golf carts in the sunbelt regions.
https://www.bloomberg.com/news/articles/2015-09-21/the-neighborhood-electric-vehicle-revolution

References

Evaluation of Solar-Assisted, Electric and Gas Golf Carts. (2010). Retrieved 21 February 2021, from https://sustainabletechnologies.ca/app/uploads/2013/01/SAEGC-FINAL-2010.pdf

Grabar, H. (2015, September 15). Bloomberg.com. Retrieved February 22, 2021, from https://www.bloomberg.com/news/articles/2015-09-21/the-neighborhood-electric-vehicle-revolution

Lynott, J., Poncy, A., & Twaddell, H. (2011). Accommodating Low-Speed Vehicles and Golf Carts in Community Transport... Retrieved 21 February 2021, from https://www.aarp.org/home-garden/transportation/info-09-2011/insight-54.html

Poncy, A., Twaddell, H., & Lyncott, J. (2011). Policy and Design Considerations for Accommodating Low-Speed Vehicles and Golf Carts in Community Transportation Networks. Retrieved 21 February 2021, from https://assets.aarp.org/rgcenter/ppi/liv-com/insight54.pdf

Troutdale, Oregon Population 2021 (Demographics, Maps, Graphs). (2021). Retrieved 21 February 2021, from https://worldpopulationreview.com/us-cities/troutdale-or-population

Appendix G

Electric Micro Mobility: City of Troutdale

By Alyson Oross, Julia Anderson, and Tsukasa Okada

Executive Summary

This plan will outline recommendations we have for Troutdale, Oregon in order to improve and modernize their standing transportation systems and also potential new systems that would benefit their community for years to come. With Troutdale's main concerns being in maintaining safety, increasing sustainability, and expanding equity, we have formulated some recommendations to present to the City of Troutdale that address these three fundamental focuses. Throughout our research, we focused on two main options: electric scooters and electric bike share programs. Ultimately, we found that it would be most beneficial to Troutdale if a bike share program were introduced into their transportation planning processes.

Bicycles are more common and accessible and are also more efficient when it comes to commuting to work or going from neighborhoods to the downtown area than typical bicycles. Electric scooters have been found more effective in high-density urban areas, such as Portland or San Francisco. Because Troutdale has hills, electric bicycles are likely to be beneficial and engage community members to try a car-free trip. The downtown area of Troutdale has bike lane infrastructure which will be helpful to implement a bike share program. We can assess speed limits as well to ensure the safety of potential riders. Deciding on the location of the bike share docks will likely be the most challenging task. Because Troutdale emphasizes equity as a main goal, it will be important to ensure equal access to the stations including: price and locations. This project would also address the goal of mitigating climate change by encouraging alternative and active forms of transportation. In order to ensure success, it will be essential to connect with community members to determine how to make them feel safe and encourage them to use this new form of transit.

Introduction

Our task is to assess electronic micro mobility as an option for expanding transportation options for the city of Troutdale. The City of Troutdale is home to roughly 16,000 people. Located about 30 minutes outside of Portland, Troutdale is a lively city of only 6 square miles. It is on the banks of the Sandy River and Columbia River, providing beautiful views and many outdoor activities. Troutdale's main planning priorities include: climate change, safety, and equity. Throughout this report we address how each of these priorities are compatible with a micro

mobility plan. Many cities around the world have begun enacting bike share and electric scooter programs. Some of these examples are right here in the state of Oregon, while others are across the country, or even abroad. We used a variety of different methods for our research and were sure to evaluate both of the main options, e-scooters and e-bikes.

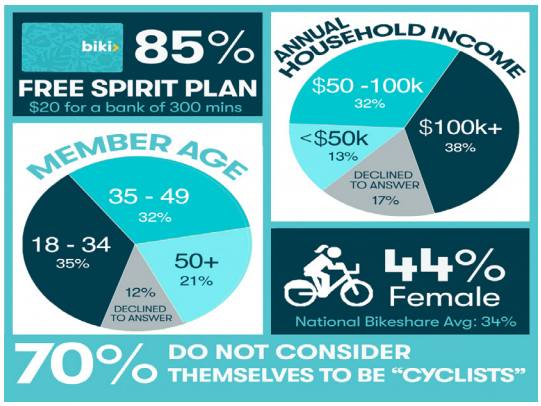
Methods

For our research we decided to focus primarily on electric bike and scooter sharing programs in the U.S. and abroad to determine what would be the best option for the City of Troutdale. As a team we each researched different cities with e-bike and e-scooter programs. These cities ranged from within the U.S to Spain and varied in program type and city size and population. We used Google and Google Scholar for our preliminary research. We analyzed our data by reading literature on how these programs worked in the cities they operate in and then comparing it to how they would look in Troutdale.

Findings

Bike Share:

We researched bike share programs in different cities around the world in order to analyze the effects bike share programs have had on different communities big and small. Our findings are included below.



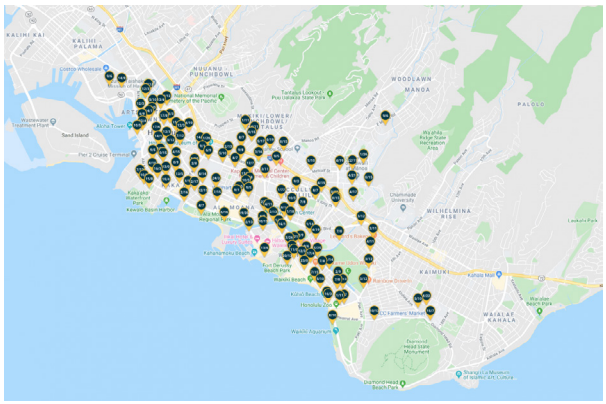
Waikiki, Hawaii

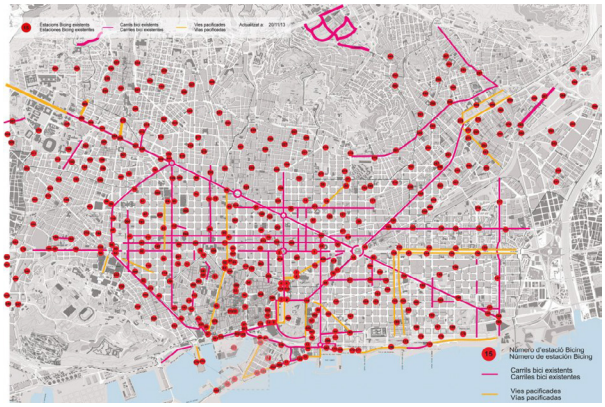
In Waikiki, the bike share program called Biki has expanded and spread dramatically throughout the city since its launch in 2017. Waikiki is a part of the city of Honolulu and has a population of roughly 25,000 people. The program is widely utilized by both citizens and tourists. Currently, there are 1,300 bikes and 130 bike stations installed, and the program is a success. In 2019 Hawaii Magazine explored the results of the bike share in Honolulu. Biki stated they had just about 1.38 million riders which was a 22% increase in ridership since their 2018 report. 68% of those riders were residents of Waikiki utilizing the bikes to commute to work or just run errands. In Waikiki, parking lots are few and far between. Less parking lots allows there to be space for other types of transportation planning such as bikes. Kelsey Colpitts, marketing and communications director at Biki states in the interview, “We have introduced new programs such as Biki Social Rides—a free ride series for residents 50-plus, Biki Bicycling Basics safety and education workshops, and an Access Program for income-qualifying residents" (Hawaii Magazine, 2020). The first step to creating a successful bike share program is educating your residents. Biki has done an excellent job of this,

which is why their bike share program is so successful and provides equity for every resident and tourist.

Barcelona, Spain

Barcelona, Spain has been using a bike share program since 2007. This city is home to more than 1.6 million residents who heavily rely on bicycle transportation. Barcelona's bike share program called "Bicing" has become an essential form of transportation throughout the city. Barcelona has had many years to perfect and expand their bike share program, and they have done just that. As of 2014, there are 6,000 bikes and 420 bike stations in the city, and the program had 28,000 riders a day. It is only fair to infer that these numbers have grown extensively since the 2014 report. It is also important to note that "Bicing" is only available to local residents and not tourists. Riders have a personal rider card that is shipped to their house, it is not lendable or transferable. They have created this system solely for residents of Barcelona and consider it to be used as a form of public transportation not as a recreational activity. The reason for this is to keep bicycle rental shops in business, as tourists will go to them if they would like to enjoy the opportunity to ride a bike around the city. In order to utilize "Bicing" throughout the city, users can download their app that shows them bike availability, CO2 they've saved by riding, their calories burned, and even if they have placed their bike back correctly. "Bicing"'s sole purpose is to support the residents of Barcelona in their everyday travel while simultaneously saving the planet. This is how Barcelona keeps up their reputation as the #1 biking city in the Mediteranean.

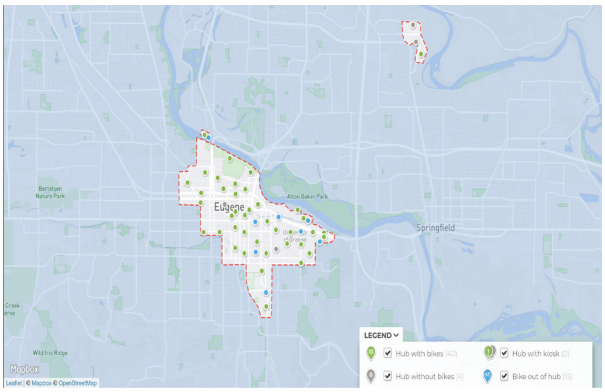




Eugene, OR

In April of 2018, Eugene launched a Bike Share program called PeaceHealth that has become an integral part of the community. With 41 stations currently housing over 300 bikes across the University of Oregon campus and the downtown Eugene area, users have found the bike share program to be a great asset to the community. The program is funded by a 3 year, $900,000 sponsorship from PeaceHealth, a $200,000 contribution from Associated Students of the University of Oregon (ASUO), and a grant from Oregon Transportation Commission. In the first

year, users rode over 210,000 miles. This included anyone from young college students to senior citizens. Bicycling gives people an opportunity to get outside while also providing a valuable form of transportation, which helps reduce the number of motorized vehicles on the road. PeaceHealth's evaluation at the year anniversary of the program stated that the presence of the PeaceHealth bikes prevented more than 181,177 pounds of carbon gases from being released into the atmosphere (Peacehealth.org, 2019). The bike stations are also strategically placed around Eugene in locations such as Valley River Center, Lane Events Center, and even across town at the Sacred Heart Medical Center at RiverBend. The locations make it easily accessible for riders to embark on a ride and disembark at locations all over town, making it convenient and reliable for potential riders. Another aspect that makes the bikes easily accessible is the price. A student, faculty, or staff can ride 15 minutes for free per day and then it costs 10 cents per minute after that. There is also a monthly subscription option at $5 a month which includes 60 minutes of riding per day. Any other rider pays $1 for 15 minutes and 10 cents per any minute after that and a monthly subscription option priced at $15 a month including 60 minutes of riding per day. This University of Oregon discount encourages students, faculty, and staff to use active transportation when commuting to campus. In order to hold riders accountable for responsible bicycle parking, they are charged $1 if they park a bike outside a hub and receive $1 credit if they park it back at any hub. Chief executive of PeaceHealth Oregon, Mary Kingston, states "PeaceHealth Rides is a signature program that supports health, the environment and access to affordable transportation -- Many local residents have come to rely on the community's bike-share system to get to work or school, and residents and visitors enjoy exploring our city on these bikes."



Aspen, CO

Zagster, Social Bikes, and WE-cycle are organizations that specialize in e-bikes, e-scooters, and bike share programs. They have proven to be successful and beneficial in a wide range of cities from Washington D.C to smaller cities such as College Park, Minnesota. College Park has a population of about 30,000, so it is still much bigger than Troutdale. However, the mayor discusses how bike share has been very cost-effective and beneficial to the community, because of its lower cost "Plain Jane" bikes and bike racks that are cheaper to build and easier to move (Zagster). This makes them more desirable for a city trying out bike share, because they can track ridership through the bike GPS system and use that data to easily move the bike racks to better locations. Additionally, there have been even smaller cities with successful bike share programs like Aspen, Colorado, which has a population of only about 7,000 people.WE-Cycle is the bike share company operating in Aspen that has free accounts that include free 30 minute

rides. They currently have over 40 bike stations and 240 bikes (WE-cycle). This example demonstrates that bike share programs can be effective at any population size, no matter how small. In 2020, WE-cycle updated their bike share to include e-bikes at their Aspen and Basalt locations and had over 20 riders on the first day (Sackariason, 2020). Additionally they have shown 47% of ridership replaced car trips in 2019. This aligns with the goals of addressing climate change through transportation planning.

Concerns

One main problem that cities face when implementing bike share programs into their communities is the issue that people tend to leave bikes outside of the designated locations, creating obstacles on sidewalks for pedestrians and mobility device users. Abandoned bikes are a safety issue because they can get in the way of a pedestrian's path, which is especially problematic for people in wheelchairs or other similar devices. Heidi Grover discussed the issues with bikes parked incorrectly in an article for the Seattle Times. Grover states, "In the first three months of [2019], SDOT found that about 14% of bike-share bikes checked by city staff were creating an obstacle that could be hazardous to people who are visually impaired or use a wheelchair" (Grover, 2019). The article stresses the need for accountability among riders. Abandoned bikes can be hazardous, because they create a further roadblock for people who already may struggle to safely get around city sidewalks. They have even been cited to fall on top of someone using a wheelchair (Grover, 2019). In Singapore, they have come up with an innovative way to reduce the issue of abandoned bikes as a barrier for pedestrians. The Singapore bike share company,"oBike", initiated a point system for users as an incentive for riders to park bikes responsibly in their designated locations (Choo, 2017). This arrangement works based on a point system where riders who park a bike in a non designated parking area have 20 points deducted from their account and those who report a misparked bike will have 3 points added to their account. Once a user's account hits 0 points, they will no longer be able to use the service. This system encourages responsible riding for users in order to create a safe space for not only themselves and other bike riders, but also pedestrians who wish to use sidewalks as well.

