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Science, Advocacy, Policy, Planning: Tools for Advancing Transportation Equity

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SCIENCE, ADVOCACY, POLICY, PLANNING: TOOLS FOR ADVANCING TRANSPORTATION EQUITY

by

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Portfolio

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Garrett McAllister, M.S., Environmental Studies – May 2018

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Abstract
The theme of this portfolio is how different tools and approaches can be used for advancing transportation equity. Broadly defined, transportation equity is about fairness in transportation. There are a number of ways this fairness can be assessed. The most common way to assess transportation equity is by looking at the fairness of outcomes, distributed geographically, socially, or even by mode of transportation. Equity can also be defined by the fairness of processes. The first half of the portfolio illustrates some of the problems with the current transportation system and how it is unhealthy (Piece 1) and unjust (Piece 2). The second half of the portfolio focuses on one of the potential solutions: encouraging and promoting increased levels of multimodal transportation (Piece 3); and then analyzing how community planners and leaders best work to achieve this in an equitable way (Piece 4). The first piece of this portfolio is a literature review of how scientists measure near-road air pollution exposure from mobile sources, which provides a better understanding of just one important environmental health impact our transportation systems. There are key social and geographic equity implications from those studies, which planners and activists can use as evidence in arguments for solutions. The second piece is an environmental justice analysis of a road expansion project in Missoula, Montana. This piece seeks to better understand the procedural, distributive, and social impacts from the project and brings in themes of advocacy and best practices in an effort to argue for sensible alternatives. The third piece is a reflection essay from my internship with the Missoula Metropolitan Planning Organization, where I wrote a white paper as part of the 2016 update to the Long Range Transportation Plan. This white paper discusses multimodal solutions to vehicle-oriented transportation development and provides a policy-based approach to increasing levels of multimodal transportation rates in Missoula. The last piece is a case study of a multimodal transportation project in Miami, Florida. This piece analyzes transportation planners' approaches to procedural equity and discusses successes and areas for improvement.

Table of Contents

Portfolio Introduction

I came into the EVST program with experience in the non-profit sector, specifically serving the transportation needs of homeless and low-income individuals by providing them refurbished bicycles through human resource organizations in Bend, Oregon. My intent was to continue in the non-profit sector upon graduation, but the EVST program opened up new and exciting possibilities for me. Thanks to David Shivley's class "Planning Principles and Processes" and my internship with the Missoula Metropolitan Planning Organization, I discovered the discipline of planning. Planning is intersectional and dynamic, with numerous links between all types of planning, such as transportation planning, economic development planning, land use planning, disaster and emergency preparedness planning, and historic preservation and cultural resource planning, just to name a few. The multi-faceted approach of the modern planning paradigm appeals to me as a way to address complex environmental and social issues.

In addition to planning, Christopher Preston's class "Issues in the Anthropocene" had a profound impact on the way that I think about environmental issues from a deeper philosophical perspective, particularly in that there is a need to pay attention to the health of the human-built environment just as much, or perhaps more, as the "natural" environment. These new concepts, combined with a strengthened foundational understanding of environmental justice, has led to more in-depth study of transportation systems and how they impact the condition of the built environment. This is important because the condition of the built environment has profound implications on environmental sustainability, public health, social conditions, and climate change.

Transportation planning and transportation advocacy can contribute positively to the process of creating a more resilient, healthy, equitable built environment, which plays an integral role in the larger context of global climate change. Along with reducing impacts in non-human landscapes, improving the condition of the human landscape is a key part of long-term sustainability solutions. These solutions are important for both slowing the progression of human caused climate change and for building resiliency against the impacts that we are already seeing and will continue to see. Climate impacts are felt more heavily by historically marginalized and vulnerable groups, which makes climate change just as much a social justice issue as an environmental issue.

The central theme of this portfolio is how different tools and approaches can be used for advancing transportation equity. Broadly defined, transportation equity is about fairness in transportation. The first half of the portfolio illustrates some of the problems with the current transportation system and how it is unhealthy (Piece 1) and unjust (Piece 2). The second half of the portfolio focuses on one of the potential solutions; encouraging and promoting increased levels of multimodal transportation (Piece 3) and then analyzing how community planners and leaders best work to achieve this in an equitable way (Piece 4).

The first part of the portfolio is a literature review titled "Understanding Near-Road Mobile Source Pollution Exposure". The purpose of this paper is to provide a science-based understanding of an important public health issue related to transportation: air pollution. The

paper starts with background information about the Clean Air Act and criteria pollutants, as well as a brief history on air pollution modeling. The paper then provides a literature review of the methods used for measuring near-road air pollution exposure, as well as some of the models used to predict the movement of pollutants, and discusses the impact of emerging technologies on this field of science. These new technologies include mobile devices (like backpacks or even handheld monitors) and are allowing scientists to take more dynamic, real-time measurements of pollutants, which are showing more acute and nuanced pollution exposures. These results have important implications on public health, environmental justice, and transportation planning.

The second part of the portfolio is an environmental justice review of a road expansion project in Missoula, Montana. The piece is titled "Using Environmental Justice Best Practices to Analyze a Transportation Project in Missoula, Montana: A Case Study of the Russell Street Road Expansion". The major objective of this paper is to perform an environmental justice review of the Russell Street road updates in Missoula, Montana. The paper briefly explores the historical roots of transportation injustice in the United States, followed by a discussion of current planning practices. Background details on the Russell Street road updates are provided and the heart of the paper investigates the Russell Street Environmental Impact Statement. Potential impacts considered are procedural, geographic, and socio-economic. The Ohio Department of Transportation's 2002 report, *Guidance and Best Practices for Incorporating Environmental Justice into Ohio Transportation Planning and Environmental Processes,* is the guiding document for the analysis. Finally, modest alternatives to the Russell Street updates are proposed, and the paper concludes with a broader discussion in support of a widespread social shift away from individualized car culture and toward more equitable transportation systems.

Part three of the portfolio is an internship reflection essay that describes what ended up being a yearlong policy research internship for the Missoula Metropolitan Planning Organization (MPO), which is a transportation planning body that is required for any urbanized area over 50,000 people. MPO planners wanted to set mode share goals as part of the 2016 Long Range Transportation Plan update, but little guidance exists on how to set sensible and achievable goals for increasing different modes of transportation, such as cycling, walking, and transit. I was tasked with collecting data and analyzing policy on mode share goals from case studies across the country. I focused on nine case study communities, researching their methods for goal-setting and I analyzed planning documents for policies, programs, and initiatives the communities were implementing to help achieve those goals. Lastly, I developed a policy matrix, which gave MPO planners a menu of policy options to consider for achieving mode share goals. In November 2016, I presented my research findings in a joint Transportation Technical Advisory Committee (TTAC) and the Transportation Policy Coordinating Committee (TPCC) meeting. The final result was a White Paper that was published as an appendix to the 2016 Long Range Transportation Plan update in May 2017.

The final piece of my portfolio is a procedural equity case study analysis of the Strategic Miami Area Rapid Transit (SMART) Plan in Miami-Dade, Florida. I use the SMART Plan to investigate the degree to which equity is woven into the public participation process, and I provide insight

and observations on what kind of impact advocacy planning has (if any) on procedural equity. I do this by reviewing Miami TPO planning documents for procedural equity strategies that are employed in the planning process. I also conduct interviews with TPO planners to further identify outreach strategies. The paper concludes with a recap of findings, including notable successes and areas for improvement.

This portfolio project has helped me crystallize a number of important themes and concepts on transportation equity. I believe that this portfolio also demonstrates a sound understanding of the social and environmental issues we face in our current (and future) transportation systems and offers reasonable and thoughtful, collaborative, and equitable approaches to solving these problems via multimodal transportation options.

My work on this portfolio project, and in the EVST program in general, has set me up for success in ways I never could have imagined. My foundational understanding of environmental issues serves as the bedrock for all of my current and future professional work. Because of the EVST program, I will always look at the world through the lens of environmentalism and what I learned in my time in Missoula.

Understanding Near-Road Mobile Source Pollution Exposure

A Literature Review

Garrett McAllister

ENSC 501: Scientific Approaches to Environmental Problems

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ABSTRACT

Air pollution is an important public health issue. Methods and models for assessing air pollution exposure are continually evolving with emerging technologies. This paper provides a literature review of mobile-source air pollution exposure studies. Particular focus is paid to innovative new methods of measuring near-road pollution exposure, as outputs from these studies have implications on public health, environmental justice, and urban transportation planning.

Acknowledgements

I would like to thank Jacob Hanson of The University of Montana's Writing Center. He provided comments, suggestions and guidance as I worked though this paper. His ability to help me crystallize ideas and clarify my writing was invaluable.

Table of Contents

Terms and Abbreviations

HC – Hydrocarbons

NOx - Nitrogen Oxides

VOC - Volatile Organic Compounds

PM - Particulate Matter 2.5 and 10

UFP - Ultrafine Particulate

MSAT – Mobile Source Air Toxics

NAAQS - National Ambient Air Quality Standards

HDDV - Heavy Duty Diesel Vehicle

LDGV - Light Duty Gas Vehicle

Introduction

Emissions from motor vehicles are a significant factor in overall air quality. Pollutants from motor vehicles include various "greenhouse gases, particulate matter, mobile source air toxics, hydrocarbons, nitrogen oxides, and carbon-monoxide."[1] The amount of mobile source pollutants in the air has public health implications.

Over the last several years, an increasing number of epidemiological studies have shown that vehicle generated pollutants are linked to various negative health impacts.[2,3] These health problems can include hypertension,[4] childhood asthma,[5] developmental issues,[6,7] heart ailments,[8] cancer,[9] and other health complications. Epidemiological studies are important to help understand the health impacts from air pollution, but they are only the first step.

Measuring traffic-specific population exposure is a necessary component of a comprehensive health risk assessment. In other words, if these pollutants are indeed bad for human health, what are the exposure risk levels? Furthermore, who is at-risk for the highest levels of exposure?

Epidemiology and exposure assessment are inextricably linked: "The results from a population exposure study, when combined with epidemiology data, will help in providing a full health risk assessment."[10] The purpose of this paper is to provide a literature review on near-road mobile source pollution exposure, to understand the emerging technologies and the new methods of measuring pollution exposure, and to explore the implications that this research may have on planning and policy-making.

Background

Under the Clean Air Act, the United States Environmental Protection Agency (EPA) seeks to

[1] Vallamsundar, S., et al. (2016a). A comprehensive modeling framework for transportation-induced population exposure assessment. *Transportation Research Part D*, 46, 94-113. Pg 94.

[2] Brugge, D., Durant, J. L., & Rioux, C. (2007). Near- highway pollutants in motor vehicle exhaust: A review of epidemiologic evidence of cardiac and pulmonary health risks. *Environmental Health*, 6, 23.

[3] Shekarrizfard, M., et al. (2015). Investigating the role of transportation models in epidemiologic studies of traffic related air pollution and health effects. *Environmental Research*, 140, 282-291.

[4] Foraster, M., et al.. (2014). Association of long-term exposure to traffic-related air pollution with blood pressure and hypertension in an adult population-based cohort in Spain (the REGICOR study). *Environmental Health Perspectives, 122*(4), 404.

[5] McConnell, R., et al. (2010). Childhood incident asthma and traffic-related air pollution at home and school.(children's health)(report). *Environmental Health Perspectives, 118*(7), 1021.

[6] Gauderman, et al. (2007). Effect of exposure to traffic on lung development from 10 to 18 years of age: A cohort study. *The Lancet, 369* (9561), 571-577.

[7] Vallamsundar, S., et al. (2016b). Maternal exposure to traffic-related air pollution across different microenvironments. *Journal of Transport and Health*, 3(2), 72.

[8] Brook, R. D., et al. (2010). Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association. *Circulation*, 121(21), 2331-2378.

[9] Parent, M., et al. (2013). Traffic-related air pollution and prostate cancer risk: A case–control study in Montreal, Canada. *Occupational and Environmental Medicine*, 70(7), 511.

[10] Vallamsundar, S., et al. (2016a). Pg 96.

improve air quality by setting and enforcing limits on air pollutants. The EPA's Office of Air Quality Planning and Standards sets the limits that form the National Ambient Air Quality Standards.[11] The process of establishing ambient air quality standards is a complex dance between science and policy.[12]

The EPA lists ambient air quality standards for six common and dangerous air pollutants, which are referred to as "criteria" pollutants. These pollutants are either primary or secondary. A primary pollutant is one that is emitted directly from a source. A secondary pollutant is created when two primary pollutants chemically react in the atmosphere. One criteria pollutant that is a secondary pollutant is ground level ozone, which is created when VOCs and NOx react in the presence of sunlight. Primary criteria pollutants that come mostly from mobile sources include carbon monoxide, nitrogen dioxide, and some types of particulate matter. Secondary criteria pollutants created from reactions between mobile-source (and other) primary pollutants include ground level ozone and some types of particulate matter.

Acceptable pollution levels vary, based on the pollutant. Primary standards (not to be confused with primary pollutants) for all six criteria pollutants are set to protect human health and secondary standards are set to protect resources, including soil, water, and crops.[13] (See Table 1 on page 4 for full list of criteria pollutants). The EPA also lists 187 primary and secondary hazardous pollutants, which include MSATs such as benzene, acetaldehyde, acrolein, naphthalene, ethylbenzene, formaldehyde, and 1,3-butadiene.[14,15] Many exposure studies measure one or more hazardous pollutants in addition to criteria pollutants.[16,17,18]

Traditionally, ambient air quality monitoring requires air samples to be taken in static (i.e., fixed, stationary) locations away from direct sources of pollution. This widespread distribution of monitoring devices is required to get reliable and accurate readings that reflect the generalized, average air quality in a certain area.

While the Clean Air Act is a valuable policy tool that requires monitoring ambient air quality, it

[11] United States Environmental Protection Agency. (2016). "Air Pollution Monitoring." Retrieved from: https://www3.epa.gov/airquality/montring.html

[12] McClellan, R. (2012). Role of science and judgment in setting national ambient air quality standards: How low is low enough? *Air Quality, Atmosphere & Health*, 5(2), 243-258.

[13] United States Environmental Protection Agency. (2016). "Hazardous Air Pollutants." Retrieved from: https://www.epa.gov/haps

[14] Union of Concerned Scientists. (2014). "Cars, Trucks, and Air Pollution." Cambridge, MA. Retrieved from: http://www.ucsusa.org/clean-vehicles/vehicles-air-pollution-and-human-health/cars-trucks-air-pollution#.WETBu3eZNR0

[15] Kimbrough, S., Palma, T., & Baldauf, R. W. (2014). Analysis of mobile source air toxics (MSATs)—Near-road VOC and carbonyl concentrations. *Journal of the Air & Waste Management Association*, 64(3), 349-359.

[16] Karner, A.A., Eisenger, D.S., & Niemeier, D.A. (2010). Near-Roadway Air Quality: Synthesizing the findings from real world data. *Environmental Science & Technology*, 2010, *44* (14), pp 5334–5344.

[17] Chang, S. Y., et al. (2015b). A modeling framework for characterizing near-road air pollutant concentration at community scales. *Science of the Total Environment,* 538, 905-921.

[18] Oakes, M., et al. (2016). Near-road enhancement and solubility of fine and coarse particulate matter trace elements near a major interstate in Detroit, Michigan. *Atmospheric Environment,* 145, 213-224.

has a limited ability to measure air pollution in a more specific spatiotemporal manner. This approach lacks the ability to determine the source of the pollution or track pollution dispersion. However, with improvements in air pollution monitoring, researchers are beginning to understand more about the behaviors of these criteria and hazardous pollutants, which has in turn led to more complex and sophisticated modeling techniques.

Air pollution modeling has increased in complexity over the last 80 years. The Gaussian model, developed in the 1930's to model the dispersion of point-source plumes, is the earliest and most successful air pollution model, despite its simplicity.[19] By the 1970's, scientists began to realize that air pollution was not just a local phenomenon, and that pollution could travel very long distances from its source.[20] Lagrangian and Eulerian models were developed to provide a more comprehensive understanding of the complex nature of pollution dispersion.

In the simplest terms, Lagrangian models predict the movement of pollutants to see how they behave. Because these studies predict pollutant movements, they tend to be conducted across large spatiotemporal scales. Eulerian models, on the other hand, set fixed spatiotemporal parameters and predict the dispersion patterns of pollutants within those fixed parameters, often in a grid form over an urban area. Dispersion models are becoming increasingly complex and are able to account for more factors. Today, these models are based on Gaussian, Eulerian, and Lagrangian concepts, but are often integrated to form complex hybrid models that contain very long model chains. Model chains use the outputs from the first model for the inputs in the next model and so on. Some studies even compare the efficacy and accuracy of the two models against one another.[21]

Currently, the EPA recommends two general air pollution dispersion models: AERMOD and CALPUFF.[22] For mobile source emissions specifically, the EPA recommends a model called MOVES, which stands for MOtor Vehicle Emission Simulator and "estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics."[23]

Many of the studies I reviewed used one or more of these EPA models. Most near-road air pollution studies use what are called line source models, which basically follow roadways, whether the road is straight or not. These traffic pollution models tend to be hybrids or

[19] Daly, A. & P. Zannetti. (2007). Chapter 2: Air Pollution Modeling – An Overview. In P. Zannetti, D. Al-Ajmi, and S. Al-Rashied (Eds.), *Ambient Air Pollution.* The Arab School for Science and Technology (ASST) and The EnviroComp Institute. Fremont, CA.

[20] Ibid.

[21] Zhang, Z. and Chen, Q. (2007). Comparison of the Eulerian and Lagrangian methods for predicting particle transport in enclosed spaces. *Atmospheric Environment*, 41(25), 5236-5248

[22] United States Environmental Protection Agency. (2018). "Air Quality Dispersion Modeling: Preferred and Recommended Models." Retrieved from: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models

[23] United States Environmental Protection Agency. (2016). "MOVES and Other Mobile Source Emissions Models." Retrieved from: https://www.epa.gov/moves

advanced iterations of basic line source models.[24,25,26] There are numerous techniques for modeling air pollution dispersion, and they are only getting increasingly complex.[27]

Objectives

The remainder of this paper is a literature review on *how* mobile source air pollution is measured. Understanding the methods used to monitor and measure air pollution in turn provides a more complete understanding of the characterization and concentration of pollutants to which populations are exposed. Research questions fall into two categories: questions about the methodology of the studies and questions about the outputs of the studies.

Methodological questions: How is near-road pollution being measured and studied? What are the methods for these studies? Are there new technologies or methods that are being developed? What do these new technologies or methods look like?

Output questions: What are the results of these studies? What are the exposure levels of mobile source air pollutants? Are the pollutant levels higher closer to roadways? If so, how much? If there are elevated levels of exposure near roadways, does that correlate with elevated health risks? Furthermore, how is this exposure socially distributed? Are there specific groups living with this elevated exposure risk? Are there environmental justice concerns in the distribution of pollutant exposure?

Discussion about the methodologies from these studies is separated into two general categories: static exposure analysis methods and dynamic exposure analysis methods. Static means the use of fixed instruments and dynamic means the use of mobile instruments. Mobile instrumentation is a relatively new method of measuring and analyzing air pollution exposure.[28,29,30] I thought it was important to split the studies this way in order to make output comparisons for the two different methodological approaches. As such, the outputs are woven into the methodology discussions. Finally, there will be a brief conclusion and a discussion of implications, which is based on my research results and influenced by my own personal values.

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[24] Chang, S. Y., et al. (2015a). Comparison of highly resolved model-based exposure metrics for traffic-related air pollutants to support environmental health studies. *International Journal of Environmental Research and Public Health,* 12(12), 15605.

[25] Snyder, M. G., et al. (2013). RLINE: A line source dispersion model for near-surface releases. *Atmospheric Environment*, 77, 748-756.

[26] Pan, L., Yao, E., & Yang, Y. (2016). Impact analysis of traffic-related air pollution based on real-time traffic and basic meteorological information. *Journal of Environmental Management*, 183(3), 510-520.

[27] Vallamsundar, S., et al. (2016a)

[28] Piedrahita, R., et al. (2014). The next generation of low-cost personal air quality sensors for quantitative exposure monitoring. *Atmospheric Measurement Techniques,* 7(10), 3325-3336.

[29] Kumar, P., et al. (2015). The rise of low-cost sensing for managing air pollution in cities. *Environment International*, 75, 199-205.

[30] Nieuwenhuijsen, M. J., et al. (2015). Variability in and agreement between modeled and personal continuously measured black carbon levels using novel smartphone and sensor technologies. *Environmental Science & Technology*, 49(5), 2977.

Approach

In order to fulfill the objectives of this paper, I focused on open source[31] peer-reviewed science journals, prioritizing studies published between 2014 and 2016 in order to find the most recent and relevant approaches to air quality monitoring. Studies from the United States and Canada were given priority, but literature from all over the world was considered, as acute population exposure from mobile source air pollution is a global issue. I found a handful of studies using the search terms listed below. From there, I followed sources cited within different studies.

General search terms included: near-road; population exposure; air pollution; criteria pollutants; mobile sources; traffic sources; dispersion modeling; and land-use regression. I also searched for specific pollutants, such as PM 2.5 and 10, ultrafine particulate matter, CO, NO2 and benzene. For the epidemiological background, I searched the terms health impacts, asthma, cancer, pregnancy, and cardiovascular disease.

Results and Discussion

Static Exposure Analysis

In recent years, scientists have recognized that traditional methods of exposure analysis used very simple modeling methods[32], such as measuring traffic intensity and composition against residential proximity to roadways. Recently, scientists have developed more sophisticated models that seek to identify and characterize pollutants and how they disperse at various temporal and spatial scales. Researchers use highly complex chains of interpolation models that attempt to account for many variables.

One of the major benefits of static exposure analysis is the ability to gather data over large spatial parameters. Stationary air monitors are fairly good at getting overall ambient air quality measurements, especially as the number of monitors increase.[33] Another study suggests that the locations of sampling sites may be of greater importance than the total number of sites.[34] Whatever the method used for placing monitors, results for ambient air measurements tend to be quite reliable.

The value of static analysis increases dramatically when combined with other types of analyses, such as population characterization[35,36] or spatial analysis.[37] This combination approach

[31] Using only open source journals did potentially limit the number of studies that I came across, which is an acknowledged limitation of this review.

[32] Batterman, S. A., Zhang, K., & Kononowech, R. (2010). Prediction and analysis of near-road concentrations using a reduced-form emission/dispersion model. *Environmental Health*, 9(29).

[33] Vallamsundar, S., et al. (2016a).

[34] Ryan, P. H., & LeMasters, G. K. (2007). A review of land-use regression models for characterizing intraurban air pollution exposure. *Inhalation Toxicology*, 19(1), 127.

[35] Gunier, R.B., et al. (2003). Traffic density in California: Socioeconomic and ethnic differences among potentially exposed children. *Journal of Exposure Analysis and Environmental Epidemiology*, 13(3), 240.

[36] Rowangould, G. M. (2013). A census of the US near-roadway population: Public health and environmental justice considerations. *Transportation Research Part D: Transport and Environment*, 25, 59-67.

attempts to provide a more refined analysis and can help show what segments of the population are most exposed, as well as exposure levels at locations where sensitive groups spend large amounts of time, such as hospitals, schools, child-care facilities, senior centers, mental health facilities, etc. What this means is that by using a combination model approach, static analysis can begin to predict pollution exposure based on various factors, such as traffic movement, fleet composition, or population density. Additional variations or factors can be added to the models, combining to build longer and more complex model chains that provide even more spatiotemporally detailed insight.

By combining static analysis with this complex modeling approach, studies confirm what we already know to be generally true. In each study, the specific pollutant concentrations varied at distances from 0 meters to 300 meters, but the results in general held steady to the same trend: Pollution concentration is greater closer to roadways, resulting in higher rates of exposure risk for individuals within those distances from a roadway.[38,39,40,41] In other words, the studies in showed that pollutant concentrations were highest between 0m and 300 meters from a roadway, no matter the specific type of pollutant measured or the geographic/meteorological variables.

The complicated part is uncovering the details of that pollution concentration and identifying the specific rates of exposure. One of the key themes of all of the studies reviewed is that the reduction of toxic concentrations further from a roadway is, among other factors, somewhat context and pollutant dependent.[42] And all of the studies recognized that there are limitations with static exposure analysis, which are specifically identified and discussed below.

Bias and error tend to be "stronger in cases where variable selection was performed with a large number of predictor variables and a small number of measurement sites, which is the most common case in practice."[43] Limited measurement sites are a difficult challenge to overcome due to the prohibitively expensive cost of placing and operating numerous monitors across large spatiotemporal areas.[44] With limited monitors, a host of uncertainties and variables that must be accounted for when building exposure models, which include, but are

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[37] Carrier, M., et al. (2016). The cumulative effect of nuisances from road transportation in residential sectors on the Island of Montreal – Identification of the most exposed groups and areas. *Transportation Research Part D,* 46, 11-25.

[38] Isakov, V., et al. (2014). Air quality modeling in support of the near-road exposures and effects of urban air pollutants study (NEXUS). *International Journal of Environmental Research and Public Health*, 11(9), 8777-8793.

[39] Barros, N., et al. (2013). How wide should be the adjacent area to an urban motorway to prevent potential health impacts from traffic emissions? *Transportation Research Part A*, 50, 113-128.

[40] Oakes, M., et al. (2016). Near-road enhancement and solubility of fine and coarse particulate matter trace elements near a major interstate in Detroit, Michigan. *Atmospheric Environment,* 145, 213-224.

[41] Chang, S. Y., et al. (2015b).

[42] Ibid.

[43] Basagaña, X., et al. (2013). Measurement error in epidemiologic studies of air pollution based on land-use regression models. *American Journal of Epidemiology*, 178(8), 1342-1346. Pg 1344.

[44] Kumar, P., et al. (2015).

not limited to:

Meteorological - Wind speed and variability, temperature, humidity, pressure.
Physiographic - Landscape, elevation, topography.
Biological - Vegetation.
Built environment characteristics - Buildings types and density, roadways & land coverage.
Measuring - Source and receptor at different heights, locations.
Emissions - Average speed and actual speed of drivers differs, which affects emissions due to accelerating and braking.
Fleet composition - Ratio of cars, trucks, motorcycles and other vehicles.
Temporal variations in traffic levels - Rush hour, off-peak, special events, etc.

Most models today try to account for several or all of these factors. As mentioned before, accounting for so many uncertainties is challenging. If one variable is off, large, complex model chains can produce significant error far down the chain and lead to a relatively high level of uncertainty in the results.[45] In addition, some variables, such as meteorological characteristics[46] like wind[47] are vastly complicated with nearly infinite ways to impact near-road pollution concentrations.

To further complicate the situation, achieving the necessary computing power for highly complex models can be a challenge. The models work best under idealized, steady state, homogenous situations, [48] so the complexity of real-world variables is difficult for these models to capture. As a result, these models tend to generalize extremely complicated and dynamic variables in order to ease computational load and reduce error, which limits specificity.

Despite advanced modeling, static models are still limited in their ability to capture spatial and temporal variability at very fine scales.[49] These models tend to spread the distribution out, which masks actual spatial and temporal variability. This falsely suggests that everyone along the roadway is receiving the same amount of pollutant exposure at all times, when in fact there can be "significant variations in concentration levels occur in the course of a day and at different locations within the same urban area."[50] Even studies that try to attempt to account for variability end up recognizing that future work may require even more refined spatial and temporal parameters.[51]

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[45] Vallamsundar, S., et al. (2016a).

[46] Baldauf, R., et al. (2008). Traffic and meteorological impacts on near-road air quality: Summary of methods and trends from the Raleigh near-road study. *Journal of the Air & Waste Management Association*, 58(7), 865-878.

[47] Hagler, G. S. W., et al. (2010). High-resolution mobile monitoring of carbon monoxide and ultrafine particle concentrations in a near-road environment. *Journal of the Air & Waste Management Association*, 60(3), 328-336.

[48] Georgopolous, P.G. (ND). Module III: Atmospheric Dispersion Modeling: Elementary Concepts and Examples. In *An Introduction to Human Exposure Modeling*. Environmental and Occupational Health Sciences Institute. Piscataway, NJ.

[49] Kimbrough, S., et al. (2014).

[50] Vallamsundar, S., et al. (2016a). Pg 95.

[51] van den Hooven, et al. (2009). Residential traffic exposure and pregnancy-related outcomes: A prospective birth cohort study. *Environmental Health*, 8, 59.

Another major problem is aggregation, which is the term used for the cumulation and averaging of results. Aggregating long-term near-road pollution data fails to capture specific temporal fluctuations in traffic volumes, where exposure levels can be significantly above criteria pollutant standards for short periods of time. Long-term exposure analysis tends to dilute results through aggregation, smoothing out the peaks and valleys and giving an average temporal measurement that can fall below criteria thresholds, despite short periods of very high exposure. To address this, studies have been incorporating travel demand models[52] into their exposure models to try and get a better understanding of traffic patterns[53] and composition,[54] which provides more accurate estimates of high-exposure risk timeframes (such as peak rush hour traffic) and reduces aggregation. Some studies also use Census data to develop more spatially fine-grained exposure analysis and pinpoint minority and low-income neighborhoods and areas.[55]

Assessing the percentage input of an individual pollutant in the overall pollution measurement is very challenging, not to mention the challenge of tracing that pollutant back to its source.[56] Most monitoring has a limited ability to identify what percentage of the total pollutant measurement is specifically from a mobile source. This is a smaller, but still important problem, particularly when attempting to specifically pinpoint mobile sources.

Probably the most significant downside of static exposure analysis is that it assumes the study population is in a fixed location at all times.[57,58] With this approach, individuals are considered to remain at home and, therefore, only exposed to pollutants at their home address.[59] This is important to note because some studies have shown that exposure can be higher at work locations[60] or when moving about the city.[61]

Because static measurement only measures fixed locations, it does not mimic real-world exposure scenarios very well. In reality, we move around all the time and exposure can be higher during commutes than at home. While modeling based on static receptors is getting

[52] Vallamsundar, S., et al. (2016a).

[53] Perugu, H., Wei, H., & Yao, Z. (2016). Integrated data-driven modeling to estimate PM2.5 pollution from heavy-duty truck transportation activity over metropolitan area. *Transportation Research Part D,* 46, 114-127.

[54] Chen, H., Namdeo, A., & Bell, M. (2008). Classification of road traffic and roadside pollution concentrations for assessment of personal exposure. *Environmental Modeling and Software,* 23(3), 282-287.

[55] Rowangould, G. M. (2013).

[56] Holnicki, P., & Nahorski, Z. (2015). Emission data uncertainty in urban air quality Modeling—Case study. *Environmental Modeling & Assessment,* 20(6), 583-597.

[57] Vallamsundar, S., et al. (2016a).

[58] Isakov, V., et al. (2014).

[59] Shekarrizfard, M., Faghih-Imani, A., & Hatzopoulou, M. (2016). An examination of population exposure to traffic related air pollution: Comparing spatially and temporally resolved estimates against long-term average exposures at the home location. *Environmental Research*, 147, 435-444.

[60] Physick, W., et al. (2011). Measurements of personal exposure to NO 2 and modeling using ambient concentrations and activity data. *Atmospheric Environment*, 45(12), 2095-2102.

[61] Shekarrizfard, M., et al. (2016).

increasingly sophisticated, it still is limited in its ability to mimic the real-world movement of human subjects, and thus capture real-world exposure. Most static exposure studies focus on fixed points along a roadway or certain traffic zones,[62] which ends up being more of a measurement of pollution in that area rather than a measure of true human exposure.

A particularly interesting study attempted to highlight this issue by using an intersecting three-model chain combined with travel trajectories (a model used to predict travel movement) to measure the dynamic exposure to NO2, and then compared it to static exposure measurements, which served as the control.[63] The results indicated that nearly 90% of study individuals had lower 24-hour at-home exposure rates than 24-hour mobile rates, and activities away from home contributed to 23-44% more exposure than just staying at home.[64] This illustrates that traditional static exposure measurement methods are unable to capture the more acute exposure risks of individuals moving around in their day-to-day activities.

Snyder et al. (2013) accurately sums up the challenges of using static analysis:

> *"Estimating exposure to roadway emissions requires dispersion modeling to capture the temporal and spatial variability of mobile source pollutants in the near-road environment. The model needs to account for the variability in mobile emissions across myriad urban and suburban landscapes, while considering factors (depending on pollutant and application scenario) such as vehicle induced turbulence, roadway configurations (e.g. depressed roadways and noise barriers), local meteorology, surrounding terrain and buildings, pollutant chemistry, deposition, and others."*[65]

Exposure variability is inherent in transportation because the sources (vehicles) are not stationary, the test subjects (humans) are not stationary, and the environmental conditions (wind, temperature, humidity, air circulation, etc.) are not static.[66] The emergence of new mobile pollutant measurement technologies has helped scientists overcome some of these challenges.

Dynamic Exposure Analysis

Mobile exposure analysis, also called dynamic exposure analysis, is becoming a more popular and affordable method of measurement due to advancing technology. While this method is still relatively new, it marks an important shift in the field, as it allows for the device that monitors the pollution to move along with the test subject. It seems that the biggest benefit of mobile instruments is the ability to measure acute pollution exposure in a "real-world" context. These new technologies help significantly reduce the aggregation of results by tracking the acute peaks and valleys of spatiotemporal exposure.

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[62] Shaibal, M., et al. (2015). Comparison of modeled traffic exposure zones using on–road air pollution measurements. *Atmospheric Pollution Research*, 6(1), 82-87.

[63] Shekarrizfard, M., Faghih-Imani, A., & Hatzopoulou, M. (2016).

[64] Ibid.

[65] Snyder, M. G., et al. (2013). Pg 748.

[66] Che, W. W., Frey, H. C., & Lau, A. K. H. (2016). Sequential measurement of intermodal variability in public transportation PM2.5 and CO exposure concentrations. *Environmental Science & Technology*, 50(16), 8760.

Mobile sensors have made it possible to measure variability in acute personal exposure[67,68,69] rather than exposure in fixed locations across an entire study area. This reduces the need for complicated model chains in order to predict specific spatiotemporal intersections of individual travel and variations in pollution rates. These monitors can also reduce the number of variables needed to build model chains. For example, mobile devices eliminate some meteorological, geological, and measuring factors. Models are still needed to understand fleet composition, temporal variation in traffic levels, and some geological and physiographic factors, as mobile monitors may not be able to discern this information. In addition, the built environment can still have a large impact on pollutant concentrations[70] and can be difficult to model.

The results generated using dynamic exposure analysis seem to indicate two things: 1) Mobile monitors are able to capture nuanced pollutant measurements in a way that static monitors cannot;.[71,72] and 2) The pollutant measurements indicate high levels of acute exposure.[73,74,75]

There are some drawbacks to this new technology. There are questions surrounding the accuracy of mobile monitors, and more studies need to be done to verify results.[76] At this time, cost is also a potential barrier, with devices still in the several-hundred dollar range.[77] However, devices are getting less expensive as the technology advances.[78]

Because these technologies are so new, there is also a lack of replication studies at this point in time. This is also partly due to the rapid development of new devices. There are a number of these devices on the market and new ones are being continually developed.[79] While this gives researchers and citizens a suite of models to choose from, it also creates complications because not all of them have been verified, bringing us back to the concern about accuracy.