Electric Scooters:

Recently electric scooters have been a new mode of transportation introduced into cities like Eugene, Oregon and Fort Pierce, Florida. Our research explores the effect electric scooters could have on cities with tight knit communities like Troutdale, Oregon. Our findings are included below.

Eugene, OR

In Eugene, OR the city council approved a pilot program for electric scooters with some restrictions in 2020. Rightfully so, there was some concern about safety in the event scooters were to be implemented into the transportation planning process. Per Oregon state law, e-scooters are not permitted to exceed a speed of 15 miles per hour. Aside from this, the council decided to reduce vehicle speed in residential areas from 25 to 20 miles per hour (Griggs, 2020). This amendment creates a safer environment for vehicle drivers as well as micro mobility users because studies have shown crashes tend to be reduced when the speed limit is lower. It also means that different modes of transportation will not be travelling at vastly different speeds in the same area. Eugene is home to the University of Oregon, making the city abundant with young people, many of whom do not own cars. This is one of the many reasons that an e-scooter program could potentially be so successful in the heart of Eugene. If the city wants to tackle emissions from transportation and reduce traffic collisions, electric scooters could help them be one step closer to these goals (Rose, 2020).

Fort Pierce, FL

In Fort Pierce, Florida, an electric scooter program was introduced into the community in 2019. The city already had a bike share program and was looking to expand their transportation options to e-scooters. People in Fort Pierce primarily use e-scooters for transit in addition to recreational activity. To ensure rider and pedestrian safety, the city developed rider zones and no ride zones, which has created a safer environment for both drivers and pedestrians (All Things Treasure Coast, 2019). The city also included specific areas where you have to dock the scooters after use and uses a GPS system to track and enforce these rules. This also works to avoid abandoned scooters in unsafe locations, such as the middle of the sidewalk or along the curb designated for vehicle parking. However, while labeled by some as a “small town,” the city of Fort Pierce actually has a population of 45,000 people. Other successful examples of e-scooter programs are in urban areas such as Portland and San Francisco. Therefore, we have concluded that electric scooters would be more suitable for more densely populated areas than Troutdale.

Recommendations

After conducting our research we concluded that implementing a bike share program in the City of Troutdale would be beneficial to transit users. Because the population of Troutdale is relatively small, a bike share program would likely be more efficient than a scooter program.

Electric scooters are more likely to be seen in higher density, urban areas. However, some of the lessons and findings would still be helpful to implement in an e-bike share program. For example, decreasing the speed limit in residential areas would increase safety and may increase ridership if people feel more safe and comfortable taking a bike. Additionally, electric bikes are becoming more popular, especially given the COVID-19 pandemic. In fact, “e-bikes sales have soared by 70 percent or more each month since the pandemic began, according to industry statistics” (Reynolds, 2020). Electric bikes allow you to go further distances faster, while still providing a work out, a great compromise between an e-scooters an a typical bicycle.

Stations placed strategically throughout the city, especially in and near highly populated neighborhoods could benefit the working class immensely. As of 2019, 74% of the Troutdale population reported they were in the civilian labor force and the mean travel time to work was 29 minutes (Troutdale Census, 2019). We feel that because a large percent of the population goes to work, it would be more practical to implement a bike share program in Troutdale because e-bikes are more efficient and reliable when it comes to longer distance travel than regular bikes. Also, placing stations in the downtown area could potentially help decrease congestion and parking issues and increase trips to downtown businesses, because electric bikes can be used for leisure and recreation as well as commuting to and from work. In addition to this, the residents of Troutdale are likely to be more comfortable with the option of riding a bicycle than an electric scooter because scooters are just making their way into the microbility transportation Whereas, bicycles are much more common. According to a 2015 study by the Breakaway Research Group, “34% or about 103.7 million Americans (ages 3 and older) rode a bike in the last year” (Breakaway Research Group, 11). Of that, 32% rode a bike for recreation and 15% rode a break for transportation. Additionally, the most common destinations for bike travel were to and from social events and run errands. Among Americans (ages 18 and older) who said that they hadn't ridden in the past year, only 12% said that they had never ridden a bicycle (Breakaway Research Group, 13). Most people have ridden a bike in their life, and the electric bikes only start when you are peddling which also increases the feeling of control and safety. Electric bikes would also be accessible to all ages, because it does not take as much effort to ride as a typical bike.

Additional ideas for this program include putting a station at the Amazon warehouse to help solve the issue of the first and last mile and give people the convenient option to take a bike into work with no hassle of having to store it. If Amazon wanted to encourage this, they could also offer some sort of incentive or rewards program. Another incentive for increasing ridership could be having a rider benefit program. For example, every ride is 10 points. Once a rider hits 200 points, they get a free 15 minute ride. However, your points can be taken from you if you leave the bike in an area where it is not permitted or could potentially be a hazard. Because leaving bikes in inappropriate locations would likely be a problem, enforcing a punishment such as a fee for people who don’t park their bicycle back at a station could be a direct incentive to prevent this. Finally, we recommend also creating stations at transit stops to help solve the issue of the

first and last mile at the Amazon warehouse and other locations. Then, people would be able to arrive at a station and take an e-bike to their actual destination, creating a way for micro mobility to compliment their current transportation system. Also, providing stations at locations like the Beaver Creek Canyon Trail will encourage using the bikes for recreation as well as transportation. Placing a station at the Holiday Inn or other hotels would also encourage non-residents of Troutdale to make use of their new convenient bike share program.

In conclusion, we recommend that the city of Troutdale implement an e-bike share program. We believe that a program such as WE-cycle would be an excellent way to meet Troutdale's planning goals. Bike share programs encourage active transportation and can help reduce emissions. For example, the bike share program, Hubway, in Boston demonstrated a carbon offset of 150 tons per year. Furthermore, they can reduce overall driving like in Minneapolis where bike share members reduced driving trips by 52% (Zagster).

Based on our research of many different cities, we have concluded that a bike share program in Troutdale could be transformational to the way the city operates. While we recognize the issues that may arise in implementing the bike share program, the benefits far outway the costs. We have only talked about a miniscule amount of cities who are finding success in bike share programs. Bike share offers residents and also tourists a way to get active, get to work, run errands, and sometimes a way to just enjoy the sunshine. There are many outdoor recreation areas to take advantage of like Sunrise Park, Sandee Palisades Park, and Beaver Creek Canyon Trailhead. We have analyzed both major forms of electric micro mobility: electric scooters and electric bikes and concluded that an electric bike share program would be a great fit for The City of Troutdale. We envision bike share in working in tandem with the current transit system to help people commute, whether in Troutdale or in surrounding cities. Electric micro mobility can have a huge impact on climate change by reducing emissions and vehicle miles travelled. Additionally, if the right methods are out in places such as reducing speed limits and managing abandoned bikes, bike share is relatively safe for all community members. Finally, it can assist in creating a more equitable city by helping lower-income folks gain access to necessary resources through affordable transportation.

Group Member Contribution Statement

Alyson: Eugene example, Conclusion, editing

Tsukasa: Waikiki and Barcelona examples

Julia: Executive Summary, Introduction, Methods, Concerns, Electric Scooters, Recommendations

Works Cited

Allen, Kevin, et al. “Hawai‘i's Bike Sharing Program, Biki, Continues to Grow in 2020.” *Hawaii Magazine*, 24 Jan. 2021, www.hawaiimagazine.com/hawaiis-bike-sharing-program-biki-continues-to-grow-in-2020/.

“Bicing in Barcelona: How Does It Work? All the Information.” *Stay in Barcelona*, Stay Barcelona Apartments, 27 July 2020, staybarcelonaapartments.com/blog/bicing-barcelona-information/.

Breakaway Research Group. “U.S. Bicycling Participation Benchmarking Study Report.” *Breakaway Research Group*, PeopleForBikes, Mar. 2015, b.3cdn.net/bikes/7b69b6010056525bce_ijm6vs5q1.pdf.

Choo, Cynthia. “Bike-Sharing Company Launches Points System to Deter Bad Behaviour.” *TODAYonline*, TODAY, 12 Apr. 2017, www.todayonline.com/singapore/bike-sharing-company-obike-introduces-scoring-system-deter-indiscriminate-parking.

“City of Fort Pierce Announces E-Scooter Share Launch.” *AllThingsTreasureCoast.com*, AllThingsTreasureCoast.com, 13 Sept. 2019, www.allthingstreasurecoast.com/news/Fort-Pierce/City-of-Fort-Pierce-Announces-EScooter-Share-Launch.html.

“Cycle: Community-Supported Bike Share in Aspen & Basalt.” *WEcycle*, 16 Mar. 2021, www.we-cycle.org/.

Groover, Heidi. “Frustrated by All Those Bikes in the Middle of Seattle Sidewalks? You're Not Alone.” *The Seattle Times*, The Seattle Times Company, 3 May 2019, www.seattletimes.com/seattle-news/transportation/frustrated-by-all-those-bikes-in-the-middle-of-seattle-sidewalks-youre-not-alone/.

Griggs, Taylor. “Eugene City Council Rides E-Scooter Pilot Forward.” *Eugene Weekly*, 15 July 2020, www.eugeneweekly.com/2020/07/14/eugene-city-council-rides-e-scooter-pilot-forward/.

“PeaceHealth Rides Bike Share System Celebrates Successful First Year.” *PeaceHealth*, PeaceHealth, 19 Apr. 2019, www.peacehealth.org/news/peacehealth-rides-bike-share-system-celebrates-successful-first-year.

Register-Guard, The. “Eugene Taking over Operation of PeaceHealth Rides.” *Guard*, Register-Guard, 11 June 2020, www.registerguard.com/story/news/2020/06/11/eugene-taking-over-operation-of-peacehealth-rides/112759010/.

Reynolds, Gretchen. “E-Bikes Are All the Rage. Should They Be?” *The New York Times*, The New York Times, 19 Aug. 2020, www.nytimes.com/2020/08/19/well/move/e-bike-safety-exercise.html.

Rose, Justin, et al. “How E-Scooters Can Win a Place in Urban Transport.” *BCG Global*, BCG Global, 25 Jan. 2021, www.bcg.com/publications/2020/e-scooters-can-win-place-in-urban-transport.

Sackariason, Carolyn. “E-Bikes Roll out in Bike Sharing Program in Aspen, Basalt.” *AspenTimes.com*, AspenTimes.com, 6 Aug. 2020, www.aspentimes.com/news/e-bikes-roll-out-in-bike-sharing-program-in-aspen-basalt/.

“U.S. Census Bureau QuickFacts: Troutdale City, Oregon.” *Census Bureau QuickFacts*, 2019, www.census.gov/quickfacts/troutdalecityoregon.

Vock, Daniel C. “Bike Share Isn't Just for Big Cities.” *Governing*, 28 June 2016, www.governing.com/archive/gov-bike-share-isnt-just-for-big-cities.html.

Zagster, 2020, www.zagster.com/.

Appendix H

SCYP
Sustainable City Year Program
University of Oregon

2021

Electric Scooter Micro Mobility

George Terry

Sustainable City Year Program

3/19/2021

Executive Summary

With the recent rise in popularity of electric scooter micro mobility in many American cities, I hope to offer recommendations intended to help the City of Troutdale determine the best course of action for introducing this exciting and modern mode of transportation. The Troutdale Transportation System Plan (TSP) provided insight to the transportation goals of Troutdale. Maintaining a thriving Troutdale Town Center while offering accessible and equitable transportation options that work to minimize vehicle congestion are goals of the Troutdale TSP and this memo. Cross pollination of communities through enhanced mobility and commerce is also important to Troutdale. As a member of the Portland metro area, Troutdale is concerned with the metro Regional Transportation Plan (RTP) which includes Transportation Demand Management (TDM) guidelines. TDM is any action that removes single occupant vehicle trips from the road network during peak travel demand periods. I will recommend measures that reduce vehicle miles and peak hour trips while encouraging development and reducing parking needs. Policy and infrastructure recommendations are the two main areas of focus for this memo. Policy recommendations include an initial pilot program in line with the Portland metro pilot program and an on-board advertising program aimed at offsetting operating expenses, growing local business awareness, and fostering equitable access. Infrastructure recommendations include expanding the existing bike lane network to include electric scooter users while growing the existing bike lane web to provide greater access to Troutdale Town Center businesses. Additionally, this memo discusses scooter hub placement and courteous user guidelines. As growth in the Troutdale area has flourished, so has the number of vehicle trips and travel demand. The ability to change travel behavior and provide alternative mode choices will help accommodate this growth. A shared electric scooter program represents an alternative transportation mode choice that can be quickly implemented and scaled to meet the modern growth demands of the vibrant community of Troutdale.

Introduction

Most American cities have by now seen the expansion of electric scooters appearing in their city. As congestion in our cities has risen, existing transportation options like cars, buses, and trains have struggled to keep pace. Americans lose an average of 99 hours a year due to traffic congestion, according to the 2019 INRIX National Traffic Scorecard, and in 2019, traffic cost Americans roughly $88B, or an average of almost $1,400 per driver *(Inrix Traffic Scorecard).* With cities under pressure to remedy their transportation ailments amid rising concerns around gas-powered emissions, parking minimums, and equitable access, electric micro mobility programs are emerging as sensible and paradigm shifting alternatives to current public transit offerings, especially as the Covid-19 crisis greatly impacts the sector. Micro mobility refers to short-distance transport, usually less than 5 miles. Increasingly, it is a term for the growing number of electric scooter sharing programs that are positioned to reshape the urban transportation landscape. With urbanization on the rise, the majority of trips people take fall within the range of micro mobility and are therefore prime candidates for electric scooter use. In the U.S., roughly 60% of all trips are 5 miles or less *(The Micromobility Revolution).* Similar to bike and car shares, electric scooters are an emerging technology and mobility service. The service provides a shared vehicle in the form of a small electric powered scooter available to rent for one-way trips. The scooters are paired with an app-based technology that allows a user to rent the vehicle for short-term rides using a credit card. Relatively easy to ride, after initial kick-off, the scooters are powered by an electric motor *(Stefan, A, et al.).*

I will evaluate electric scooter micro mobility and the best ways for the City of Troutdale to incorporate this transportation mode into their Town Center. Electric scooter micro mobility offers advantages over non-motorized modes, particularly in hilly areas like Troutdale. I gathered data from research of current literature that supports successful implementation of electric micro mobility solutions in other municipalities. This includes survey data alongside ridership and usage data compiled from the Portland Bureau of Transportation (PBOT) and TriMet. TriMet is the bus, light rail, and commuter rail transit service provider in the Portland metro area. My research also addresses the difficulties other municipalities have encountered when introducing electric micro mobility transportation options.

Recommendations have been scaled to meet the specific needs of the City of Troutdale and its residents. These recommendations include the initial information gathering process required for Troutdale through a developmental pilot program. Further, my recommendations include fleet size and placement with regulatory and rider policy guidelines. I will outline bike lane network expansion to increase access and include electric scooters. Troubleshooting both anticipated and unexpected challenges associated with a new electric scooter program will require flexibility and creativity on the part of Troutdale city planners. I hope to offer recommendations that support this flexibility and creativity.

Methods

My data analysis relied heavily on thorough reviews of existing academic sources in addition to a comprehensive study of current articles compiled by local writers and transportation observers in communities already engaged in electric micro mobility programs. My analysis method involved a deep dive into this literature. I have selected a few of these to support my findings and recommendations as they relate to the City of Troutdale's population size and density. Moreover, the Portland metro Regional Transportation Plan (RTP) which includes Transportation Demand Management (TDM) guidelines served as valuable resources for shaping Troutdale specific recommendations *(Regional Transportation Plan).* The Troutdale Transportation System Plan (TSP) contains several bike and pedestrian infrastructure improvement and expansion projects in various stages of development. A review of the Troutdale TSP revealed multiple opportunities to incorporate electric scooters into existing proposals *(City of Troutdale)*.

The City of Portland has gathered valuable information through various electric scooter pilot programs. This data includes total trips taken by electric scooter, miles traveled, and number of scooters used in addition to user surveys and citywide polls. I not only analyzed the data that resulted from these pilot programs but examined the pilot programs themselves. I feel a similar, properly scaled, pilot program in the City of Troutdale could yield similarly valuable information regarding eclectic micro mobility viability in Troutdale.

Findings

It is imperative that cities do not lock themselves into a form of transportation that will be outmoded in a few years. Taking a systems-level approach is wiser from a long-term planning perspective, but it's also more inclusive. Municipal leaders should first determine what the specific social and economic gaps are in their cities and then identify how electric micro mobility can address them. After this more strategic framework is complete, cities can choose or develop a specific technology or service to respond to fundamental needs *(Tonar, R. et al.).* A stated goal of the Troutdale TSP is that transportation facilities shall be designed and constructed in a manner which enhances the livability of Troutdale and are accessible to all members of the community *(City of Troutdale).*

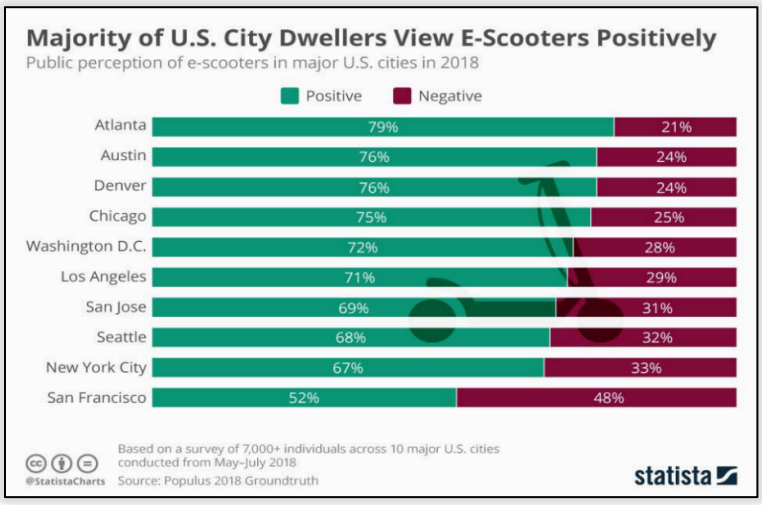
My findings involved an evaluation of a successful electric micro mobility program implemented in Portland with critical data compiled by the PBOT and TriMet that reflects the positive impacts of this program. These impacts range from increased quality of life for residents and increased commerce within program use areas to positive environmental outcomes and decreased vehicle congestion. Additionally, my findings indicate the challenges communities have encountered while introducing new electric micro mobility initiatives including user safety and education, community awareness, lack of regulation, and equitable access. I hope to mitigate these viability concerns by offering concrete recommendations for the City of Troutdale to move forward with the

implementation of electric micro mobility in its Town center and avoid the pitfalls experienced by other locations.

When the electric scooter arrived in 2017 as a mobility device, Portland took a proactive approach and created an electric scooter pilot program. The PBOT understood that this form of transportation was rapidly growing and wanted to ensure that its citizens had access to the device. They also wanted to ensure that the scooters would be in alignment with city policy values. The pilot program sought to determine whether, and how, scooters could help meet Portland's transportation needs. During a 120-day pilot period, the company operators were required to provide specific data to PBOT, which was supplemented with rider surveys, focus groups, and a citywide poll. Portland found that residents and visitors embraced electric scooters. During that four-month tracking time frame, over 700,369 trips that covered 801,887 miles were taken on 2,630 scooters. With over 62% of residents favoring the new mobility addition, the PBOT started another pilot program in April 0f 2019 that ran until April 2020 *(2019 E-Scooter Findings Report)*. This program sought measures to improve public and rider safety and protect City parks while identifying other scooter prohibited areas. Portland determined that motorized wheeled devices are prohibited in parks except on park roads, or in designated vehicle parking areas, or by permit. Multi-use paths in Portland, which are abundant, can be used by electric scooter *riders (Rules of the Road for E-Scooters in Portland)*. Further, these two programs showed that electric scooters have the potential to reduce both congestion and pollution *(Stefan, A, et al.).*

While electric scooters have faced considerable regulatory and implementation challenges, the electric scooter field has witnessed aggressive growth in just a few years. Several U.S based scooter sharing companies have enjoyed big investors placing millions of dollars into the industry. Helping to drive this popularity is the positive view Americans have of electric scooter mobility. As seen in Figure 1, about 70% of Americans living in major urban areas view electric scooters positively, according to a 2018 survey *(The Micromobility Revolution).*

Figure 1*(The Micromobility Revolution)*



In 2018, shared electric scooters overtook shared bikes as the preferred method of dock-less transportation. Today, dock-less bikes have largely disappeared from cities *(The Micromobility Revolution)*. Additionally, many scooter sharing companies are moving towards offering more durable fleets to make riding safer in inclement weather. For example, electric scooter manufacturer and ride-share program operator Bird recently announced a new scooter design that considers the comfort of riders, putting the vehicle through rigorous testing to verify its safety and durability in all environments *(Introducing Bird Two)*. Improvements include safer batteries, self-reporting damage sensors, self-sealing tires, anti-theft encryption, and seamless design removing exposed screws *(Introducing Bird Two)*. Given Troutdale's seasonal weather variability, a more robust scooter design will be important to year-round use and program sustainability.

Recommendations

An electric scooter pilot program that seeks to determine if and how scooters might meet Troutdale's transportation needs is a sound starting point. I recommend an initial 90-day pilot period for Troutdale with a starting fleet size of 100 scooters. This fleet size recommendation has been scaled using PBOT data. Portland's population is roughly 645,000 people with 2,630 electric scooters currently permitted *(2019 E-Scooter Findings Report)*. Portland's electric scooter fleet size is .41% of its total population. Troutdale's population is roughly 16,000 and my fleet size recommendation represents .63% of its total population. I recommend that 10 docking stations of 10 scooters each be strategically placed in all 5 neighborhoods of Troutdale. My research suggests that a 10-scooter dock can be accommodated by 70 square feet of space. Street corners, sidewalks, existing bike racks, and unused street buffer zones can be updated with designated and well-marked docking stations. No parking must be removed to accommodate this pilot program. I recommend a creative approach to dock placement that predominantly showcases this new mode. Appropriate scooter and dock placement should ultimately be determined by Troutdale leadership, but I recommend equitable and accessible docks spread across the community, including all 5 neighborhoods of Troutdale. With the anticipated success of this pilot program, Troutdale should be prepared to increase fleet size and number of docking stations as growth demands. This pilot program will provide a manageable and telling introduction. The designated electric scooter operating company should be required to provide specific data to Troutdale leadership including total trips taken, miles covered, and primary use areas. This data should be supplemented with rider surveys and community polls. My research shows that a likely outcome will be widespread community approval and use. This pilot program also offers an ongoing workspace to think creatively about new electric scooter models designed to meet Troutdale's unique needs.

There are creative electric scooter models offering financial sustainability that also foster equitable transit access that transit agencies and communities like Troutdale should consider. The City of Troutdale has an opportunity to fundamentally rethink the monetization strategy for shared electric scooter services. In addition to discounting trips for specific populations, one sensible model is to subsidize the cost of ridership in specific neighborhoods through on-vehicle advertising revenues. This has the potential

to help local businesses drive awareness while encouraging riders from across Troutdale to visit specific neighborhoods, providing economic value to targeted communities. This will focus the ability of an electric scooter program to connect different people across different places while creating a sustainable and scalable revenue stream for scooter providers. Further, electric scooters have the capacity to help employers ensure employees with transportation limitations make it to work consistently and on-time. This adds value for employers, who can sponsor electric scooter access and offer it to employees as an added benefit. This type of commuter benefit program is common and frequently offered by companies whose employees depend heavily on mass transit. Troutdale should work to develop these corporate sponsorships aimed at increasing ridership. These two policy recommendations support the goals of both regional TDM and the Troutdale TSP.

Within the current Troutdale TSP are a Pedestrian Action Plan (PAP) and Bicycle Action Plan (BAP). The PAP includes over 15 different infrastructure improvement proposals. These range from sidewalk installation and expansion to pedestrian crossing improvement and multi-use trail expansions. Troutdale's BAP includes over 10 different plans to install on-street bike lanes and shared roadway pavement markings and signage *(City of Troutdale)*. Both of these action plans possess a multitude of existing project proposals perfectly positioned for review and re-design to incorporate electric scooter use. This is an opportunity for Troutdale to explore a more complete street design. Additionally, I believe an eventual Troutdale Electric Scooter Action Plan (ESAP) will be required to manage and grow a robust micro mobility program.

Laws for electric scooters vary significantly by state and city. Generally, most jurisdictions are starting to regulate electric scooters in the same manner as bicycles. They must be ridden on the street or in bike lanes and are forbidden from riding on the sidewalk or pedestrian pathways. Like a bicycle, electric scooter riders must obey all traffic laws that cars must adhere to. This includes stopping at stop signs and red lights *(Ultimate Guide to Electric Scooters).* Troutdale should continue to require all road users to adhere to universal traffic laws that are commonly understood. I would caution Troutdale against attempting to re-think its traffic laws simply to accommodate cyclists and scooter riders. The City of Troutdale should coordinate with Multnomah County, the City of Portland, PBOT, and TriMet to implement strategies that monitor ongoing electric scooter safety by collecting accident data from hospitals, tracking consumer complaints, and conducting investigations of incidents to properly regulate the array of safety issues that consumers will encounter when riding electric scooters. Ultimately, rider education and training will be the best tool for keeping riders safe. During the first pilot, PBOT learned that most riders are introduced to Portland's electric scooter rules through the electric scooter apps. For the 2019 pilot, PBOT required companies to provide Portland-specific laws in their app at the time of registration and at rental. The city also installed signage and pavement markings in key locations to help educate *(2019 E-Scooter Findings Report).*

Conclusion

Electric scooter micro mobility is a sensible and attainable transportation option for bringing the City of Troutdale closer together while relieving parking and congestion pressures. This memo is intended to motivate Troutdale leadership into action. Electric scooters are viewed positively by the majority of Americans and their popularity is growing rapidly. Many cities, including Portland, have shown that shared electric scooter programs can work to provide an alternative transportation option for many citizens. Troutdale has an opportunity to explore this mode through a scaled pilot program similar to the one successfully implemented in Portland. The careful planning of this pilot program should include appropriate dock placement and mode specific regulations. There are existing street and trail system improvement projects that Troutdale can reconsider to accommodate electric scooters. The majority of trips people take daily fall within the range of micro mobility and people will embrace this new mode if given the opportunity. Troutdale also has an opportunity to implement an equitable micro mobility model that benefits the entire community. Troutdale can and should provide this service for all of its citizens. Moving forward, Troutdale leadership should work to highlight issues that merit future attention and research, and foster dialogue about the planning and management of electric scooter programs.

Lastly, owing to its popularity, ease of deployment, and level of program control, electric scooter micro mobility and the recommendations of this memo directly impact these six goals stated in the Troutdale TSP:

- Transportation facilities shall be designed and constructed in a manner which enhances the livability of Troutdale.
- Provide a transportation system in Troutdale which is safe, reduces length of travel and limits congestion.
- Provide a balanced, multi-modal transportation system and reduce the number of trips by single occupant vehicles.
- Develop transportation facilities which are accessible to all members of the community.
- Develop a transportation system that is consistent with the City's adopted comprehensive land use plan, and with the adopted plans of state, local and regional jurisdictions.
- Establish a clear and objective set of transportation design and development regulations that address all elements of the city transportation system and promote access to and utilization of a multi-modal transportation system *(City of Troutdale)*.

The ability of a shared electric scooter micro mobility program to simultaneously support so many of Troutdale's transportation objectives makes electric scooters exceedingly appealing as a legitimate and pragmatic form of modern transportation.

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Works Cited

Inrix. “Traffic Scorecard.” *Inrix*, 8 Mar. 2020, inrix.com/scorecard.