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[67] Che, W. W., et al. (2016).

[68] Nieuwenhuijsen, M. J., et al. (2015). Variability in and agreement between modeled and personal continuously measured black carbon levels using novel smartphone and sensor technologies. *Environmental Science & Technology*, 49(5), 2977.

[69] Patel, D., et al. (2016). Challenges in evaluating PM concentration levels, commuting exposure, and mask efficacy in reducing PM exposure in growing, urban communities in a developing country. *Science of the Total Environment*, 543, 416-424.

[70] Xu, J., Wang, A., & Hatzopoulou, M. (2016). Investigating near-road particle number concentrations along a busy urban corridor with varying built environment characteristics. *Atmospheric Environment,* 142, 171-180.

[71] Che, W. W., et al. (2016).

[72] Patel, D., et al. (2016).

[73] Physick, W., et al. (2011).

[74] Vallamsundar, S., et al. (2016b).

[75] Patel, D., et al. (2016).

[76] Piedrahita, R., et al. (2014).

[77] Handwerk, B. (2015). "With Wearable Devices That Monitor Air Quality, Scientists Can Crowdsource Pollution Maps." *Smithsonian Magazine Online*. Retrieved from: http://www.smithsonianmag.com/innovation/with-wearable-devices-that-monitor-air-quality-scientists-can-crowdsource-pollution-maps-180954556/

[78] Ibid.

[79] Ibid.

One study that is fully embracing these new mobile air monitors is currently underway in Europe. It is called the CITI-SENSE project and is a consortium of 29 organizations that utilize both professional and citizen scientists to gather exposure data using personal mobile monitors.[80] I was unable to find results from this study, though one journal article I found laid out a timeline for the project: "From autumn 2014 to the end of 2015, full deployment of the sensors will be conducted, and we expect to have the final results and overall evaluation of the project by the end of 2015."[81] This appears to be the largest and most comprehensive study to date using the new technologies available to researchers.

Implications and Future Work

There are a number of interesting and important questions that arise from the output implications of near-road exposure studies, both static and dynamic: How can the results from this research be applied? Is this science influential for policy making? How do we take the outputs of these studies and translate them into policy? Are some of the mitigation suggestions in the research politically feasible? What additional information do we need to move forward with the policy process? Are there environmental justice implications? If so, what do those mitigation strategies look like? I will not attempt to answer all of these questions in this final section, but rather provide a more general overview and discussion on the outputs from these studies and what they might mean for policy-making.

There is a promising and important trend in a lot of these studies, which is that outputs are used to explore population demographics in the near-road environment to see if a disproportionate number of people from one socioeconomic group who live near roadways have higher exposure risks than others. Results from one study, which has been used by the EPA's Office of Research and Development, suggest that racial/ethnic and socioeconomic disparities exist on a national level with respect to those populations living near high traffic and road density areas.[82] Another study found that in California, children of color were about three times more likely to live in high-traffic areas than were white children.[83] Using traffic and census data to explore race and income disparities along major roadways, another study found 19% of the US population lives near a high volume road.[84] Furthermore, 84% of US counties show some level of disparity in the demographic and racial make-up of the households living near those high volume roads.[85]

These studies suggest that there are considerable environmental justice issues along our major roadways, which in turn expose the limitations of the national ambient air quality monitoring

[80] Bartonova, A. (2016). CITI-SENSE Project. Retrieved from: http://www.citi-sense.eu

[81] Castell, N., et al. (2015). Mobile technologies and services for environmental monitoring: The CITI-SENSE MOB approach. *Urban Climate,* 14, 370-382. Pg 380.

[82] Tian, N., Xue, J., & Timothy, M. B. (2012). Evaluating socioeconomic and racial differences in traffic-related metrics in the United States using a GIS approach. *Journal of Exposure Science and Environmental Epidemiology*, 23(2).

[83] Gunier, R.B., et al. (2003).

[84] Rowangould, G. M. (2013).

[85] Ibid.

network. Mobile pollution monitors present an interesting shift in the ability to measure air quality in more specific spatiotemporal parameters. This technology, combined with the identification of EJ communities, can be employed in creative and innovative new ways to provide a more complete and nuanced understanding of the demographic disparities from near-road mobile source pollution exposure. Furthermore, it seems that dynamic exposure analysis is highlighting the inequitable public health externalities associated with traditional, car-centric transportation planning.[86]

A number of studies also indicate that their outputs can be used as a tool for transportation planning policy that focuses on exposure reduction and mitigation strategies. Examples of pollution reduction strategies include retrofitting busses with particle filters.[87] Mitigation strategies include installing roadside vegetation barriers,[88] which the EPA has also recommended.[89] Another study ran models that indicated the conversion of medium duty diesel trucks to low emission trucks correlated to 4% reduction in HC and 12% reduction in NOx emissions in their Toronto study area.[90] In one particularly successful (yet slow moving) case, outputs from the Brakepad Partnership Study,[91] a 15-year collaborative effort between brake pad manufacturers, environmental groups, and communities in California, resulted in Governor Arnold Schwarzenegger signing into law Senate Bill 346, which phased out copper from vehicle brake pads sold in California.[92]

Other studies suggest using transportation and land use planning as specific tools to help guide and control development along major roadways.[93] One case study from Québec calls for normalizing planning policies that protect sensitive populations. The policy suggestion is that municipalities should limit certain land uses, (such as schools, hospitals, childcare centers, seniors' residences and other residential uses[94]) in order to protect populations that are deemed to be sensitive to pollutant emissions. The policy would prohibit the siting of these uses less than 200m from an artery where there is a daily traffic flow of more than 40,000 vehicles. With a more normative approach, it might be possible to minimize the negative effects

[86] Vallamsundar, S., et al. (2016a).

[87] Kunzli, A.A. (2014). Effects of near-road and regional air pollution: The challenge of separation. *Thorax.* 69,503-504

[88] Hagler, G. S. W., et al. (2011). Model evaluation of roadside barrier impact on near-road air pollution. *Atmospheric Environment*, 45(15), 2522-2530.

[89] Baldauf, R. (2016). Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality. United States Environmental Protection Agency, Office of Research and Development. Retrieved from: https://www.epa.gov/air-research/research-near-roadway-and-other-near-source-air-pollution#roadways

[90] Amirjamshidi, G., et al. (2013). Integrated model for microsimulating vehicle emissions, pollutant dispersion and population exposure. *Transportation Research Part D*, 18(16), 16-24.

[91] Moran, K. (2008). "Copper Water Pollution From Vehicle Air Emissions: Science and Solutions from the Brakepad Partnership." TDC Environmental and California Stormwater Quality Association. San Mateo, CA. Retrieved from: http://www.tdcenvironmental.com/resources/BPP_Overview_05_08.pdf

[92] Copper Development Association, Inc. (2013). "Copper in Brake Pads." Retrieved from: https://www.copper.org/environment/impact/copper-brake.html

[93] Barros, N., et al. (3013).

[94] Carrier, M., et al. (2016).

of transportation on the health of the population groups most vulnerable to noise and air pollution.[95]

Despite all of these different strategies, many studies (even those from other countries)[96] echo the same theme: The key to reducing pollution exposure is, not surprisingly, controlling vehicle emissions.

Conclusions

We know that there are health impacts from air pollution, but targeting and quantifying exposure from mobile source air pollution is challenging.[97] Separating mobile source pollution from stationary source pollution and other ambient pollution sources is a major challenge with any exposure analysis study. Pollution exposure is hard to measure accurately because of mobile nature of both the vehicles emitting the pollutant and the pollutants themselves, the movement of human beings in and out of near-road areas, and the dynamic nature of weather patterns and other environmental factors.

It seems that mobile instruments are a promising new development in exposure analysis. This method has the capacity to help researchers overcome the barrier of pollutant source separation because these instruments have the ability to measure exposure in a highly detailed spatiotemporal capacity. Another benefit is that these instruments model real-world scenarios in which humans are potentially exposed to acute concentrations of mobile source pollutants. When used in conjunction with stationary exposure instruments and improved modeling, there is potential for more accurate and individualized exposure analysis, which is data that can be used as part of a comprehensive health risk assessment.

The specifics around how pollutants behave may always be difficult to measure. A number of researchers echo similar conclusions about the complexity and uncertainty of air pollution modeling. Yet, study after study indicates similar general insight: Pollution levels are highest near roadways.

Citizen groups can use this scientific insight to justify limitations on road expansions that might increase their exposure to mobile source pollution. Or, they may also use it to discourage development that may locate certain sensitive populations, such as those in schools or hospitals, near major roadways. At the same time, policy-makers must develop and implement pollution mitigation strategies, encourage and incentivize pollution reduction strategies (such as investment in cleaner fuel technologies), and address and correct environmental justice issues. In order to solve this important issue, it will take a collaborative value-based policy effort that is informed by good science, that recognizes emerging technology, and that acknowledges the complex relationship between transportation planning, land use planning,

[95] Carrier, M., et al. (2016).

[96] Du, X., et al. (2012). Intake fraction of PM2.5 and NOX from vehicle emissions in Beijing based on personal exposure data. *Atmospheric Environment*, 57, 233-243.

[97] Kunzli, A.A. (2014).

and housing policy, and leverages all of these fields to provide the most fair and equitable solutions to near-road mobile source pollution exposure.

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Using Environmental Justice Best Practices to Analyze a Transportation Project in Missoula, Montana

A Case Study of the Russell Street Road Expansion

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ABSTRACT

Environmental justice analysis is a critical (and federally required) component of any major transportation project. The objective of this paper is to perform an environmental justice review of the Russell Street road expansion project in Missoula, Montana. The 2002 Ohio Department of Transportation Environmental Justice guidance report is used to review and critique the environmental justice analysis provided in the Russell Street Environmental Impact Statement, exploring potential procedural, geographic, and socioeconomic impacts. Finally, an alternative design option is discussed, along with a discussion about shifting away from transportation systems developed around the single occupancy vehicle and toward sustainable, just, and resilient options.

Table of Contents

Introduction

Nearly all human beings travel in some form on a daily basis. Such movement is a basic reality of our existence. Despite this self-evident truth, not enough consideration is given to how and why transportation impacts our lives. Transportation justice is a critical (and often overlooked) element of viable, healthy, and sustainable communities, not to mention viable, healthy, and sustainable individuals. Transportation justice is defined as the socially equitable movement of humans. It is a key component to equal opportunity for all community members, particularly low-income communities, communities of color, and those with mobility limitations. Without equitable and fair access to transportation options, it is nearly impossible for an individual to be an active community participant. In addition to community participation, access to services and other opportunities are diminished without equitable and inclusive transportation plans. Participation in and creation of community is weakened when groups are left out due to inaccessible and unjust transportation policies.

The major objective of this paper is to perform an environmental justice analysis of the Russell Street road updates in Missoula, Montana. This paper begins by briefly exploring some of the historical roots of transportation injustice in the United States in order to provide background for understanding current transportation policies, followed by a discussion of how environmental justice best practices are incorporated into transportation planning policy. The heart of the paper explores the Montana Department of Transportation and City of Missoula's Final Environmental Impact Statement, considering potential procedural, geographic, and socio-economic impacts associated with the project. The Ohio Department of Transportation's 2002 report, *Guidance and Best Practices for Incorporating Environmental Justice into Ohio Transportation Planning and Environmental Processes,* is the guiding document for the analysis. Finally, modest alternatives to the Russell Street updates are proposed. The paper concludes with a discussion arguing for a widespread social shift away from individualized car culture and toward more equitable transportation systems.

In their landmark 1997 book *Just Transportation*, Bob Bullard and Glenn Johnson write that equitable access to transportation "is basic to many other quality of life indicators such as health, education, employment, economic development, access to municipal services, residential mobility, and environmental quality."[1] Bullard and Johnson lay out three broad categories of transportation inequity: (1) Procedural; (2) Geographic; and (3) Social.

Procedural inequity has to do with *how* transportation decisions are made and whether or not they are equal and representative. Bullard and Johnson characterize procedural justice as, "Attention directed to the process by which transportation decisions may or may not be carried out in a uniform, fair, and consistent manner with involvement of diverse public stakeholders."[2] Including all of the diverse interest groups is key to procedural equity, with special attention being paid to those groups that are most vulnerable and least powerful. This is particularly

[1] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). *Just Transportation: Dismantling Race and Class Barriers to Mobility.* Pg 2. Gabriola Island, B.C., Canada: New Society Publishers.

[2] Ibid. Pg 2.

important with low-income populations, as car culture can be expensive and unattainable, leaving them without the most commonly used and convenient transportation option. Individuals without vehicles need fair representation in transportation planning decisions, and it is even more important when facing new road construction or road expansions in their neighborhood, which can make walking, cycling, or accessing transit services more challenging.

Geographic inequity relates to the distributive impacts of transportation planning outcomes, both positive and negative. In other words, one geographic location should not receive a disproportionately high amount of either transportation service benefits or burdens. Bullard and Johnson define geographic inequity as transportation system policies "that disproportionately favor one geographic area or spatial location over another."[3] One measure of geographic inequity is comparing neighborhoods and access to public transit. For example, the Allied Drive neighborhood in Madison, Wisconsin, has been geographically isolated over the years due to poor transportation planning, making accessibility to the rest of Madison challenging. To compound the problem, "approximately 80 percent of residents do not own a vehicle, and only one bus line serves the neighborhood."[4] Geographic equity is ensuring that, to the greatest extent possible, all communities and neighborhoods receive equal transportation opportunities and do not bear a disproportionate amount of burdens.

Social inequity is the imbalance of political and economic power, resulting in lopsided social distributions of the benefits and burdens of transportation policies. Some policies offer a significant amount of benefits and resources to one community or group of people, while placing a disproportionate amount of the external burdens on another. Negative externalities include, but are not limited to displacement, disruption, gentrification, pollution, traffic, isolation, decreased property values, public transit rate increases, and reduced services. Bullard and Johnson point out that historically, "transportation amenities (benefits) accrue to the wealthier and more educated segment of society, while transportation disamenities (burdens) fall disproportionately on people of color and individuals at the lower end of the socioeconomic spectrum."[5]

These three categories of transportation inequity can be seen in the history of transportation in the United States, from segregation and the civil rights movement to current transportation policies and unequal distribution of benefits and burdens. "Transportation policies did not emerge in a race and class-neutral society"[6] and inequities came about due to the structure of our political and economic systems, regardless of intentionality. The transportation planning policies of the last several decades have disproportionately benefitted middle to upper class white suburban commuters, with highways and roads cutting through lower income, urban neighborhoods of color.

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[3] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 2.
[4] Wisconsin Department of Transportation. (1999). *Verona Road/West Beltline Needs Assessment.* Pg 4. Madison, Wisconsin.
[5] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 2.
[6] Ibid. Pg 1.

History of Transportation Justice

Transportation has played a somewhat inconspicuous yet pivotal role in the history of the United States. In the famous Supreme Court case from the late 1800s, *Plessy vs Ferguson*, a "separate but equal" ruling was the direct result of an act of civil disobedience by an African-American man named Homer Plessy, who boarded a white-only train car and was arrested when he refused to leave. Transportation justice moved squarely into the limelight as an important platform for social justice during the modern civil rights movement of the 1950s and 60s. In 1955, Rosa Parks' act of civil disobedience led to the Montgomery Bus Boycott, which eventually led to the 1956 ruling that "segregation on city busses was unconstitutional."[7] A few years later, black and white activists who called themselves the Freedom Riders tested this ruling and "journeyed from Washington, D.C., through the deep South to New Orleans on interstate buses in an effort to desegregate interstate travel facilities."[8] Despite opposition, their defiant efforts were rewarded with the Interstate Commerce Commission's 1961 desegregation of all interstate transportation facilities.[9]

In post-World War II America, federal transportation policies poured billions of dollars into the Interstate Highway System, which greatly enhanced mobility and encouraged movement from the city-center to the suburban outskirts. Most of the individuals and families moving to the suburbs were white, a phenomenon known as 'white flight'. White flight was no accident; in addition to the interstate highway system, it was powerfully fueled by federal policies such as heavily subsidized housing loans by the Federal Housing Authority, which conferred massive benefits on higher-income whites at the expense of lower-income people of color who remained behind, often involuntarily, in the central cities.[10] The movement of whites from urban areas depleted the tax-base and stifled investment, resulting in "under-funded schools, lower levels of municipal service, heavier tax burdens, less access to work, deteriorating housing stock often owned by absentee landlords, and lower levels of safety and health."[11]

In order to combat the loss of resources, urban renewal policies were implemented on both the federal and state level. These policies and practices such as "exclusionary zoning, [further] highway construction, urban renewal, and public housing developments further segregated the city"[12] and created barriers to social and economic integration that had severe unintended consequences. In a span of 25 years, the interstate highway system, and other related policies and programs, displaced nearly one million people in cities across the nation. The majority of those displaced due to construction of interstates were from low-income and/or minority

[7] Marcantonio, R. & Brenman, M. (ND). *Lessons from the History of Transportation Justice.* Legal Services of Northern California, Race Equity Project. Retrieved from http://equity.lsnc.net/lessons-from-the-history-of-transportation-justice/

[8] Ibid.

[9] Arsenault, R. (2007). *Freedom Riders: 1961 and the Struggle for Racial Justice.* New York, New York: Oxford University Press.

[10] Marcantonio, R. & Brenman, M. (ND).

[11] Ibid.

[12] Ibid.

communities.[13] It is important to note that displacement includes not just the movement of people, but also the destruction of social fabrics of neighborhoods, the loss of minority-owned small businesses, and other impacts.

The emergence of the environmental justice movement, beginning in the 1980s, has provided a glimmer of hope. The movement has served to highlight disproportionate environmental burdens on communities of color and low-income populations. Providing backbone to the environmental justice movement was Executive Order 12898, signed into law by Bill Clinton in 1992. The Order established low-income and minority communities as specific populations to be identified and considered by federal agencies, and the Interagency Working Group on Environmental Justice facilitates the active involvement of all agencies:[14]

> *Executive Order 12898 mandates that each Federal agency develop an agency-wide EJ strategy that identifies and addresses disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.*

Current Transportation Policies

Despite the rise of environmental justice and Executive Order 12898, there are still deep systemic issues in our current transportation planning, policies, and practices. American cities are still marked by deep segregation by race and income, while "public transit service is being slashed across the nation."[15] And car-centered transportation planning and policies show few signs of change.

Barbara McCann highlights one particularly important issue she calls, "the modal divide."[16] Funding, resources, and even policy approaches are different for each separate mode of transportation. The US Department of Transportation has two agencies that deal with different modes of transportation: The Federal Highway Administration deals with the nation's highway system and the Federal Transit Administration deals with public transit. They receive separate funding allocations and have separate policies – and are even under the jurisdiction of separate Senate committees.[17] There are no agencies specifically for bicycle or pedestrian transportation. These agency separations have arguably led to disjointed and unbalanced transportation planning and policy-making.

Funding for transportation projects comes predominantly from federal, state, and even some local gasoline taxes and these resources are not distributed evenly by mode. As McCann points out, "Only 20 percent of the gasoline tax goes to mass transit, while 80 percent goes to

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[13] Marcantonio, R. & Brenman, M. (ND).

[14] Federal Highway Administration, Office of Planning, Environment, and Realty. (2014). *Questions and Answers on Environmental Justice*. Pg 3. United States Department of Transportation. Retrieved from: https://www.fhwa.dot.gov/environment/environmental_justice/faq/index.cfm

[15] Marcantonio, R. & Brenman, M. (ND).

[16] McCann, B. (2013). *Completing Our Streets: The Transition to Safe and Inclusive Transportation Networks.* Pg 10. Washington D.C.: Island Press.

[17] Ibid. Pg 10.

highways."[18] This means that the overwhelming share of resources goes to projects that favor motorized transportation, mostly in the form of road expansion for personal vehicles and trucking. Bullard and Johnson also state that due to such lopsided funding, "The end result has meant more pollution, traffic congestion, wasted energy, urban sprawl, residential segregation, and social disruption."[19]

One of the major reasons for the lopsided allocation of resources is a rigid system that defines roads "solely by the amount and type of traffic they carry and divides them in to arterial (major) streets, collector streets, or local streets."[20] The carrying capacity (how much vehicle traffic they can handle without congestion) of roads and the subsequent grading system for project funding is called Level Of Service (LOS), which is perhaps the most devastating policy for alternate transportation and for vulnerable populations that require transportation services and facilities not related to personal vehicles.

Level of Service is the conventional and most commonly used grading system that measures the success or failure of a road based on traffic flows.[21] Traffic patterns and peak congestion data are collected and the road in question is given a letter grade based on the amount of time vehicles are delayed. The grading system is 'A-F', with 'A' being uninterrupted traffic flow and 'F' being gridlock. Based on the grade that the road receives, policies are implemented to expand the road's vehicle carrying capacity in accordance with traffic demands and congestion needs.

This transportation measurement tool used to model and predict roadway traffic is explicitly mono-modal in its evaluation methods and does not take into account any other mode of transportation. McCann criticizes this transportation model saying that, "It is often the *only* method used to rank and make decisions about projects – and it assumes that a community's primary goal is to minimize automobile delay."[22] Thus, exclusive use of the LOS model to assess the narrow problem of traffic congestion does not actually provide a holistic assessment of the transportation needs in a community and is often detrimental to alternate forms of transportation.

The LOS model is unjust in two related and important ways: It is inherently biased towards benefitting socioeconomic groups that are able to own personal vehicles, and it stifles funding and resources for transportation facilities that support alternate modes of travel, such as transit, cycling, and walking, which are modes that tend to be used more heavily by lower-income groups.

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[18] Ibid. Pg 10.
[19] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 7.
[20] McCann, B. (2013). Pg 11.
[21] New methods of measuring roadway performance have been developed in recent years, including Multimodal Level of Service (MMLOS). More information can be found here: https://usa.streetsblog.org/2013/10/23/the-problem-with-multi-modal-level-of-service/
[22] McCann, B. (2013). Pg 14.

Incorporating Environmental Justice into Transportation Planning and Policy

In recent years, as a result of the environmental justice movement and Executive Order 12898, there have been more intentional efforts to put forth environmental justice guidance manuals in order to address some of the unequal distributions of benefits and burdens due to poor transportation planning and policy. While there are too many to list here, these efforts are coming from academia[23,24] as well as policy institutes, think tanks, and agencies at the federal and state level.

In the US Department of Transportation's (USDOT) environmental justice strategy, (a result of Executive Order 12898) environmental justice is defined as "the fair treatment and meaningful involvement of all people, regardless of race, ethnicity, income, national origin, or educational level with respect to the development, implementation and enforcement of environmental laws, regulations and policies."[25] In 2015, the Federal Highway Administration, an agency of the USDOT, published an "Environmental Justice Reference Guide"[26] that outlined its commitment to environmental justice issues through three guiding principles:

The US DOT is committed to the principles of EJ, which include:

- *To avoid, minimize or mitigate disproportionately high and adverse* h*uman health and environmental effects, including social and economic effects, on minority populations and low-income populations*
- *To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process*
- *To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations*

In 2002, the States of Ohio[27] and Colorado[28] both published comprehensive environmental justice guidance reports through their respective departments of transportation. The State of Pennsylvania also published an EJ best practices guide in 2004.[29] Currently, the State of Montana Department of Transportation has a chapter dedicated to EJ guidance, but it is just a

[23] Chakraborty, J., 2006. Evaluating the environmental justice impacts of transportation improvement projects in the US. *Transportation Research Part D*, 11(5), pp.315–323

[24] Sen, S., 2008. Environmental Justice in Transportation Planning and Policy: A View From Practitioners and Other Stakeholders in the Baltimore-Washington, D.C. Metropolitan Region. *Journal of Urban Technology*, 15(1), pp.117–138.

[25] United States Department of Transportation, Office of Policy Development, Strategic Planning and Performance. (2014). *Department of Transportation Environmental Justice Strategy.* Washington, D.C. Retrieved from: https://www.transportation.gov/policy/transportation-policy/environmental-justice-strategy

[26] Federal Highway Administration. (2015). *Environmental Justice Reference Guide.* Pg 2. United States Department of Transportation. Washington, D.C.

[27] State of Ohio Department of Transportation. (2002). *Guidance and Best Practices for Incorporating Environmental Justice into Ohio Transportation Planning and Environmental Process.* Columbus, Ohio.

[28] Van Orden, D. & Grauberger, C. (2002). *Environmental Justice Research Study.* Colorado Springs, CO: State of Colorado Department of Transportation Research Branch.

[29] Brinckerhoff, P. (2004). *Every Voice Counts: Environmental Justice Plan, Toolbox of Resources and Additional Information.* Developed for State of Pennsylvania Department of Transportation, Office of Planning. Harrisburg, PA.

review of federal policies.[30] The Ohio Department of Transportation guide states that, "Identifying objective methods to evaluate potential economic, social and environmental impacts of transportation system changes on a target population is an imposing task."[31] While this task is a challenge, both of these states (along with others) have put forth thoughtful and comprehensive transportation policy documents that serve as guides for evaluating environmental justice issues as they relate to transportation projects.

Knowing where these vulnerable populations exist is key. In the Colorado Department of Transportation's guide, the first step outlined is to use US Census data to determine where these population groups are most prevalent.[32] To best pinpoint minority or low-income areas the state uses the smallest population unit possible, which are block groups.[33] This is used in combination with the Housing and Urban Development's (HUD) low-income thresholds for each county in Colorado.[34]

Identifying vulnerable populations is an important first step, but outreach is also needed. This is explicitly stated in the Colorado guide: "Having identified where the low-income households and minority populations reside in the State, a successful public involvement program will seek out these targeted population groups in order to provide opportunities for involvement in the transportation planning decision-making process."[35] Identification and outreach are key to procedural equity in the planning process. The Ohio Department of Transportation's guide also recognizes that "A critical element for complying with EJ is the identification and involvement of low-income populations and minority populations early in the transportation decision making process."[36] Methods vary, but the overall goal is procedural equity.

In the Russell Street case study section of this paper, selected best practices from the Ohio DOT report will be reviewed and applied in order to analyze and critique the Russell Street update project. The guide identifies 14 types of potential impacts and asks both objective and subjective questions relating to those potential impacts. (See appendix A for full list of analysis questions).

Russell Street Project Background

The existing stretch of Russell Street (between West Broadway and Mount) that is being considered for updates is a mix of two and two-plus lane road segments. Two-plus indicates two travel lanes and a center turn lane. This section of Russell Street has seen high traffic volumes for a number of years, so the LOS grade is poor and traffic congestion is a major reason

[30] State of Montana Department of Transportation. (2010). Environmental Manual, Chapter 24: Environmental Justice. Montana DOT. Helena, MT.
[31] State of Ohio Department of Transportation. (2002). Pg 12.
[32] Van Orden, D. & Grauberger, C. (2002).
[33] United States Census Bureau. "Geographic Areas Reference Manual." Retrieved on 3.24.18 from: https://www.census.gov/geo/reference/garm.html
[34] Van Orden, D. & Grauberger, C. (2002).
[35] Ibid. Pg vii.
[36] State of Ohio Department of Transportation. (2002). Pg 20.

for the expansion and updates. The project's Environmental Impact Statement (EIS) began in 2001 and was completed in 2011. The $25 million construction project is set to begin in 2018.

In the Russell Street EIS, there is a detailed description of the purpose of the proposed action:[37]

> *Given the physical location and functional designations of the Russell Street and South 3rd Street routes, the high traffic volumes, crash history, and multi-modal use of the corridors, the purpose of this proposed project is to provide substantive safety and mobility improvements for all modes of travel in the Russell Street and South 3rd Street corridors.*

Facilities and services for other modes of transportation received a lot of attention in the public participation process. The EIS indicates that the public requested the project "include bicycle facilities, sidewalks, bus turnouts, curbs and gutters for storm water management, river trail system access to the roadway, illumination, landscaping, and pedestrian crossing facilities."[38] Based on transportation patterns and community requests, the Russell Street corridor needs improvements in several facility areas, not just vehicle capacity. Establishing a need for the project was the relatively easy part. Determining the best possible solution for all stakeholders involved is where the challenge lies.

The Montana Department of Transportation and the City of Missoula offered six different project alternatives in the EIS report.[39] (See Figure 1 below). Alternative 1 was a no build option, meaning that nothing would be done to Russell Street. Alternative 2 through the 'refined' Alternative 5 all expand the roadway from 2+ lanes all the way up to 4+. Each Alternative includes increasing levels of roundabouts, signals, lanes and other facilities. Alternative 4 was selected as the Preferred Alternative, which the EIS justifies in this way:[40]

> *Based on the fact that Alternative 4 satisfies the purpose and need to provide substantive safety and mobility improvements for all modes of travel within the corridor, has fewer Section 4(f) impacts, and less overall impact as compared to Alternative 5 and the refined Alternative 5, the four-lane roadway improvement with a center turn lane/raised median, and signalized intersections proposed under Alternative 4 for Russell Street is identified as the Preferred Alternative.*

[37] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Executive Summary, pg 2.
[38] Ibid. Exec. Summary, pg 2 & Chapter 2, pg 2.
[39] Ibid. Chapter 2.
[40] Ibid. Chap 2, pg 112.

Figure 1: Russell Street Alternatives as Shown in Table 2.1 of the EIS

Table 2.1
Russell Street Alternatives – Overview of Major Features

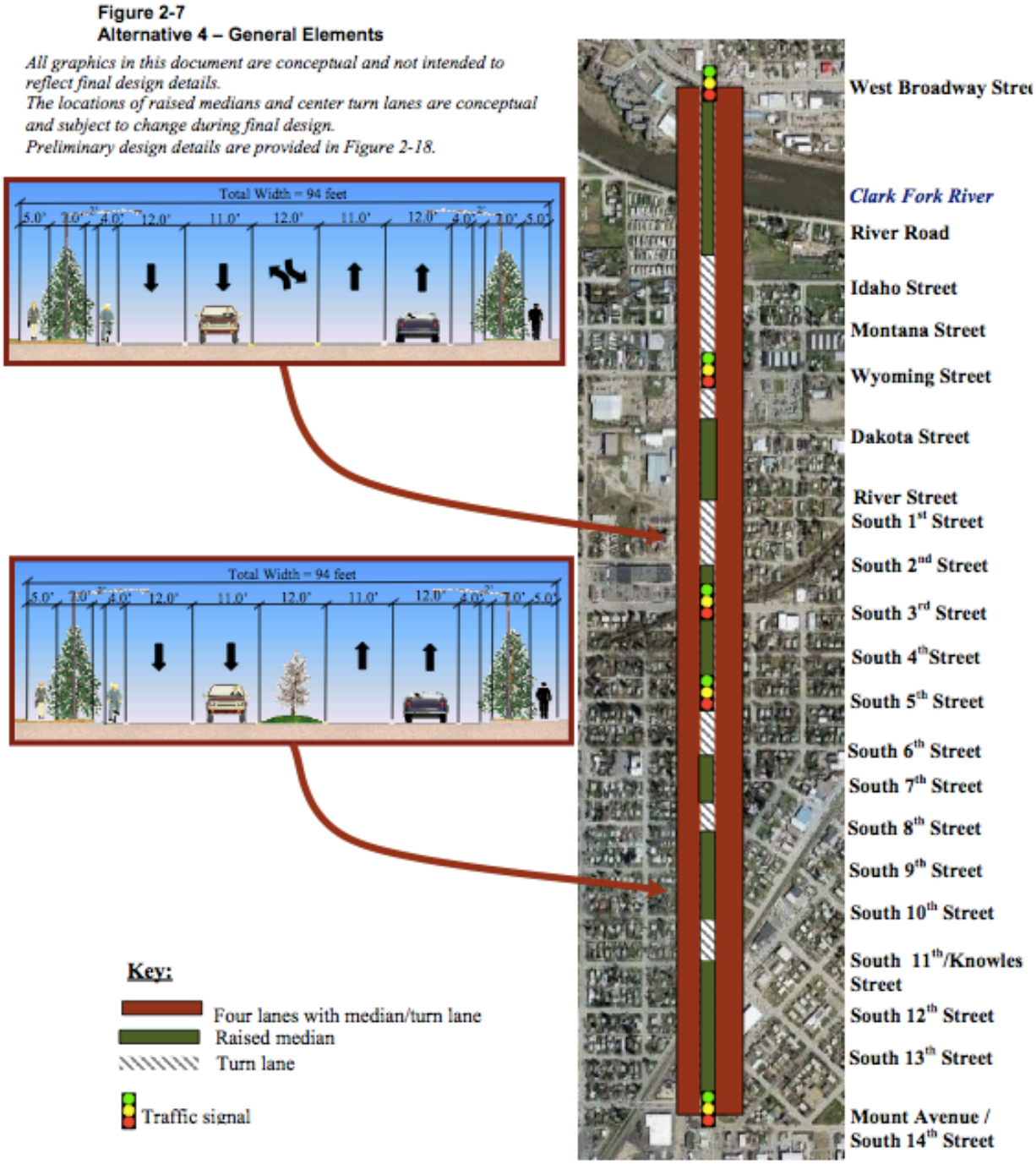
	Alt. 1 (No Build)	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Number of Vehicular Lanes:					
Mount to South 8th	2	2	2+	4+	4+
South 8th to South 5th	2	2+	2+	4+	4+
South 5th to South 3rd	4	4	4	4+	4+
South 3rd to the bridge	2+	2+	2+	4+	4+
The bridge to W. Broadway	2	4	4	4+	4+
Intersection Control:					
Signals	✓			✓	
Roundabouts		✓	✓		✓
Design Elements:					
Sidewalks		✓	✓	✓	✓
Bike lanes		✓	✓	✓	✓
Boulevards		✓	✓	✓	✓
Curb/Gutter		✓	✓	✓	✓
Lighting		✓	✓	✓	✓
Bus Pullouts		✓	✓	✓	✓

Notes: 2+ denotes a two-lane section with a center turn lane/raised median
4+ denotes a four-lane section with a center turn lane / raised median

Source: HKM Engineering., 2007

The following map[41] from the Russell Street EIS is intended to show the general design elements and facilities planned for the project corridor.

Figure 2: Alternative 4 - General Elements as Shown in Table 2.1 of the EIS



[41] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chapter 2, pg 17.

Russell Street Project Discussion

There are some Environmental Justice concerns associated with the chosen Alternative 4. Using the Ohio Department of Transportation's Environmental Justice Guide as a reference, this section will identify relevant EJ best practices criteria and apply them to the Russell Street expansion project. Supplemental questions from Bullard and Johnson's book *Just Transportation* will also be used, keeping in mind their three categories of transportation equity: procedural, geographic, and social. Discussion is generated using the Montana Department of Transportation and City of Missoula's Final Environmental Impact Statement to further assess the potential negative and/or positive impacts of the Russell Street project updates.