The Micromobility Revolution: How Bikes and Scooters Are Shaking Up Urban Transport Worldwide. *Business Trumpet News*, CBInsights, 20 May 2020, businesstrumpet.com/the-micromobility-revolution-how-bikes-and-scooters-are-shaking-up-urban-transport-worldwide/.

Stefan, A. Top Electric Scooter Friendly Cities in the US. *Noble Urban*, 27 Nov. 2020, www.nobleurban.com/top-electric-scooter-friendly-cities-in-the-us-and-the-rise-of-the-environmental-friendly-transportation/.

Regional Transportation Plan. Metro, 30 July 2020, www.oregonmetro.gov/regional-transportation-plan.

City of Troutdale. Transportation System Plan, 8 Apr. 2014, https://www.troutdaleoregon.gov/sites/default/files/fileattachments/community_development/page/8451/final_tsp_03-04-2014.pdf. Kittelson and Associates, Inc.

Tonar, Remington, and Talton, Ellis. Cities Need to Rethink Micromobility To Ensure It Works for All. *Forbes Magazine*, 8 Jan. 2020, www.forbes.com/sites/ellistalton/2020/01/07/cities-need-to-rethink-micromobility-to-ensure-it-works-for-all/.

2019 E-Scooter Findings Report. *Portland Bureau of Transportation*. Sept. 2020, www.portland.gov/sites/default/files/2020-09/pbot_escooter_report_final.pdf.

“Rules of the Road for E-Scooters in Portland.” *Portland.gov*, www.portland.gov/transportation/escooterpdx/rules-road-e-scooters-portland.

“Introducing Bird Two.” *Bird Two*, 2019, two.bird.co/.

“Ultimate Guide to Electric Scooters”. *Electric Scooter Guide Laws*. Electric Scooter Guide, 21 Dec. 2020, electric-scooter.guide/guides/definitive-guide-electric-scooters/#laws.

Appendix I

Yuxiang Xiong
PPPM 399
SCYP Paper

Executive Summary

E-scooters have been a widely growing trend for use in cities around the world. They offer an alternative to other forms of transit, both public and private. Some of their potential benefits include a reduction of carbon emissions associated with current transportation options, a reduction of accidents caused by automobile collisions, and a decrease in overall congestion which can result in more efficient travel times. Many cities have turned to this alternative form of micromobility in the hopes of addressing important transportation goals. The e-scooter trend is still relatively new, but it has grown exponentially with over 100 cities throughout the U.S. having implemented some form of e-scooter use, including through pilot programs. There remains relatively little hard data available though, given the short time period in which e-scooter programs have been in operation. The data that has been made available has also led to conflicting results, some of which indicate that e-scooters have not been able to live up to their potential as an alternative form of transit.

The City of Troutdale has considered implementing an e-scooter program in order to address some of its specific performance targets outlined in its most recent Transportation System Plan. Though e-scooters may ultimately offer a potential to help the city meet those performance targets, there remains little conclusive evidence to suggest that immediately implementing an e-scooter program will be able to do so. More data will continue to be collected from ongoing e-scooter programs in cities that have begun pilot programs. Until these data are made available and more analysis has been made, the current recommendation is to hold off on implementing an e-scooter program. There are alternative strategies that are available to meet the same goals, strategies for which more data is readily available. Troutdale should first consider other alternatives in the short run, while considering e-scooters for possible future implementation.

Introduction

Since the industrial revolution, global populations have risen exponentially. There has also been an important demographic shift in terms of spatial dispersion of populations. Urban centers have seen increasing population densities, and this concentration of people in tightly packed communities has led to an increase in a host of new problems. Impacts of anthropogenic climate change, a result of many industrial practices including the burning of fossil fuels, is one example. Rising public health and safety risks are another. Increasing time constraints of travel, a result of increasing urban sprawl, is still another problem. Transportation plays a key role in each of these problems, and addressing these problems cannot be done without simultaneously reviewing current transportation systems.

The most common form of transportation for most urban residents is single occupancy vehicle travel. The rise of the auto industry fundamentally shaped city design, and allow for the growth of larger cities, both in terms of total population but also in terms of total geographic area. Urban sprawl has increased significantly as a direct result, as people are able to live further from commercial centers and places of employment, traveling rapidly via personal automobiles. While cars have played a key role in the spread of urban centers, “about 40 percent of car trips are less than 2 miles” (Irfan, 2018). At the same time, these short trips can directly increase

congestion in city centers. Increased congestion in urban centers directly contributes to greater carbon emissions as cars are stuck in traffic more often, increased potential for accidents leading to bodily harm, and greater delays and loss of productive time. Therefore, reducing dependence on single occupancy vehicle travel remains a key goal moving forward. This report offers a review of one potential mitigating strategy: the use of electronic scooters.

Electronic scooters, or e-scooters, is a form of micromobility that has been growing in popularity in cities around the world. E-scooters are seen by many as a simple, cheap, and quick way to manage short trips that would otherwise be done in cars, or through other forms of public transit. Many cities, mostly larger urban centers, have already implemented successful e-scooter programs aimed at meeting specific goals outlined by those communities. As per the request of the City of Troutdale, this report will focus on the feasibility, as well as practicality, of adopting similar e-scooter programs as a way to ease congestion and mitigate negative impacts on the environment, public health, and efficiency that exist under the current transit system within the city.

Troutdale is a relatively small community compared to others which have previously implemented e-scooters, e.g. Atlanta, Nashville, Los Angeles. According to the most recently published census data in 2010, Troutdale's population was just under 16,000, with an estimated increase of around 200 over the next decade (Population and Housing Unit Estimates). Located on the outskirts of the greater Portland metropolitan area, the economy is closely tied to that of Portland. A significant percentage of the population commutes to work in Portland each day, and some do so through a variety of public transit services, while a majority drive their cars.

This report seeks to assess the relative costs and benefits of adopting an e-scooter program by the City of Troutdale. The assessment will be focused on specific performance targets that have been identified in the City of Troutdale Transportation System Plan, adopted in 2014. This plan identifies the goal of reducing transportation-related carbon dioxide emissions by 40 percent below 1990 levels, by 2035. It also establishes the goal of reducing vehicle hours of delay per person by 10 percent compared to 2005, again by 2035. The research question of whether or not Troutdale should implement an e-scooter program relies on the framework of these specific transportation goals, as well as an assessment of potential economic and public health and safety impacts.

Methods

Assessment of the potential for Troutdale to adopt an e-scooter program was based on various reviews of similar programs in other cities. Many of these reviews did not consist of in depth studies, but rather of more limited research about specific aspects of e-scooter programs, such as their impacts on the environment or whether they affect public health. The e-scooter trend is still fairly recent, with many cities having only adopted these programs within the last couple of years, and many of these have only been implemented on a pilot basis. Therefore, there remains very little clear data about e-scooters and their effectiveness in meeting the goals established by communities. Most of the cities that have adopted e-scooters are also large urban centers, and there exists a different dynamic within those centers. In a large suburban center, e-scooters may be a more practical alternative, because of ease of access and their ability to meet specific regional goals. However, needs may be similar across communities of various sizes, but solutions to these needs are not necessarily the same.

In 2018, the city of Portland prepared a findings report on an e-scooter pilot program. The pilot program in Portland collected data from companies that included availability

information and complaints. It also collected data about injuries or collisions involving scooters, as reported by individuals, police, fire services, and e-scooter companies. There were also surveys, a citywide poll, and three focus groups, all of which provided direct data regarding the public response to the pilot program. Though Portland is significantly larger than Troutdale and thus cannot be considered an accurate model, similar differences exist in all other cities and municipalities that have already adopted existing models that could be used as a comparison. Portland's findings report does have a particular advantage as a model for Troutdale given the proximity of these two cities. The findings of the Portland study are considered and then scaled in order to predict the outcome of Troutdale implementing its own pilot program.

Findings

Reducing Delay

One of the long-term goals outlined in Troutdale's transportation plan was to reduce the total vehicle hours of delay per person. E-scooters offer a potential solution to this problem, by reducing the amount of time that individuals spend in traffic, particularly congestion. Even for those who currently use alternative methods of travel, including public transit, there are often unavoidable delays in travel. Scooters allow for point-to-point transportation, eliminating the loss of time associated with transportation to transit stations, i.e. bus stops. In some cases, traveling to and from transit stations can represent up to 20% of total travel time (Boarnet, 2018). E-scooters can reduce this extra travel time, provided that scooters replace other forms of alternative transit options.

The Portland findings report included surveys of those who had used e-scooters at some point during the initial pilot program. Results of these surveys indicated that 34% of those who utilized the scooters would have used their personal vehicles, or some similar mode of travel, otherwise, and this number rose to nearly half when selecting for tourists (E-Scooter Findings Report). The findings also indicated that there was an increase in e-scooter trips that replaced walking or biking. E-scooter use can vary depending on where they are designated for use. Most e-scooters are similar to bikes and follow the same traffic laws. This means that, depending on location and other regulations in place, e-scooters may be used on streets, bike lanes, or sidewalks. If designated for street use, the ability for e-scooters to mitigate congestion is reduced, since they must obey the same laws as other automobiles. E-scooters are able to significantly reduce congestion when limited to sidewalks and bike lanes. The extent to which e-scooters will help Troutdale to meet its stated goals will depend on the extent to which the public would be willing to use this alternative method of transportation. In order to determine this willingness, Troutdale should fist conduct surveys regarding the willingness to adopt micro mobility solutions.

Public Health & Safety

E-scooters may also have the potential to increase public health and safety by reducing the number of collisions that occur on a regular basis. Motor vehicle use continues to be the most common cause for emergency room traumas, "with an estimated 89 related deaths per day in the United States" (Nisson et al., 2020, p. 178). Most e-scooters travel at much lower speeds than that of cars, but there are also fewer safety features available in scooters. Portland's e-scooter pilot program resulted in an increase of 176 emergency room visits over a 4-month period (E-Scooter Findings Report). Similar increases in hospital admissions from trauma related to e-scooter use was also found following the introduction of e-scooters in Los Angeles (Nisson et al.,

2020). The types of trauma vary and may consist of collisions between scooters and cars or trucks, between scooters and pedestrians or bikes, or simple falls from a scooter.

Direct trauma that results from e-scooter collisions is not the only potential source of concern. E-scooters are typically parked on sidewalks following their use, as they wait for another interested user. Improperly parked scooters may pose a potential hazard, as they "can impinge sidewalk access or pose a danger to people with mobility limitations" (Thigpen et al., 2020, p. 48). Some of this potential danger can be mitigated through installation of parking spaces specifically designed for scooters, though this solution will be limited based on available space on sidewalks or streets. Although e-scooters have a potential to reduce the amount of trauma associated with motor vehicle use, there is still very limited data available on whether or not e-scooter usage appreciably decreases collisions resulting in trauma overall.

Economics

E-scooters have become an increasingly popular trend as a micromobility solution to various problems associated with city traffic and congestion. The trend has been so popular that two of the largest companies operating these scooters, Bird and Lime, each "became the fastest ever US companies to reach billion dollar valuations" (Ajao, 2019). The economic potential of e-scooter companies is clear, though there remain questions about the costs associated with e-scooter programs in general. The Portland e-scooter pilot program sought to address some of these questions, and did so through an analysis of revenues coming in. Revenues consisted primarily of application and permit fees, a surcharge added for each e-scooter trip, and additional fines and penalties for improper use of scooters. Expenses consisted of an initial program design, administration expenses, and educational materials. These revenues and expenses essentially balanced each other out, though there was also a cost of program evaluation that led to a balance of $75,205 in the red (E-Scooter Findings Report). As this was only a pilot program, both revenues and expenses are likely to scale upwards following full implementation.

Environment

Another performance target established in the Transportation System Plan was the reduction of transportation related carbon dioxide emissions. Carbon dioxide emissions are a leading cause of global warming and a significant portion of current carbon emissions are a result of traffic. Most cars on the road today rely on burning fossil fuels, a process that directly leads to carbon emissions. Electric scooters do not burn fossil fuels as a source of energy, though they still may indirectly rely on fossil fuels depending on where the energy used to power the electric scooters is generated. The Portland e-scooter findings report indicated a need for more data collection to determine whether or not there was any significant reduction of carbon emissions. The authors of the report did offer an estimate of impacts based on full implementation of an e-scooter program, suggesting that it could potentially reduce the equivalent of "27 average passenger vehicles from the road for a year" (E-Scooter Findings Report, p. 27).

Though a reduction in the total amount of driving by passenger vehicles is likely to reduce overall carbon emissions, the direct emissions by scooters are not the only impact to consider. Much of the uncertainty regarding the net impacts are based on how e-scooters are managed. In existing e-scooter programs, there are a limited number of charging stations for scooters. As users ride scooters, they park them at their destination and they must eventually be returned to a charging station. This is often accomplished via conventional gas powered vehicles

which gather depleted electric scooters around the city before returning them to charging stations. A recent study considered additional impacts of e-scooter uses throughout their life cycle, including the materials and manufacturing costs and transportation of scooters from their manufacturing origin, as well as transportation for charging. The authors of the study found "a net increase in global warming impact when compared to the transportation methods offset in 65% of our simulations" (Hollingsworth et al., 2019, p. 9). This figure was using a conservative base model, though models assuming greater efficiency suggested a reasonable potential for reducing carbon emissions and impacts on global warming.

Recommendations

After a review of currently available data, the recommendation is clear. Implementing an e-scooter program in the City of Troutdale is not practical at this time. Such a program may be feasible given the willingness or determination of elected officials to implement one, but this study does not support this strategy going forward. E-scooter programs have been shown effective in some larger cities, particularly through their ability to reduce congestion in dense urban centers. Troutdale does not have a dense urban center, and there are more practical micromobility solutions that the city could adopt. A significant portion of Troutdale's population does not work in the city, but instead commutes to Portland. These commuting trips are unlikely to be conducted via e-scooters given the distance of the commute. Most e-scooters in commercial use today only have a range of around 15 miles (Nisson et al., 2020). Scooters would not be able to make the full commute, and the costs of retrieving scooters with depleted charges would offset any benefits that the scooters themselves provided. The pilot program in Portland indicated that e-scooter use was more common for tourists, but tourism is not a significant part of Troutdale's economy.