Procedural Injustices and Best Practices

Locating, reaching out to, and engaging with at-risk populations are key components of procedural justice. As discussed above, there are a number of ways to go about assessing where key populations are located. One interesting resource that was recently developed is the Environmental Protection Agency's (EPA) new program called EJSCREEN.

The program was started in 2010 and, after a few years of changes and updates and peer-reviews, it was launched on the EPA website in 2015. As computer-mapping technology has advanced, the EPA "recognized the opportunity and the need to develop a single, nationally consistent tool that can be used by EPA, its governmental partners and the public to understand environmental and demographic characteristics of locations throughout the United States."[42] This mapping tool allows the user to locate and isolate an area on the map (up to 10 square miles) and run a report that highlights 12 different EJ indexes.

The environmental justice index is composed of 11 environmental indicators and six demographic indicators. The environmental indicators related to vehicular traffic are: "National-Scale Air Toxics Assessment (NATA) air toxics cancer risk; NATA respiratory hazard index; NATA diesel PM (particulate matter); Particulate matter; Ozone; Traffic proximity and volume."[43] The demographic indicators are: "Percent low-income, percent minority, less than high school education, linguistic isolation, individuals under 5, and individuals over 64."[44]

This has potential to be a highly valuable tool in the future of both transportation justice and environmental justice at-large, allowing users to collect data in order to consider EJ issues in a specific area or community. "This screening information may be of interest to community residents or other stakeholders as they search for environmental or demographic information and it can also support a wide range of research and policy goals."[45] While this new tool is a

[42] United States Environmental Protection Agency, Office of Environmental Justice. (2015). *EJSCREEN: Environmental Justice Mapping and Screening Tool, Technical Documentation*. Washington, D.C. Retrieved from: http://www2.epa.gov/ejscreen

[43] Ibid.

[44] Ibid.

[45] United States Environmental Protection Agency, Office of Environmental Justice. (2015). *EJSCREEN.*

valuable advancement in citizen participation resources, it is by no means comprehensive of all possible EJ considerations.

One important type of environmental impact that is missing from the EPA's list, as it relates specifically to transportation justice, is noise pollution. In the EPA's Technical Documentation Guide, this omission is recognized and listed, along with a host of others that did not make it to the final version of EJSCREEN.[46] Noise impacts from road construction, car traffic, and potentially new building construction are all cause for EJ concerns.

When running a buffer report on the Russell Street road update project, one demographic indicator that stands out is the poverty rate. A buffer report is simply using an isolation tool to draw a circle or box around a specific area on the map. In this case, the buffer report included roughly the three blocks east and west of Russell Street along the entire proposed project corridor. (See Appendix B for EPA EJ SCREEN Report for Entire Russell Street Project Corridor).

The Montana DOT's EIS report on Russell Street indicates that 27 percent of the residents in the Russell Street project area are below the national poverty level, "while the percentage for the state was…at 14.7 percent."[47] The affected area has a population living below the poverty level that is nearly twice as high as the rest of the state of Montana. Clearly, these statistics indicate cause for close EJ consideration. And it is important to note that the distribution of poverty across the Russell Street project is not equal; there are concentrated pockets of low-income areas on the north end of Russell Street according to EJSCREEN.

The EIS report recognizes that there are "two Section 8 housing units and a mobile home park within the study area that represent likely clusters of lower income residences than the remainder of the corridor, and likely affect the poverty level data presented above."[48] The report is referring specifically to the North Russell neighborhood, near the bridge on both sides of the road. It ranks in the 90th percentile in Montana, meaning that only 10 percent of the census block groups in Montana have higher poverty rates than those in this buffered area report. (See Appendix C for EPA EJ SCREEN Report for North Russell Street Neighborhood).

In addition to the low-income indicator, the traffic proximity indicator, which is a health and safety risk, also ranks this section of North Russell as being in the 88th percentile in Montana. When combining these two factors, it could be the case that low-income individuals who are walking or biking may have trouble crossing Russell to access businesses, bus stops, or other services due to high volumes of car traffic.

While this does not mean that there are immediate and obvious environmental justice concerns, it does indicate an area that should be considered closely. And it certainly means that public outreach is warranted. The buffer report and resulting EJ indexes potentially indicate

[46] Ibid.
[47] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chap. 3, pg 7.
[48] Ibid. Chap. 3, pg 7.

that residents along North Russell are experiencing disparate health and safety impacts of road traffic, and increasing the number of lanes required to cross could only exacerbate the issue.

The Russell Street EIS report does a satisfactory job of locating and recognizing pockets of low-income groups, there are no specific recommendations addressing EJ impact mitigation for these at-risk populations, nor is there any outreach strategy outlined for procedural involvement in the planning process. Simply reaching out to these populations in the planning process is an important first step.

Zooming back out to the entire project corridor, there are also other important demographic factors that are not identified by the EIS report. While it is federally required to focus on communities of color and low-income populations, the Colorado EJ guide points out additional demographic data to consider: "Data on population groups such as the elderly, disabled persons, and persons with limited English proficiency may be necessary to help better define the transportation system necessary to accommodate the area."[49]

The Colorado study even mentions locating households without auto availability, which is an important demographic indicator that should be applied to the Russell Street project. Missoula is a university town with a large student population in the Russell Street project corridor. These students rely heavily on public transit and alternative transportation, like cycling and walking. While challenging to track and even more challenging to engage, it is important to consider is the homeless population as well.

When looking for policies that address the needs of other demographic groups, I searched the EIS using keywords such as homeless, elderly, and disabled. The words homeless and elderly did not appear at all in the main EIS, only in the comments section. And the word disabled appeared only once in the entire EIS, yet four times in the comment section. It is also troublesome that there was no mention in the EIS of the mental health facility (Western Montana Mental Health Center) located at the junction of Russell Street and the Milwaukee Trail[50] just south of Wyoming Street. Unfortunately, the EIS misses the mark on locating and identifying a wide variety of demographic groups that could be negatively impacted by the project, which is a procedural injustice that leaves these groups vulnerable to potentially negative project impacts. Getting a diverse variety of voices to the table in the planning process is critical to procedural equity.

Geographic Injustices and Best Practices

Significantly, the very first best practices question of the *Ohio Environmental Justice Guidance and Best Practices Study* deals with "bodily impairment, infirmity, illness or death."[51] This is a critical transportation justice question. Road expansion projects that have the potential to

[49] Van Orden, D. & Grauberger, C. (2002). Pg vii.

[50] The Milwaukee Trail is a paved cyclist and pedestrian path that runs East/West across Missoula along the South side of the Clark Fork River.

[51] State of Ohio Department of Transportation. (2002). Pg 13.

increase traffic also have the capacity to increase rates of injury to roadway users and local neighborhood constituents who live in close proximity to the roadway. Thus, the Ohio report asks: "How will traffic speed within the target area change? How will traffic volumes change? Is there a change in the volume or pattern of through traffic on local (target area) streets?"[52] Bullard and Johnson ask an additional important question when considering vulnerable non-motorist user groups: "Will the proposed action increase or decrease the likelihood of accidents for non-motorists?"[53]

The Russell Street EIS report addresses potential changes in traffic volumes and patterns by claiming that, "If no improvements are made, traffic congestion in the corridor will worsen and the peak periods (morning and evening rush hours) will extend in duration by the year 2035."[54] There was no specific data provided indicated While it may be true that over time Russell Street will continue to experience a worsening of congestion during peak periods, expanding the road to handle higher volumes of traffic is not necessarily the proper solution. The problem with simply expanding a road to meet capacity needs is a phenomenon known as 'induced demand'.

The Montana Department of Transportation and the City of Missoula are familiar with this phenomenon, as they address it a few times in the Russell Street EIS report. In Chapter 4, which deals with Environmental Consequences and Mitigation, they claim that, "the project is not intended to induce new traffic or population growth, but merely to meet current and foreseeable demands for new multi-modal travel capacity."[55] This claim is ironic in that the unintended consequence of increased traffic due to road expansion is exactly the problem with road expansion.

In Anthony Downs' 2004 book entitled *Still Stuck in Traffic*, he defines induced demand simply as "increases in desires to use the expanded road caused by its very expansion."[56] Of course, it is not hard to see how this is a "self-defeating tactic."[57] The expansion of the roads attracts more motorists because of the road's increased capacity. In the short-term, this is usually not an issue and there will likely be a relief in congestion and the expansion of the road will allow traffic to move more freely.

However, as Anthony Downs argues, there are "two long-run impacts of induced demand for the expanded road."[58] The first long-term impact is simply the potential of increased auto use in residential areas around the road expansion. The road expansion might relieve traffic at first, but as more people use the roadway, it becomes more congested and motorists will look for alternate routes around Russell Street, potentially cutting through neighborhoods and

[52] State of Ohio Department of Transportation. (2002). Pg 13.
[53] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 14.
[54] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chap 1, pg 7.
[55] Ibid. Chap 4, pg 1.
[56] Downs, A. (2004). *Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion.* Pg 103. Washington D.C.: Brookings Institution Press.
[57] Ibid. Pg 103.
[58] Ibid. Pg 104.

presenting safety concerns. (This may already be occurring to some extent on Caitlin and Johnson, two North/South routes near Russell Street.)

The second long-term impact is the potential movement of more people and businesses into the region due to the road expansion. While land use controls, such as zoning, can mitigate this to a certain extent, businesses may be attracted to the area because of the increased capacity of the road and the potential for greater numbers of customers. If commercial land uses near the road increases enough, Downs argues "it is conceivable that induced demand might add enough traffic to the expanded roadway in the long run so as to raise the intensity of its peak-hour congestion above that which prevailed before the expansion occurred."[59]

The theory of induced demand may be fairly simple, but determining whether or not it is a measurable consequence of road expansion is vastly difficult and full of complex factors beyond just traffic capacity. As Downs explains, "While better roads can induce more growth, more growth can also induce authorities to build more and better roads."[60] Determining the causality of road expansion and increases in traffic patterns can be tremendously challenging.

In addition, the increased road capacity of Russell Street is related to another important transportation justice question: Does the project favor one mode of transportation over another? Certainly taking Russell Street from a two plus lane road up to a five-lane road encourages the use of personal vehicles, despite the updates calling for improved bike lanes and additional bus stops. As Downs discusses, projects that increase vehicle lanes and traffic capacity tend to perpetuate the use of the personal vehicle. While unintentional, the Russell Street project does exactly that, which favors those who have the means to own a car.

While offsetting this increased vehicle capacity with facilities like bike lanes and additional bus stops is helpful, the updates do not actually do enough to change car-use habits and encourage alternate forms of transportation. It does not actually *shift* modal choice patterns in a meaningful way, nor does it address how to change the systemically flawed systems that influence the creation of new roads and the maintenance of old roads. It simply adds more carrying capacity to the roadway.

Providing services for alternative forms of transportation seems to be an afterthought in the Russell Street updates. This is a common theme in road update projects around the country. McCann laments the fact that all too often, "a complete streets approach is 'additive', that the main task is to simply add sidewalks, add bike lanes, or add curb ramps and crosswalks."[61] Due to flawed policies discussed earlier, it is clear that the primary purpose of the Russell Street road update is to first accommodate the needs of personal vehicles.

[59] Downs, A. (2004). Pg 104.
[60] Ibid. Pg 105.
[61] McCann, B. (2013). Pg 53.

Impact Question #5 of the *Ohio Environmental Justice Guidance and Best Practices* report deals with the potential "destruction or disruption of community cohesion."[62] Community cohesion is difficult to define and perhaps more difficult to evaluate whether or not it has been disrupted.

However, projects can unintentionally isolate neighborhoods from the greater community or isolate groups of people within their own neighborhood. This impact question seeks to limit the segmentation of neighborhoods and the loss of community cohesion by asking: "Will man-made dividers (overpass, bridge, 4 lane or greater roadway or rail tracks) be constructed through a portion of an existing community and cause it to be segmented?"[63] Bullard and Johnson pose similar questions: "Is a wall or barrier effect created? Will the community's aesthetic character be changed? Has aesthetics surfaced as a community concern?"[64]

The Russell Street EIS claims that Russell is a road that does not split neighborhoods, as it already is an "urban arterial" that serves "both local and regional traffic, and currently marks the edge of these neighborhoods and districts", thus not dividing or splitting any existing neighborhoods or cutting off residents from facilities and amenities.[65] The EIS actually goes further by saying that "the proposed project will have an overall positive effect on neighborhood connectivity through the installation of sidewalks, bike lanes, and grade-separated pedestrian crossings at three locations within the Russell Street corridor."[66]

The claim that the Russell Street changes will not further divide the neighborhood is certainly up for debate. It could be reasonably argued that Russell Street already divides the neighborhood. Adding additional car lanes will only serve to increase geographic segregation of neighborhoods and create a more formidable barrier when moving across the road from east to west or vice versa. This point is reiterated in the Russell Street EIS comment section by Nancy Wilson, Director of the Associated Students of The University of Montana Office of Transportation: "…people living on the east side of Russell need to cross Russell to get to the grocery store and school and people living on the west side of Russell need to cross Russell to get to downtown and the University."[67]

Not only will the road update create a crossing barrier, but it will also isolate the neighborhood to the south of 3rd Street that lies between the west side of Russell and the east side of Reserve, known as the 'Franklin to the Fort' neighborhood. In the EIS comment section, residents of this area express those concerns and predict that, in the future "People between Russell and Reserve would be on an island with highway-style traffic on either side."[68] The EIS report's claim that additional facilities (such as bike lanes and sidewalks) will help neighborhood connectivity is founded on shaky logic. These facilities help people move in a parallel fashion

[62] State of Ohio Department of Transportation. (2002). Pg. 15.
[63] Ibid. Pg 15.
[64] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 13.
[65] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chap 4, pg 4.
[66] Ibid. Chap 4, pg 5.
[67] Ibid. Appendix H, pg 154.
[68] Ibid. Appendix H, pg 88.

with or against traffic, but do little to address perpendicular movement *across* traffic. To think that north/south bike lanes and sidewalks will increase the connectivity of neighborhoods on either side of Russell Street when there are an additional three lanes of vehicle traffic to cross is problematic.

In the Russell Street EIS, there are no plans for increased crossing zones for pedestrians and cyclists. There are only three designated crossings in the entire 1.5-mile project corridor. This concern is raised by John Wolverton of the Bike/Walk Alliance of Missoula in the comment section of the EIS: "Other frequently used cyclist and pedestrian crossing locations such as Wyoming, 1st Street, 4th Street and 7th Street should be evaluated for potentially receiving enhanced crossing treatments in addition to common intersection treatments."[69] Further criticizing the Russell Street EIS, Wolverton goes on to say "The document exhibits a failure to take a hard look at these potential direct impacts on the character of the neighborhoods."[70] Geographic isolation and physical barriers are legitimate environmental justice concerns with the Russell Street road expansion.

There is a second part to Impact Question #5 in the *Ohio Environmental Justice Guidance and Best Practices Study*: "Is the proposed project or plan perceived to significantly benefit one portion of an existing neighborhood and significantly harm another portion of the same neighborhood?"[71] This seems to be the key question regarding geographic injustice, whether the topic is safety, traffic rates, neighborhood cohesion, or connectivity.

At the heart of all of these issues is the concern that residents living around Russell Street are bearing the unfair distribution of burdens, while the rest of the community enjoys the benefits of a high-capacity thoroughfare to access north or south Missoula. Acute levels of air and noise pollution will most definitely increase due to higher levels of vehicle traffic through the Russell Street neighborhood corridor. There will certainly be unintended consequences of increased vehicle traffic, many of which are difficult to measure at this time, which is perhaps an argument for an even stronger and more robust geographical injustice analysis.

On top of all of that, residents may not even be fully aware of the risks of increased air and noise pollution. And if residents are not aware, it is not likely that anyone representing that community will speak up and bring these issues to the attention of planners and decision-makers. This problem is an unfortunate example how a specific neighborhood might be impacted without even knowing it and illustrates why planners must be vigilant in their research and understanding of community characteristics.

Social Injustices and Best Practices

The social impacts from transportation planning can be either due to procedural injustices, geographic (distributive) injustice, or both. The three all work together in compounding ways. For instance, poor public outreach (procedural justice) can lead to negative transportation

[69] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Appendix H, pg 257.
[70] Ibid. Appendix H, pg 258.
[71] State of Ohio Department of Transportation. (2002). Pg 15.

outcomes (geographic/distributive justice) that impact the social fabric of a neighborhood or community. One of the most easily recognizable social impacts is gentrification. It is important to note that these are social impacts are highly complex issues and poor transportation planning does not inevitably lead to an outcome like gentrification. Nor does transportation planning happen in a vacuum. Often there are other powers at work, and economic forces can play a very big role in driving the social changes in a neighborhood.

With all of that said, there is one major social concern that directly implicates the Russell Street project, and that is displacement and property acquisition. In the *Ohio Environmental Justice Guidance and Best Practices Study*, Impact #10 deals with the "displacement of persons, businesses, farms, or nonprofit organizations" by asking the question: "How many target vs non-target population persons will be displaced? How many businesses? How many nonprofits?"[72] Additional relevant questions posed by Bullard and Johnson include: "What are the effects on the neighborhood from which people move and into which people are relocated? What types of dwellings: Apartments or other multi-unit dwellings, single family homes, others? Are there residents with special needs (disabled, minority, elderly)? Are there available sites to accommodate those displaced?"[73] It is also important to know if the residents are owners or renters.

For the chosen Alternative 4, the EIS indicates eleven homes and ten commercial buildings will need to be relocated. The EIS does not specify if the displaced homes and businesses are part of the low-income target population or not. There is also no indication that there was any direct outreach to the displaced residents. This is a cause for concern in terms of procedural justice. As noted at the beginning of this section, procedural injustice perhaps played a role in the displacement of individuals and social disruption of the Russell Street neighborhood.

It is also important to note that, according to the EIS, there are an additional eight businesses and six private residences that are less than ten feet from the proposed right of way. These properties will not be relocated, but they certainly will feel the effects of a wider road, increased traffic, increased noise and air pollution, and decreased property values due to such close proximity to the right of way. These individuals are certainly bearing a disproportionate amount of burdens to the benefit of the rest of the community. One might wonder if stronger (or any) procedural justice in the planning and decision-making process could have rendered more desirable outcomes for these individuals. The City would be smart to exercise caution after a mistake in claiming right-of-way for South Avenue improvements resulted in a 2005 lawsuit.[74]

According to the EIS report, low-income and minority groups are not disproportionately affected by displacement: "This determination was made based on the fact that neither the

[72] State of Ohio Department of Transportation. (2002). Pg 16-17.
[73] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 14.
[74] Szpaller, K. (2015). "City is out $671,000 from South Avenue property rights lawsuits." *The Missoulian.* Retrieved from: http://missoulian.com/news/local/city-is-out-from-south-avenue-property-rights-lawsuits/article_964c863f-f2c7-519d-a1bb-97f4e6a9c53d.html

Section 8 housing nor the mobile home park identified in Chapter 3 are directly impacted by the project and that the impacted residences are dispersed throughout the two linear corridors."[75] (The two linear corridors the EIS refers to are 3rd Street and Russell Street). While the Section 8 housing may not be directly affected, what are the actual demographics of the eleven private residences that will be displaced? Are the displaced residents owners or renters? Where are the residents being relocated? How is fair market value calculated? Perhaps it is out of the scope of the report, but the EIS does not answer these questions.

The Russell Street EIS vaguely addresses the issue of displacement by citing compensation policies:[76]

> *Property to be acquired for the proposed project would be purchased for fair market value, and displaced residents and commercial property owners would be provided with relocation advisory services and may be eligible for relocation benefits in compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended in 1987 and Sections 70-31-101 and 70-31-311 of the Montana Code Annotated (MCA).*

The language in this section of the EIS is cause for concern, as displaced residents and property owners are not guaranteed anything, but rather *may be* eligible for relocation benefits. This language makes it seem as though the burden of proof required to receive relocation benefits is placed on the victim of displacement. In Missoula, there is also a shortage of affordable housing and likely few if any comparable places where these folks could move. A quick overview of the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* shows a brief listing of the steps involved in relocation:[77]

- *Provide relocation advisory services to displaced tenants and owner occupants*
- *Provide a minimum 90 days written notice to vacate prior to requiring possession*
- *Reimburse for moving expenses*
- *Provide payments for the added cost of renting or purchasing comparable replacement housing*

Another important social justice issue brought up in the Ohio guide is Impact Question #6, which deals with the "Desecration or disruption of a community's economic vitality" by asking: "Will the number of locally owned business in that area change? Will property owners land value change?"[78] Bullard and Johnson pose similar questions: "Will the proposed action alter business visibility to traffic-based businesses? How will visibility and access changes alter business activity? What is the likely effect on property values caused by relocation or changes in land use?"[79]

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[75] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chap 4, pg 4.
[76] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chap 4, pg 6.
[77] United States Department of Housing and Urban Development. (2015). *Overview of the Uniform Act (URA).* Washington, D.C. Retrieved from: https://www.hud.gov/program_offices/comm_planning/affordablehousing/training/web/relocation/overview
[78] State of Ohio Department of Transportation. (2002). Pg 15.
[79] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 13.

Future economic impacts of road construction projects can be very difficult to assess. According to Downs' second theory of induced demand, the attraction of additional businesses due to the road expansions tend to perpetuate increased road usage.[80] Beyond increased road usage, how will road changes affect land value, thus affecting development patterns? It is possible that developers could become more interested in purchasing and developing land, shifting more power and influence into the hands of a few. There is also the possibility of traffic-influenced development patterns due to increased road usage.

The EIS report attempts to address this issue, saying that "While improved access and mobility may make adjacent properties more desirable, ultimately, the growth and land use changes adjacent to the project corridor are dictated by the city zoning and land use plans which restrict the density and types of development that may occur."[81] Currently, the west side of Russell Street from 3rd to the bridge is commercial and the rest of the corridor is mostly multi-family residential with a few spot zones for small commercial developments.

While the EIS report indicates that land use and zoning laws will not change, the report acknowledges that the *desirability* of the land within the Russell Street corridor will change. This has the potential for dramatic unintended consequences. The land has the potential to become more valuable for business development and less valuable for private homeowners located within a close proximity to the project corridor. While the EIS claims that development along Russell Street is subject to city zoning regulations, it is not unrealistic to see development patterns trigger zoning changes or at least myriad variances. If the land becomes valuable enough and there are powerful stakeholders that have vested interest in development, zoning changes that drastically change the permitted land uses are certainly possible, depending on the strength of local and state regulations.

The Three-Plus Plan

While there are positive attributes to the Russell Street changes, including raised bikeways, improved road surfaces, additional bus stops, and increased sidewalk connectivity, there are clearly a number of potential environmental justice issues. But it does not need to be this way. There is one particular build alternative that would limit or even decrease the amount of car use along the Russell Street corridor, while simultaneously encouraging and incentivizing more sustainable forms of alternative transportation by providing all of the same benefits to alternative transportation as Alternative 4. This plan was submitted by citizens, and unfortunately was not an alternative considered in the EIS.

Bob Giordano, the Executive Director of the Missoula Institute for Sustainable Transportation (MIST) and community leader who led the submittal of the Three-Plus Plan, commented during the public comment period on the EIS and highlighted a few ways in which the road changes could be more sustainable and more socially just. The Three-Plus Plan would include two lanes

[80] Downs, A. (2004).

[81] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Chap 4, pg 1.

of traffic with a middle turn lane for the entire length of the Russell Street project corridor. In addition, instead of traffic signals, there would be six single-lane roundabouts at strategic intersections along the road, including two of the busiest intersections: Russell/3rd and Russell/Mount. The benefits of single-lane roundabouts are well-documented and laid out in detail by Giordano:[82]

> *The capacity of single lane roundabout at Russell/3rd: 25,000 a day, or 2,500 per hour. The last count I did (9/9/08) at rush hour (4:30pm to 5:30pm) showed 2,122 cars passing through (right, straight, and left: all legs). Thus we could handle about 15.12% more cars- at rush hour, under current context. Yet we know more people are cycling, walking and taking transit and that trend will likely grow. We also know other TDM measures, like ones Missoula in Motion is promoting and working on, are very successful and will likely become even more successful. Simply shifting 100 cars out of rush-hour has a huge positive effect. Making Russell very 'human-scale', as a 3-lane instead of 5-lane, further encourages walking, cycling and transit.*

The Three-Plus Plan also would not displace a single resident or business. As Giordano points out, "not tearing down any houses keeps people in situations that make walking, cycling and transit very feasible and keeps with the 'focus inward' theme of the long range plan."[83] It is also important to note that in Missoula's 2008 Long Range Transportation Plan, a comprehensive public outreach plan showed that the public ranked "widening roads was #22 on the list of solutions."[84] Walking, cycling, and public transit were all ranked higher on the list. Giordano sums up the comments by saying, "In general, we feel that that the 3+ for Russell proposal - submitted by citizens, MIST, MAST, BWAM, over 1,000 citizens, and others - is a more appropriate alternative."[85]

Conclusion

There are several factors that can help shape what transportation looks like in the future. For example, transportation choices are different in neighborhoods that have both compact and mixed-use design. This means that if there suitable amenities that are easily accessible, people will be more likely to walk or ride a bike and less likely to use a vehicle. These amenities include, but are not limited to, grocery stores and farmers markets, banks and credit unions, childcare services, parks, locally owned shopping stores, and social gathering places like bars, coffee shops, and restaurants.

The closer services are in the neighborhood, the less likely cars will be used to access these services. In John Holzclaw's article *How Compact Neighborhoods Affect Modal Choice,* he provides statistics on how dense a neighborhood is and what mode of transportation an individual will choose. He explains his findings by saying that "When density increases, driving

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[82] Giordano, B. (2008). *Comments on EIS for Russell Street.* Missoula Institute for Sustainable Transportation. Missoula, Montana. Retrieved from: http://www.strans.org/russellcomments.html

[83] Ibid.

[84] Ibid.

[85] Ibid.

falls, as trip lengths are shortened and more can be taken by transit or walked or bicycled."[86] As a result, low-income residents who do not own cars are not left behind. This of course assumes that these residents have not been displaced out of these neighborhoods.

Unfortunately, increasing a neighborhood's 'livability' by making it more walkable can also make it more attractive for new businesses and development that can in turn lead to an influx of wealthier residents. Shifting demographics can change the culture of a neighborhood, drive up rent prices and other costs of living, and can lead to gentrification and the displacement of long-time residents. Despite gentrification and displacement risks, in a compact neighborhood model, access to services is more balanced and equitable across all demographic groups because a single occupancy vehicle is not as needed.

McCann discussed this more comprehensive approach to transportation infrastructure at length. She says that advocacy for alternative transportation at an individual project level is often a losing proposition. Instead of fighting for a bike lane or a sidewalk each time a road update is proposed, she advocates for a more holistic approach in how we design our communities, stating that "Complete streets policies are intended to end this project-by-project approach to change, and they do so by focusing not on projects but on changing the internal guidelines, policies, processes and systems that have been set up to provide for a single mode."[87]

In the end, traffic congestion is a simple fact of modern society. No matter how hard we try to combat it, "effective anti-congestion tactics may reduce the rate at which peak-hour congestion gets worse, but they will not eliminate it and often will not even prevent it from intensifying at least somewhat.[88] In fact, Downs actually acknowledges that traffic congestion is not *always* a bad thing in that it can provide a necessary function in our modern societies by encouraging the use of alternative transportation, which is beneficial for maintaining social equity and environmental integrity. As someone astutely observed in the EIS comment section about the traffic problem along the Russell Street corridor, "We do not need to spend millions of dollars to solve this problem."[89]

The Russell Street road updates are a microcosm of a macro problem. The disjointed nature of transportation planning continues to disrupt communities by favoring car culture and building bigger and faster roads. As Bob Giordano says in the Russell Street EIS comments, "The best solution also looks city-wide and considers system wide improvement."[90] A more holistic approach to planning our transportation system will not only have environmental and social benefits, but it stands to provide substantial economic benefits as well.

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[86] Holtzclaw, J. (ND). *How Compact Neighborhoods Affect Modal Choice: Two Examples.* Sierra Club Website. Retrieved from http://vault.sierraclub.org/sprawl/articles/modal.asp

[87] McCann, B. (2013). Pg 53.

[88] Downs, A. (2004). Pg 323.

[89] State of Montana DOT & City of Missoula. (2011). *Final EIS.* Appendix H, pg 90.

[90] Giordano, B. (2008).

In Naomi Klein's momentous book entitled *This Changes Everything: Capitalism vs The Climate*, she espouses the economic benefits of investing in a 'green' transportation system, which is worth quoting at length:[91]

> *The potential job creation is huge. For instance, a plan put forward by the U.S. BlueGreen Alliance, a body that brings together unions and environmentalists, estimated that a $40 billion annual investment in public transit and high-speed rail for six years would produce more than 3.7 million jobs during that period. And we know that investments in public transit pay off: a 2011 study by research and policy organization Smart Growth America found they create 31 percent more jobs per dollar than investment in new road and bridge construction. Investing in the maintenance and repair of roads and bridges creates 16 percent more jobs per dollar than investment in new road and bridge construction. All of which means that making existing transportation infrastructure work better for more people is a smarter investment from both a climate and an economic perspective than covering more land with asphalt.*

Unfortunately, the development trend over the last 50 years has been suburban sprawl, decentralizing our neighborhoods, and making us increasingly dependent on cars for transportation. Thus, we build bigger and bigger roads to transport more and more people across further and further distances. We must stop inducing demand for car-use and stop expanding roads. At the same time, we must implement policies that de-incentivize car use, such as congestion pricing, and incentivize alternative methods of transportation, such as reliable and accessible transit service and protected bikes lanes. The efficiency of our transportation systems can be greatly increased, while simultaneously decreasing the severity of environmental and social impacts. We must have the political willpower to create an equitable and sustainable transportation system. As Henry Holmes says in *Just Transportation,* "Social justice and ecological sustainability, embodied in the Principles of Environmental Justice, must be at the heart of this political struggle and transformation."[92]

[91] Klein, N. (2014). *This Changes Everything: Capitalism vs. The Climate.* Pg 127. New York: Simon & Schuster Paperbacks.

[92] Bullard, R. D., and Johnson, G. S. (Eds.) (1997). Pg 32.

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Appendix A: Ohio Department of Transportation EJ Guidance Impact Questions

due to separation and isolation, destruction of aesthetic value, decreased land value projections, and adverse employment lend themselves poorly to quantitative analysis and should to be evaluated based on qualitative standards. They will require subjective analysis by staff and discussion during the public involvement process. Some impacts will require both types of evaluation.

The adverse effects identified in the DOT Order (5610.2) can be grouped into fourteen (14) impact categories. Following is a list of the 14 impacts and possible measures or questions that can be used to determine if they are disproportionate for a target area or population. It is recommended that each impact be rated or scored for the project area, regional area or state and again for the target area or population. The format for this type of analysis is best demonstrated by the use of a matrix similar to the one below. The ratings can then be compared to determine the potential for disproportionate impacts.

Each impact could be evaluated by asking and rating the suggested questions which follow. A matrix placing the following variables on one axis and the 14 impacts on the other axis could be developed. Using this type matrix on a project by project basis can provide a visually simple comparative impact analysis. The suggested questions under each impact can be expanded or reduced depending on the project being analyzed.

Current Measure or Value in Region or State	Altered Measure or Value in Region or State	Positive Impact / Benefit to Region or State	Adverse Impact to Region or State	Current Measure or Value W/in Target Population or Area	Altered Measure or Value W/in Target Population or Area	Positive Impact / Benefit to Target Population or Area	Adverse Impact to Target Population or Area	Short Term Impact	Long Term Impact

1. IMPACT: BODILY IMPAIRMENT, INFIRMITY, ILLNESS OR DEATH

ANALYSIS QUESTIONS:

Quantitative:

How will the traffic speed within the target area change?
How will traffic volumes change?
Is there a change in the volume or pattern of through traffic on local (target area) streets?

Subjective:

Will there be a change in the relative safety in the target area for pedestrians, bicyclists, motorists?
Will the safe and easy access to community or regional resources (shopping, bus stops, schools, etc) be changed?

2. ***IMPACT: AIR, NOISE, AND WATER POLLUTION AND SOIL CONTAMINATION***

ANALYSIS QUESTIONS:

Quantitative:

Will traffic noise level change?
Will traffic induced air quality change?
Will local waters and soil contamination levels change?

Subjective:

Will overall air, water, and noise quality of the target area change?

3. ***IMPACT: DESTRUCTION OR DISRUPTION OF MAN-MADE OR NATURAL RESOURCES***

ANALYSIS QUESTIONS:

Quantitative:

Will the number of trees and other plants change?
Will waterways such as streams and brooks change?
Will the number or size of parks, parkland or outdoor recreational opportunities change?

Subjective:

Will the changes provide overall improvement or harm to the natural and man made resources?

4. ***IMPACT: DESTRUCTION OR DIMINUTION OF AESTHETIC VALUES***

ANALYSIS QUESTIONS:

Quantitative:

Will any public art or statutes be added, moved or removed?
What % of project costs are being spent on enhancements?
Will the amount of open space change?

Subjective:

Is the improvement attractive?
Will the view or vista change?

5. ***IMPACT: DESTRUCTION OR DISRUPTION OF COMMUNITY COHESION***

ANALYSIS QUESTIONS:

Quantitative:

Will man-made dividers, (such as an overpass, bridge, 4 lane or greater roadway or rail tracks) be constructed through a portion of an existing community and cause it to be segmented?

Subjective:

Is the proposed project or plan perceived to significantly benefit one portion of an existing neighborhood and significantly harm another portion of the same neighborhood?

6. ***IMPACT: DESTRUCTION OR DISRUPTION OF A COMMUNITY'S ECONOMIC VITALITY***

ANALYSIS QUESTIONS:

Quantitative:

Will the number of locally owned businesses in the target area change?
Will the total number of businesses in the target area change?

Subjective:

Will the financial investment benefit the target area's population?
Will property owners land value change?
Will the number of jobs available in the target area change?

7. ***IMPACT: DESTRUCTION OR DISRUPTION OF THE AVAILABILITY OF PUBLIC AND PRIVATE FACILITIES AND SERVICES***

ANALYSIS QUESTIONS:

Quantitative:

Will the time to travel to public and private facilities and services (such as schools, medical facilities, shopping, community centers, libraries, etc. change? (Note: See MORPC analysis in Appendix B for computer modeling analysis to evaluate this impact.)

Will there be a change in the number and type of impediments to access public and private facilities (such as more or wider roadway crossing, additional bus transfers and increased walking distance to bus stops)?

Will the number or location of public or private facilities be changed?

Subjective:

Will changes to the perceived distance to or difficulty to get to public and private facilities from the target area result in target populations "giving up" interest in using them?

8. IMPACT: VIBRATION

ANALYSIS QUESTIONS:

Quantitative:

Will vibration levels caused by increased traffic or transit improvements change?