If city officials are committed to implementing an e-scooter program, there are important concerns that must first be addressed. These include what type of e-scooters are permitted, since they vary in speed. Those e-scooters with a higher end speed may be better suited for use on roads, whereas ones with lower speeds may be better suited for use in bike lanes and sidewalks. The different commercial types will appeal to different uses, and they will also result in potentially different impacts on public health and safety. There will be significant costs of implementing a new e-scooter program and without significant usership, these costs are unlikely to be offset by the collection of fees or permits. The available data on existing e-scooter programs is still too limited to show an obvious benefit from implementing a similar program in Troutdale. The limited data that is available also comes from much larger cities, with denser urban centers, and therefore these data are not necessarily comparable to what Troutdale would experience. Given the uncertainty of benefits or of ability to meet established performance targets, combined with unknown increases in various costs, this study cannot recommend Troutdale implement an e-scooter program, at least until more data are available. There are also other, more practical, alternatives that exist to address these needs, such as a bike share program.

*This was a solo project, so no group member contribution statement is included.

References

Ajao, A. (2019, February 1). Electric scooters and micro-mobility: Here's everything you need to know. *Forbes.* www.forbes.com/sites/adeyemiajao/2019/02/01/everything-you-want-to-know-about-scooters-and-micro-mobility/?sh=3a3d63a5de65

Boarnet, M. (2018, October 2). Why scooters are the future of transportation. *Transfer Magazine.* transfersmagazine.org/2018/10/02/why-scooters-are-the-future-of-transportation/

E-Scooter Findings Report. (2018). *Portland Bureau of Transportation.* www.portlandoregon.gov/transportation/article/709719

Hollingsworth, J., Copeland, B., & Johnson, J. (2019). Are e-scooters polluters? The environmental impacts of shared dockless electric scooters. *Environmental Research Letters, 14.* 1-9.

Irfan, U. (2018, December 19). The scooter stampede of 2018 is great news for urban transportation. *Vox.* www.vox.com/energy-and-environment/2018/12/5/18116647/electric-scooter-lime-bird-skip-spin-2018?fbclid=IwAR00a_I7JE2_n9icvaPMA_hhUglD4GsS8Lc3AKAm-W0gwbyVrgLBK-ZQWFc

Nisson, P., Ley, E., & Chu, R. (2020). Electric scooters: Case reports indicate a growing public health concern. *American Journal of Public Health, 110*(2). 177-179.

Population and Housing Unit Estimates. *United States Census Bureau.* www.census.gov/programs-surveys/popest/data/tables.2019.html

Thigpen, C., Klein, N., & Brown, A. (2020). Parking problems: Motor vehicle parking violations vastly surpass scooters and bikes. *Institute of Transportation Engineers, 90*(6). 45-49.

Appendix J

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SCYP Project

Executive Summary

The City of Troutdale is a town outside of Portland, Oregon. The town is experiencing a stage of expansion as new people and businesses move into the area. Two of those businesses which have moved into the area within the last decade are a FedEx ground distribution center and an Amazon plant. Both plants focus on shipping and logistics for complex delivery systems. These plants located near the Troutdale Airport employ thousands of people from in and out of the City of Troutdale.[1,2] As employees began to flock to the plants looking for work it became clear that many would use public transit to get to work; however, this posed a problem. The nearest bus stop is over a mile away. This distance can be prohibitive for people trying to get to and from work using public transportation. In this project we explore how to bridge the gap between the nearby bus stops and the two plants. We explored both a shuttle as is currently operated by Multnomah County,[3] and a bikeshare program. The shuttle would continue to operate on the weekends and would run every 20 minutes. Although, we are hesitant to recommend this method as continuing to operate a shuttle long term would represent a serious ongoing cost to the operator (although the recommendations for moving forward with such a program are included in this report).

We recommend that the city move forward on widening existing sidewalks to create a multi-use path to and from a nearby bus stop. This path would follow an existing road and sidewalk network, but allow many different uses on the same path. Additionally, we recommend that the city work with bike share companies and industry partners to bring bikeshare to the area with docks near the Columbia Gorge Outlets, FedEx, and Amazon entrances. This would provide a source of active transportation to and from the plants that is inexpensive for the city to maintain in comparison with the shuttles. If the City of Troutdale chose to move forward with a city owned bike share it could even prove profitable to operate. This low operating cost combined with eliminating the need for ongoing costs for the shuttle in the long term, encouraging exercise, and easy flexibility should other employers be added near the area led us to recommend this option.

[1] Hsuan, A. (2010, April 15). FedEx distribution CENTER PROMISES jobs, taxes From superfund site. Retrieved February 22, 2021, from https://www.oregonlive.com/business/2010/04/fedex_distribution_center_prom.html

[2] Marum, A. (2017, June 08). Amazon to hire 1,500 In Troutdale, offer tuition assistance. Retrieved February 22, 2021, from https://www.oregonlive.com/politics/2017/06/amazon_to_hire_over_1000_at_tr.html

[3] Multnomah County. (2020, May 13). Troutdale job Connect Shuttle. Retrieved March 12, 2021, from https://multco.us/transit-services/troutdale-job-connect-shuttle

Introduction

Public transportation is an excellent mode of travel for a wide variety of people. Currently, citizens of the City of Troutdale have access to bicycle paths, pedestrian walkways, and transit systems to use for their transportation needs. Troutdale's public transportation system offers two types of services; fixed route and dial-a-ride. The fixed-route service consists of four bus lines provided by TriMet which mainly run along major roadways in the area. All of these bus lines follow similar hours of operation with the average service running from 6 am-9 pm, Monday through Friday, and offering limited to no availability on the weekends or outside the 6 am-9 pm hours. Additionally, some of these lines only run roughly every hour. TriMet also provides the dial-a-ride service through their paratransit program (LIFT) to residents who are unable to use the fixed-route services due to disabilities. Dial-a-Ride is operated within the same area and during the same hours of service as the fixed-route bus lines.

While these services may have been useful to residents in the past the relatively recent addition of these plants has generated new destinations as people go to work. The establishment of FedEx and Amazon warehouses was projected to create 3,000 jobs within the city.[4,5] Additionally, workers of FedEx and Amazon are faced with overcoming the issue of public transportation not offering service to (or near) their workplace as well as the complications of limited availability on the weekends. The success of these companies almost ensures continued growth in the area, which will lead to increased travel demands. One way that the City of Troutdale can alleviate the burden of transportation on both the employees and employers of Amazon and FedEx is to provide first and last-mile services to this area. Multnomah County currently operates a similar first mile/last mile route with a temporary grant from TriMet. So far TriMet has been unwilling to extend service or provide the shuttle directly.

Methods

The group used a series of data, literature, and news sources to determine how to address the first mile/last mile problem. For example, the group reviewed academic literature related to the time which it takes to stop a bus on a busy street to unload and load passengers. This was used to estimate the time which would be needed to complete a loop of the shuttle. Additionally, we used the GIS datasets regarding property lines and ownership in our brainstorming phase to assess potential paths for a multi-use path, and where there was potential to place bikeshare docking stations. The public ownership of the plot of grass near the Columbia Gorge Outlets was a major factor in placing the proposed bikeshare dock there. Furthermore, we used other transit systems as inspiration for the solutions proposed here, Finally, we used TriMet scheduling tables to assess the frequency with which the bus line comes to Troutdale, and to determine where it goes

[4] Amy Hsuan, T. (2010, April 15). FedEx distribution CENTER PROMISES jobs, taxes From superfund site. Retrieved March 12, 2021, from https://www.oregonlive.com/business/2010/04/fedex_distribution_center_prom.html

[5] Oregonian/OregonLive, M. (2019, August 06). Amazon in Troutdale: LOGISTICAL marvels and persistent worker complaints. Retrieved March 12, 2021, from https://www.oregonlive.com/silicon-forest/2019/08/amazon-warehouse-in-troutdale-logistical-marvels-and-persistent-worker-complaints.html

once in town. An area of possible future study is data from Amazon regarding how often its employees use the shuttle service. This service operates very similarly to the way that the proposed shuttle would operate, and it could provide valuable insights into the number of employees that need additional transportation to and from the nearby bus stops. We have contacted the City who has contacted Amazon, but at the time of writing this no data has been passed to us, and as of Friday, March 11 the City did not have that data if it exists.

Multi-Use Paths as a First Mile/Last Mile Solution

Multi-use paths also known as shared-use paths are pathways that allow for pedestrian and bicycle traffic. They provide a designated area separate from vehicle traffic. The separation allows for increased safety and a reduction of stress level for those utilizing the pathway for transportation or recreation. According to pedbikesafe.org "riding on a bike path was associated with an 86 percent reduction in the risk of injury when compared to riding in the street."[6]

Bike share

Bike share programs have been introduced to numerous cities across the country. They have seen their most success in major cities and towns. Bike share programs impact environmental and traffic, and health and recreation.

The typical users of bike share customers are those looking for alternative transportation.This may be because they do not own a vehicle due to the high cost of automobile ownership, they are wanting to reduce their carbon footprint, biking may be easier and a faster means transportation due to traffic or it may come down to convenience when dealing with parking in a congested area.

Other users have prioritized health and recreation as their reasoning for utilizing bike share programs. In Bend, OR tourists are able to utilize the bike sharing program Zagster to explore the different trails around the city or take a leisurely bike ride to visit the Old Mill District for lunch and shopping.[7] [8]

The appeal of bike sharing programs is the ability to bike without the liability and upfront cost associated with biking. Bike theft has surpassed the 2 million per year mark as interest in the activity continues to grow due to the well known health and environmental benefits.[9] Theft represents a major liability for someone storing their personal bike outside, but with bikeshare consumers do not take on that risk. Furthermore, bicycles cost between $200 to $1000 and have

[6] *Evaluation of Bicycle-Related Roadway Measures: A Summary of Available Research*. (2014). https://www.pedbikeinfo.org/cms/downloads/06%2013%202014%20BIKESAFE%20Lit%20Review_FINAL.pdf

[7] Options, C. (2016, November 17). *The Many Benefits of Bike Sharing Programs*. Commute Options. https://www.commuteoptions.org/the-many-benefits-of-bike-sharing-programs/

[8] Lee, D. 2017, June 20) *New Bend Bike Sharing Station Opens*. KBND. https://kbnd.com/kbnd-news/local-news-feed/310414

[9] *Bicycle theft surpasses 2 million a year in the USA*. (2019). Cycling Industry News. https://cyclingindustry.news/bicycle-theft-surpasses-2-million-a-year-in-the-usa/

an added cost of a good quality lock. This expense may price new cyclists out of bike ownership.[10]

Multi-Use Path Recommendations

We propose the creation of a multi-use path that will connect the Columbia Gorge Outlets to both the FedEx and Amazon distribution centers. The path will start at the north east corner of the shopping center. This location was chosen because of its close proximity (approx 350 ft) to the bus stop at NW 257th Avenue. The bus comes to this stop roughly every hour.[11] The pathway will replace the sidewalk that currently runs along NW 257th Way to NW 257th Ave. The pathway will then replace the bike path that leads under Interstate 84 and proceeds north along the Sandy River and NE Harlow road. The route of this path can be seen in Figure 2. The pathway will continue to follow NE Harlow Rd until it meets with NE Graham Rd. It will then proceed north on NE Graham Rd. and replace the existing sidewalk that continues north on NW Swigert Way. The multi-use path will continue until it reaches the crosswalk in front of 1250 NW Swigert Way.

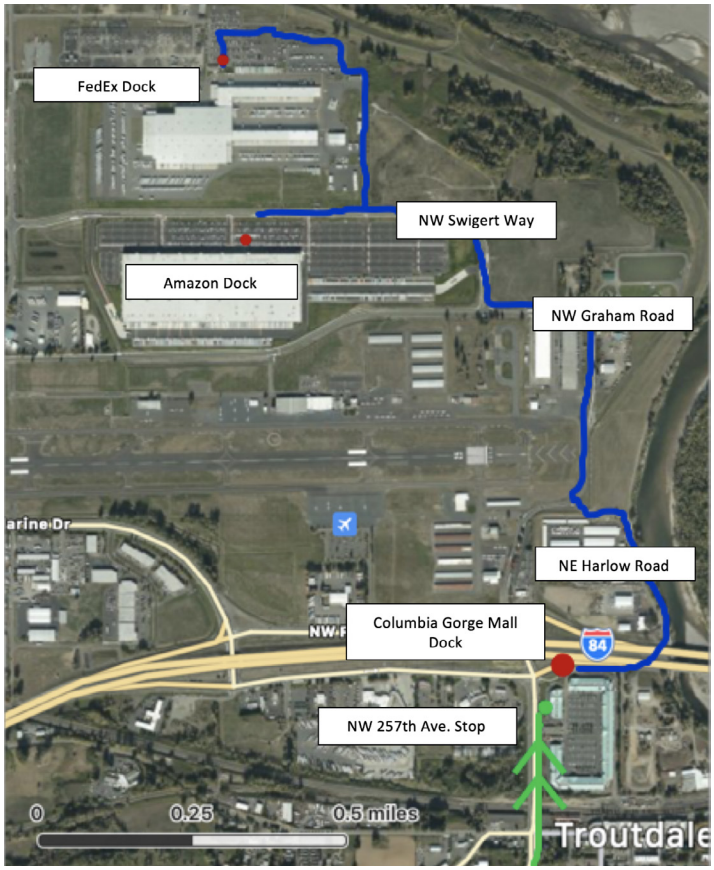
The pathway should follow the standards as listed in the 2012 ODOT Highway Design Manual, section 13.7.2.1 *Two-way Separated Paths*. These standards include a width of 12 feet or more (16 feet recommended) with a minimum of 8 feet to be used at pinch points and only through a design exception.[12] This width would include the path below Interstate 84.