Subjective:

Will vibration levels caused by increased traffic or transit improvements change?

9. IMPACT: ADVERSE EMPLOYMENT EFFECTS

ANALYSIS QUESTIONS:

Quantitative:

Will time to travel to jobs throughout the regional area change?
Will time to travel to jobs within the target area change?
Will the number of jobs change (How many jobs within the target area vs. regional area or state will be lost / gained?)

Subjective:

Will the type of jobs available within the target area change?
Will the target area become a more attractive place for employers to locate their facilities?

10. IMPACT: DISPLACEMENT OF PERSONS, BUSINESSES, FARMS, OR NONPROFIT ORGANIZATIONS

ANALYSIS QUESTIONS:

Quantitative:

How many target vs non-target population persons will be displaced?

How many target vs non-target population businesses will be displaced?
How many target vs non-target population farms will be displaced?
How many target vs non-target population non-profit corporations will be displaced?

Subjective:

Will an alternative project location or project approach (which meets the project or plan's purpose and need) displace fewer target vs non-target population persons, businesses, farms or non-profit corporations?

11. IMPACT: INCREASED TRAFFIC CONGESTION

ANALYSIS QUESTIONS:

Quantitative:

Will traffic congestion levels change?

12. IMPACT: ISOLATION

ANALYSIS QUESTIONS:

Quantitative:

Will access roadways into and out of the target area become dead ends or be cut-off?

Subjective

Will roadways, bridges and other traffic improvements be constructed to surround the target area and create the feeling of an isolated "island"?

13. IMPACT: EXCLUSION OR SEPARATION OF MINORITY OR LOW-INCOME INDIVIDUALS WITHIN A GIVEN COMMUNITY OR FROM THE BROADER COMMUNITY

ANALYSIS QUESTIONS:

Quantitative:

Will the transportation changes result in increased travel time from the target area to community resources such as schools, churches, shopping, jobs, recreational facilities, etc? (Note: See MORPC

analysis in Appendix B for computer modeling analysis to evaluate this impact.)

Subjective:

Will the transportation improvements increase the feeling of exclusion or alienation between the target populations and the broader region or state?

14. IMPACT: THE DENIAL OF, REDUCTION IN, OR SIGNIFICANT DELAY IN THE RECEIPT OF, BENEFITS

ANALYSIS QUESTIONS:

Quantitative:

Will access to or use of the transportation improvement be denied to any low income or minority population or groups (for reasons such as cost to use, ability to access, etc.)?
Will access to or use of the transportation improvement be denied or more difficult to access based on its location?

Subjective:

Will the overall benefits and improvements being proposed by the plan or project be available to the same level and within the same basic time frame to the target population as it will to the broader community, region, or state?

It is important in conducting the above analysis that the impacts have been discussed and evaluated, even at a subjective level; some type of a "balance sheet" is prepared; and the 14 issues are presented through the public involvement process to the target area population for their comment and suggestions for evaluation and mitigation. To avoid having to collect massive amounts of new data for every plan or project, it is possible to use the data currently in the MPO models and compare changes based on Traffic Analysis Zones (TAZ). Again, examples of this type of analysis can be found in the MORPC EJ Report previously referenced. Remember, EJ was not intended to create massive amounts of new data or work. It was intended to ensure nondiscrimination in federally funded activities.

C. MORPC APPROACH

Early in 2000 the Mid-Ohio Regional Planning Commission (MORPC) formed an MPO Environmental Justice Task Force to assess and ensure compliance of its transportation planning process, plans, and Transportation Improvement Program with Title VI. MORPC had to move quickly because its Federal MPO Certification Review was scheduled for May

Appendix B: EPA EJ SCREEN Report for Entire Russell Street Project Corridor

EPA United States Environmental Protection Agency

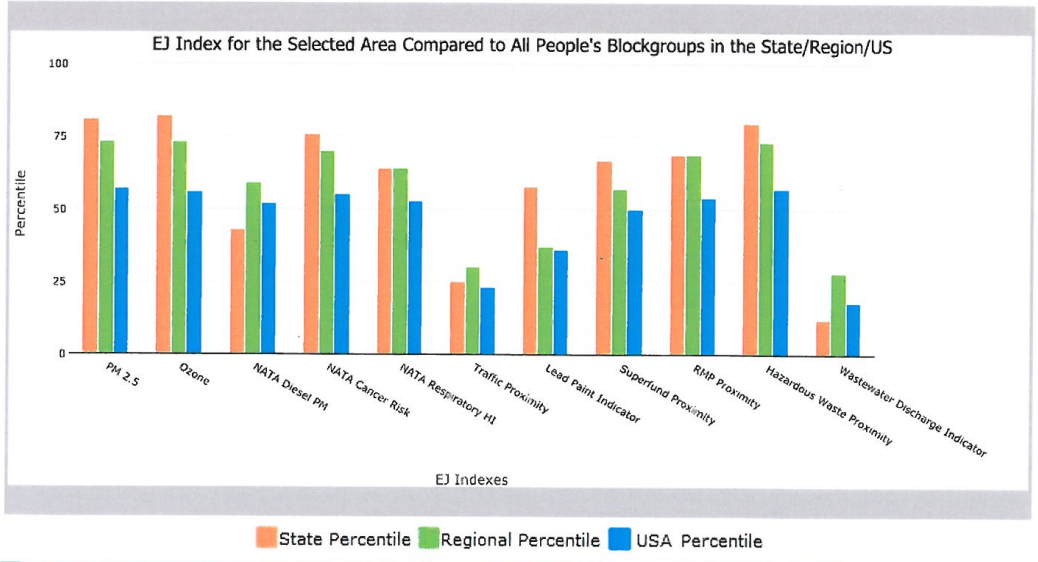
EJSCREEN Report (Version 2017)

the User Specified Area, MONTANA, EPA Region 8

Approximate Population: 2,882

Input Area (sq. miles): 0.61

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	81	73	57
EJ Index for Ozone	82	73	56
EJ Index for NATA* Diesel PM	43	59	52
EJ Index for NATA* Air Toxics Cancer Risk	76	70	55
EJ Index for NATA* Respiratory Hazard Index	64	64	53
EJ Index for Traffic Proximity and Volume	25	30	23
EJ Index for Lead Paint Indicator	58	37	36
EJ Index for Superfund Proximity	67	57	50
EJ Index for RMP Proximity	69	69	54
EJ Index for Hazardous Waste Proximity	80	73	57
EJ Index for Wastewater Discharge Indicator	12	28	18



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

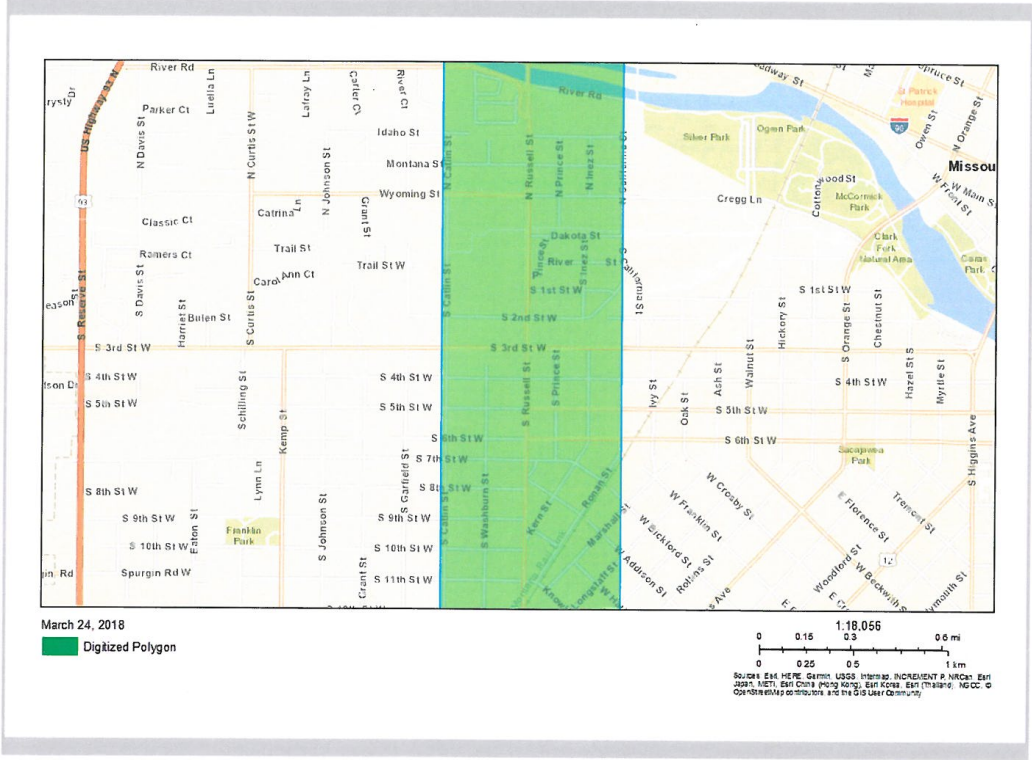
March 24, 2018

1/3

EJSCREEN Report (Version 2017)

the User Specified Area, MONTANA, EPA Region 8

Approximate Population: 2,882
Input Area (sq. miles): 0.61



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

EJSCREEN Report (Version 2017)

the User Specified Area, MONTANA, EPA Region 8

Approximate Population: 2,882

Input Area (sq. miles): 0.61

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	5.85	5.21	97	7.3	31	9.14	2
Ozone (ppb)	37.4	38.4	34	43.5	7	38.4	42
NATA* Diesel PM (µg/m^3)	0.691	0.244	91	0.607	60-70th	0.938	<50th
NATA* Cancer Risk (lifetime risk per million)	40	22	97	30	80-90th	40	50-60th
NATA* Respiratory Hazard Index	2.2	0.84	97	1.4	80-90th	1.8	70-80th
Traffic Proximity and Volume (daily traffic count/distance to road)	590	150	93	250	88	590	80
Lead Paint Indicator (% Pre-1960 Housing)	0.45	0.29	76	0.22	81	0.29	72
Superfund Proximity (site count/km distance)	0.086	0.13	57	0.12	61	0.13	61
RMP Proximity (facility count/km distance)	0.27	0.47	64	0.61	49	0.73	47
Hazardous Waste Proximity (facility count/km distance)	0.012	0.042	64	0.078	25	0.093	9
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.019	0.033	92	480	69	30	84
Demographic Indicators							
Demographic Index	33%	24%	82	27%	71	36%	54
Minority Population	11%	13%	66	24%	34	38%	25
Low Income Population	55%	36%	85	31%	87	34%	81
Linguistically Isolated Population	0%	0%	82	2%	55	5%	44
Population With Less Than High School Education	5%	7%	35	9%	40	13%	25
Population Under 5 years of age	3%	6%	18	7%	12	6%	16
Population over 64 years of age	6%	16%	7	12%	20	14%	13

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJSCREEN outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

Appendix C: EPA EJ SCREEN Report for North Russell Street Neighborhood

EPA United States Environmental Protection Agency

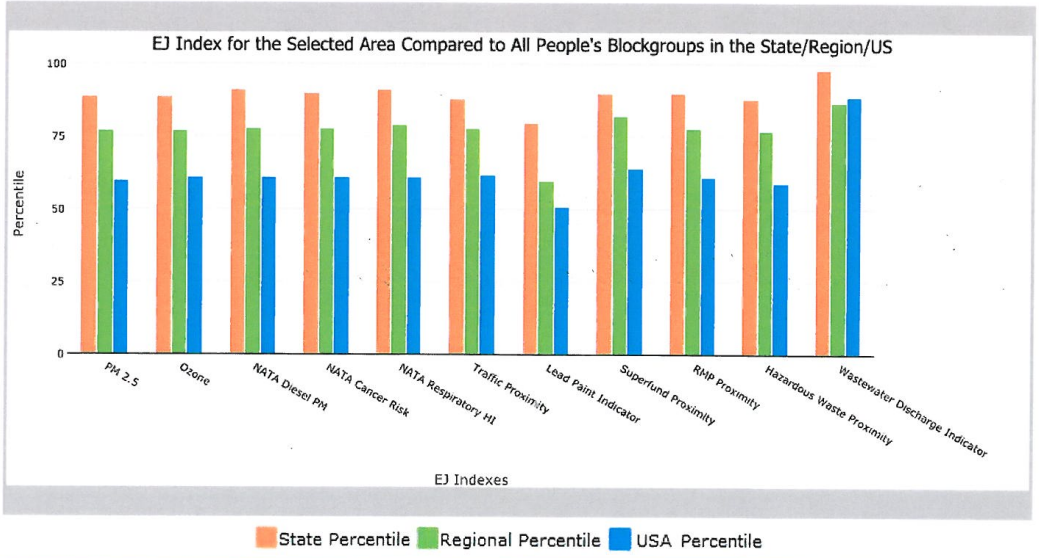
EJSCREEN Report (Version 2017)

the User Specified Area, MONTANA, EPA Region 8

Approximate Population: 1,169

Input Area (sq. miles): 0.44

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	89	77	60
EJ Index for Ozone	89	77	61
EJ Index for NATA* Diesel PM	91	78	61
EJ Index for NATA* Air Toxics Cancer Risk	90	78	61
EJ Index for NATA* Respiratory Hazard Index	91	79	61
EJ Index for Traffic Proximity and Volume	88	78	62
EJ Index for Lead Paint Indicator	80	60	51
EJ Index for Superfund Proximity	90	82	64
EJ Index for RMP Proximity	90	78	61
EJ Index for Hazardous Waste Proximity	88	77	59
EJ Index for Wastewater Discharge Indicator	98	87	89



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

March 25, 2018

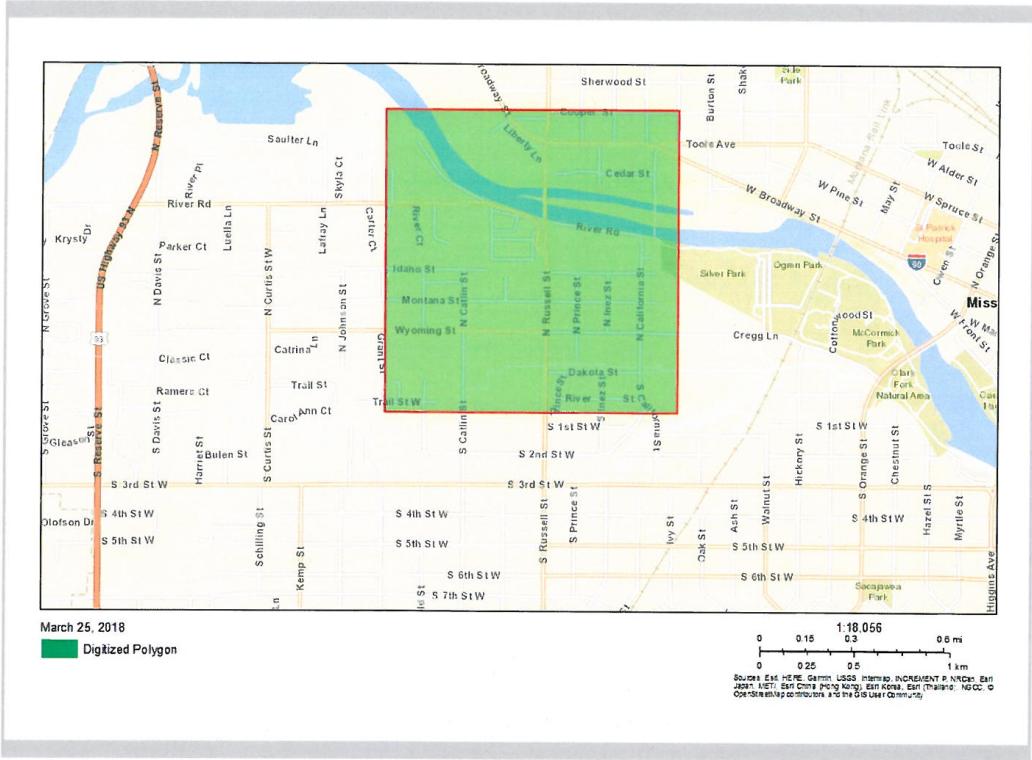
1/3

EJSCREEN Report (Version 2017)

the User Specified Area, MONTANA, EPA Region 8

Approximate Population: 1,169

Input Area (sq. miles): 0.44



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

EJSCREEN Report (Version 2017)

the User Specified Area, MONTANA, EPA Region 8

Approximate Population: 1,169

Input Area (sq. miles): 0.44

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	5.83	5.21	96	7.3	30	9.14	2
Ozone (ppb)	37.4	38.4	36	43.5	7	38.4	43
NATA* Diesel PM (µg/m^3)	0.732	0.244	91	0.607	60-70th	0.938	<50th
NATA* Cancer Risk (lifetime risk per million)	38	22	95	30	70-80th	40	<50th
NATA* Respiratory Hazard Index	2.1	0.84	96	1.4	80-90th	1.8	60-70th
Traffic Proximity and Volume (daily traffic count/distance to road)	600	150	93	250	89	590	80
Lead Paint Indicator (% Pre-1960 Housing)	0.23	0.29	53	0.22	67	0.29	54
Superfund Proximity (site count/km distance)	0.085	0.13	57	0.12	61	0.13	61
RMP Proximity (facility count/km distance)	0.35	0.47	70	0.61	56	0.73	53
Hazardous Waste Proximity (facility count/km distance)	0.012	0.042	64	0.078	25	0.093	9
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.041	0.033	94	480	73	30	87
Demographic Indicators							
Demographic Index	37%	24%	87	27%	76	36%	60
Minority Population	14%	13%	75	24%	44	38%	31
Low Income Population	60%	36%	90	31%	91	34%	86
Linguistically Isolated Population	0%	0%	82	2%	55	5%	44
Population With Less Than High School Education	7%	7%	55	9%	54	13%	35
Population Under 5 years of age	5%	6%	45	7%	33	6%	41
Population over 64 years of age	8%	16%	16	12%	35	14%	26

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

Internship Reflection Essay

Link to Mode Share White Paper: http://activatemissoula.com/resources/

In May 2017, I completed a yearlong policy research internship for the Missoula Metropolitan Planning Organization (MPO). An MPO is a transportation planning body that is required for any "urbanized area over 50,000 people". I started the internship in June of 2016, just as the Missoula MPO was in the final stages of putting together the updates to the Long Range Transportation Plan. I collected data and analyzed policy on mode share goals from case studies across the country, which informed MPO planners and decision-makers. The result was a White Paper that was published as an appendix to the 2016 Long Range Transportation Plan update.

The bulk of the research was in the summer of 2016. I started by brainstorming with MPO planners a list of cities similar to Missoula. I collected information on each of those communities to see if they had set mode-share goals, and if so, what those goals were. Based on that information, I narrowed my case studies down to nine communities. From there, I collected additional information about mode share goals and began conducting interviews. By early fall I had the goal-setting research done and I was moving into analyzing planning documents for policies/programs/initiatives that communities were implementing to achieve their goals. Along the way I had meetings with MPO planning staff, the Transportation Technical Advisory Committee (TTAC), and the Transportation Policy Coordinating Committee (TPCC). The last step of the project was to develop a policy matrix, which I did with the help and guidance of MPO Planners. The goal of the policy matrix was to provide decision-makers a menu of policy options. We ranked the options from 'easy' to 'difficult' in terms of political feasibility. In November, I presented my research findings to a joint TTAC/TPCC committee.

While I am still working on my public speaking skills, I felt more prepared to give a presentation to the joint TTAC/TPCC committee after giving presentations in most of my graduate classes. Another skill that I had learned in the EVST program that I applied to the internship was

research. I utilized the research skills I learned in the EVST program when I read and scanned planning documents, looking for key words and phrases to help narrow and refine my research. The big takeaway from the internship was learning more about multimodal transportation planning in general. There are so many different forces and factors at play when planning a transportation system, from grassroots political pressure to federal requirements to financial constraints. As far as skills, I challenged myself a lot with PowerPoint, as I had to prepare a presentation for the joint TTAC/TPCC. I created all of the graphs for the report, which was a new skill learned for me. The internship enhanced my understanding of technical planning documents, clear and concise communication of complicated information, and professional correspondence. As part of my research, I reached out to several transportation planners across the country in the case study communities and I even conducted two interviews with transportation planners, one in person and one over the phone. The project required extensive self-direction and demonstrated to myself that I am capable of working under minimal supervision.

The minimal supervision was challenging at times, but it also contributed to my sense of accomplishment. Completing such a large research project with that amount of autonomy was rewarding. Collecting information for so many different case study communities, searching transportation planning documents, narrowing the case study list down to nine, and then analyzing policies from each of those case study communities was an enjoyable challenge. Most importantly, conducting research and producing a document for transportation planners and decision-makers in a practical capacity was the most satisfying part of the whole project. My document was actually used in a real-world, professional setting. I provided a research paper that the MPO wanted and I am proud to have that document published as an appendix to the 2016 LRTP.

The internship served MPO planners by providing them information to help set mode share goals. This is what I would consider one of the very first steps toward increasing multimodal transportation rates in Missoula. Obviously, setting goals is just a first step, but I do think that it

is a critical first step. The policies/programs/initiatives that come along with the mode share goals are critical to guiding Missoula toward those goals. In the bigger picture, increasing multimodal transportation rates and reducing single occupancy vehicle rates has a host of benefits for both the local and global community, which I lay out in detail in the background of the white paper. The short list includes reducing greenhouse gas emissions, managing population growth and added stress on the transportation system, improving air quality, promoting healthy habits, increasing public safety, and striving for social equity.

Writing a big research paper was challenging, and at times the sheer volume of information was overwhelming. At first, I struggled to organize all of the information and present it in a logical and consistent manner. I was not prepared for the amount of time it was going to take to come up with a final, polished document. I will say that despite the struggle, I think some of my best writing is in this paper and I enjoyed the challenge and I am satisfied with the results. I enjoy writing long range planning documents and I can see myself doing this as a future career in some capacity.

This experience really got me interested in the possibility of a career as a transportation planner, and interested in planning as a career path in general. My previous experience with transportation planning was that of an outsider, as a non-profit active transportation activist. I cannot say that I knew very well what transportation planners did, but I certainly knew about the outcomes of transportation planning. And more often than not the outcomes did not line up with the environmental and/or social values that I held. In other words, I often thought of transportation planners as the ones who simply designed roads for cars. There is some truth to this, but there is much more to the profession.

During my research, I spoke with transportation planners from other cities and it allowed me to see the struggles and the pressures that they face from so many different directions. Many planners I spoke with actually had very similar environmental and social values to my own. This made me believe that there is the possibility for change being affected from the “inside”. As an

active transportation advocate, I'd always felt like I was on the outside looking in, unable to make any real decisions that would impact peoples lives in a way that was more far-reaching than just one individual at a time. With the discovery of transportation planning, I was optimistic about the possibility of creating change. It inspired me to take a planning class in the geography department, and after a week in the classroom with Dr. Shively I knew with certainty that this was the career path I wanted to pursue after graduate school.

Transportation Mode Share White Paper

May, 2017

Prepared for the Missoula Metropolitan Planning Organization

By Master of Science Candidate Garrett S. McAllister

Univeristy of Montana
Environmental Studies Department
Faculty Advisor: Robin Saha, Ph.D.

ACKNOWLEDGEMENTS

I would like to thank Jessica Morriss and Aaron Wilson of the Missoula Metropolitan Planning Organization Transportation Planning Division. It was a pleasure to work with both of them, and I hope I am fortunate enough in the future to work with colleagues of their caliber again.

I would also like to thank the Brainerd Foundation, which generously supports the University of Montana Environmental Studies program. Without the foundation's funding this project would not have been possible.

Thank you to the city planners who responded to my emails and engaged in the conversation with me: Eli Cooper of Ann Arbor, MI; Brandon Vieg of Chico, CA; Aaron Iverson of Fort Collins, CO; Adam Fukushima of San Luis Obispo, CA.

A special thank you to Randall Rustch, Senior Transportation Planner in Boulder, Colorado and Tyler Deke, Transportation Manager with Bend's Metropolitan Planning Organization, who both took the time out of their busy schedules to patiently answer my questions.

Lastly, I owe a debt of gratitude to my advisor Dr. Robin Saha. He provided valuable feedback and has been instrumental in my education at the University of Montana.

EXECUTIVE SUMMARY

In 2016, the Missoula Metropolitan Planning Organization (MPO) set out to research transportation mode share goals as part of its 2016 Long Range Transportation Plan. Mode share goal setting is a relatively new method for encouraging a shift away from single-occupancy vehicle (SOV) use and toward multi-modal transportation options, such as walking, bicycling, transit, and carpooling. Mode share goals can help encourage the shift away from single occupancy vehicles toward a more balanced multi-modal transportation system. Increasing multi-modal transportation options is important for a number of reasons relating to growth management, safety and public health, roadway efficiency, social equity, and mitigating climate change. Setting mode share goals also directs policy formulation and funding allocations. By implementing policy and funding changes, the city and county can facilitate steady movement toward these goals over the next 30 years.

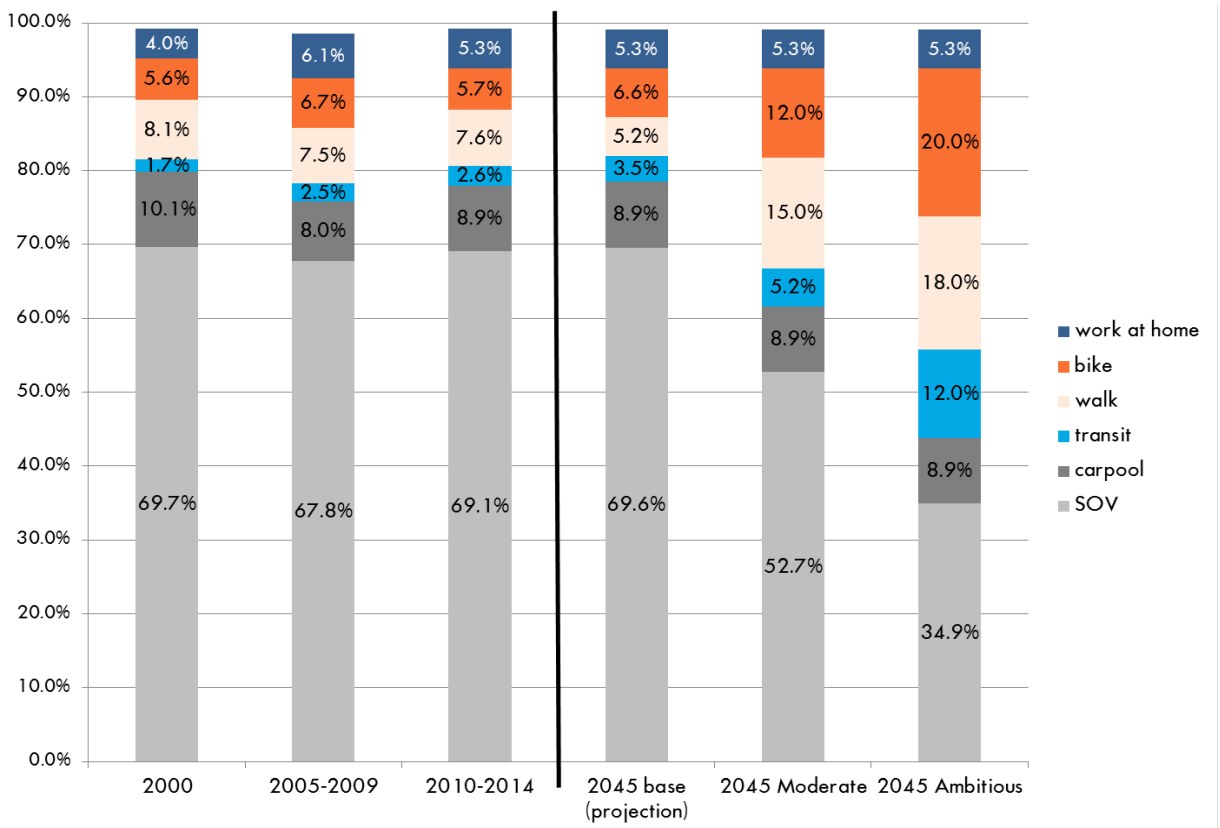
The purpose of this paper is to document the methods and process of how the MPO researched and set mode share goals, providing a framework/blueprint for city planners in other communities, should they consider setting mode share goals of their own. This paper is also intended to help guide planners in considering different policy options that will help support mode share goals and ultimately help reduce SOV usage.

To begin the process of setting mode share goals, relevant case study information needed to be collected from other communities. Knowing what the mode share goals are for other communities was a critical first step. The objective of the case studies was twofold: to determine *what* mode share goals are for other communities similar to Missoula, and perhaps more importantly, to get a better understanding of *how* these communities set their goals. In order to set thoughtful, reasonable mode share goals for Missoula, we needed to better understand how other communities have approached mode share goal setting. We were also looking for critical insight into the most effective and common transportation policies and practices used to affect mode share.

With the help of transportation planners Jessica Morriss and Aaron Wilson, I identified a preliminary list of cities to study. I then contacted each community and examined planning documents to see if any mode share goals had been set. Once preliminary information was collected, case studies were narrowed down to nine communities. Three of the chosen communities do not have mode share goals, but they do have transportation policies that aim to reduce single-occupancy vehicle use, which was worth investigating further. Three other communities have only select mode share goals, such as goals for cycling or walking. The last three communities have mode share goals for all modes of transportation. Each of the nine communities was studied in-depth. I looked at their mode share goals, if they had any, and researched *how* they developed these goals.

Once sufficient data were collected from these nine case study communities, I created three different mode share goal options for the MPO to review. Mode share goal options were categorized under “business as usual”, moderate, and ambitious. Using my data,

transportation planners created a graph to compare Missoula's historical mode share trends side-by-side with each mode share goal option:



After developing these mode share goal options, I analyzed policy documents from each case study community and identified a host of relevant transportation policies that were either associated with mode share goals or aimed at single-occupancy vehicle reduction. I also contacted city planners in these nine communities. I interviewed planners from Bend, OR and Boulder, CO and exchanged emails with several other planners to find out what policies are being implemented in their communities. Missoula MPO Transportation Planning Manager Jessica Morriss reviewed this list of policies that I complied and, based on her professional recommendations, assisted with sorting them into three different feasibility categories: easy, medium, and difficult. The resulting document is a "policy feasibility matrix", which is intended to serve as a menu of transportation policies that planners may use to influence modal choices.

Finally, this paper concludes with my own brief list of policy suggestions that I put together for the MPO to consider in conjunction with setting mode share goals. It is not within the scope of this paper to do a comprehensive policy analysis. These suggestions are simply a list that identifies some of the most common and effective policies and programs that I came

across in my case study research. These are tactics that other communities are using to support achievement of mode share goals and, ultimately, reductions in SOV use.

My policy suggestions include:

1) Increase funding for non-motorized and transit transportation projects
2) Move away from exclusively Level of Service and toward Multi-Modal Level of Service
3) Increase mixed-use urban infill and density
4) Consider feasibility of parking districts or other parking management strategies
5) Promote, educate, advocate
6) Continue to increase mode share data gathering
7) Assess progress, review policies, and revise goals

The City of Missoula and Missoula County face important transportation challenges in the future. Setting mode share goals is the first critical step that will hold decision makers accountable and shape policy that will lead to a more sustainable transportation system. A future transportation system with more multi-modal options will improve safety for all roadway users, improve air quality by reducing emissions, improve public health by encouraging more active transportation, ease congestion by reducing our dependence on single-occupancy vehicles, address social equity by diversifying our transportation options, and limit our contribution to global climate change by reducing the amount of fossil fuels consumed in our community. The City of Missoula and Missoula County have an opportunity to create a transportation system that serves all Missoulians and sets the standard for other communities.

TABLE OF CONTENTS

INTRODUCTION

The City of Missoula has shown a commitment to solving the social, economic, and environmental issues that face our community and modern society at-large. According to the City of Missoula's Growth Policy, "By providing guidance for the development of different types of land uses, their design, their accessibility, and their intensity, it [the Growth Policy] becomes the foundation for ensuring economic vitality, affordable housing, efficient transportation planning, environmental protection, and the health, welfare, and happiness of the community's residents."[1] Adoption of transportation mode share goals as part of the 2016 Long Range Transportation Plan is another step toward meeting these foundational commitments.

It is helpful to know how residents in the community travel to work. Measuring mode share gives city planners a sense of transportation habits and trends over time. When we understand how people travel in the community, we understand what modes of transportation need more or less attention. We see where we need to move resources in order to accommodate the needs of various modes of transportation. We may find that cycling ridership is on the rise and therefore additional facilities may be needed to accommodate this growth. Or, we may find that cycling ridership is trending down, so we may opt to increase funding for education and advocacy programs that promote cycling. Knowing how residents move around the city is crucial to providing the best transportation system possible and understanding where money is best spent.

Understanding these mode share patterns over time gives us a baseline when considering future mode share goals and what is reasonable and realistic. For example, a community with a current bicycle mode-share of 5% may not want to set a mode share goal of 20%, especially if they set that goal for a short timeline. This may be too ambitious, based on the available commute data that tracks historical trends. Conversely, for a community with a current bicycle mode share of 18%, setting a goal of 20% might not be ambitious enough. Knowing your baseline data is critical for setting realistic, achievable, thoughtful goals.

The purpose of this paper is to document the methods and process of how the Missoula Metropolitan Planning Organization researched and set mode share goals, providing a framework/blueprint for city planners in other communities, should they consider setting mode share goals of their own. This paper is also intended to help guide planners in considering different policy options that will help support mode share goals and ultimately help reduce SOV usage.

This paper will define transportation mode share, explain the reasons behind setting mode share goals, outline our methodology for case study data collection, provide background data on Missoula's historic and current transportation mode share trends, present the case study data and discuss some of the relevant transportation policies from each community, and then finish with a list of my own policy suggestions for the Missoula MPO.

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[1] City of Missoula, Montana. (2015). Our Missoula: 2035 City Growth Policy. Pg 9. Missoula, MT.

BACKGROUND

This paper was written for the Missoula Metropolitan Planning Organization. Any urbanized area with a population of more than 50,000 has a metropolitan planning organization (MPO) that plans out transportation systems at a regional level.[2] A board made up of local elected officials sets policy for an MPO and adopts long-range plans and short-range programs of future transportation improvements.[3]

"Mode" simply refers to the type of transportation being used. Mode share is a breakdown of the percentage of residents using a particular form of transportation. The US Department of Transportation (USDOT) breaks down modes of transportation into four distinct categories; two motorized and two non-motorized. Motorized categories are split between public and private vehicles. Non-motorized categories are split between bicycling and walking.[4]

The USDOT defines commute mode share as the percentage of workers aged 16 years and over who commute either 1) by bicycle; 2) by private vehicle, including car, truck, van, taxicab, and motorcycle; 3) by public transportation, including bus, rail, and ferry; and 4) by foot.[5]

As Anthony Downs argued in his important 2004 book *Still Stuck in Traffic*, "Congested roads waste commuters' time, cost them money and degrade the environment."[6] Around the United States, more and more communities are recognizing the need to address transportation issues brought on by an over-reliance on automobile travel. This over-reliance leads to crumbling infrastructure and increased maintenance costs.[7] It is expensive to build roads and it is expensive to maintain them. But Downs only offers a partial list of the problems associated with congestion and heavy automobile use.

With the population of Missoula expected to continue growing at 1.5% per year, shifting our community's transportation habits away from single-occupancy vehicle (SOV) use and toward non-motorized and transit modes is important for growth management.[8] Managing this growth is necessary to maintain and even reduce current congestion levels on our roadways, to maintain or improve air quality standards in the Missoula air shed by reducing vehicle-related pollutants, and to illustrate Missoula's commitment to mitigating greenhouse gas emissions that contribute to global climate change. Additionally, reducing over-reliance on single-

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[2] United States Department of Transportation, Federal Highway Administration, Federal Transit Administration. (2015). A Guide to Transportation Decisionmaking. Washington, D.C.

[3] Ibid.

[4] United States Department of Transportation, Office of Policy. (2016). Commute Mode Share. Washington, D.C. Retrieved from: https://www.transportation.gov/mission/health/commute-mode-share

[5] Ibid.

[6] Downs, A. (2004). *Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion.* Pg 460. Washington D.C.: Brookings Institution Press.

[7] Ibid.

[8] United States Census Bureau. Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2015. Retrieved on 10/31/2016 from: https://www.census.gov/data/tables/2016/demo/popest/nation-total.html

occupancy vehicles helps increase safety for all roadway users and supports a more equitable transportation system. Setting mode share goals is an important component in the process of shifting to a more sustainable, resilient, just, and equitable transportation system that prioritizes more multi-modal transportation options.

The following is a more in-depth look at why a community may decide to set mode share goals with the aim of reducing SOV usage. There are a host of benefits, which include, but are not limited to:

Growth Management

The intermountain west is one of the fastest growing areas in the country and Western Montana has been experiencing similar growth trends. In Ravalli County, just south of Missoula, the population increased 41% from 1990-1999.[9] In Missoula, this growth has "contributed to increased congestion, decreased air quality, and longer commute times for many Missoulians."[10] The challenge Missoula faces is addressing the transportation needs of a growing population without resorting to the failed policies that lead to suburban sprawl and outward expansion, which consumes land and forces heavier reliance on single occupancy vehicles.

Setting mode share goals supports the City of Missoula's Growth Policy, which takes a "Focus Inward" approach to development by promoting "sustainable urban development and re-use rather than consumption and expansion into open space, agricultural resources, and natural areas."[11]

Transportation plays a key role in the "focus inward" approach: "As the foundation for the Growth Policy, the [Focus Inward] strategy is aimed at reducing automobile-dominated suburban development which not only helps to improve community health, cost of living, lower city infrastructure and service costs, but also mitigates the effects of climate change and lessens use of carbon-based fuels and subsequent greenhouse gas production."[12] From land use policy to health and wellness to environmental concerns, the Growth Policy recognizes that transportation serves as a foundation for achieving sustainability and resilience in Missoula.

Safety

Safety and wellness is one of the six key elements of the Growth Policy.[13] There are a number of transportation initiatives in the Growth Policy that highlight transportation's role in creating a safe community. Goal number one in the Safety And Wellness section of the Growth Policy is to

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[9] State of Montana. Department of Commerce, Community Development Division. (2006). Montana's Growth Policy Resource Book. Pg 6. Helena, MT. Retrieved from: https://comdev.mt.gov/Portals/95/shared/Resources/docs/Publications/GrowthPolicyResourceBook.pdf

[10] City of Missoula, Montana. (2015). Growth Policy. Pg 202.

[11] Ibid. Pg 11.

[12] Ibid. Pg 11.

[13] Ibid. Pg 37.

"Encourage healthy lifestyles by having a complete active transportation and transit network for all abilities and recreational opportunities that are safe, clean, beautiful, and navigable."[14] Objective 7 under that goal is to "Set and strive to achieve a mode-split goal for the overall transportation system", which is the genesis for the mode share case study.[15]

According to a recent study from the Michigan Transportation Institute, Montana ranks first in the rate of per-capita vehicle fatalities.[16] In fact, Montana's rate (22.6 per 100,000 people) is double the national average.[17,18] Population density and speed limits are both variables that are correlated with this unfortunate statistic. Montana is a large state with one of the lowest population densities in the country, ranking 48th. Montana is also one of only 7 states with a maximum speed limit of 80 miles per hour; the other states include Wyoming, Nevada, Idaho, South Dakota and Utah, as well as parts of Texas.[19] Of these 7 states, Nevada is the only one that is not in the top 10 in per capita vehicle fatalities.[20] Montana's rural landscape and high traffic speeds are possible factors for such high fatality rates.

Mitigating congestion by balancing our transportation system with more non-motorized users improves safety for all roadway users. Maintaining efficient roadways also reduces the likelihood of automobile drivers cutting through neighborhoods to avoid congested areas. Keeping automobiles on major arterials helps keep traffic down in our residential neighborhoods and improves safety for those living there. Providing sidewalks and bicycle lanes helps keep non-motorized travelers safe by keeping them separated from vehicles. Building more densely and avoiding sprawl allows for less reliance on single occupancy vehicles and promotes built environments that are "human scale." These are all ways to achieve greater safety for all users of our transportation system.

Public Health

Shifting transportation modes away from single-occupancy vehicle use will also help to address public health issues. Besides safety, which is considered a public health issue, there are two other major public health issues associated with transportation choices. One is the issue of air quality and the other is the dangerous rise of obesity. Air quality concerns include harmful emissions from vehicles like carbon monoxide, benzene, volatile organic compounds, hydrocarbons, and dust in the form of particulate matter 2.5 and 10. This is an important public

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[14] City of Missoula, Montana. (2015). Growth Policy. Pg 39.

[15] Ibid.

[16] Schoettle, B. & Sivak, M. (2015). Mortality from Road Crashes in the Individual U.S. States: A Comparison with Leading Causes of Death. *The University of Michigan & Sustainable Worldwide Transportation*. Ann Arbor, MI.

[17] Florida, R. (2015). "The Geography of Car Deaths in America." [Blog Post]. CityLab, *The Atlantic.* Retrieved from: http://www.citylab.com/commute/2015/10/the-geography-of-car-deaths-in-america/410494/

[18] Litman, Todd. (2016). "Rethinking Traffic Safety." [Blog Post]. Planetizen. Retreived from: http://www.planetizen.com/node/88561/rethinking-traffic-safety

[19] Insurance Institute for Highway Safety & Highway Loss Data Institute. (2017). "Map: maximum posted daytime speed limits on rural interstates." Retrieved from: http://www.iihs.org/iihs/topics/laws/speedlimits/mapmaxspeedonruralinterstates?topicName=Speed

[20] Florida, R. (2015).

health concern for Missoula, a community with historic air quality issues due to its situation in the Bitterroot Valley.

A 2013 study published in the *Journal of Environmental Health* states that there are "links between vehicle emissions and air quality, as well as the health and economic benefits from alternative transport use", and the authors argue that, "a comprehensive understanding of the multiple benefits of alternative transport could assist with policy making in the areas of transport, health, and environment."[21]

The link between walkability and air pollution is also highlighted in a 2009 study published in *Environmental Health Perspectives*. One of the conclusions of the article is that,"neighborhoods with high pollution and low walkability are far from the city center."[22] These areas are suburban sprawl, where land uses are highly segregated and design is based around the automobile.

In addition to public health issues related to air quality, there are also an increasing number of studies that show how the lack of "active" transportation, such as walking or cycling, is closely linked to a rise in obesity and certain cardiovascular diseases.[23,24] Land-use planning and urban design are important factors in the link between public health and transportation.[25,26] In other words, how we design our community influences how we travel around it. And how we travel has direct impacts on our health.[27,28,29]

A 2004 study also indicates that "land-use mix had the strongest association with obesity" and suggests that "strategies to increase land-use mix and distance walked while reducing time in a

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[21] Xia, T., Zhang, Y., Crabb, S., & Shah, P. (2013). Cobenefits of Replacing Car Trips with Alternative Transportation: A Review of Evidence and Methodological Issues. *Journal of Environmental and Public Health*, 2013. Pg 1. doi:10.1155/2013/797312.

[22] Marshall, J. D., Brauer, M., & Frank, L. D. (2009). Healthy Neighborhoods: Walkability and Air Pollution. *Environmental Health Perspectives*, 117(11), 1752. Pg 1757.

[23] Sallis, J. F., Frank, L. D., Saelens, B. E., & Kraft, M. K. (2004). Active Transportation and Physical Activity: Opportunities for Collaboration on Transportation and Public Health Research. *Transportation Research Part A*, 38(4), 249-268. doi:10.1016/j.tra.2003.11.003

[24] Yang, J., & French, S. (2013). The Travel - Obesity Connection: Discerning the Impacts of Commuting Trips with the Perspective of Individual Energy Expenditure and Time Use. *Environment and Planning B: Planning and Design*, 40(4), 617-629. doi:10.1068/b38076

[25] Frumkin H, Frank L, Jackson R. (2004). *Urban Sprawl and Public Health: Design, Planning, and Building for Healthy Communities.* Washington, DC: Island Press.

[26] Zhao, Z., & Kaestner, R. (2010). Effects of Urban Sprawl on Obesity. *Journal of Health Economics*, 29(6), 779-787. doi:10.1016/j.jhealeco.2010.07.006

[27] Frank, L. D. (2000). Land Use and Transportation Interaction: Implications on Public Health and Quality of Life. *Journal of Planning Education and Research,* 20(1), 6-22. doi:10.1177/073945600128992564

[28] Frank, L. D., & Engelke, P. O. (2001). The Built Environment and Human Activity Patterns: Exploring the Impacts of Urban Form on Public Health. *Journal of Planning Literature*, 16(2), 202-218. doi:10.1177/08854120122093339

[29] Gelormino, E., Melis, G., Marietta, C., & Costa, G. (2015). From Built Environment to Health Inequalities: An Explanatory Framework Based on Evidence. *Preventive Medicine Reports,* 2, 737-745. doi:10.1016/j.pmedr.2015.08.019

car can be effective as health interventions."[30] As all of these studies show, there is a close link between transportation, community design, and public health.

These connections are being taken seriously at the highest level of transportation government. In 2012, the Federal Highway Administration established the Health in Transportation Working Group in order to "develop an agency-wide understanding of health in transportation, identify aspects of existing agency programs that relate to health, and address health-related concerns and communicate these concerns with management."[31]

Efficiency

Setting multi-modal transportation goals aims to move more people more efficiently, which will help mitigate traffic congestion as Missoula grows. By setting mode share goals and implementing relevant policies to go along with them, we use the current transportation network more efficiently, and we avoid the failed practices of suburban sprawl and the resulting road expansions.

In the Growth Policy, efficiency is tied to Travel Demand Management (TDM) initiatives. Missoula In Motion is an example of an organization implementing TDM strategies by advocating for sustainable transportation and promoting educational events.[32] Other organizations include Associated Students of the University of Montana's Office of Transportation and the Missoula-Ravalli Transportation Management Division.[33]

Social Equity

Historically, social equity is not considered in transportation plans, but this is beginning to change.[34] Providing more transportation options and improving access to those options addresses, if at least indirectly, socioeconomic imbalances in the community. A single occupancy vehicle becomes just one of several reasonable and reliable transportation choices. An equitable transportation system does not *require* the use of a single occupancy vehicle for any given trip. Instead, it balances the needs of all transportation system users and provides safe, convenient options.

Missoula's Growth Policy touches on transportation's role in social equity in the Economic Health section. Goal 13 states: "Provide a full range of viable transportation mode choices to

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[30] Frank, L. D., Andresen, M. A., & Schmid, T. L. (2004). Obesity relationships with community design, physical activity, and time spent in cars. *American Journal of Preventive Medicine*, 27(2), 87-96. Pg 87. doi:10.1016/j.amepre.2004.04.011.

[31] United States Department of Transportation, Federal Highway Administration. (2015). Health in Transportation Working Group - 2015 Annual Report. Pg 1. Washington, D.C. Retrieved from: http://www.fhwa.dot.gov/planning/health_in_transportation/workgroup/2015_annual_report/ar02.cfm

[32] City of Missoula, Montana. (2015). Growth Policy.

[33] Ibid.

[34] Manaugh, K., Badami, M. G., & El-Geneidy, A. (2015). Integrating social equity into urban transportation planning: A critical evaluation of equity objectives and measures in transportation plans in North America. *Transport Policy*, 37, 167-176. doi:10.1016/j.tranpol.2014.09.013

meet the needs of residents, businesses, and visitors."[35] This goal is certainly a step forward in promoting alternative forms of transportation that meet the needs of all Missoulians and meets the needs of our most vulnerable populations. These populations can include low-income residents, residents with specific mobility challenges, historically marginalized neighborhoods, the elderly, and children, just to name a few.

Policy Formulation

Setting mode share goals provides guidance when making policy decisions and helps keep the city accountable for achieving those goals. Setting goals is only the first step; drafting policies and implementing those policies is the important (and difficult) part. Mode share goals mean nothing without relevant policies to back them up. Multi-modal planning policies include prioritizing urban infill and compact community design to encourage walking and cycling, implementing parking districts that generate funding, and promoting educational events such as bike to work day.

Funding Allocations

Related to policy, setting mode share goals informs funding allocations. To be serious about shifting transportation patterns, funding must work together in relative unison with the mode share goals and policy. San Luis Obispo has taken important steps by tying funding directly to mode share goals.[36] Practically speaking, this means increasing funding for alternative transportation like transit and prioritizing non-motorized capital improvement projects, such as bike lanes and sidewalks.

Climate Change

Perhaps most importantly, for the long-term health of our planet, shifting away from single-occupancy vehicles reduces greenhouse gas (GHG) emissions and sets the tone for a future transportation system that works to address the seriousness of climate change and takes direct action to mitigate impacts from one of the contributing causes. According to the United States Environmental Protection Agency (EPA), the transportation sector made up 26% of total GHG emissions in 2014, which "primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes."[37]

Missoula's Growth Policy addresses climate change and the environmental impacts of transportation. In the Environmental Quality section of the Growth Policy, goal number one states that, "In order to build a more resilient community, Missoula will promote local decisions that mitigate the effects of climate change and prepare the City and its residents for the

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[35] City of Missoula, Montana. (2015). Growth Policy. Pg 57.

[36] Meyer, E. & Revorie, D. (2015). "How San Luis Obispo Established the Most Powerful Bike Funding Policy in the Nation." *Alliance for Biking And Walking*. Retrieved from: http://www.bikewalkalliance.org/blog/535-how-san-luis-obispo-just-established-the-most-powerful-bike-funding-policy-in-the-nation

[37] United States Environmental Protection Agency. (2014). Sources of Greenhouse Gas Emissions. Washington, D.C. Retrieved from: https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

impacts climate change will have on the human, natural, and built environments."[38] Objective number two under this goal deals directly with transportation: "Reduce reliance on single-occupancy vehicles and continue support for the expansion of public transportation and cycling/walking systems."[39] Lastly, goal five in the Environmental Quality section states that, "Missoula will have a safe and efficient transportation system that reduces impacts to the environment and emphasizes walking, bicycling, and transit."[40]

There are a host of reasons to set mode share goals and prioritize multi-modal transportation options. From public health and safety to climate change to traffic congestion, setting mode share goals and following through with those commitments will help alleviate a number of problems associated with over-reliance on single-occupancy vehicles.

METHODS

For this study we did not measure mode share of all trips, but instead just measured commute mode share. The reason for this is because it is the only accurate and measureable data that is currently available for the Missoula MPO area. Some communities have done studies using trip-diaries, including Boulder, CO, Bellingham, WA and San Luis Obispo, CA. But most communities do not have the funding or resources to implement travel studies in such a comprehensive and detailed way. Our case study analysis was done based on American Community Survey (ACS) 5-year averages (2010-2014) of commute data. ACS commute data is, at this moment, the most accurate, consistent and reliable data available for measuring the Missoula communities travel habits.

It should not be assumed that commute mode choice is an accurate representation of *all* trips taken by any given individual. An individual may use a single-occupancy vehicle because their workplace is too far to ride or walk or not on a bus route, and then they might use a bicycle for a significant portion of other trips because they live very close to amenities (grocery store, bank, entertainment, etc). Or they may ride a bike, take the bus, or walk to work if it is close and use a vehicle for trips to access amenities, such as businesses on Reserve Street or recreation opportunities farther away. The point is that we are dynamic travelers, using various forms of transportation based a number of factors, including trip purpose, distance, weather, convenience, speed, etc. Commute data is only part of the story.

However, using commute data to understand modal choice does give us insight into the larger, more general trends of city residents. Commute mode share reflects, to some degree, the modal choice of an individual for any given trip. If an individual take the bus to commute to work, it is not unreasonable to posit that this person also takes the bus for other trips. The same can be said for cycling, walking, or single-occupancy vehicle use.

[38] City of Missoula, Montana. (2015). Growth Policy. Pg 81.
[39] Ibid. Pg 81.
[40] Ibid. Pg 83.

Commute information helps us build a rough understanding of general mode share patterns and trends in the Missoula MPO area. Extrapolating commute data to general travel trends is a very loose, heuristic, and observational approach, but worth explaining. As stated before, it is currently the best (and only) way we can begin to understand larger travel patterns in the Missoula MPO area.

Early in my preliminary research, I came across a case study completed by Fehr & Peers Transportation Consultants for the City of Fresno, California. The study compiled a list of 24 jurisdictions around the United States and the world to understand best policies and practices for implementing bicycle mode share goals.[41] The study was done as part of the City of Fresno's Bicycle Master Plan, in which bicycle mode share goals were set. The Fresno report gave us a good starting point for what a mode share case study might look like.

We brainstormed a list of jurisdictions that are similar to Missoula in a few important ways, including: demographics, climate, landscape, population, and if it has a university or not. These were loose guidelines for choosing our locations, but they provided some framework and context with which to work. For instance, it is not particularly useful to study mode share in Miami, Florida. The population is much larger, population density is greater, the demographics are much different, the climate is warmer and the landscape is flat. These are all reasons that comparison studies with Miami would not be appropriate.

We did consider one community outside of the United States that has set mode share goals and two states that have set statewide mode share goals. (See Figure 1). Despite these exceptions, we tried to focus our case studies on similar sized communities located in the West.

Figure 1: Preliminary List of Case Study Communities

Ann Arbor, Michigan	Austin, Texas	Bend, Oregon
Bellingham, Washington	Boulder, Colorado	Burlington, Vermont
Calgary, Alberta, Canada	Chicago, Illinois	Chico, California
Fort Collins, Colorado	Minneapolis, Minnesota	Portland, Oregon
San Luis Obispo, California	State of Nevada	State of Wisconsin

From this list, I contacted each jurisdiction with a list of questions to see whether they set mode share goals, and if so, how. (See appendix A for full list of interview questions). At the same time, I reviewed documents from each city to find anything on mode share goal setting.

Based on responses (or not) from city planners and using the information that I found in city documents regarding mode share goals, we ended up selecting nine communities. In order to get a wider range of data, we chose three communities without mode share goals, three with

[41] Fehr & Peers Transportation Consultants. Prepared for the City of Fresno, California. (N.D.). *City, County, and State Bicycle Goals Across the Country and Abroad.* Los Angeles, CA.

only select mode share goals, and three with goals set for all modes of transportation. (See Figure 2: Case Study Map on page 13).

The purpose of selecting cities with no mode share goals or with only a few mode share goals was to get a larger sample of communities. There are not a lot of communities that have set mode share goals for all forms of transportation, particularly those that align with some of the demographic criteria we were looking for. Had we only chosen communities that were very similar to Missoula and that had mode share goals for all forms of transportation, our case study sampling would have been quite limited. Additionally, the communities we selected that do not have mode share goals do have relevant and interesting transportation policies that aim to reduce SOV use, and we felt that they were worth investigating further.

I used American Community Survey (ACS) data to find mode share percentages for each case study community and I graphed each community's current mode share percentages up against their respective mode share goals. Some communities did not have mode share goals to graph, while some communities had multiple mode share goals for different timelines or geographic areas. Using this information, I created three different mode share goal options for the Missoula MPO: None, which we name "business as usual", moderate, and ambitious. The methods for developing these three options will be discussed later in the paper.

After creating three different mode share goal options, I read through each of the nine case study community's respective transportation (and other) planning documents. I identified transportation policies that were either associated with mode share goals or aimed at SOV reduction. I also contacted city planners in these nine communities. I interviewed planners from Bend, OR and Boulder, CO and exchanged emails with several other planners to find out what policies are being implemented in their communities. (See Appendix B for list of supplementary questions.)

This research formed the basis for the development of the policy feasibility matrix, which was a compilation of policy options from all case study communities. Each policy was then reviewed and categorized into "Easy", "Medium" and "Difficult", based on professional recommendations from Jessica Morriss and Aaron Wilson. Jessica provided final adjustments and additions to the policy feasibility matrix. (See Table 4 on page 45).

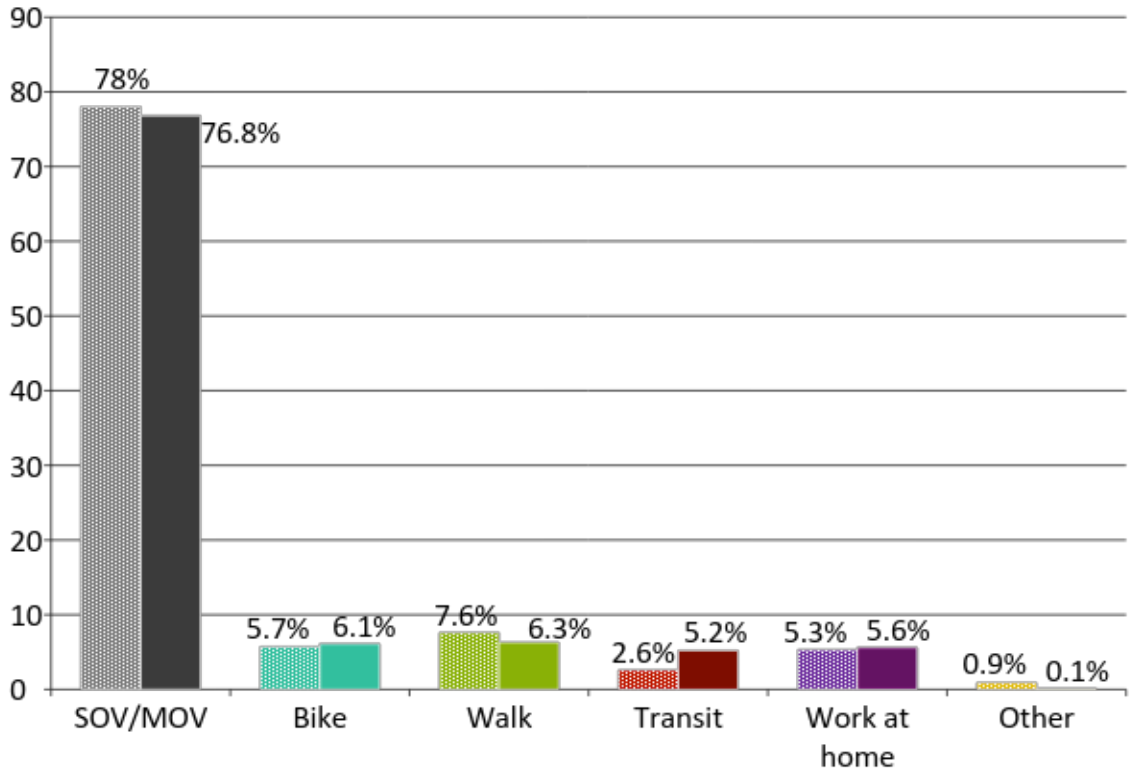
Lastly, I put together a short list of policy suggestions that the Missoula MPO might consider in achieving mode share goals. These suggestions are based on some of the more common policies and programs that I came across in my case study research, and are tactics that other communities are using to support achievement of mode share goals.

Before looking at case study results, it is important to understand more about Missoula's mode share. According to 5-year averages of ACS data from 2010-2014, the average percentage of commuters using single-occupancy vehicles to get to and from work was about 70%.[42]

Figure 2 shows side-by-side comparisons of 5-year and 2014 estimates for each mode of transportation.[43] Figure 3 (pg 12) shows Missoula's mode share trends from 2000-2014 for each mode of transportation. Figure 4 (pg 13) shows Missoula's mode share trends from 2000-2014 for multi-modal transportation, which includes walking, cycling, and transit.

Missoula, Montana
Total Population (2013): 69,122
Estimated population of workers 16 years and over: 43,632

Figure 2: Missoula's Current Mode Share - 5-year and 2014 Estimates, side-by-side comparison



[42] United States Census Bureau. 2010-2014 American Community Survey 5-Year Estimates. Table S0801: Commuting Characteristics By Sex. Retrieved on 7/6/2016 from https://factfinder.census.gov/

[43] Note: In Figure 2, SOV/MOV is combined to show total vehicle commute rates.

Figure 3: Missoula Mode Share Trends, 2000-2014

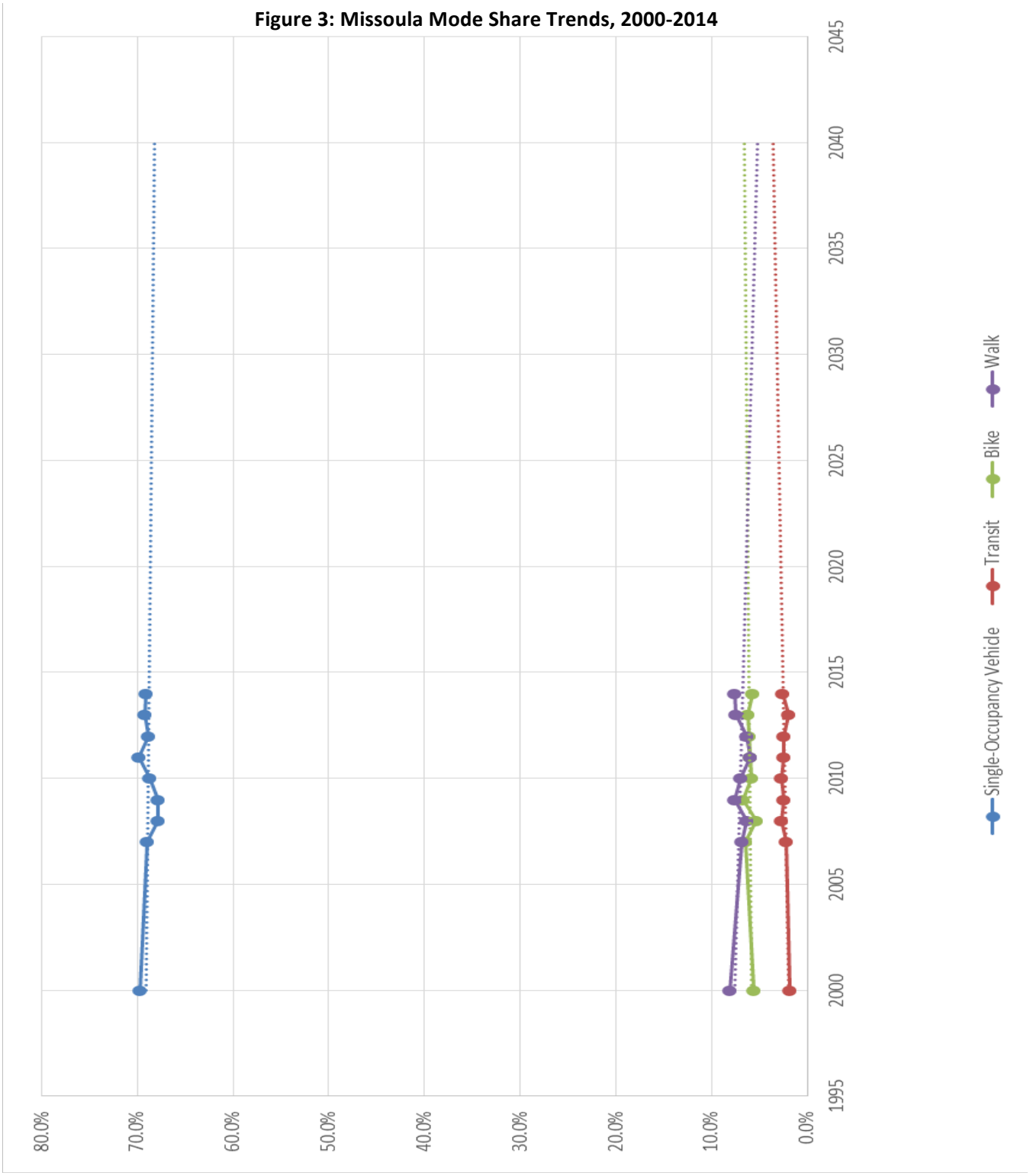
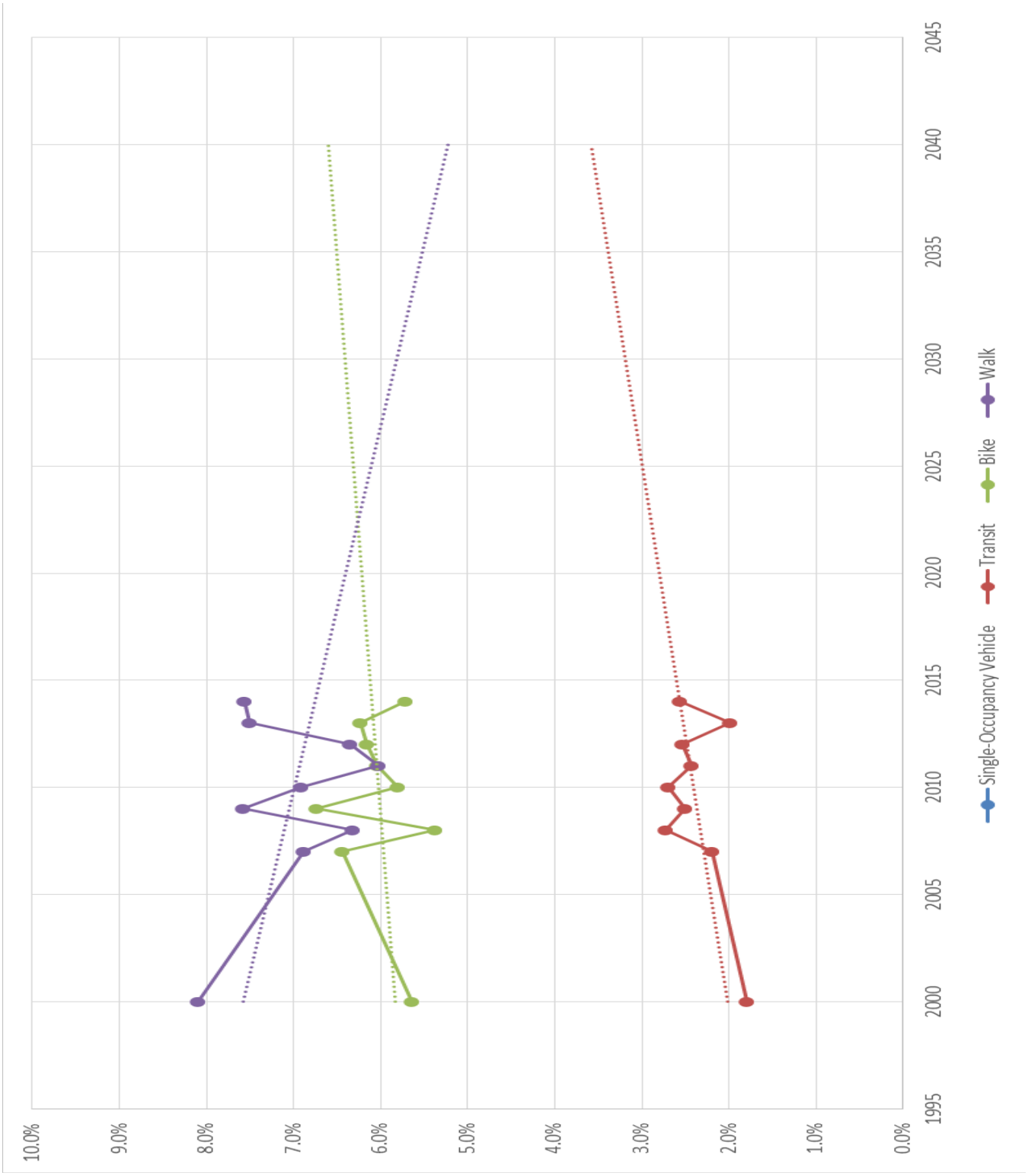
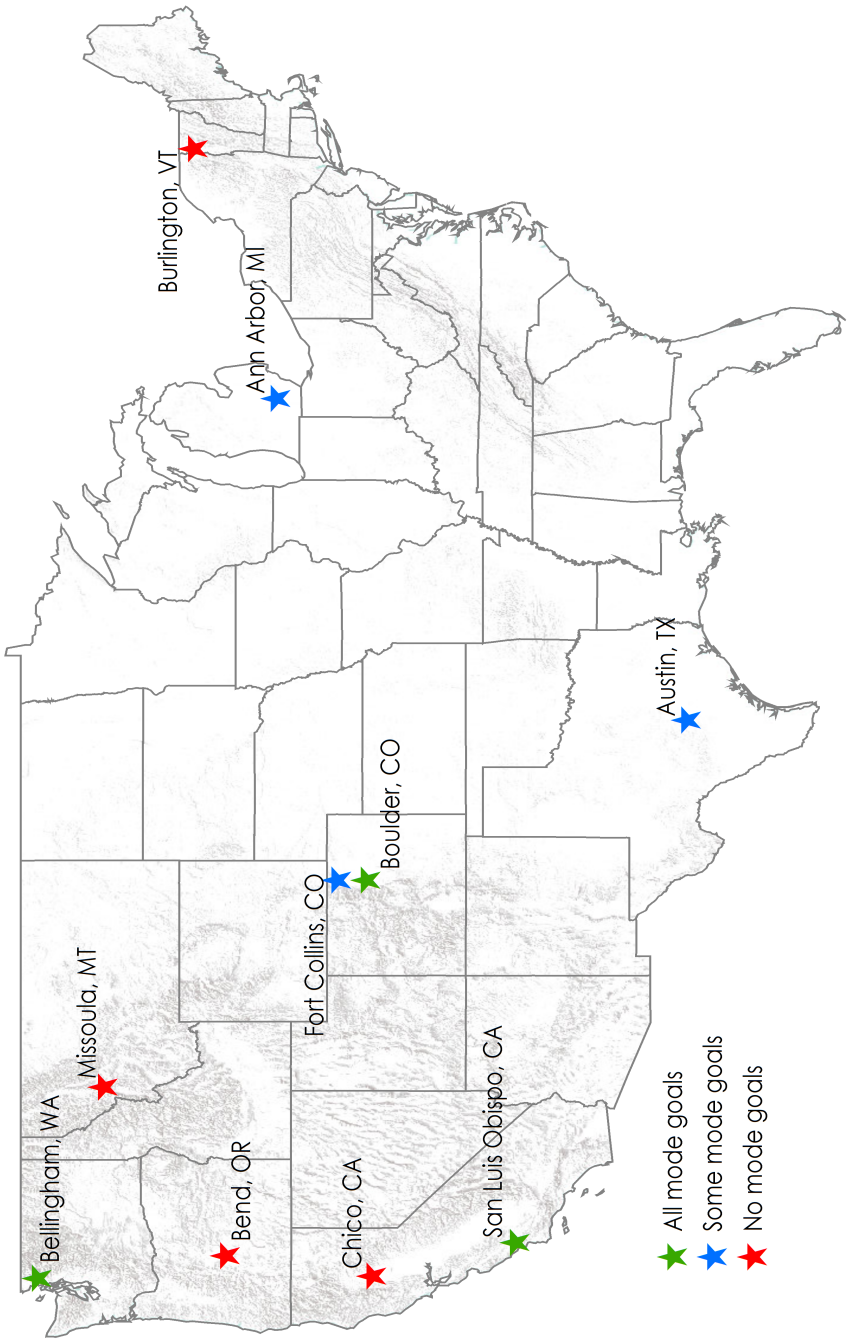


Figure 4: Missoula Multimodal (Bike, Walk, Transit) Trends, 2000-2014



CASE STUDIES

Figure 5: Case Study Map



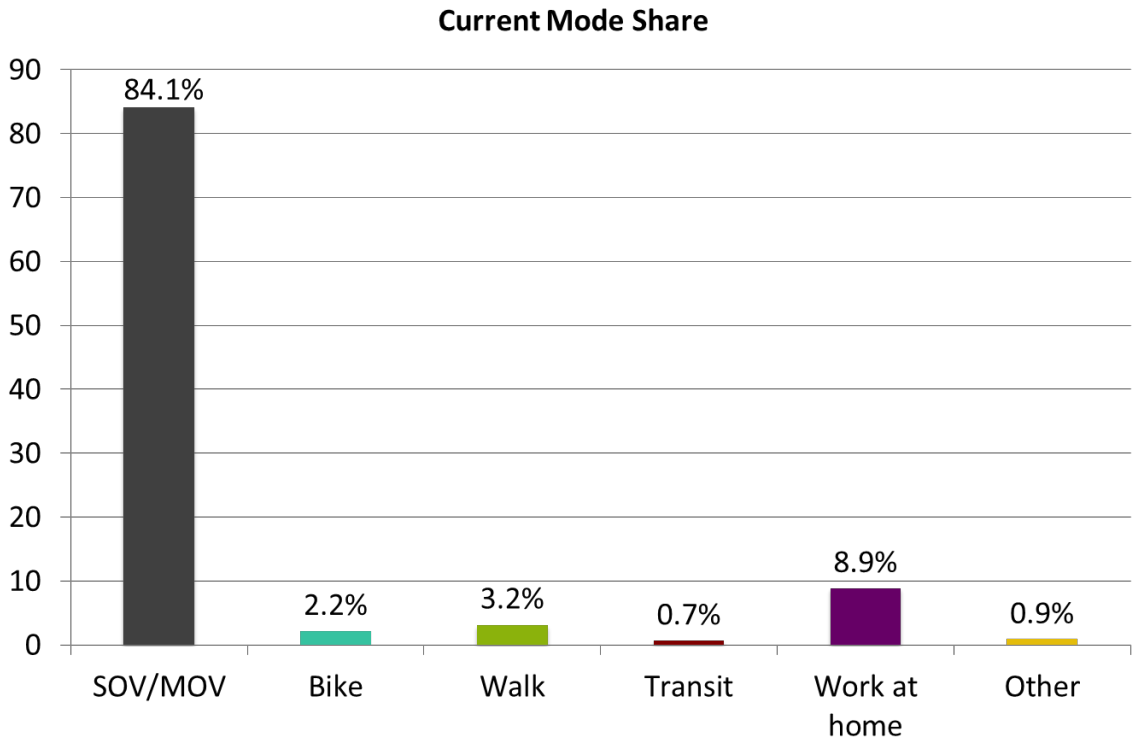
No Mode Share Goals

These three case study communities did not set mode share goals. One of the reasons we chose to study these communities is to find out why mode share goals were not set and what the community is or is not doing to facilitate a shift away from SOVs. There were numerous important transportation policy findings that are applicable for the Missoula MPO.