[10] *How Much Does A Bike Cost?* (2020). Bicycle Universe. https://bicycleuniverse.com/how-much-does-a-bike-cost/#:~:text=However%2C%20the%20following%20are%20average,Single%2Dspeed%20bike%20%24400

[11] TriMet. (2021). Line 77 Schedule. Retrieved February 22, 2021, from https://trimet.org/ride/stop_schedule.html?stop_id=9470&route=77

[12] Roadway Engineering Unit in Technical Services. (2012). Chapter 13: Pedestrian and Bicycle. In *Oregon Department of Transportation Highway Design Manual*. Salem, Oregon.

We propose that the multi-use path be marked with directional arrows as well as being marked with yellow paint as the pathway crosses entry and exit points to businesses. This will help increase awareness to vehicles of pedestrian and bike traffic.



We propose a discussion with FedEx to create an alternative entry point for pedestrian and bike traffic. This entry point would use the existing gate at the south east corner of the property. Allowing entrance from this gate will save time and energy for employees looking to utilize the pathway. Even if FedEx is unable to create an alternate entry point on NW Swigert at their cargo entrance it should be noted that currently a path is being developed along the Sandy River. This path will meet with the proposed path on NW Graham Road and an entrance at the back side of the facility near the current employee parking lot could be created to allow entry from near the river. This would provide comparable access to the facility without requiring employees to go all the way across NW Swigert Way and up NW Sundial Road before entering the facility.

Figure 2. Proposed Multi-Use Path[13]

[13] Blue- Proposed Route
Green- Existing TriMet Route 77

Bikeshare

Bikeshare programs have seen success in Portland. We propose a pilot program be initiated with Biketown PDX to set up a station at the Columbia Gorge Outlets, a location in front of the Amazon facility, and a location at the FedEx facility. The proposed location at the Columbia Gorge Outlets would be near the start of the proposed multi-use path near the north west corner of the shopping center. In conjunction with the multi-use path, the Biketown pilot will allow options for Amazon and FedEx employees that utilize the bus stop in front of the Columbia Gorge Outlets.

Biketown currently has different tier options for businesses looking to pay for part of employee membership on their website.[14] Sponsoring memberships lets employers provide the bikeshare at low or no cost to their employees. This allows Amazon and Fedex to pick the option they feel would benefit their employees and help with creating a more environmentally conscious image in the community. The cost of creating new stations can be seen as a marketing cost for Biketown. Employees looking to try the pilot may live in different areas where Biketown is currently established. This exposure to the company and bike share experience can open up opportunities for travel outside commuting to and from work.

Shuttle Services as an Alternative to Multi-Use Paths

An alternate option to solve this growing first mile/last mile problem is for the City of Troutdale to run its own shuttle service to and from the Amazon/FedEx facility. Shuttles are used across the country to provide reliable service through public transit systems, bridge gaps in service, and to supplement at peak need. One example, well known to the region of study here, is the shuttle operated by Multnomah County to help employees get to and from work currently. Potentially less familiar is the Rogue Valley Transportation District (RVTD) in Southern Oregon which operates several shuttle services. The Rogue Valley Connector is a shuttle bridging gaps between cities, and Valley Lift which is a paratransit service which is "provided within three-quarters of a mile from an RVTD fixed route bus lane" and costs $4.00 per trip[15,16] This last service is similar to what is proposed to be provided here except instead of being on a fixed schedule it is provided on a request basis. This is used to bridge the gap between the origin and the bus line destination for those with disabilities. In 2019, this service offered 230 rides a day on average across the service area.[17] RVTD's service area contains an estimated total population of approximately 150,000 people.[18]

[14] *BIKETOWN for Business*. (2021). Biketown. https://www.biketownpdx.com/pricing/business

[15] Rogue Valley Transportation District. (2020, July 28). Rogue Valley Connector. Retrieved February 17, 2021, from https://www.rvtd.org/Page.asp?NavID=24

[16] Rogue Valley Transportation District. (2020, April 06). Valley Lift. Retrieved February 17, 2021, from https://www.rvtd.org/Page.asp?NavID=22

[17] KTVL. (2019, January 19). RDTV Accessible Rides. Retrieved February 17, 2021, from https://ktvl.com/news/local/rdtv-accessible-rides

[18] Rogue Valley Transportation District. (2016, December 9). Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2016. Retrieved March 11, 2021, from https://www.rvtd.org/Files/2015-16_CAFR.pdf

Another shuttle that currently supplements transportation systems in high demand periods is the Lane Transit District's (LTD) Route 990X-999X also called the "Autzen Express." This shuttle runs to and from Autzen Stadium between several large parking lots in the area on game days. On opening day in 2016 LTD estimated that about 9000 people would be transported using the Autzen Express. This shows how shuttles can be used at surge periods. This shuttle runs every 10 to 20 minutes beginning at four hours before kickoff, and costs $3.50 per ride.

Finally, there are airport shuttles that run between parking areas and the main terminal. This is present in Portland at PDX where a shuttle runs from the economy lot to the terminal which runs every 7-9 minutes. This service is free.[19]

Shuttle Recommendations

The proposed shuttle would have the following characteristics:

1. Run every half hour except at peak demand around shift changes when it will run every twenty minutes
2. Looped route starting near the bus stop potentially in the Columbia Gorge Premium Outlet mall
3. Operated by the City of Troutdale in the near term for a trial of the project using temporary funds
4. Working with TriMet to demonstrate the efficacy of the project to transition it in the long term to TriMet operating the service when the temporary operating funds run out

The shuttle would continue to function in much the same way that the current Amazon shuttle is designed. It would close the first mile last mile problem with a driver in a small bus or van. This shuttle would go in a loop which would start and end near the bus stop that is currently the 77 line at NW Graham and 257th Way. The 77 line includes stops near the Rose Quarter MAX station and runs all the way to NW Graham and 257th Way stop. The Rose Quarter MAX station is served by the blue, green, and red MAX lines.[20]

This shuttle would make a roughly four and a half mile long loop starting at the bus stop on NW Frontage Road. From there it would run west on NW Frontage Road until it hits NW Marine Drive. At NW Marine Drive it will head northwest until NW Sundial Road. It will take NW Sundial Road to go to FedEx. From FedEx it will double back on itself and run on NW Sundial Road again headed south toward the intersection with NW Swigert Way. It will head east on NW Swigert Way to the front of Amazon and stop again. Finally, it would return from Amazon to the NW Frontage Road bus stop by taking NW Swigert Way to NW Graham Road which would take the shuttle south until NW Frontage Road. Figure 1 marks this route in blue with each address and the Columbia Gorge Outlets listed as stops for the shuttle.

[19] Port of Portland. (n.d.). Parking at PDX. Retrieved February 17, 2021, from https://www.flypdx.com/Parking

[20] TriMet. (n.d.). TriMet interactive map. Retrieved February 19, 2021, from http://ride.trimet.org/?tool=routes&find=77#/

Figure 1. Shuttle Routes[21]

The full loop would take twelve minutes to drive with no stops.[22] Further, research from Washington, D.C. found that bus stop wait times were no longer than 66.8 seconds per stop (upper end of a 95% confidence interval) from the time at which the bus pulls up to a stop to the time it pulls away from a stop.[23] This was at peak hours in the middle of an intersection in a large city. Assuming this worst case held for the area in question then approximately four minutes and twenty-seven seconds would be added to the total drive. This would bring the total time for the proposed loop to approximately seventeen minutes with stops. At nonpeak hours the shuttle would operate running every thirty minutes although this number could be reduced as needed.

Finally, there is an orange route marked on Figure 1. This is a current cargo entrance used by FedEx to move materials in and out of their facility. Currently this area is a series of fences and gates which would not permit the shuttle to run through this area; however, if it were retrofitted to accommodate that path additional time would be saved by not doubling back onto NW Sundial Road. This would result in Amazon employees getting dropped slightly further from their place of work if the shuttle stopped at the exit to the FedEx facility.

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[21] A- Starting point at the Frontage Bus Stop on Route 77
B- FedEx Stop
C- Amazon Stop
D- Ending point also at the Frontage Bus Stop in Route 77
Blue- Proposed Route
Orange- Proposed FedEx modification
Green- Existing TriMet Route 77

[22] Google. (n.d.). Map Route Length. Retrieved February 19, 2021, from https://www.google.com/maps/dir/45.5453724,-122.3964192/45.5581206,-122.4039299/45.5550919,-122.4004783/45.5454712,-122.3964443/@45.5502473,-122.4078781,15z/data=!4m2!4m1!3e0

[23] Arhin, S., Noel, E., Anderson, M. F., Williams, L., Ribisso, A., & Stinson, R. (2016). Optimization of transit total bus stop time models. *Journal of Traffic and Transportation Engineering (English Edition), 3*(2), 146-153. doi:10.1016/j.jtte.2015.07.001

Funding Mechanisms

One more important recommendation related to this is more political in nature. Finding a way to fund this project through temporary funds which are not easily reallocated once they run out could be a way to create a sort of artificial deadline in an attempt to force action on the part of TriMet. This could assist in the transition from a City of Troutdale operated system to a TriMet operated system because it can be used as a point at which a new arrangement must be reached. Additionally, bringing in Amazon and FedEx as stakeholders could save some cost burden, but because they already pay transit taxes they may be less likely to do so.

Conclusion

As new employees flock to the Troutdale Industrial Park area transportation is becoming an increasingly complex situation to manage. Adding more than 3,000 employees in less than 10 years to the area has exposed flaws in the infrequency of public transit, and the lack of weekend availability. To mitigate this problem the City of Troutdale should install a multi-use path stretching from Columbia Gorge Outlet Mall to the industrial park. Furthermore, they should work with industry partners to sponsor a bikeshare that could offer options for commuters who do not have a bike, or do not want to take their bike on public transit with docks near the outlet mall and near their entrances. This offers the city a cost effective way of encouraging active transit and promoting environmental stewardship. An alternative to the multi-use path is a shuttle bus running every 20-30 minutes to take commuters from a nearby bus stop to the industrial zone. This would have a higher ongoing cost, but would be a more traditional transit experience for those who are uncomfortable or skeptical about riding a bike to work.

Group Member Contribution

The members of our group consisted of Brian Josephson, Neve Luna and Luis Soria. Brian facilitated the formatting and proofreading of the report including the creation of the maps/figures used. He also was responsible for research and recommendations regarding the shuttles portion of the report. Brian also was responsible for reaching out to the city of Troutdale for data to be used in the report. Neve was responsible for the introduction portion of the report. Luis was responsible for the research and recommendations regarding multi-use paths and the bike share portions of the report along with coordinating meeting times to discuss the project. All team members contributed in brainstorming options for the project.

Appendix 1- Bibliography

Amy Hsuan, T. (2010, April 15). FedEx distribution CENTER PROMISES jobs, taxes From superfund site. Retrieved March 12, 2021, from https://www.oregonlive.com/business/2010/04/fedex_distribution_center_prom.html

Arhin, S., Noel, E., Anderson, M. F., Williams, L., Ribisso, A., & Stinson, R. (2016). Optimization of transit total bus stop time models. Journal of Traffic and Transportation Engineering (English Edition), 3(2), 146-153. doi:10.1016/j.jtte.2015.07.001

Bicycle theft surpasses 2 million a year in the USA. (2019). Cycling Industry News. https://cyclingindustry.news/bicycle-theft-surpasses-2-million-a-year-in-the-usa/

BIKETOWN for Business. (2021). Biketown. https://www.biketownpdx.com/pricing/business

Evaluation of Bicycle-Related Roadway Measures: A Summary of Available Research. (2014). https://www.pedbikeinfo.org/cms/downloads/06%2013%202014%20BIKESAFE%20Lit%20Review_FINAL.pdf

Google. (n.d.). Map Route Length. Retrieved February 19, 2021, from https://www.google.com/maps/dir/45.5453724,-122.3964192/45.5581206,-122.4039299/45.5550919,-122.4004783/45.5454712,-122.3964443/@45.5502473,-122.4078781,15z/data=!4m2!4m1!3e0

How Much Does A Bike Cost? (2020). Bicycle Universe. https://bicycleuniverse.com/how-much-does-a-bike-cost/#:~:text=However%2C%20the%20following%20are%20average,Single%2Dspeed%20bike%20%24400

Hsuan, A. (2010, April 15). FedEx distribution CENTER PROMISES jobs, taxes From superfund site. Retrieved February 22, 2021, from https://www.oregonlive.com/business/2010/04/fedex_distribution_center_prom.html

KTVL. (2019, January 19). RDTV Accessible Rides. Retrieved February 17, 2021, from https://ktvl.com/news/local/rdtv-accessible-rides

Lee, D. 2017, June 20) New Bend Bike Sharing Station Opens. KBND. https://kbnd.com/kbnd-news/local-news-feed/310414

Marum, A. (2017, June 08). Amazon to hire 1,500 In Troutdale, offer tuition assistance. Retrieved February 22, 2021, from https://www.oregonlive.com/politics/2017/06/amazon_to_hire_over_1000_at_tr.html

Multnomah County. (2020, May 13). Troutdale job Connect Shuttle. Retrieved March 12, 2021, from https://multco.us/transit-services/troutdale-job-connect-shuttle

Options, C. (2016, November 17). The Many Benefits of Bike Sharing Programs. Commute Options. https://www.commuteoptions.org/the-many-benefits-of-bike-sharing-programs/

Oregonian/OregonLive, M. (2019, August 06). Amazon in Troutdale: LOGISTICAL marvels and persistent worker complaints. Retrieved March 12, 2021, from https://www.oregonlive.com/silicon-forest/2019/08/amazon-warehouse-in-troutdale-logistical-marvels-and-persistent-worker-complaints.html

Port of Portland. (2021). Parking at PDX. Retrieved February 17, 2021, from https://www.flypdx.com/Parking

Roadway Engineering Unit in Technical Services. (2012). Chapter 13: Pedestrian and Bicycle. In Oregon Department of Transportation Highway Design Manual. Salem, Oregon.