Bend, Oregon

Total Population (2013): 81,236
Estimated population of workers 16 years and over: 37,918

Figure 2: Bend, Oregon Current Mode Share (2010-2014 Average)



Of all the case studies, Bend had the highest SOV/MOV mode share and some of the lowest bike/walk/transit rates. This was a surprising discovery, considering Bend touts itself as a bike-friendly community and has earned labels such as "Bike Town USA", as well as a silver rating from the League of American Bicyclists.[44,45]

Interestingly, the "work from home" rate in Bend is quite high compared to the other case study communities. In my interview with Bend MPO Manager Tyler Deke, he indicated that

[44] Rook, Erin. (2015). "Bike Town USA: Does Bend deserve the accolades?" The Source Weekly. Bend, OR. Retrieved from: http://www.bendsource.com/bend/bike-town-usa/Content?oid=2426700

[45] League of American Bicyclists. (2016). Award Database: Bend, Oregon Report Card. Retrieved from: http://bikeleague.org/sites/default/files/bfareportcards/BFC_Fall_2016_ReportCard_Bend_OR.pdf

Bend's work from home rates are about twice the national average and have been increasing in the last several years.[46]

Deke indicated that conversations around mode share goals were just starting to happen. One of the reasons mode share goals have not been set is because focus has been on expanding the Urban Growth Boundary (UGB), which are required for every community in Oregon.[47]

Despite not having mode share goals yet, Bend has set other important goals that are designed to help lead to the reduction of single-occupancy vehicle use, including Green House Gas (GHG) reductions and Vehicle Miles Traveled (VMT) reductions. GHG reduction mandates come from the Oregon Sustainable Transportation Initiative, which was developed by the Oregon Department of Transportation and the Department of Land Conservation and Development.[48] The 2011 GHG emissions reduction target for the Bend metropolitan area is an 18% reduction per capita in greenhouse gas emissions in the year 2035 below year 2005 emissions levels.[49]

The VMT reduction mandate comes from Oregon Transportation Planning Rule, which states that Metropolitan Planning Organizations (An MPO is an urbanized area with a population of 50,000 or more) can be in compliance of the rule "by demonstrating to the commission that adopted plans and measures are likely to achieve a five percent reduction in VMT per capita over the 20-year planning period."[50] Deke explained that, "They haven't been able to do so because of UGB expansion. Small communities can show VMT reductions, but city-wide it is very difficult."[51]

I asked Deke about other policies that Bend has been exploring to help facilitate mode shift. Deke mentioned the possibility of transitioning to a Multi-Modal Level of Service (MMLOS) instead of the traditional Level of Service (LOS), which is an automobile-centric way of measuring roadway efficiency. Because LOS only measures automobile usage on a roadway, it becomes a tool to justify widening roadways and making other changes that only accommodate the needs of vehicles.

Deke indicated that Bend had been experimenting with MMLOS, saying, "Some MMLOS was done with a couple specific corridors in Bend. ODOT has developed at tool called Bicycle Level

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[46] Tyler Deke, Bend MPO Manager. Personal Interview. (7/21/16). Bend, OR.
[47] Ibid.
[48] State of Oregon, Department of Transportation. (2011). Oregon Sustainable Transportation Initiative. Salem, OR. Retrieved from: http://www.oregon.gov/ODOT/TD/OSTI/Pages/index.aspx
[49] State of Oregon, Land Conservation and Development Commission. (2011). Adopted New Rules: Metropolitan Greenhouse Gas Reduction Targets. Salem, OR. Retrieved from: https://www.oregon.gov/LCD/docs/rulemaking/trac/660_044.pdf
[50] State of Oregon, Department of Land Conservation and Development. (2011). Transportation Planning Rule 660-012-0035: Evaluation and Selection of Transportation System Alternatives. *Oregon Administrative Rules*. Salem, OR. Retrieved from: http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_660/660_012.html
[51] Tyler Deke, Bend MPO Manager. Personal Interview. (7/21/16). Bend, OR.

of Stress.[52] If a street is too stressful for bicycles, they might move the bicycle corridor over a block or two to reduce stress for cyclists. Bend has identified several parallel corridors/routes where traffic volume is high and cyclists feel stressed."[53]

As we were closing our interview, Deke mentioned, "One policy that was on the table but didn't get passed was no more road expansion beyond three lanes."[54] Deke said that despite that policy not being passed, residents living on Westside of Bend are, "well-organized politically, and they influence policy. Because of this, the City must go through comprehensive planning process before widening roads beyond three lanes. About ten to 15 years ago, it divided the community, but looking back now it was a good policy decision."[55] Deke said that Westside residents have held firm in not wanting to expand roads in their area, despite the fact that "tourist influx is really stressing out the Westside, increasing 50% the just last three years!"[56]

He went on to say that "Bend has chosen not to expand these roads because people in those neighborhoods don't want bigger roads. They want roads to operate as efficiently as possible. Expanding roads just doesn't work politically. Safety is also an issue. Crashes are heavily concentrated on the larger roadways. Expanding roads equals more dangerous roads: for cyclists, pedestrians and motorists."[57]

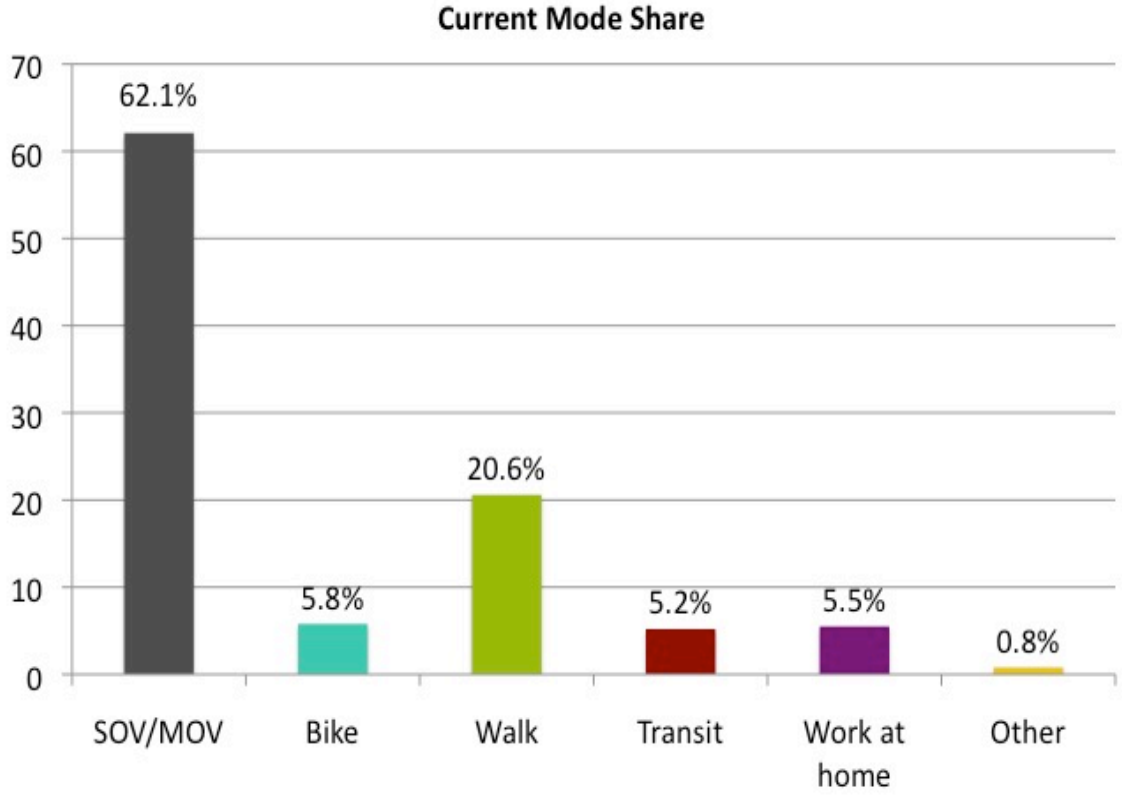
Limiting road expansion is not an official policy in Bend because it is a politically "tough sell." While it is not likely to happen in the near future, adopting a no-road-expansion policy, officially or unofficially, requires planners to push for creative multimodal transportation options. In closing Deke asked, "What does Bend need to do to help keep people from driving short distances on the Westside?"[58]

[52] State of Oregon, Department of Transportation. (2016). "Oregon Bicycle and Pedestrian Plan." An Element of the Oregon Transportation Plan. Salem, OR.
[53] Tyler Deke, Bend MPO Manager. Personal Interview. (7/21/16). Bend, OR.
[54] Ibid.
[55] Ibid.
[56] Ibid.
[57] Ibid.
[58] Ibid.

Burlington, Vermont

Total Population (2013): 42,284
Estimated population of workers 16 years and over: 21,345

Figure 3: Burlington, Vermont Current Mode Share (2010-2014 Average)



Burlington's walk mode share immediately stands out as the highest of all case study communities. Without having a conversation with a city planner and without having first-hand experience with Burlington, it is hard to speculate as to why the walk rates are so high.

Burlington's 2014 Municipal Development Plan includes a transportation chapter, which was last updated in 2011.[59] While the city does not have mode share goals, it does have a number of policy initiatives designed to influence mode share choices away from SOVs, which include:

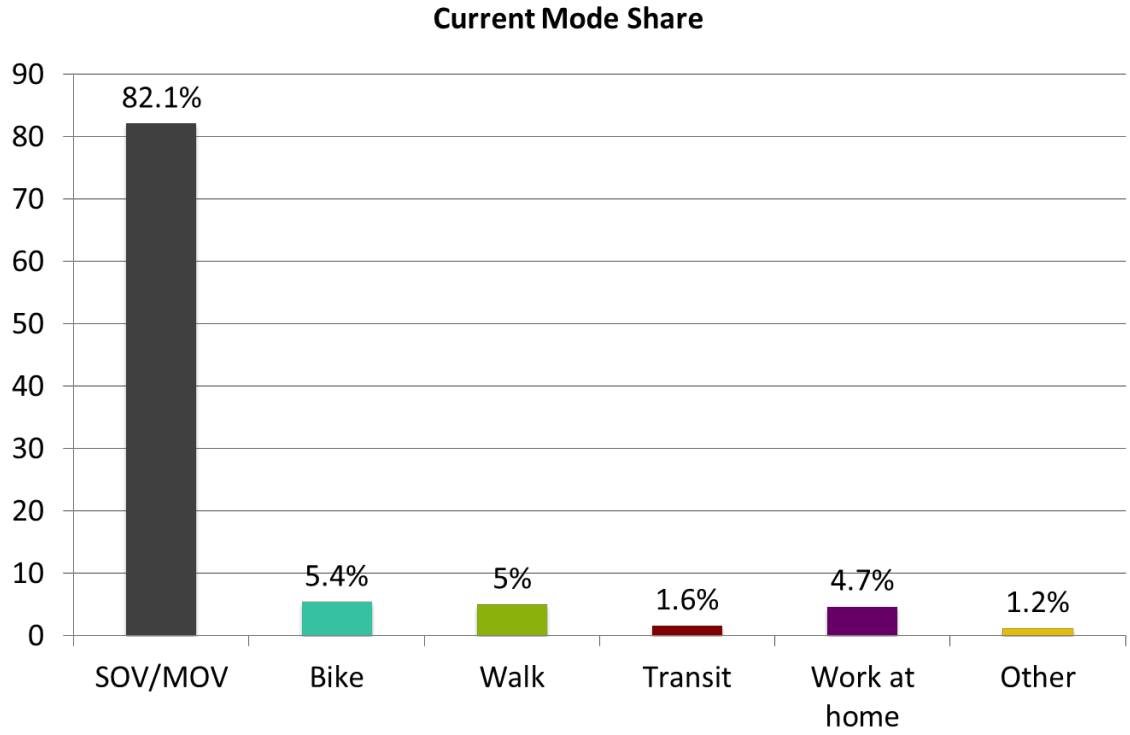
- Supporting creation of a downtown Transportation Management Association (TMA).
- Changing speed limits to 20 mph in the downtown Slow Streets zone and to 25 mph on neighborhood streets without posted speed limits.
- Supporting improvements to the western corridor rail infrastructure and expansion of passenger rail services to Burlington.
- Supporting alternative funding sources for public transit operations.
- Changing zoning parking requirements to permit impact fee or payment-in-lieu options.[60]

[59] City of Burlington, Vermont. (2014). *2014 Municipal Development Plan*. "Chapter 5: Moving Forward Together: Transportation Plan for the City of Burlington." Burlington, VT.

Chico, California

Total Population (2013): 88,077
Estimated population of workers 16 years and over: 39,841

Figure 4: City of Chico, California Current Mode Share (2010-2014 Average)



Chico is similar to Bend in that the SOV mode share is above the national average. However, the walk and bike mode share are both a few percentage points higher in Bend, which is significant considering they share almost the same size population.

Chico's 2020 Climate Action Plan (CAP), adopted in 2012, set overall GHG reduction goals for the city: "The ultimate goal of the Climate Action Plan is to reduce emissions for the year 2020 to 385,749 MtCO2e, 25% below the base year (2005) levels."[61] The CAP comes from mandates set in the 2030 General Plan, which was adopted in 2011.[62] The General Plan serves as the major guiding document that informs other city plans. The Circulation Element of 2030 General Plan lists specific transportation policies and contains a list of 9 Goals, Policies, and Actions.[63]

[60] City of Burlington, Vermont. (2014). *2014 Municipal Development Plan*. "Chapter 5: Moving Forward Together: Transportation Plan for the City of Burlington." Burlington, VT.
[61] City of Chico, California. Sustainability Task Force. (2012). *Chico 2020 Climate Action Plan.* Pg 19. Chico, CA.
[62] City of Chico, California (2011). *Chico 2030 General Plan.* Chico, CA.
[63] City of Chico, California (2011). *Chico 2030 General Plan.* "Chapter 4: Circulation Element." Chico, CA.

In my email conversation with Community Development Director Brendan Vieg, I asked about some of the policies that Chico has adopted or is planning to adopt in order to reduce SOV use. He said that, "We do have an adopted GHG emission reduction goal, which relies very heavily on reducing SOV use through enhancements to the City's bicycle infrastructure and promotion of transit."[64] A GHG reduction goal is something that came up repeatedly when analyzing other city plans.

I asked about plans to adopt a Multimodal Level of Service policy, and Vieg said that, "We haven't adopted MMLOS yet, but our General Plan directs us to investigate and adopt standards in the future."[65] This corroborates with a specific action item found in the Circulation Plan, which mandates the city to: "Monitor the development of MMLOS standards by the Transportation Research Board and other jurisdictions. When a valid methodology for Chico is identified, develop and adopt Transportation Impact Analysis Guidelines that include MMLOS standards specific to Chico to supersede the LOS standards."[66] As with Bend, Chico is seeing that moving away from LOS as the dominant transportation measure is an important policy tool for shifting mode share.

About mode share goals specifically, Vieg said, "I've not heard of any push to set a mode split, nor am I aware of any particular reason to do so. Mode split is not necessarily the language used in the discussion, but everyone knows that the goal is to get people out of their cars."[67]

Some Mode Share Goals

The following communities have only set select mode share goals. One of the reasons we chose to study these communities is to see why goals were set for only certain modes. For some city planners, setting goals for all modes of transportation was not as important as setting goals for non-motorized transportation. The theory is that setting goals for increasing non-motorized transportation use will in turn reduce single occupancy vehicle use.

Note about the graphs in this section: I reduced the SOV/MOV part of the graph in accordance with the bike and walk goal increases. (See Fig. 8 below) In other words, when all of the 6.7% total *increase* in bike and walk mode share was taken from SOV/MOV, the result was a 6.7% *decrease* in SOV/MOV usage, lowering SOV/MOV mode share to 57.1%. I did this for Ann Arbor, Austin, and Fort Collins. I assumed a 1 to 1 shift, meaning all additional increases in bike and walk percentage were taken from *only* the SOV/MOV percentage. However, it should be noted that this is not likely the reality, as increases in biking and walking rates *could* pull from other modes besides SOV/MOV, such as transit or other modes. For example, a new bicycle lane might prompt someone to ride a bike to work instead of taking transit as they usually do.

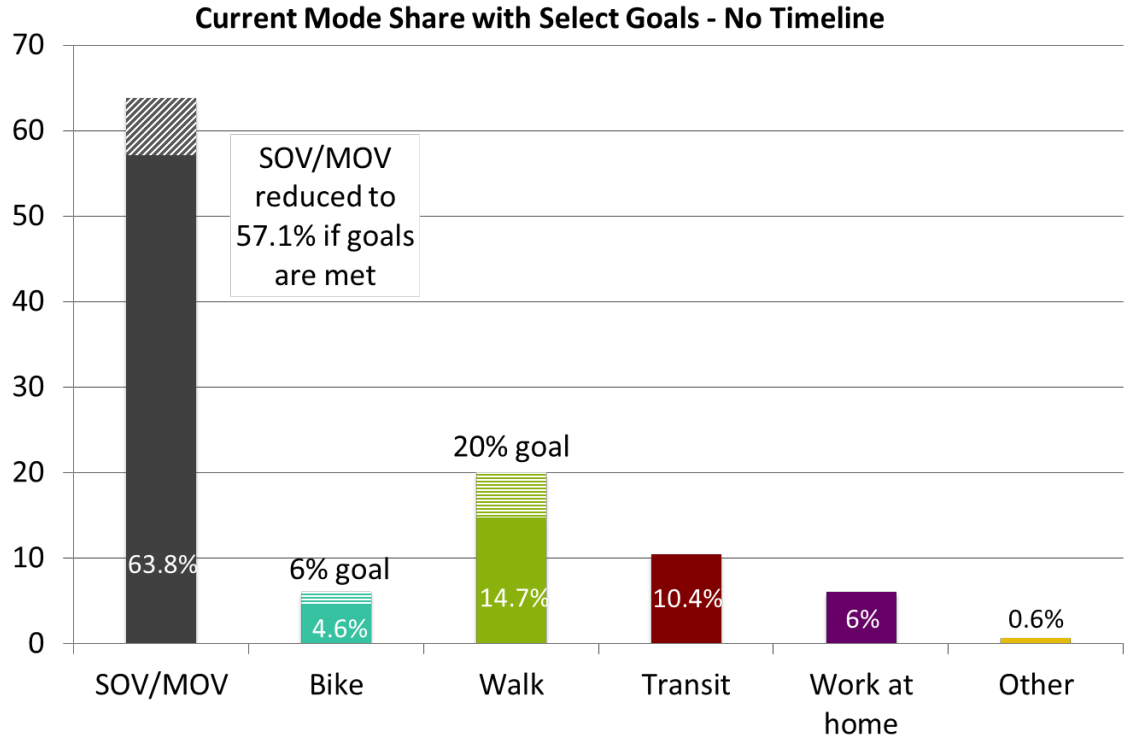
[64] Brendan Vieg, Community Development Director. Email. (7/18/16). Chico, CA.
[65] Ibid.
[66] City of Chico, California (2011). *General Plan.* "Chapter 4" Pg 22.
[67] Brendan Vieg, Community Development Director. Email. (7/18/16). Chico, CA.

One of the reasons I did this is because the following cities do not have SOV/MOV reduction goals. They only have goals for increasing walking, cycling, or both. Missoula city planners wanted to see what the impacts on SOV reduction would be if the mode share goals were met. We felt that for the purposes of this study, it would be interesting to see what the impact would be if we took the total mode share goal percentage increases and subtracted it from SOV/MOV mode share percentage. It is not intended to be more than an observation and should not be considered an accurate model of mode shift.

Ann Arbor, Michigan

Total population (2013): 117,025
Estimated population of workers 16 years and over: 57,113
Document: 2013 Non-Motorized Transportation Plan

Figure 5: City of Ann Arbor, Michigan Current Mode Share (2010-2014 Average) and Goals



Ann Arbor has relatively high walk rates compared to the other case study communities. This is partly due to the University of Michigan. In my email conversation with Eli Cooper, Ann Arbor's Transportation Program Manager, he said that the University of Michigan's "primary campus is adjacent to and integrated into our downtown."[68] With the University located so close to downtown, large numbers of students walk to access amenities.

He continued to explain other factors that contribute to Ann Arbor's high walk rates by saying that "the fact we have a compact, walkable downtown is another feature that facilitates high

[68] Eli Cooper, Transportation Manager. Email. (11/4/2016). Ann Arbor, MI.

levels of pedestrian activity here. We also have higher-density, viable, vibrant neighborhoods immediately adjacent to the downtown core and UM campus area. So the physical layout of our city clearly fosters increased pedestrian activity. Would also want to be on record of providing input that our city infrastructure, streets, sidewalks, crosswalks, pedestrian signal timing and the like, have for decades realized and accommodated pedestrian activity."[69]

Ann Arbor's mode share goals were initially set in the 2007 Non-Motorized Transportation Plan (NTP), which was last updated in 2013.[70] There is no set timeline for achieving these goals, which was unique among case studies. All other communities (except for San Luis Obispo who requires a biannual review[71]) have some kind of timeline. In an email response to my question about *how* Ann Arbor set their non-motorized mode share goals, Cooper said the goals were set based on "a combination of professional judgment, analysis of existing facilities, and data from other similar cities reasonable targets."[72]

An important policy that Ann Arbor is considering that relates to bicycle mode share is urban design standards. The 2013 update of the 2007 NTP includes a policy that seeks to assess the feasibility of implementing an Urban Bikeway Design Guide in Ann Arbor.[73] This design guide comes from the National Association of Transportation Officials (NACTO), a non-profit organization that sets best practices and design guides for city planners.[74] The Ann Arbor policy states that, "During and following the review process, NACTO guidelines will be scrutinized to determine whether they comply with Michigan law and whether the proposed designs are feasible in Ann Arbor."[75] Adopting an Urban Bikeway Design Guide will help the city design bicycle facilities that are safer and more intuitive, which will encourage cycling.

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[69] Eli Cooper, Transportation Manager. Email. (11/4/2016). Ann Arbor, MI.

[70] City of Ann Arbor Planning and Development Services and the Alternative Transportation Program. (2013). *City of Ann Arbor Non-Motorized Transportation Plan Update 2013*. Ann Arbor, MI.

[71] City of San Luis Obispo, California. (2014). *2035 General Plan. "*Chapter 2: Circulation Element." San Luis Obispo, CA.

[72] Eli Cooper, Transportation Manager. Email. (7/6/2016). Ann Arbor, MI.

[73] City of Ann Arbor Planning and Development Services and the Alternative Transportation Program. (2013).

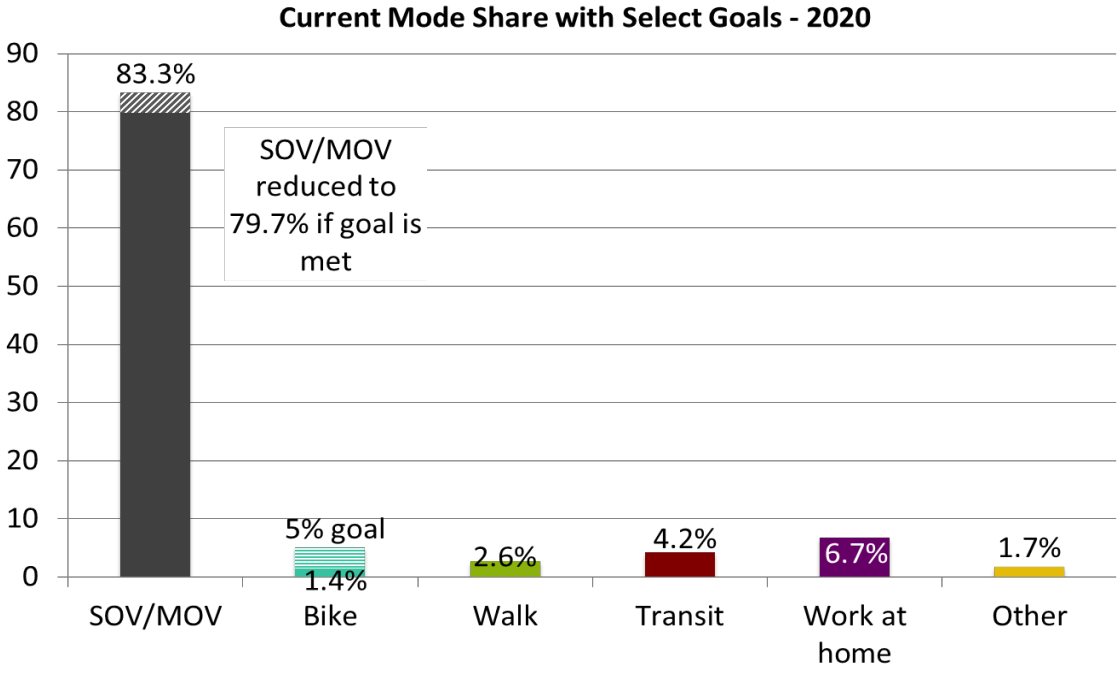
[74] National Association of City Transportation Officials. (2014). Urban Bikeway Design Guide, 2nd Edition. Island Press: Washington, D.C.

[75] City of Ann Arbor Planning and Development Services and the Alternative Transportation Program. (2013). Pg 16.

Austin, Texas

Total Population (2013): 885,400
Estimated population of workers 16 years and over: 464,085
Document: 2014 Bicycle Master Plan

Figure 6*:* City of Austin, Texas Current Mode Share (2010-2014 Average) and Goal



A 5% bicycle mode share goal for a city the size of Austin is quite ambitious. In fact, of all case study communities it had the highest percentage increase from current levels, at 257%! The bike mode share goal comes from the 2014 Bicycle Master Plan, in which 61 objectives and benchmarks are set,[76] which include:

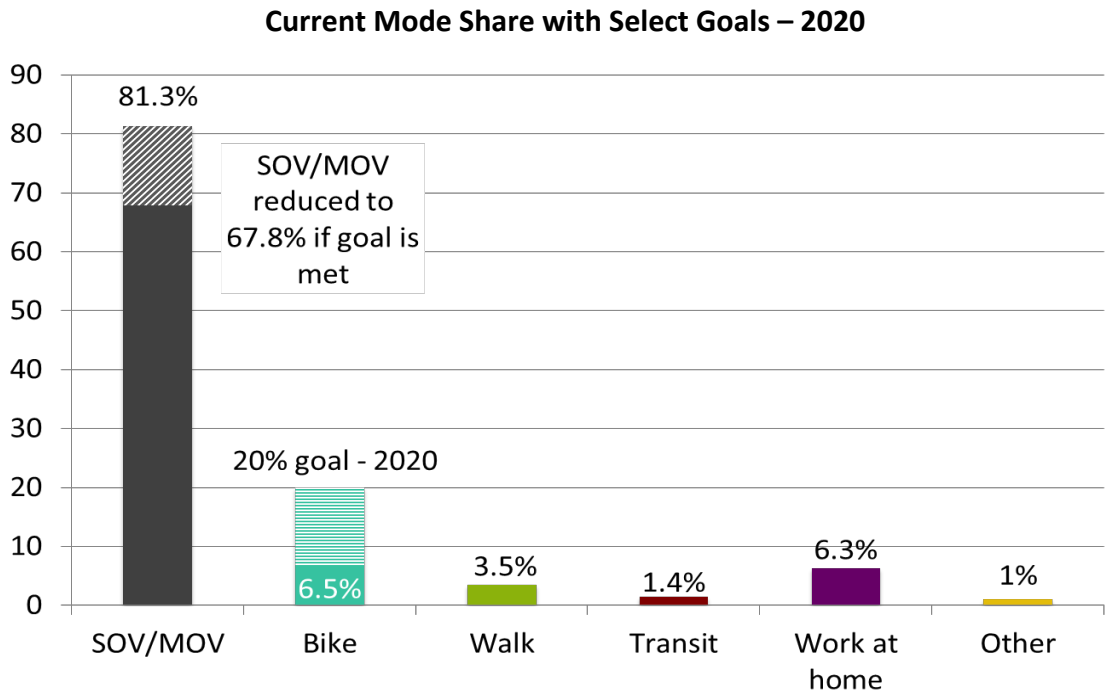
- Increase citywide workforce commuter bicycle mode to 3% by 2015 and 5% by 2020
- Increase central city workforce commuter bicycle mode to 10% by 2015 and 15% by 2020
- Achieve League of American Bicyclists gold status by 2015 and platinum by 2021
- Reduce bicycle fatalities by 50% from 2009 levels by 2015 and eliminate completely by 2020
- Expand the city's BikeShare system from 40 to 100 stations by 2016 and 300 stations by 2017
- Distribute 5,000 bicycle maps each year
- Increase number of bike to work day participants by 10% each year
- Increase bicycle mode share of children commuting to school to 25% by 2020
- Train 100% of Austin Police Department officers in bicyclist and motorist issues.[77]

[76] City of Austin Transportation Department and the Active Transportation Program. (2014). *2014 Bicycle Master Plan*. Austin, TX.
[77] Ibid.

Fort Collins, Colorado

Total Population (2013): 152,061
Estimated population of workers 16 years and over: 77,462
Document: 2014 Bicycle Master Plan

Figure 7: City of Fort Collins, Colorado Current Mode Share (2010-2014 Average) and Goal



In the 2014 Bicycle Master Plan, Fort Collins set their goal of 20% bicycle mode share by 2020, and, like Ann Arbor, is considering a policy endorsing NACTO Urban Bikeway Design Guide standards.[78] When asked how the goal was decided, Senior Transportation Planner Aaron Iverson told me that, "The bicycle modal percentage was chosen as a representative goal based on similar communities and community input."[79]

In 2015, Fort Collins adopted a Climate Action Plan. A number of ambitious GHG reduction goals are set in this plan, including:

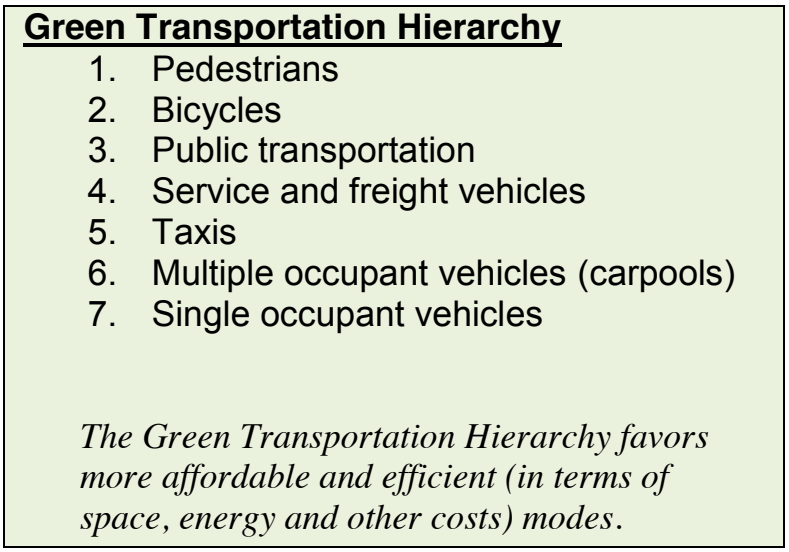
- 20% below 2005 by 2020
- 80% below 2005 by 2030
- Carbon neutrality by 2050
- VMT 29% below 2015 by 2030[80]

[78] City of Fort Collins, Colorado. (2014). *2014 Bicycle Master Plan.* Fort Collins, CO.
[79] Aaron Iverson, Senior Transportation Planner. Email. (7/8/16) Fort Collins, CO.
[80] City of Fort Collins, Colorado. (March, 2015). *A Climate Action Plan Framework.* Pg 2. Fort Collins, CO.

One policy being considered by Fort Collins, as well a number of other communities is to "evaluate codifying modal hierarchy with a Complete Streets policy."[81] In a multi-modal hierarchy, sometimes called a green transportation hierarchy, single-occupancy vehicle needs would not always come first. In fact, most modal hierarchy models place the needs of single occupancy vehicles last in the hierarchy of consideration and favors more affordable and efficient modes of transportation, such as walking and cycling.[82] (See Figure 11 below and Figure 14, example of modal hierarchy from 2016 Bellingham Draft Comprehensive Plan).

The Fort Collins Bicycle Transportation Plan justifies and explains this policy by saying "The adoption of a transportation mode hierarchy in Fort Collins could help streamline decision-making and clarify priorities for different areas of the City based on the surrounding land use and adopted transportation plans."[83]

Figure 8: Example of Green Transportation Hierarchy from "Introduction to Multi-Modal Planning: Policies and Practices." Victoria Transport Policy Institute, 2014.



[81] City of Fort Collins, Colorado. (2014). *2014 Bicycle Master Plan.* Pg 32. Fort Collins, CO.
[82] Litman, Todd. (2014). Introduction to Multi-Modal Transportation Planning: Principles and Practices. *Victoria Transport Policy Institute*. Victoria, British Columbia, Canada.
[83] City of Fort Collins, Colorado. (2014). *2014 Bicycle Master Plan.* Pg 32. Fort Collins, CO.

All Mode Share Goals

The following communities have set mode share goals for all modes of transportation, and in the case of Bellingham, for "work from home" as well. These were the most intensively studied communities and provided the most information about mode share goal setting and policies.

Bellingham, Washington

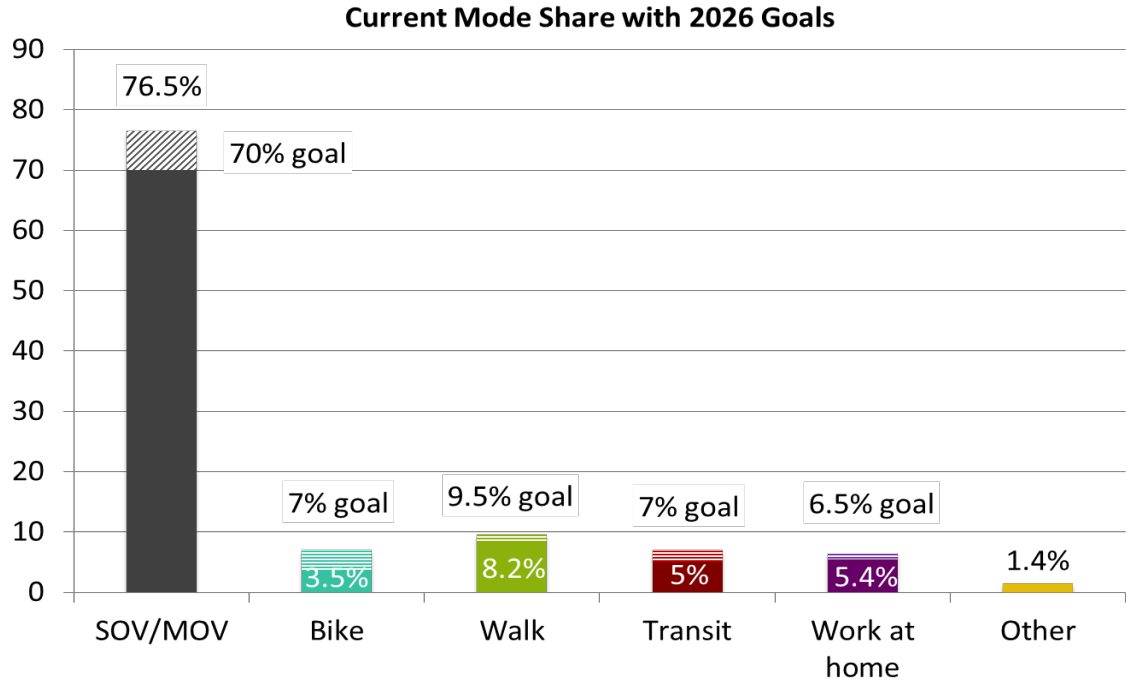
Total Population (2013): 82,631
Estimated population of workers 16 years and over: 40,660
Document: 2016 (Draft) Comprehensive Plan

A number of goals and strategies were set in Bellingham's 2014 Bicycle Master Plan, including:

- 100% of bicycle network completed by 2035.
- 100% of households in Bellingham within 1⁄4 mile of a bicycle facility by 2035.
- League of American Bicyclists Gold rating by 2020, Platinum rating by 2035.
- Increase bicycle mode share.[84]

Goals for all modes were then set in the Multimodal Transportation Chapter of the 2016 draft Comprehensive Plan.[85] Bellingham is unique in that they set two goal timelines; 2026 and 2036.

Figure 9: City of Bellingham, WA - Current Mode Share (2010-2014 Average) and 2026 Goals



[84] City of Bellingham, Washington. (2014). *Bicycle Master Plan.* Bellingham, WA.
[85] City of Bellingham, Washington. (2016). *Bellingham Draft Comprehensive Plan.* "Multimodal Transportation Chapter." Bellingham, WA.

Figure 10: City Of Bellingham, WA - current mode share (2010-2014 Average) and 2036 goals

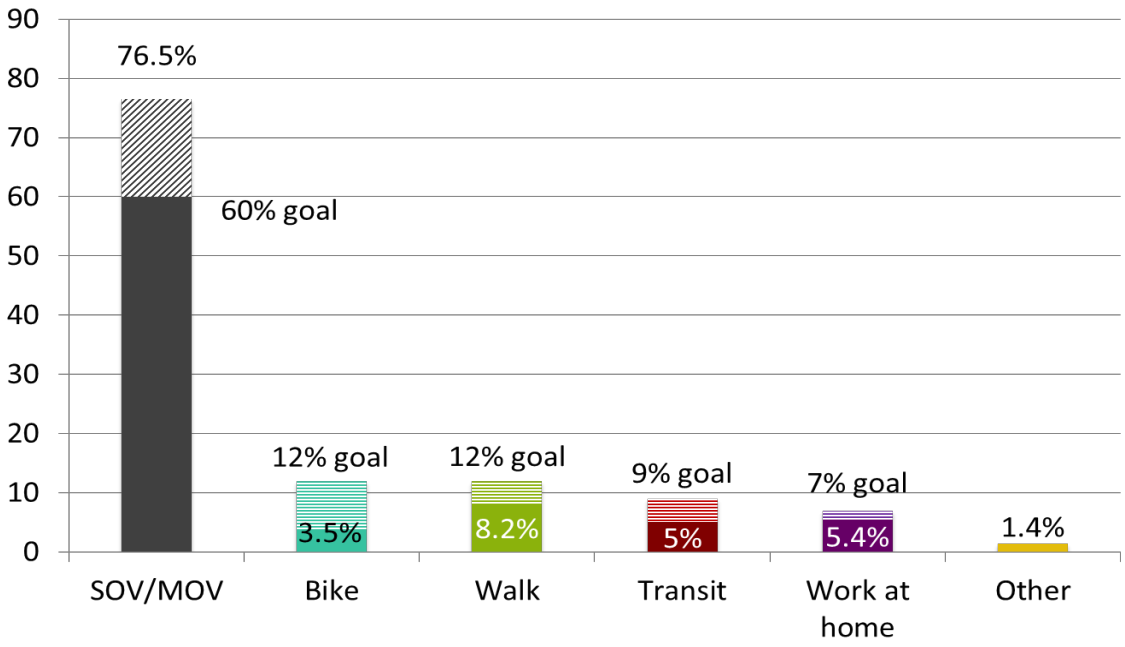
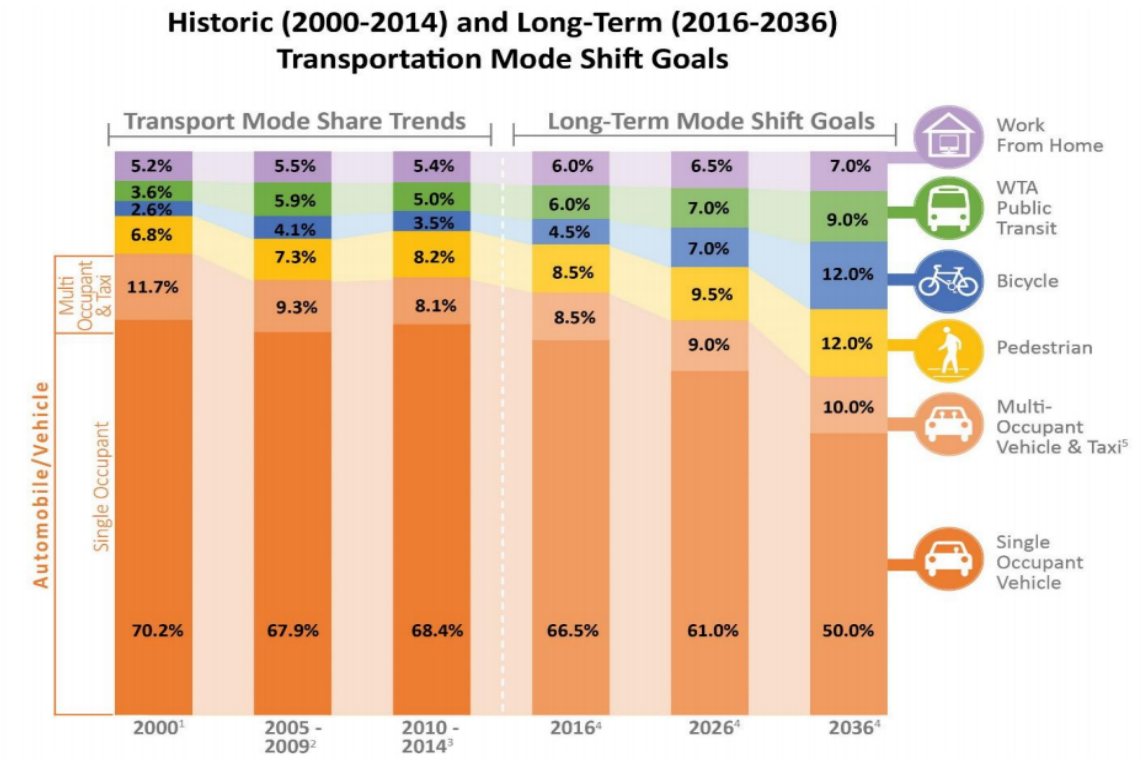


Figure 11: Bellingham, WA Historic Trends and Long-Term Goals, from 2016 Draft Comprehensive Plan

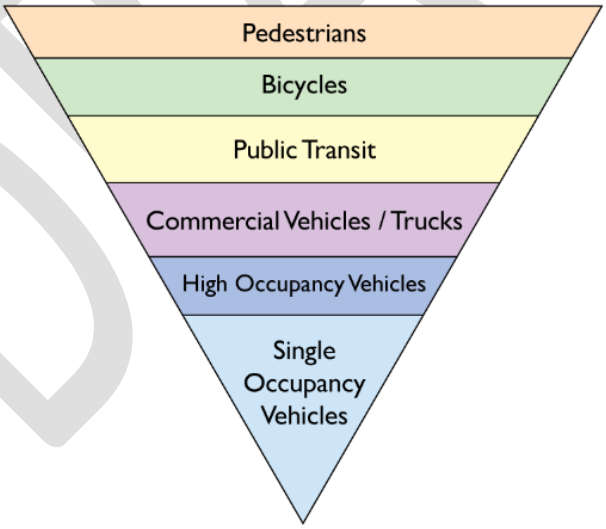


Bellingham has been conducting travel surveys over the past several years. A 2012 document by Socialdata, a transportation-consulting firm based in Munich, Germany, provides highly detailed information about the travel behaviors of Bellingham residents.[86] Socialdata collected information via two Individualized Marketing (Indi-Mark) projects in Bellingham; a 2004 pilot project, a 2008 large-scale project, and an in-depth mobility survey in 2007.[87]

As a result of this extensive data collection, planners have pinpointed the types of trips people make, the distances travelers are willing to go, the purpose of trips and a lot of other highly-valuable travel data. Again, collecting data is crucial for understanding travel behaviors, setting informed mode share goals and implementing relevant policy.

One major policy that Bellingham has adopted is to implement a priority hierarchy on all roadway projects, from existing street improvements to new road builds. This policy comes from the goal of providing "safe, well-connected and sustainable mobility options for all."[88] Implementing a priority hierarchy considers the needs of all user groups, with "priority emphasis placed on the most vulnerable user groups."[89]

Figure 12: Example of Modal Hierarchy, from 2016 Bellingham Draft Comprehensive Plan

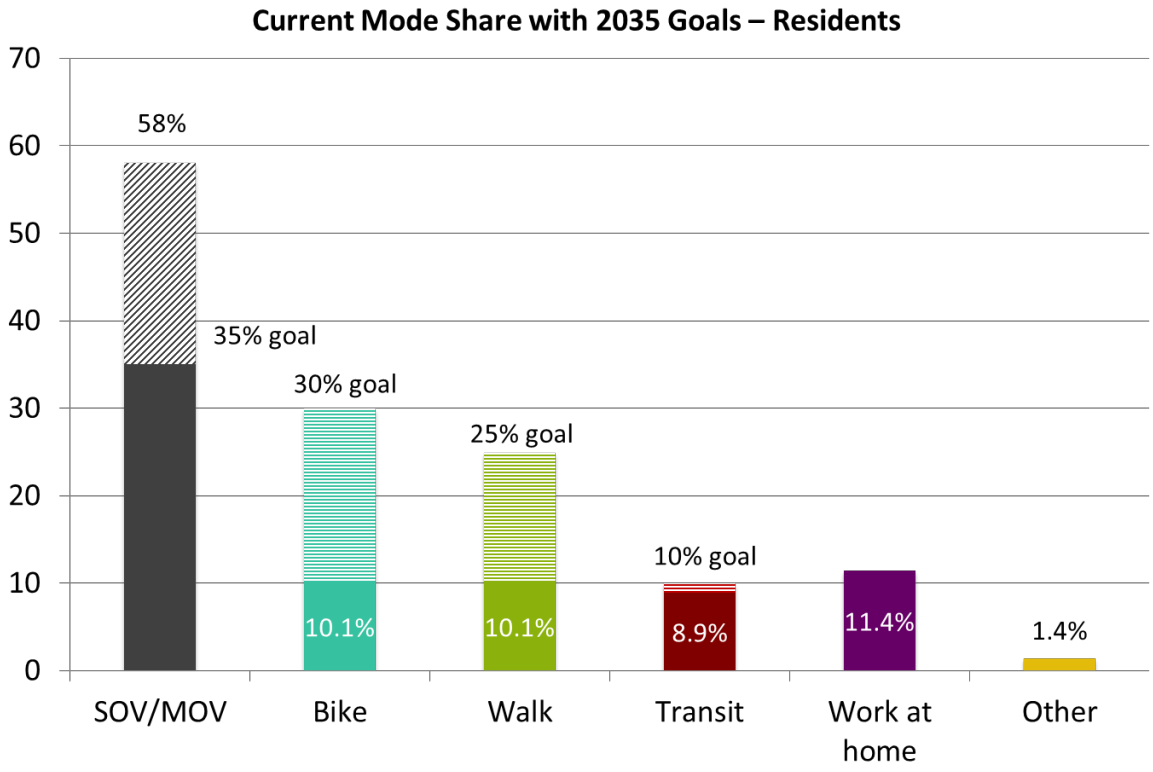


[86] Socialdata Consulting Firm. Prepared for the City of Bellingham, Washington. (2012). *The Surprising Story of Travel Behavior in Bellingham, Washington.* Bellingham, WA.
[87] Ibid.
[88] City of Bellingham, Washington. (2016). *Bellingham Draft Comprehensive Plan.* "Multimodal Transportation Chapter." Pg 1. Bellingham, WA.
[89] Ibid. Pg 7.

Boulder, Colorado

Total Population (2013): 103,166
Estimated population of workers 16 years and over: 54,516
Document: 2014 Transportation Master Plan

Figure 13: City of Boulder, CO - current mode share (2010-2014 avg) and 2035 goals – *Residents Only*



Not surprisingly, Boulder's mode share goals for residents are very ambitious. SOV use in Boulder is already low, and reducing that even further down to 35% would have incredible impacts on transportation patterns in the community. Additionally, the cycling and walking rates are already quite high compared to the national average, so increasing these would set Boulder apart from the rest of the country.

Interestingly, Boulder also has a mode share goal for non-residents, which is unique among our case studies. (See Figure 14 below) Part of this is due to its proximity to Denver and the number of commuters who live in Denver and work in Boulder.

Figure 14: City of Boulder, CO - Current mode share (2010-2014 avg) and 2035 goals – *Non-Residents*

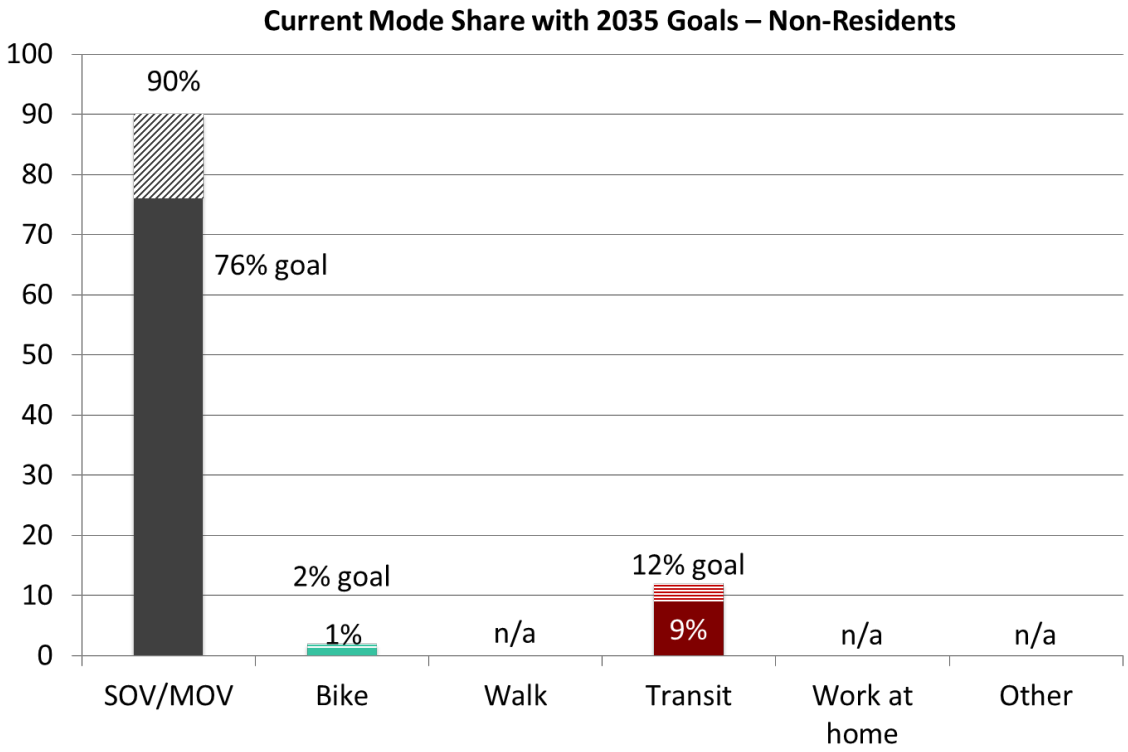


Table 1: Boulder, CO "Proposed Modal Targets for 2035", from 2014 Master Transportation Plan

Figure 3-5

Proposed Modal Targets for 2035

	Boulder's Current Mode Share		2020 Targets Established for Resident Trips in the Previous TMP	New Proposed 2035 Mode Share Targets	
	Resident Trips	*Non-Resident Trips*		*Resident Trips*	*Non-Resident Trips*
Ped	20%	0%	24%	25%	0%
Bike	19%	1%	15%	30%	2%
Transit	5%	9%	7%	10%	12%
SOV	36%	80%	25%	20%	60%
MOV	20%	10%	29%	15%	26%

Current Mode Share estimates are derived from the 2012 Travel Diary Survey. The Boulder Valley Employee Survey was also used to establish current mode share.

Beyond mode share goals, Boulder's 2014 Transportation Master Plan has a number of additional goals, including:

- 16% GHG reduction by 2035
- 20% VMT reduction by 2035
- 80% of residents in complete street neighborhoods
- Reduce daily VMT to 7.3 miles per capita[90]

Boulder has done extensive trip diary studies to survey in detail the transportation habits of its residents. 2012 marked the 9th and latest replication of the original survey, conducted by the National Research Center (NRC) located in Boulder.[91] In my interview with Randall Rutsch, Boulder's Senior Transportation Planner, he explained the history of the NRC: "An audits and evaluation division was established in 1990s. There were 5 or 6 people in that office that did various surveys for the city. Eventually, they moved on and formed a private business called the National Research Center. These same people have been doing surveys in Boulder since 1991."[92]

Because of this partnership with the NRC, Boulder has an incredible database of information about the travel patterns of its residents. As a result, they have the ability to track data very closely, which helps in assessing the impact of a given policy.

One regulatory policy that has shown significant results in facilitating mode shift is the implementation of parking districts. Boulder's Transportation Master Plan justifies parking districts in this way: "Studies have calculated that the auto driver only pays for 10 to 60% of the true cost of an auto trip. One of the largest hidden costs is 'free parking' and paying for parking is one of the biggest factors in mode choice. The city has developed principles to minimize the amount of required parking, increase parking efficiency, and support mode shift. Minimizing required parking promotes high quality urban design, place-making and the pedestrian oriented place that support community."[93]

Rustch explained some of the implications with parking districts, saying that "The University District is all paid parking and there are three other paid parking districts in the city. The downtown parking district is the big one. When we compare the effects of paid parking versus other parts of town, it doubles and triples non-SOV mode share. For Boulder, paid parking generates a lot of revenue and is a foundation for disincentives."[94]

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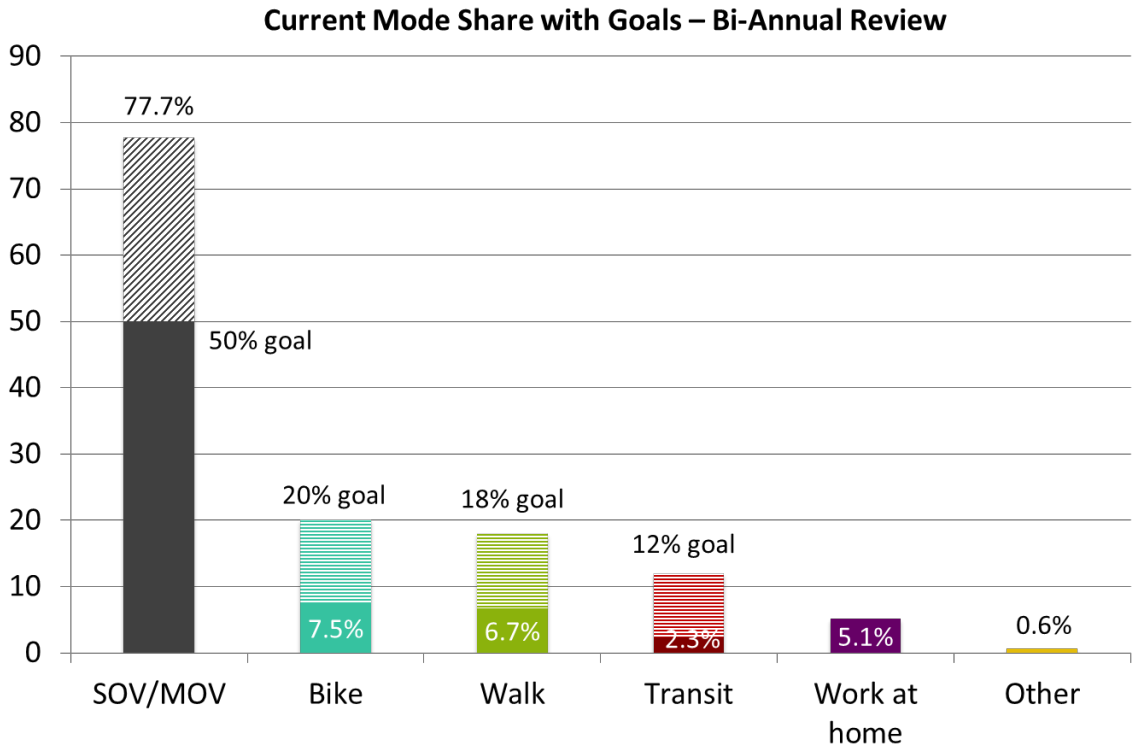
[90] City of Boulder, Colorado. (2014). *2014 Transportation Master Plan*. Boulder, CO.
[91] National Research Center. Prepared for the City of Boulder, Colorado. (2013). *Modal Shift in the Boulder Valley, 1990-2012.* Boulder, Colorado.
[92] Randall Rutsch, Senior Transportation Planner. Phone call. (7/7/2016). Boulder, CO.
[93] City of Boulder, Colorado. (2014). *2014 Transportation Master Plan*. Pg 44. Boulder, CO.
[94] Randall Rutsch, Senior Transportation Planner. Phone call. (7/7/2016). Boulder, CO.

San Luis Obispo, California

Total Population (2013): 46,377
Estimated population of workers 16 years and over: 22,376
Document: 2014 General Plan

Figure 15: City of San Luis Obispo, CA - Current mode share (2010-2014 avg) and goals



Mode share goal setting in San Luis Obispo has followed an incremental approach. The goals were originally set in the Circulation Element of the General Plan.[95] The 2012 Climate Action Plan (CAP) moderately increased the mode share goals with the aim of improving air quality.[96] Adam Fukushima, Active Transportation Manager, explained the process by saying, "it was an exercise in building upon prior precedent. The former Circulation Element set a goal of 16% bikes by 2020. The Climate Action Plan sought to increase that to 20%."[97]

The 2013 Master Bike Plan (MBP) then adopted those goals to be consistent with the CAP.[98] Finally, in 2014, a major update to the Circulation and Land Use Element of the General Plan

[95] City of San Luis Obispo, California. (2014). *2035 General Plan. "*Ch. 2: Circulation Element." San Luis Obispo, CA.
[96] City of San Luis Obispo, California. Community Development Department. (2012). *Climate Action Plan*. San Luis Obispo, CA.
[97] Adam Fukushima, Active Transportation Manager. Email. (7/18/16). San Luis Obispo, CA.
[98] City of San Luis Obispo, California. Public Works Department. (2013). *Bicycle Transportation Plan.* San Luis Obispo, CA.

adopted the goals set in the previous two documents.[99] San Luis Obispo shows a high level of consistency between planning documents.

The 2014 General Plan changed roadway analysis to MMLOS: "The City shall strive to achieve level of service objectives and shall maintain level of service minimums for all four modes of travel: Pedestrians, Bicyclists, Transit, & Vehicles."[100] However, the city did not stop with just MMLOS policy.

It also established modal priorities in accordance with MMLOS standards. In an article for the Alliance for Biking and Walking, authors Eric Meyer and Dan Rivoire explain: "With this MMLOS objective in mind, the city re-prioritized the modal hierarchy of all of its streets. Some high-traffic arterials are automobile-focused, then transit, then bikes, then pedestrians. Other streets have different hierarchies. Residential neighborhood streets are prioritized for pedestrians first. Major arterials are prioritized for transit first. It is a complex 'complete streets' effort that will balance the needs of all modes in the city over time as streets are rebuilt or modified."[101]

A key point of these priority rankings is that "construction, expansion, or alteration for one mode should not degrade the service level of a higher priority mode."[102] Table 2 below provides a general outline of areas in San Luis Obispo and the corresponding priority mode ranking.

Table 2: San Luis Obispo, CA - Modal Priorities for Level of Service, from 2014 General Plan

Complete Streets Areas	Priority Mode Ranking
Downtown & Upper Monterey Street	1. Pedestrians 2. Bicycles 3. Transit 4. Vehicle
Residential Corridors & Neighborhoods	1. Pedestrians 2. Bicycles 3. Vehicle 4. Transit
Commercial Corridors & Areas	1. Vehicles 2. Bicycles 3. Transit 4. Pedestrians
Regional Arterial and Highway Corridors	1. Vehicles 2. Transit 3. Bicycles 4. Pedestrians

Notes: Exceptions to multimodal priorities may apply when in conflict with safety or regulatory requirements or conflicts with area character, topography, street design, and existing density.

Perhaps most importantly, the 2014 General Plan update created a policy that allocates general fund transportation spending by mode to match the mode share percentage goals desired.[103]

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[99] City of San Luis Obispo, California. (2014). *2035 General Plan. "*Chapter 2".
[100] City of San Luis Obispo, California. (2014). *2035 General Plan. "*Chapter 2" Pg 20.
[101] Meyer, E. & Revorie, D. (2015). "How San Luis Obispo Established the Most Powerful Bike Funding Policy in the Nation." *Alliance for Biking And Walking*. Retrieved from: http://www.bikewalkalliance.org/blog/535-how-san-luis-obispo-just-established-the-most-powerful-bike-funding-policy-in-the-nation
[102] City of San Luis Obispo, California. (2014). *2035 General Plan. "*Chapter 2" Pg 20.

Meyer and Revorie explain that this policy "mandates that our city must allocate general fund transportation spending at the same ratio as the mode share goal desired. Meaning 20 percent of funding needs to go to bicycling."[104]

San Luis Obispo is perhaps the best example of a community that is very intentional about attaching policy measures and appropriate funding to mode share goals. Without policy and funding, there is less accountability and little to support the goals. Both are important components and outcomes of mode share goal setting.

DISCUSSION

Despite a number of case studies having no or only select mode share goals, the overall goal was the same: Reduce the use of single-occupancy vehicles. Some cities, such as Bend, went about it by seeking VMT reductions or GHG reductions. Others just had select mode share goals, hoping that increasing cycling and walking will in turn reduce SOV use. A couple of planners I spoke with told me that to a certain degree, it does not matter what the actual mode share breakdown is, as long as people are driving less.

As for the actual goals themselves, cycling was the most common mode share goal and it tended to be the most ambitious of all modes. Figure 20 (below) shows the average percentage increase for each mode. At 175%, biking is easily the highest increase of all mode shares.

One of the most important findings of our research was discovering that there is essentially no analytical process for setting mode share goals. It was very difficult to figure out *how* these case study communities set mode share goals. Most city planners I spoke with could not directly answer that question. There was very little, if any, comprehensive research done to see what other communities are doing and to see what kind of mode share goals were reasonable and attainable. And perhaps most importantly, there is virtually no implementation research that identifies what policies are most effective for reaching those goals.

Additionally, there is little federal support for mode share goal setting. There is no federal guidance or best practices. There is one document from 2010, and in it there are recommendations for "Setting mode share targets for walking and bicycling and tracking them over time: A byproduct of improved data collection is that communities can establish targets for increasing the percentage of trips made by walking and bicycling."[105] However, in the 2015

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[103] City of San Luis Obispo, California. (2014). *2035 General Plan. "*Chapter 2".

[104] Meyer, E. & Revorie, D. (2015). "How San Luis Obispo Established the Most Powerful Bike Funding Policy in the Nation." *Alliance for Biking And Walking*. Retrieved from: http://www.bikewalkalliance.org/blog/535-how-san-luis-obispo-just-established-the-most-powerful-bike-funding-policy-in-the-nation

[105] United States Department of Transportation, Federal Highway Administration. (2010) United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations. Retrieved from: http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/policy_accom.cfm

update, FHWA Guidance: Bicycle and Pedestrian Provisions of Federal Transportation Legislation, mode share goals were removed as a recommendation.[106]

Perhaps this speaks to the fact that setting a mode share goals is something that is still relatively new. Besides Boulder, who set mode share goals in the 1990's, all other communities set their goals in the last 10 years. As discussed earlier, setting mode share goals is an important new tactic for facilitating a shift away from single occupancy vehicles and toward more sustainable forms of transportation. Still, *how* mode share goals are set is entirely up to city planners. Since there is no standardization for the process of mode share goal setting, city planners must use the best data possible and their own professional judgment to decide what goals are appropriate and achievable. Regardless of how it is done, mode share goal setting is a way to start the conversation and encourage policies and programs that support multi-modal transportation choices and reduce single-occupancy vehicle use.

MODE SHARE GOAL OPTIONS FOR MISSOULA

Using the mode share goals from the case studies, I formulated three different mode share goal options for the Missoula MPO: None, which we name "business as usual", moderate, and ambitious.

One part of my methodology worth noting is that I did *not* factor timeline into my calculations or considerations. Each community has different timelines for achieving their mode share goals, which makes the yearly percent increase variable between communities. Timeline impacts the goal. For example, Austin's 2013 goal of 5% bicycle mode share by 2020 is a 257% increase in 7 years. That is a roughly 37% yearly increase in bicycle commute rates, which is quite a significant yearly increase for their population. Thus, timeline impacts policy considerations and feasibility in reaching the goals.