Rogue Valley Transportation District. (2016, December 9). Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2016. Retrieved March 11, 2021, from https://www.rvtd.org/Files/2015-16_CAFR.pdf

Rogue Valley Transportation District. (2020, April 06). Valley Lift. Retrieved February 17, 2021, from https://www.rvtd.org/Page.asp?NavID=22

Rogue Valley Transportation District. (2020, July 28). Rogue Valley Connector. Retrieved February 17, 2021, from https://www.rvtd.org/Page.asp?NavID=24

TriMet. (2021). TriMet interactive map. Retrieved February 19, 2021, from http://ride.trimet.org/?tool=routes&find=77#/

TriMet. (2021). Line 77 Schedule. Retrieved February 22, 2021, from https://trimet.org/ride/stop_schedule.html?stop_id=9470&route=77

Appendix K

Nick Keough & Madeline Snoke

PPPM 399: Anne Brown

19 March 2021

SCYP Final Paper: Loading/Unloading

Passenger and Goods Loading in the Troutdale Town Center

Executive Summary

This paper offers recommendations to the city of Troutdale, Oregon, for implementing loading and unloading zones in the Troutdale Town Center. Currently, there are no on-street loading zones in the Troutdale Town Center which has led to unnecessary congestion when a local business is receiving goods. Furthermore, the lack of loading zones has made loading and unloading of goods and people challenging, especially with the emergence of e-commerce services like Amazon and ride-hailing services like Uber and Lyft. We based our recommendations on research of current Troutdale policies around loading, policies around loading implemented by cities similar to Troutdale, and observations of the Troutdale Town Center. Our recommendations include loading zone locations as well as curb management policies to accompany the new zones. In proposing the location of potential loading zones, we considered the location of restaurants and local businesses in the Troutdale Town Center. Our recommendation to the city proposes the installation of three loading zones in the Troutdale Town Center: one loading zone between Taste of Village and Calcagno Cellars Winery, another loading zone in front of Troutdale Dental, and another loading zone between Sage Salon and Troutini. In regard to curb management policies, our recommendations propose six policies to ensure the success of loading zones. In short, we recommend loading zones to be free, dynamic loading zones with time limits and time of day restrictions. Additionally, we recommend an update to the Troutdale city code, the painting of designated parking spots in the town center, and the implementation of a curb productivity index system. In doing so, our hope is that loading and unloading can become less disruptive to traffic in the Troutdale Town Center and boost the accessibility to local businesses and restaurants.

Introduction

The city of Troutdale, Oregon, is looking for new ways to dedicate street space to on-street loading and unloading in the Troutdale Town Center. The rapid emergence of e-commerce services like Amazon and ride-hailing services like Uber and Lyft calls for the dedication of more street space to loading in the city center. Within this next year, over 2.14 billion people worldwide are expected to buy goods and services online in 2021 (Sabanoglu). With COVID-19 limiting in-person shopping, these numbers are expected to grow as the average items per order increased by 60% during the COVID-19 pandemic (Qian). Ride-hailing experienced similar rapid growth with 36% of all United States adults in 2018 saying they have used a ride-hailing service such as Uber or Lyft (Pew Research Center). With the COVID-19 pandemic severely

impacting ride hailing services, it is unclear if post-pandemic these numbers will rebound to similar levels (Siddiqui). Regardless, it is increasingly important for cities to dedicate street space and curb space to loading to meet the growing needs of these industries and services.

In this paper, we researched current loading zone policies implemented by other cities and offer recommendations to the city of Troutdale on implementing loading and unloading zones in the Troutdale Town Center. To begin, we highlight and detail the methods we used to conduct our research on the loading needs of the town center. Next, we summarize our findings of this research. Following that, we offer recommendations to the city that are most applicable to the built environment, density, and development patterns of the Troutdale Town Center.

Methods

In determining our recommendations for the city, we used various research methods to access the potential locations for loading zones and determine what curb management policies would be most effective in Troutdale.

Conversations with City Staff and Research of Current Policy

Our first research method in determining our recommendations was a virtual conversation with Troutdale city staff on January 13th, 2021. Beyond our conversations with city staff, we also conducted online research into existing city code and policies around loading spaces in the city of Troutdale.

Researching the Troutdale Town Center

In determining the best possible locations for loading zones in the Troutdale Town Center, we relied on Google Maps to get an accurate understanding of the layout and built environment of the town center. Specifically, we used the Google Maps street viewer tool to virtually walk the streets of the town center and access the set-up of parking, where businesses are located, and what potential obstacles there may be to the installation of loading zones. When looking for businesses, we specifically looked for restaurants as city staff had mentioned that beer trucks deliveries were typically an obstruction to traffic in the town center. Additionally, we took note of the bike paths close to the curb, the ample parking and loading areas located behind the north side of the city center, and the current curb signage of the area.

Researching Curb Management Policies

In researching effective curb management policies, we relied on online databases, news articles, and city websites to determine what other policies cities similar to Troutdale implemented to address the growing need for loading zones in city centers. For instance, we used the City of Eugene website to review their commercial loading zone policies that the city implemented for their downtown (City of Eugene Parking Services). In reviewing and comparing a plethora of other cities' policies, we gained inspiration and helpful language for crafting our final recommendations.

Findings

Based on our research, this section of the paper lays out our relevant findings around curb management policies and our assessment of the Troutdale Town Center. First, we highlight our observations of the Troutdale Town Center's built environment. Second, we discuss our findings from our research of other cities' policies surrounding curb management and loading zones.

City Staff Conversation and Current Policy

In talking with city staff, it became clear that the absence of loading zones and effective curb management policies was an issue in the Troutdale Town Center. For instance, one city staff member had said that it was a common occurrence for beer trucks to block traffic when making deliveries to restaurants. The staff member mentioned that cars would often have to drive around the delivery vehicles and that this could be avoided with the installation of designated loading zones in the Troutdale Town Center.

Currently, the city of Troutdale development code defines a loading space as "An off-street space or berth used for the temporary parking of a vehicle while loading or unloading persons, merchandise, or materials," (Troutdale Development Code). Additionally, the city code outlines the area minimum requirements for loading zones for commercial and industrial development sites. Given that the Troutdale Town Center is already developed, these requirements did not play a big role in the determination of our recommendations. That said, the "exceptions" section of the city code for the installation of loading spaces in the Central Business District (CBD) did seem relevant to our research. The code states that loading zones may be approved for installation in the CBD when (1) they are short in duration, (2) their use is infrequent, (3) they do not unreasonably obstruct traffic, (4) they do not obstruct a primary emergency response, and (5) is acceptable to the applicable roadway authority (Troutdale Development Code).

Observations of Troutdale Town Center

In our observations of the Troutdale Town Center, we made sure to specifically take notice of the location of restaurants due to their frequent need for delivery of goods like food and alcohol. According to a document published by the City of Troutdale, Oregon, there are thirty-six restaurants inside city limits, and satellite maps show that seven of them are located in the Troutdale Town Center along a strip of Historic Columbia River Highway (Troutdale Restaurant List). Four of the restaurants are on the north side of the street and three are on the south side of the street, making the distribution on both sides of the street relatively equal. In regard to parking, it appears that currently the on-street parking is parallel to the street and is not divided into individual parking spaces. Furthermore, it appears ample parking exists (see Figure 1) behind the north side of the town center and multiple free parking lots on the south side of the town center. In reviewing parking signage, all parking is free in the town center with some areas closer to the town center having 2-hour parking limits between 8:00 AM and 6:00 PM and some parking areas further from the town center having 4-hour parking limits. There does not appear to be any paid parking in the Troutdale Town Center.

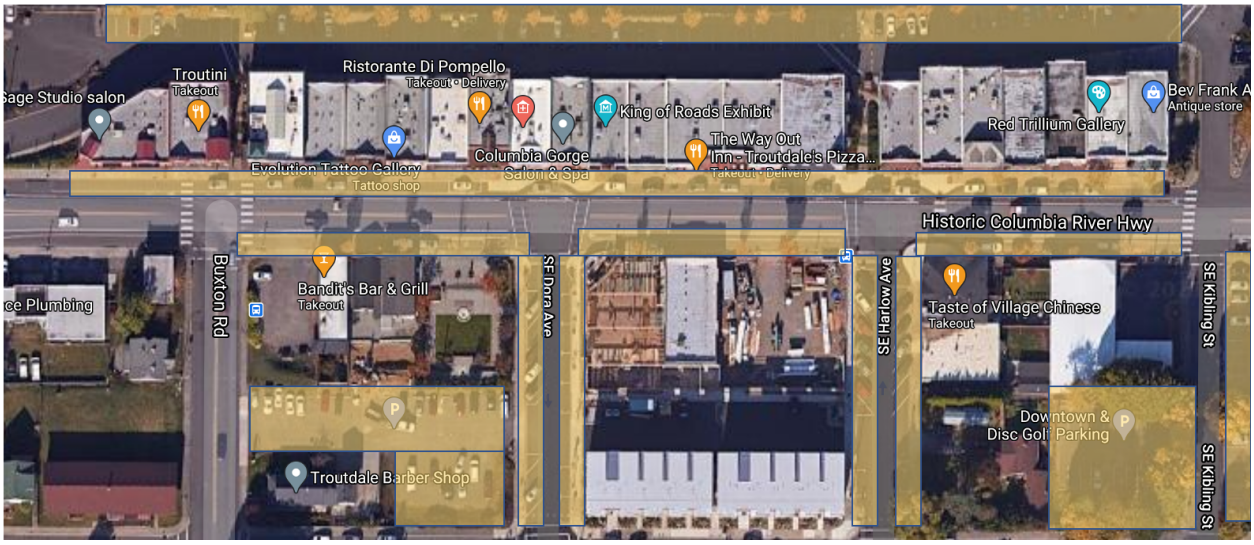

Fig. 1. [Parking in the Troutdale Town Center, highlighted in yellow] **Source:** Google Maps

Next, we took notice of the biking lanes and their close proximity to the curb. This is of concern because when the city installs a loading zone, they may have to reclaim some sidewalk to make room for a loading zone that is big enough to cater to a large delivery truck or beer truck. Coincidentally, in our review of the Google Maps satellite images there appears to be two deliveries taking place (see Figure 2 & 3) where in one instance the delivery truck (UPS) is blocking the biking lane.

Fig. 2 & 3. [Delivery trucks in the Troutdale Town Center] **Source:** Google Maps

Curb Management Policies and Loading

In researching curb management policies, we found a plethora of ways that cities have used policy to address the growing demand for loading and unloading zones. One concept we found while researching is the curb productivity index. Developed in 2018 by Fehr and Peers Transportation Consultants, a curb productivity index is a measurement of how many people a section of curb space is serving per hour (Wylie). The equation is simple: it is the number of passengers divided by the number of hours elapsed, multiplied by the length of the curb in feet. For instance, if the curb is 8- feet long and serves 100 passengers in 4 hours, the curb productivity is 0.3125 (Wylie). This number can then be compared to other curbs to determine which curbs are serving more people than others. When we conducted our research, we tried to find areas to put the loading zones where the curb productivity was already low, so that parking spaces that customers deem more valuable would not be affected. Extrapolating from the idea of curb productivity, one can approach curb management policy in terms of ratios of productivity. For instance, if both sides of a street are initially equal in productivity, before loading zones, and the addition of a loading zone on one side lowers curb productivity for parking by removing valuable spaces, increasing turnover of parking spaces on the other side of the street via the use of time limits could increase overall curb productivity for the street to the original level before the addition of a loading zone.

Types of Loading Zones

Another common theme that our research presented was the classification of different types of loading zones, particularly for larger cities with dense city centers. For example, the city of Seattle designates four main loading zone types: passenger loading zones, loading zones, truck zones, and commercial vehicles loading zones (Miller). Passenger loading zones are primarily for the loading and unloading of people via taxi and ride-hailing services, while commercial loading zones and truck zones are primarily for loading and unloading goods. Combining all of these, Seattle's designation of some loading zones as just "loading zones" is meant to be flexible with areas that have dynamic loading needs. In these more general loading zones, all vehicle types are allowed to use the zone for loading either people or goods. Next, another common theme throughout our research of types of loading zones was the varying sizes of loading zones themselves. Commercial loading zones must be large enough to accommodate large trucks, and it was typical for cities to designate 20-60 feet of space for loading zones. (Miller) Using Seattle as an example again, "Most passenger loading zone spaces are in zones that are two to four car lengths. The overwhelming majority (73%) of commercial and truck loading zone space is in zones that are more than one car length but not quite three..." (Miller).

Pricing/Timing of Loading Zones

In regard to pricing, we found that most cities had various pricing policies around loading zones. For instance, it was typical to find that larger cities with bustling city centers charged for occupation of loading zones. For example, the city of Chicago charges a fee for use of all the city's commercial loading zones that is higher than regular street parking and that must be paid 24-hours a day, 7 days a week (ParkChicago). Even in smaller mid-size cities like Eugene, Oregon, commercial parking in loading zones also has a cost that ranges from $5 per space per day to $15 per space per day (City of Eugene). On the other hand, smaller cities around the size of Troutdale (i.e Pendleton, Coos Bay, The Dalles, etc) tended to not charge for occupation of

loading zones. Furthermore, it appears that most cities do not charge for loading and unloading in passenger loading zones. This could be due to passenger loading with Uber and Lyft services being relatively quick. That said, time limits help ensure cars and taxis are not idling in passenger loading zones and blocking other vehicles from access.

Our research also showed cities often develop policies surrounding times of day use of loading zones. Typically, the time slots that cities select align with regular business hours. For example, the city of Portland often designates their zones as "combination zones" that allow loading zones to serve commercial loading functions during designated periods (typically 7 AM - 7 PM) and to be used as timed zones for visitors or residential uses at times outside of that zone (Portland Bureau of Transportation). Even in smaller cities, we found that time limits and time of day requirements help ensure that people parking residentially and recreationally were not occupying loading zones during crucial delivery times and business hours.

Recommendations

Based on our findings, this section offers recommendations for the city of Troutdale for the location of loading zones and curb management policies to accompany the zones. We made sure to take into account the built environment, density, and development patterns that are unique to the Troutdale Town Center.

Location of Loading Zones

We recommend the installation of three loading zones in the Troutdale Town Center: One loading zone between Taste of Village and Calcagno Cellars Winery, another zone in front of Troutdale Dental, and another zone between Sage Salon and Troutini (see Figure 4).

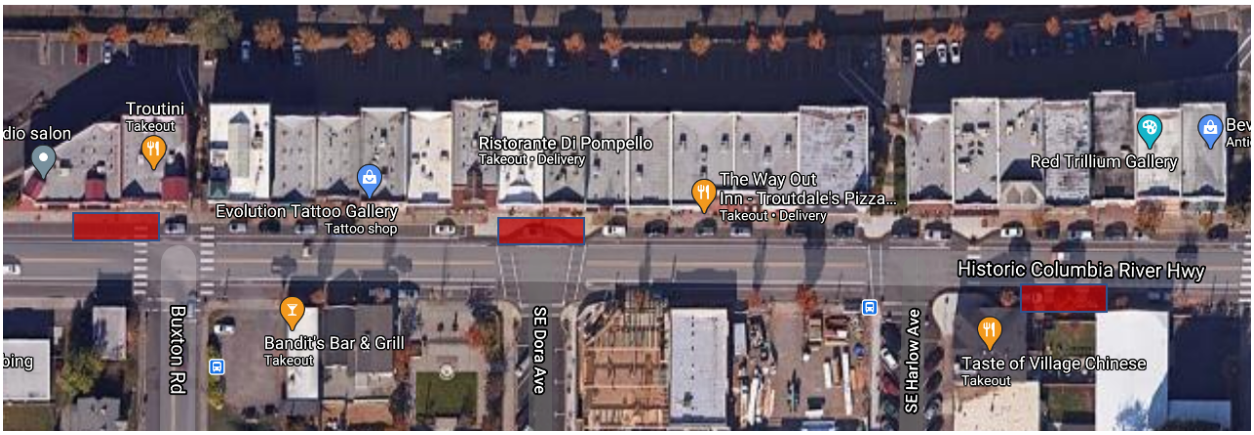

Fig. 4. [Proposed locations of zones in the Troutdale Town Center] **Source:** Google Maps

While we acknowledge that our proposed locations are where parking currently exists, we noticed in our research that often cities place loading zones in what used to be on-street

parking spaces. Given the more than ample amount of parking (see Figure 1) in the Troutdale Town Center, we figured that the loss of parking in these areas would not be too significant.

The first loading zone we propose is between Sage Salon and Troutini. This loading zone is the furthest to the left in Figure 4. In proposing this location, we wanted to ensure that the nearby businesses and restaurants had ample access to a loading zone that was nearby while still being a good distance away from the other proposed loading zones. Furthermore, in our research of the Troutdale Town Center we found two separate instances on Google Maps street view where loading was happening in this exact spot (see Figure 2 for example).

The second loading zone that we propose is directly in front of Troutdale Dental. This location is in the center of the Troutdale Town Center in Figure 4. We believe this location is optimal because it is in the heart of the town center and in close proximity to numerous restaurants and businesses. Furthermore, the street is already cut out here for a single parking space and could easily and cheaply be retrofitted to become a new loading zone. A challenge to note in regard to this loading zone is the close proximity of the crosswalk to the loading zone that could lead to potential blind spots for pedestrians when crossing the street from the north side during a delivery.

The third loading zone we are proposing is between Taste of Village and Calcagno Cellars Winery. This loading zone is furthest to the right in Figure 4. We believe this to be an ideal location for a loading zone due to the zone's close proximity to the two restaurants. Furthermore, we wanted to ensure that we proposed loading zones on both sides of the street to reduce unnecessary street crossings for those delivering goods or those being picked up/dropped off via ride-hailing services.

Curb Management Policies

Loading Zone Types

Our first curb management policy recommendation to the city of Troutdale relates to the type of loading zone that should be installed. We recommend that all three loading zones should be dynamic use loading zones, meaning that loading of any kind is permitted. This includes passengers using services such as Uber and Lyft, as well as commercial loading of goods. Given Troutdale's small size, we do not believe it makes sense to designate loading zones as commercial only or passenger loading only. By ensuring dynamic use, the city can be flexible with loading in the town center and save infrastructure costs with multipurpose zones.

Time Limits and Hours of Operation of Loading Zones

Our second curb management policy recommendation to the city of Troutdale relates to the time of day and time limits of loading zone use. We recommend the city of Troutdale only enforce loading zones from 7 AM - 7 PM every day with a time limit of 30 minutes. Outside of this time frame, loading zones should serve as additional parking. Our reasoning for this decision is that deliveries and ride-sharing loading typically only happen during business hours. If this time frame does not work for the city, the city should assess the times that loading presently occurs and determine when the loading zones should be "active." The city should implement

proper signage to alert drivers of the specific hours at which loading occurs and to ensure that the vehicles using the loading zone do not exceed 30 minutes in their stay in the designated zones.

Pricing of Loading Zones

Our third curb management policy recommendation to the city of Troutdale relates to the pricing of loading zone use. We recommend that the loading zones in Troutdale should all be free. Not only do we believe that Troutdale is too small of a city to charge for loading zone use, but we hope that by keeping loading zone use free it will also encourage their use. Furthermore, we believe that charging for use of the loading zones could potentially decrease demand and lead to perpetuation of the current situation of trucks unloading in the street instead of in designated zones separate from traffic. While this decision may cost the city potential revenue, it is important to note that our examination of the places in which loading zones had a cost tended to be large cities with dense downtown districts. If revenue is a concern, it may be worthwhile for the city to look into instead charging for off-street parking in this area.

Designate Parking Spots Clearer

Our fourth curb management policy recommendation to the city of Troutdale is to paint parking spaces to be more clearly designated spots. When exploring the city center via Google Earth, we found that the on-street parking is not currently marked as individual spaces. Instead, drivers have a lot of freedom to decide where they will park along the curb. This could be potentially problematic when a car parks with inefficient spacing. Including clearly painted markings of where parking spaces start, and end could encourage drivers to park more efficiently and help clarify what is a parking zone and what is a loading zone.

Update City Code on Loading

Our fifth curb management policy recommendation to the city of Troutdale relates to updating the Troutdale city code. As mentioned previously, the Troutdale city code currently outlines the area minimum requirements for loading zones for commercial and industrial development sites. Due to the city code focusing primarily on loading zones at the time of development, it may be worthwhile for the city to update the code to address installation of loading zones post-development. Given the rapid expansion of e-commerce services like Amazon and ride-hailing services like Uber and Lyft, it is likely that this will not be the last time that the city may need to install loading zones post-development. Additionally, the current terms for an on-street loading zone appear to be relativity dated and do not address the growing demand.

Gather Data on Curb Productivity Index

Our final curb management policy recommendation to the city of Troutdale is to gather data on the curb productivity index. A curb productivity index is a measurement of how many people a section of curb space is serving per hour and can be helpful in determining which curbs are serving more people than others. As we only had access to Google Maps satellite imagery for our research, we did not have access to the full data to make these calculations. We urge the City of Troutdale to take into account curb productivity when determining final placement of the three loading zones that we have suggested, or any future loading zone-related projects. Observations

of where loading zones are most needed (i.e. outside of the restaurants that are the busiest) and subsequent calculations and comparisons to other locations can help the City of Troutdale to determine final placement of the loading zones.

Potential Challenges

There are several potential challenges to our recommendations. First and foremost, we want to acknowledge the financial cost of implementation. This is including, but not limited to: the cost of signage, repainting the parking spaces and marking loading zones, and possibly cutting into the sidewalk to make room for the on-street loading zones. While we do recognize the financial burden of these recommendations, we believe that the installation of loading zones in the Troutdale Town Center is a cost that the city will have to address inevitably with the explosion of e-commerce and ride-hailing. In addition, the loading zones will greatly benefit Troutdale citizens getting to the town center via ride-hailing and ease of local business delivery.

The next challenge with on-street loading zones is the aesthetic effect on storefronts. Not only could loading zones negatively impact the "look and feel" of the Troutdale Town Center, but large trucks could potentially block the storefronts from view altogether. However, it is important to remember that the loading zones have a 30-minute time limit, and storefronts would likely not be constantly blocked by trucks, especially considering that the loading zones are of dynamic use and include passenger loading with ride hailing services like Uber and Lyft.

While the installation of each loading zone may have its own unique challenges, one challenge that all the loading zones face is the bike lanes' close proximity to the curb. As highlighted by Figure 3, it is a common occurrence for delivery trucks who are parked in the on-street parking to be hanging into the biking lane. Not only could this be a safety issue for cyclists, but there may be a cost to relocating the bike lanes or further cutting into the sidewalk. If the city wishes to proceed with on-street loading zones, the bike lane issue will have to be something the city works to address. Regardless, there should be ample signage and warnings to alert trucks and other vehicles utilizing the loading zone to be cautious of cyclists.

Beyond these challenges, we believe that overall, the benefits of the installation of on-street loading zones in the Troutdale Town Center far outweigh the challenges. Not only do we believe that the installation of loading zones will benefit traffic flow in the town center, but we also believe the loading zones will benefit local businesses who rely on e-commerce and local residents who rely on ride-hailing services. The city of Troutdale should be proactive in addressing the ever-changing needs of the future, and on-street loading zones are a simple way to get ahead of the curve in a world of rapidly changing technology and commerce.

Group Member Contribution Statement

What did Madeline work on?

Madeline contributed to this paper and project in a number of ways. She conducted preliminary research, created a shared folder in Google Drive with a brainstorming document and the outline, the latter of which would later split into two documents, one for this essay draft. Madeline met with Nick over zoom at least once a week for 20-30 minutes to discuss the project, make recommendations, set mini-deadlines to keep the group on track, and collaborate on the paper. Madeline communicated with Nick frequently via texting as well as through comments on the documents and in the zoom meetings, responding immediately as much as possible. She set realistic goals and deadlines, while remaining flexible during unexpected schedule conflicts. Madeline created the bibliography and internal citations for this essay except for a few of the internal citations, and she contributed to general formatting of the paper. In addition, she wrote half of the Group Member Contribution Statement, the bulk of the Findings and Recommendations sections, as well as around half of the Methods section. Madeline conducted research via Google Maps as well as many other sites and PDF documents online. She also applied her notes from the class' meeting with the City of Troutdale in the beginning of the project.

What did Nick work on?

Nick contributed to this paper and project in a multitude of ways. First, Nick worked heavily on drafting, editing, and writing the paper. For example, Nick wrote the Executive Summary, the Introduction, the Methods section, and helped edit all other sections that Madeline wrote. It was important to Nick that the paper sounded cohesive despite being written by two different people, so they made sure the paper had smooth transitions and used similar language throughout. While Madeline worked heavily on the research and findings side of things, Nick worked hard to format the paper, create graphics and imagery, and bring it all together for a final product. Nick and Madeline met frequently throughout the week to check in with each other, discuss questions, access each other's work, and collaborate on research. Nick and Madeline used Google Drive and Google docs to draft this paper, which gave them ample ways to edit each other's work and provide feedback to each other. Additionally, Google Maps was instrumental to this assignment and Nick explored the Troutdale City Center via the street viewer tool in depth. Finally, much like Madeline, Nick worked diligently to keep the group on track and to stick to their deadlines. Nick helped send reminders, set up office hour meetings with Anne, create a timeline for the project, and was very flexible with scheduling conflicts. The group had a goal to finish the SCYP draft early, and they did so. Overall, the project went smoothly, and Nick and Madeline worked well together in collaboration and research.

Works Cited

City of Troutdale. “Town Center Plan 2020-2040.” City of Troutdale, 30 Nov. 2020.

Jiang, Jingjing. “More Americans Are Using Ride-Hailing Apps.” *Pew Research Center*, Pew Research Center, 22 July 2020, www.pewresearch.org/fact-tank/2019/01/04/more-americans-are-using-ride-hailing-apps/.

Kulach, Karolina. “10 Significant Ecommerce Statistics You Need to Know in 2021.” *Webinterpret*, Webinterpret, 19 Oct. 2020, www.webinterpret.com/us/blog/ecommerce-statistics/.

Miller, Dawn. “Comparing Loading Zones.” *Home*, COORD, 26 May 2020, www.coord.com/blog/comparing-loading-zones.

ParkChicago, director. *ParkChicago Loading Zones 2018*. *YouTube*, YouTube, 6 Apr. 2018, www.youtube.com/watch?v=fAphnXvVHks.

Parking Services. “Commercial Parking.” *Eugene, OR Website*, City of Eugene, Oregon, www.eugene-or.gov/784/Commercial-Parking.

Sabanoglu, Tugba. “Coronavirus: Consumer Spending E-Commerce By Age U.S. 2020.” Statista, 1 Dec. 2020, www.statista.com/statistics/1104962/spending-on-goods-from-online-marketplaces-coronavirus-by-age-us/.

Siddiqui, Faiz. “Uber Ridership Has Cratered and No One Knows When It'll Come Back.” The Washington Post, WP Company, 10 Aug. 2020, www.washingtonpost.com/technology/2020/08/10/uber-coronavirus-lockdowns/.

“Troutdale Development Code.” City of Troutdale, 2017.

“Troutdale Restaurant List.” *Troutdale Oregon*, City of Troutdale Oregon, Nov. 2020, www.troutdaleoregon.gov/executive/page/troutdale-restaurant-list.

“Truck Loading Zones (TLZ).” Portland Bureau of Transportation, Nov. 2017.

Wylie, Allison. “Sharing the Curb.” *Medium*, Uber Under the Hood, 9 Sept. 2019, https://medium.com/uber-under-the-hood/sharing-the-curb-b5fde02b97dd.

Qian, Joyce. “[Report] How Has COVID-19 Impacted Ecommerce Trends? - ContactPigeon: Blog.” ContactPigeon, 4 Nov. 2020, blog.contactpigeon.com/covid-19-ecommerce-impact/.

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