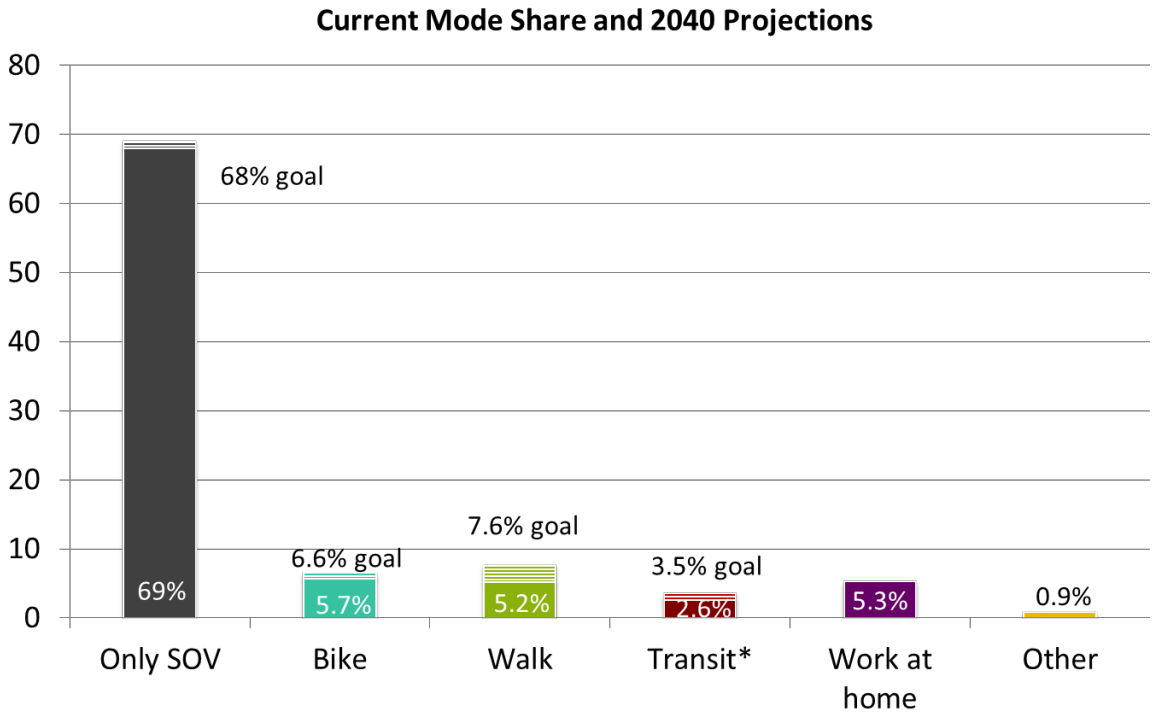
Missoula's Long Range Transportation Plan projects out to 2045, which is later than most of the other case study communities. (The latest of the case studies is Bellingham's second phase goal, which stretches out to 2036.) The "ambitious" goals are perhaps not as ambitious when considering Missoula's 2045 timeline is quite longer than the other case study communities. For this reason, the Missoula MPO might consider adopting more ambitious mode share goals.

Option 1: Business as Usual

The first graph is "business as usual." Extrapolating current trends out to 2045, with no goal setting, this is what we can reasonably expect the mode share to look like.

[106] United States Department of Transportation, Federal Highway Administration. (2015). FHWA Guidance: Bicycle and Pedestrian Provisions of Federal Transportation Legislation. From: http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/guidance_2015.cfm#bp7

Figure 16: Missoula, MT - Current Mode Share and 2045 Projections - "Business As Usual"



As we can see, the trends will not change dramatically. All mode share percentages will remain relatively stagnant, with very modest increases over the next 30 years.[107] This of course does not take into account the emergence of autonomous vehicles, which is a technology that could rapidly change the transportation landscape in the United States, for better or worse. There is no way to know the impact that this technology will have on our transportation systems.

Option 2: Moderate Goals

This graph represents "moderate goals" based on the case studies. Moderate goals were developed by first calculating the percentage increase from current rate to the goal for each mode of transportation. For example, Fort Collins' current bicycle mode share percentage is 6.5%. Their goal is 20%, which calculates to a 208% increase. I did this calculation for each community (as well as the 2026 and 2036 goals for Bellingham) and then totaled up the percentage increases. I then divided the overall percentage by the number of communities to find the average percentage increase for bicycle mode share. I used this same method for each different mode of transportation.[108]

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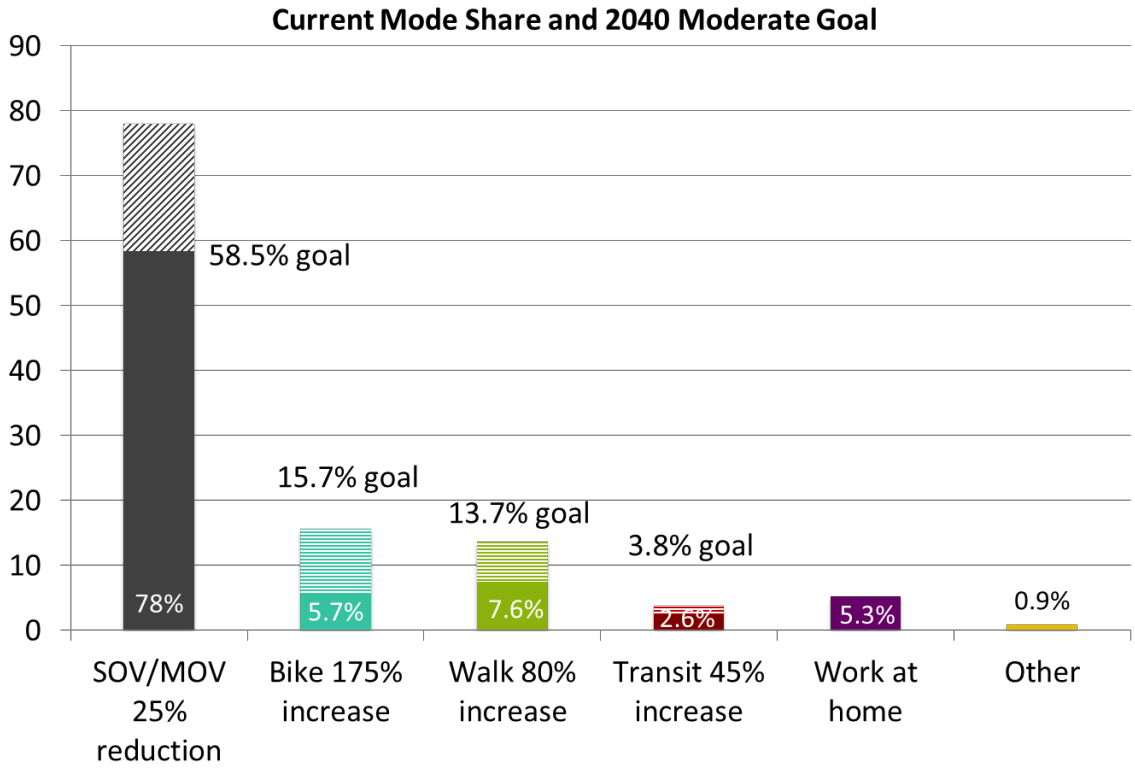
[107] Note: The asterisk on "Transit" indicates that Missoula may already be surpassing 2040 transit mode share projections. Preliminary data suggests that since the inception of Zero Fare in January of 2015 and the increased service on high volume routes, transit ridership has increased significantly.

[108] Note: In my transit calculations, I did not use San Luis Obispo's transit goal. At 422%, the percentage increase was such an outlier it would have significantly skewed the data toward a higher percentage. The transit goals set in other communities is 40%, 80%, and 12%, which are the figures I used to calculate the goal for Missoula.

Figure 17: Missoula, MT - Current Mode Share and 2045 Projections - Moderate

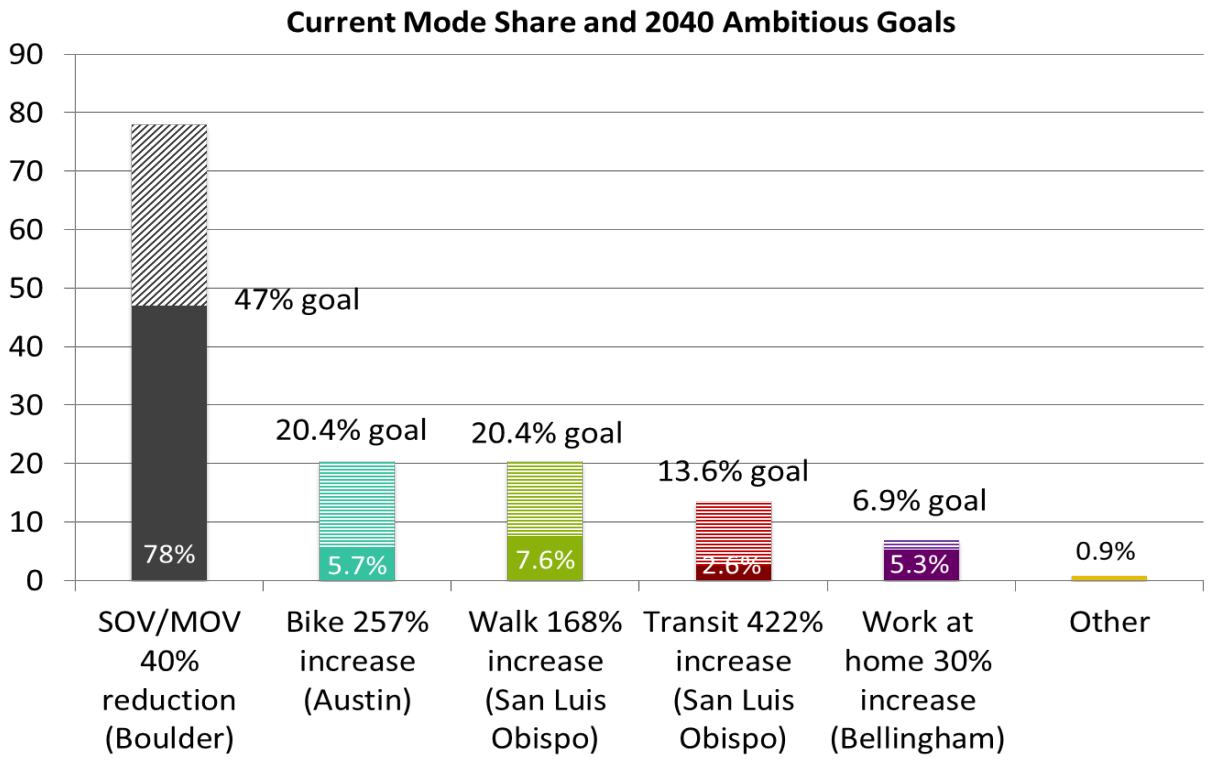


Increasing bicycle mode share tends to be what most cities target most aggressively. Even though 175% seems like a large increase, it was the average from all of our case studies. This would bring Missoula's bike mode goal to around 15%, which is similar to San Luis Obispo's goal and Bellingham's 2036 goal. Walking mode share goals tended to follow a similar pattern to bike, which were both relatively high increases compared to transit increases or SOV/MOV decreases.

Options 3: Ambitious Goals

The third graph is ambitious mode share goals. For these goals, I did not use the highest percentage goal itself, but the greatest *percentage increase* from the current mode share to the proposed goal. For example, San Luis Obispo's current walk mode share is 6.7% and their goal is 18%. This is a 168% increase, which was the largest percent increase of all the case study communities. To apply this to Missoula, I calculated a 168% increase from Missoula's current walk rate, which came to 20.4%. In order to match the ambitiousness of San Luis Obispo, Missoula would need to set a walk share goal of roughly 20%.

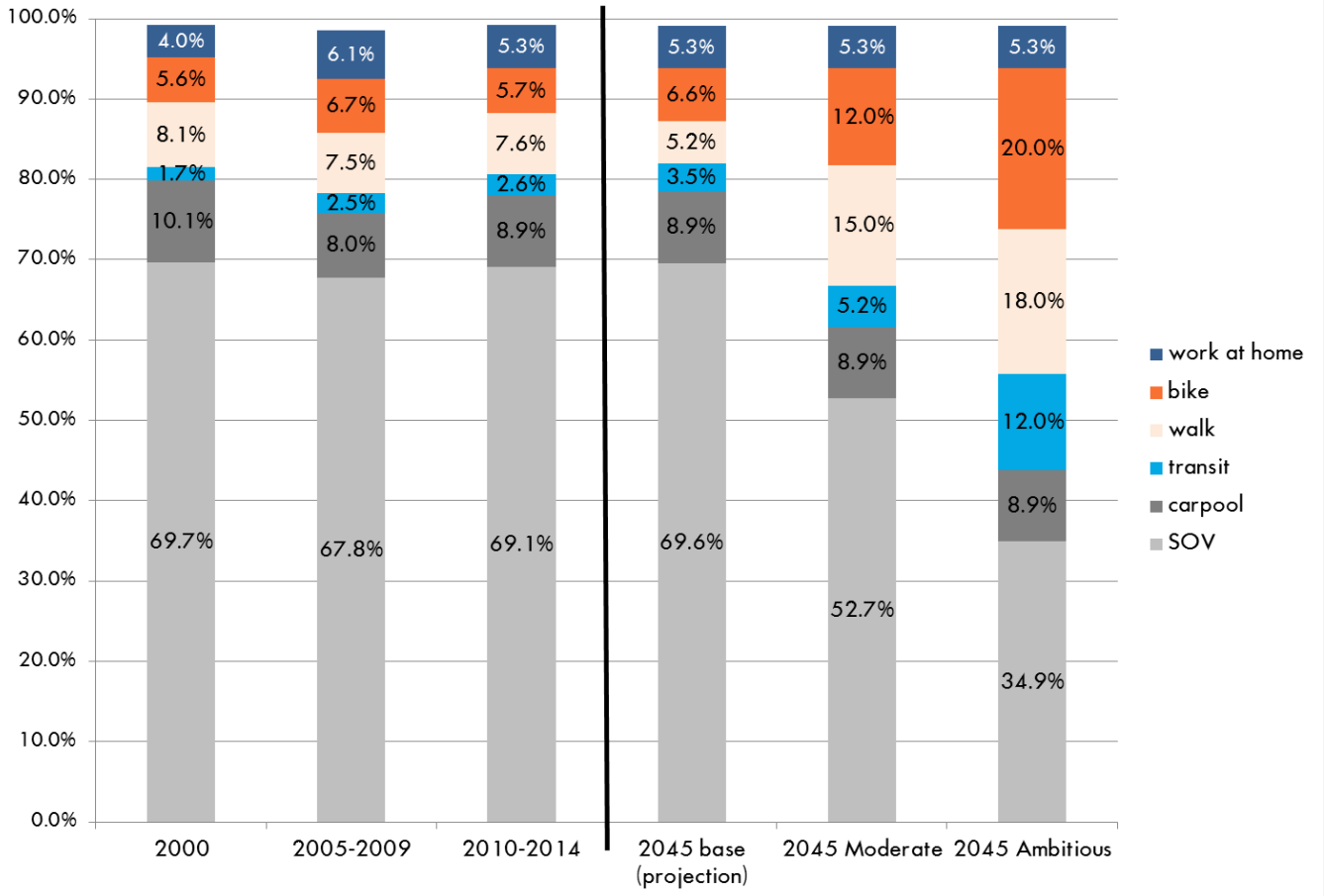
Figure 18: Missoula, MT - Current Mode Share and 2045 Projections - Ambitious



Some of these goals would put Missoula on par with the most progressive places in the country, including Boulder, Fort Collins, and San Luis Obispo. Achieving this percentage of mode share would have significant implications on traffic patterns in Missoula, which will be discussed in further detail below.

Missoula MPO planners Jessica Morriss and Aaron Wilson took these three mode share goal options and made minor adjustments based on their professional judgment. The result of the changes is the graph below, which is another way to view all three mode-share goal options, but put together against an historic timeline of mode share in Missoula. It was modeled after the Bellingham graph. (See Figure 13 above)

Figure 19: Missoula, MT - Historic Trends and Long-Term Goals



Mode Share Goals and Traffic Projections

The following table below (Table 3) shows future SOV traffic projections based on each of the three mode share goals. It is extremely important to understand and is worth taking a moment to explain in detail.

In the first row is the 2014 single-occupancy vehicle baseline data according to the ACS (does not include multi-occupancy vehicle mode share, i.e. carpooling) The data includes the estimated number of workers in Missoula (43,632) and the estimated percentage of workers using single-occupancy vehicles to get to work (71.9%). From this data, we can calculate the estimated number of commuters using single-occupancy vehicles for any given workday (33,528). The daily trips column is simply the number of estimated commuters multiplied by two, which accounts for travel to and from work (67,056). Under the "Workers" column, the next three cells represent the estimated number of workers in Missoula in 2045 (69,223), which was calculated based on Missoula's yearly growth average of 1.5%.

Table 3: Future traffic projections based on each Mode Share Goal option

Year	Workers	SOV Mode %	SOV Commuters	Daily Trips
2014 - Baseline	43,632	71.9%	33,528	67,056
2045 BAU	69,223	70.5%	48,802	97,604
2045 Moderate goals	69,223	50.0%	34,611	69,223
2045 Ambitious goals	69,223	34.1%	23,605	47,210

Note: SOV mode % does not include MOV (carpool).

Notice the 2045 Moderate goals row. If we set "moderate" mode share goals and achieve the 50% single-occupancy vehicle use goal by 2045, we have roughly *the same number of single-occupancy vehicle commuters on the road as we have today.* In other words, assuming no expansion of our roadway system and a steady population increase, just *maintaining* the current congestion rates requires reducing single-occupancy vehicle use down to 50% over the next 30 years.

Given the population increase trends in Missoula, if we do not set mode share goals and reduce SOV usage but instead choose to continue with the "business as usual" approach, we will have roughly 15,000 more commuters on the road in 2045. This calculates to an additional 30,000+ trips per day! Imagine that scenario on an already stressed transportation system. If we want to manage traffic in this community without continually expanding roads, we must support and implement policies that encourage people to get out of their vehicles and use alternative forms of transportation.

POLICY OPTIONS

After graphing mode share goals from each case study community and formulating three different options for the Missoula MPO, I read through each of the nine case study community's respective transportation (and other) planning documents. I identified transportation policies that were either associated with mode share goals or aimed at SOV reduction. I also contacted city planners in these nine communities. I interviewed planners from Bend, OR and Boulder, CO and exchanged emails with several other planners to identify what policies are being implemented in their communities.

This research formed the basis for the development of the policy feasibility matrix. Each policy was reviewed and categorized into "Easy", "Medium" and "Difficult", based on professional recommendations from Jessica Morriss and Aaron Wilson, as well as from conversations with city planners from our case study communities. Jessica Morriss provided final adjustments and additions to the policy feasibility matrix. (See Table 4 below).

Table 4: Policy Feasibility Matrix[109]

Easy	Medium	Difficult
Adopt NACTO urban bikeway design guides (Fort Collins, Austin) and work with MDT to incorporate into projects	Adopt a Trip-Reduction Ordinance (Bend, Bellingham)	Increase or implement new taxes or fees: state gas tax, local option gas tax, development impact fees, local option sales tax, carbon tax, user fees, etc.
Create a dedicated funding source for bicycle projects (Fort Collins)	Require Travel Demand Management Plans as a Condition of Approval for Conditional Uses of a certain type (Bend, Chico)	Reduce or eliminate LOS requirements; implement MMLOS requirements and/or modal hierarchy (San Luis Obispo, Bellingham, Fort Collins)
Revise bicycle parking in Title 20 to separate from vehicle ratios and increase for certain uses	Implement additional Parking Management Strategies, including demand pricing, unbundling of parking, shared use, cash out, eliminating minimums, etc. (Boulder, Burlington)	Implement an urban growth boundary to prohibit outward development (Boulder, Bend); "no new annexations" policy
Provide back-in angle parking near bike lanes where feasible (Fort Collins)	Implement additional land use strategies to encourage biking, walking, and transit, such as overlays, Transit-Oriented Development, streetscape standards, smaller lot size requirements, etc.	Adopt a "no new roads/lane miles" policy; no new "cul de sacs" policy
Improve on-street winter bicycle facility maintenance (Fort Collins)	Increase residential and mixed use density in priority transit corridors	Adopt a "no new parking lots/garages" policy in CBD.
Encourage flexible work schedules or telework; adopt flex schedules or telework policies for large employers	Implement car-share or other shared-mobility technologies (Fort Collins, others)	Implement multi-modal concurrency requirements and tracking system (person trips per service area) (Bellingham)
Improve education and encouragement for non-SOV, including increased funding (Several cities)	Implement additional truck restrictions in certain areas or at certain times (e.g. downtown or peak hours)	Implement city-wide speed limit reductions (Boston, Burlington)
Implement online and mobile ride-sharing, trip planning applications (Boulder)	Utilize parking revenues for walking, biking, and transit projects. (Boulder)	Implement utility pricing, public service fees and taxes which reflect differences in the costs of supplying public services due to differences in location accessibility
Create dedicated funding source for traffic calming projects	Consider additional "road diets" where feasible to provide additional modal access and improve safety (Bend)	Apply special taxes to vacant, abandoned, blighted, and/or underutilized land to encourage redevelopment and infill
Implement incentives for development that discourage SOV use (several cities)	Increase funding for non-motorized transportation projects and operations, including sidewalks. (Several cities)	Apply special taxes or fees to parking facilities or on impervious surfaces (stormwater impacts)
Implement additional infill development incentives (Several cities)	Increase funding for transit, including capital and operational. (Burlington)	Implement Transfer of Development Rights policies and process

[109] Note: these are NOT policy recommendations by the MPO. These are examples of policies that staff has researched and have either been implemented in other locations or have been recommended by other transportation professionals to encourage mode shift.

CONCLUSIONS AND POLICY SUGGESTIONS

It is beyond the scope of this paper to do a comprehensive policy analysis. However, based on my case study research, I have identified a number of policies that other communities are adopting and that could be considered by the Missoula MPO.

Each policy suggestion comes with its own set of challenges, from political to economic to administrative and others. Feasibility of implementing a policy is based on the magnitude of these challenges. The goal of policy-making is to find an optimal balance of all stakeholders involved, as well as balancing economic considerations with social and environmental impacts.[110]

Analyzing what policies are most effective for shifting transportation behaviors is a challenging task, and more policy research needs to be done in this area. It is extremely difficult to single-out any specific policy and pinpoint its influence as a causal factor in behavioral changes. This type of policy analysis would need to be part of a longer-term study. As far as I know, there are no comprehensive studies of mode share policy making and its impact on travel behavior.

It should also be noted that policy is not the only way to affect behavior. There are numerous other factors besides policy that contribute to behavior changes, including cultural values and norms, economic changes, changing climate patterns, technological developments and other factors. Shifting cultural values is one of the most important and powerful ways to change behavior. When discussing Ann Arbor's high walk commute rates, Transportation Manger Eli Cooper reinforced the influence that cultural values play on transportation choices by saying that "Above all is the fact Ann Arbor is a community with a strong environmental ethic. We have bicyclists that ride in our community with bumper stickers on their backpacks stating "Burn Calories, Not Carbon."[111]

While shifting societal norms is a complex equation of factors, policy does play an important role and *can* facilitate that shift by encouraging or discouraging certain behaviors. In other words, policy does not force the cultural shift, but rather supports it and guides it. City planners and officials, therefore, have a responsibility to cultivate the shift toward more responsible and sustainable forms of transportation.

These suggestions are simply a list that identifies some of the more common policies and programs that I came across in my case study research. These are tactics that other communities are using to support achievement of mode share goals and, ultimately, reductions in SOV use. In order to justify the following policy suggestions, I tied them to the Implementation Action Table found in Missoula's Growth Policy, which is a list of action items that address each of the 7 themes of the Growth Policy.[112]

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[110] Weimer, D. L., & Vining, A. (1992). *Policy Analysis, 2nd Ed.* "Chapter 10: Thinking Strategically About Adoption and Implementation." New Jersey: Prentice Hall.

[111] Eli Cooper, Transportation Manager. Email. (11/4/2016). Ann Arbor, MI.

[112] City of Missoula, Montana. (2015). Growth Policy. Pg 95.

1) Increase funding and support for non-motorized and transit projects
This is already being considered in the updated Long Range Transportation Plan. Increases in funding can be used for educational purposes, such as Missoula in Motion, or for capital improvement projects, such as sidewalks, bike lanes, greenways, etc.

This additional funding can be used to improve non-motorized infrastructure, particularly closing gaps in connectivity. The Reserve Street pedestrian overpass is a good example of addressing connectivity issues for non-motorized commuters. This facility helps commuters safely cross Reserve Street, which is a busy vehicle corridor and is challenging to cross.[113]

One tactic that could be used to help prioritize funding for non-SOV modes is to develop an investment hierarchy as Boulder and San Luis Obispo have done. This would prioritize non-motorized transportation (which is tends to be the least expensive mode[114]) and transit over single-occupancy vehicles.

Another important program that must be supported is the Zero Fare program through Mountain Line. This program is critical to addressing issues of social equity and transportation justice in Missoula. As part of shifting toward a multi-modal future, continuing the Zero Fare program and expanding transit service and accessibility must be prioritized over roadway expansion and car-centric development.

Growth Policy Action 4.10: Invest in transportation improvements that promote safety, reduce crashes, and reduce bicycle/car/pedestrian conflicts.[115]

Growth Policy Action 8.2: Work with Mountain line transit to increase transit and para-transit options through more routes and expanded hours especially near affordable housing areas and health care facilities.[116]

Growth Policy Action 8.3: Continue to support free fares for transit while also evaluating the impacts to transportation costs for households.[117]

Growth Policy Action 8.22: Explore ways to reduce transportation costs for households by exploring bike share and car share programs.[118]

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[113] Erickson, David. (2016). "Construction of New South Reserve Pedestrian Bridge Begins." The Missoulian. Retrieved from: http://missoulian.com/news/local/construction-of-new-south-reserve-pedestrian-bridge-begins/article_4988efad-921f-5a95-808d-5250230f456a.html
[114] Litman, Todd. (2014).
[115] City of Missoula, Montana. (2015). Growth Policy. Pg 100.
[116] Ibid. Pg 94 & 107.
[117] Ibid. Pg 107.
[118] Ibid. Pg 108.

Growth Policy Action 8.28: Coordinate with Missoula County to expand transit routes or van/car pool programs to more areas of the community.[119]

2) Move away from exclusively LOS and toward MMLOS
San Luis Obispo and Bellingham have set MMLOS policies. Bend and Chico exploring options. Missoula has the opportunity to follow the lead of other jurisdictions with MMLOS policies. Missoula can learn from these communities and should strive to implement similar policies.

There are some inherent problems with MMLOS. One often cited problem is that is takes a car-centric method of measurement and applies it to non-motorized travel, which results in forced values that drivers and cyclists/pedestrians do not share.[120] For example, unlike motorists, bicycle congestion is not an issue that cyclists tend to complain about. In fact, many cyclists find strength in numbers, so reducing congestion is not as equally valued in the cycling world. For transportation modeling, however, MMLOS is a step in a more equitable direction.

Growth Policy Action 1.21: De-emphasize motor vehicle LOS[121]

3) Increase urban infill and density
This is a policy that has been adopted by Missoula and is currently being implemented. The Missoula Redevelopment District is doing work in this area. The goal is to promote density, which tends to increase walking rates and reduce automobile use.[122] Additionally, urban infill policies help protect open space around the community, which can be used for local agriculture, outdoor recreation, environmentally sensitive land preservation or other purposes.

Growth Policy Action 5.2: Incentivize mixed-use development so that residences are within walking distance to grocery stores and other basic necessities.[123]

Growth Policy Action 5.3: Incentivize development that is close to existing infrastructure and that can utilize non-motorized and public transportation facilities. [124]

Growth Policy Action 5.4: Adopt policies to incentivize protecting open space such as infill and cluster development.[125]

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[119] City of Missoula, Montana. (2015). Growth Policy. Pg 108.
[120] Schmitt, Angie. (2013). Beyond "Level Of Service" - New Methods for Evaluating Streets. [Blog Post]. *StreetsBlog USA*. Retrieved from: http://usa.streetsblog.org/2013/10/23/the-problem-with-multi-modal-level-of-service/
[121] City of Missoula, Montana. (2015). Growth Policy. Pg 96.
[122] Frank, L. D., & Engelke, P. O. (2001). "The built environment and human activity patterns: Exploring the impacts of urban form on public health." *Journal of Planning Literature*, 16(2), 202-218. doi:10.1177/08854120122093339
[123] City of Missoula, Montana. (2015). Growth Policy. Pg 92 & 101.
[124] Ibid. Pg 92 & 101.
[125] Ibid. Pg 92 & 101.

Growth Policy Action 5.7: Incentivize new development and redevelopment that implements safe pedestrian design.[126]

4) Consider feasibility of parking districts or other parking management strategies
In my interview with Boulder Senior Transportation Planner Randall Rustch, we talked about the impact that parking districts have on mode share, and he said that in Boulder, the "University is all paid parking and there are three other paid parking districts. Downtown the big one. Compare the effects of paid parking versus other parts of town and it doubles and triples non-SOV mode share. Paid parking is the foundation for disincentives."[127]

Growth Policy Action 9.7: Reduce parking requirements to promote transit-oriented design (housing and development).[128]

Growth Policy Action 9.18: Use overlay zones to promote how development looks and interacts with the street system, higher density housing on transit corridors, and urban design to de-emphasize parking and emphasize pedestrian scale development.[129]

Growth Policy Action 9.22: Develop new parking standards that reduce parking ratios, incentivize reduced parking supply and demand, support compact development, and recognize future land use needs.[130]

5) Promote, Educate, Advocate
The city could push to expand Missoula in Motion and to develop new programs and events. A program that could be worth examining is Commute Options in Bend, Oregon. This non-profit organization implements the Federal Safe Routes to School program and has a few initiatives similar to Missoula in Motion. Initiatives could include partnering with businesses for a trip reduction program, implementing more bike to work challenges, or even developing a car-share program similar to a Commute Options program called "Drive Less. Connect."[131]

Consider including and expanding educational goals. For example, one of the goals set in Austin's Bicycle Master Plan is for "90% of school children educated on bicycle safety each year."[132] Reaching out to children in the community can help establish healthy transportation behaviors from a young age and can influence a larger cultural shift away from such heavy reliance on SOV use.

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[126] City of Missoula, Montana. (2015). Growth Policy. Pg 93 & 101.
[127] Randall Rutsch, Senior Transportation Planner. Phone call. (7/7/2016). Boulder, CO.
[128] City of Missoula, Montana. (2015). Growth Policy. Pg 109.
[129] Ibid. Pg 110.
[130] Ibid. Pg 110.
[131] More information about Commute Options at: http://www.commuteoptions.org/your-options/drive-less-connect/
[132] City of Austin Transportation Department and the Active Transportation Program. (2014). *2014 Bicycle Master Plan*. Austin, TX.

In my interview with Randall Rustch, he said that one of the most important factors for shifting transportation habits in Boulder has been "promoting, encouraging, and educating."[133] Boulder has been a leader in sustainable transportation, and the Missoula MPO could work to implement education and advocacy programs similar to Boulder's.

Growth Policy Action 3.8: Continue to provide education and outreach on the benefits of public transit, active transportation options, promote car share opportunities, ways to reach health care facilities, and expand the employer outreach campaign.[134]

Growth Policy Action 6.17: Prioritize safety of the most vulnerable users in the design of the overall transportation network with consideration of such things as improved pedestrian and bicycle crossings in high traffic areas and safe routes to schools and parks.[135]

6) Continue to increase data gathering

The League of American Bicyclists publishes "report cards" for each bicycle-friendly community in the United States. Missoula is currently considered a Gold level cycling community.[136] One of the suggestions to help Missoula achieve Platinum status is to "Continue efforts to count bicyclists utilizing several methods of data collection to create an understanding of current bicyclists and the effects of new facilities on bicycling."[137]

There are a number of ways more data could be gathered in Missoula. This could include some trip studies in the style of Boulder, Bellingham, and San Luis Obispo. I suggest that Missoula consider the feasibility of hiring a consulting firm to conduct an Individual Marketing Campaign, similar to what Socialdata did for Bellingham in 2012. Yearly reviews of ACS data will also help get general sense of transportation trends, even though yearly ACS data has relatively high margin of error and is not the most accurate source. The Missoula MPO already engages in trip counts, and this could also be expanded.

The City could also consider automated counters like Bend has been installing recently. In my interview with Tyler Deke of Bend, he said that the city had purchased several EcoCounters and is trying to get a contractor lined up to install these, which will provide a permanent source of pedestrian and bicycle counts at various points in the city.[138] Bend is hoping to partner with Oregon State University – Cascades student interns once the campus is completed in Bend.[139] The Missoula MPO could look into the feasibility of installing these devices.

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[133] Randall Rutsch, Senior Transportation Planner. Phone call. (7/7/2016). Boulder, CO.
[134] City of Missoula, Montana. (2015). Growth Policy. Pg 99.
[135] Ibid. Pg 104.
[136] League of American Bicyclists. (2016). Award Database: Missoula, Montana Report Card. From: http://bikeleague.org/sites/default/files/bfareportcards/BFC_Fall_2016_ReportCard_Missoula_MT.pdf
[137] Ibid.
[138] Tyler Deke, Bend MPO Manager. Personal Interview. (7/21/16). Bend, OR.
[139] Ibid.

Lastly, measuring and gathering data about acute air quality impacts from vehicle emissions should be improved and implemented. Knowing where dangerous air pollutants are most concentrated is important for implementing one of the Growth Policy objectives, which is to "encourage consideration of health impacts of poor air quality when reviewing policies for transportation, development regulations, and industrial developments."[140]

Growth Policy Action 3.9: Relate Missoula City-County Health department air quality information to automobile travel.[141]

7) Assess progress, review policies, and revise goals

The process of shifting closer to our mode share goals should be reviewed as often as possible, which is a policy that is somewhat dependent on gathering good data. This may require updates in the mode share goals themselves or policy changes that further encourage the use of multimodal transportation options. Regardless, mode share goals should be continuously monitored and updated.

Growth Policy Action 7.8: Regularly update and implement transportation plans including the *Missoula Active Transportation Plan*, the *Missoula Community Transportation Safety Plan* and the *Long Range Transportation Plan* to promote such things as improved safety and the development of active transportation infrastructure.[142]

The City and County of Missoula face important transportation challenges in the future. Setting mode share goals is the first critical step that will hold decision makers accountable, help shape transportation policy, and inspire sustainable changes in our transportation system. A future transportation system with more multi-modal options will improve safety for all roadway users, improve air quality by reducing emissions, improve health by encouraging more active transportation, ease congestion by reducing our dependence on single-occupancy vehicles, address social equity by diversifying our transportation options, and limit our contribution to global climate change by reducing the amount of fossil fuels consumed in our community. The City of Missoula has an opportunity to create a transportation system that serves all Missoulians and sets the standard for other communities.

[140] City of Missoula, Montana. (2015). Growth Policy. Pg 42.
[141] Ibid. Pg 99.
[142] Ibid. Pg 105.

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More information about EcoCounters at: http://www.eco-compteur.com/en/about-us#eco-counter-recruits

More information about Commute Options at: http://www.commuteoptions.org/your-options/drive-less-connect/

Appendix A: Initial Interview Questions

Does (community) have an adopted mode share goal for each transportation mode? (i.e. a goal to increase bicycling or walking to X% by 20XX or to decrease single-occupancy vehicle use to XX% by 20XX)?

If so, what year was it established and in what community-based plan was it adopted (i.e. General Plan, Growth Policy, Transportation Plan, Climate Plan, etc.)?

How was the modal percentage chosen and why? Was there a specific methodology or analysis used to determine it?

What data source(s) do you use to measure the current mode split? (i.e. Census-based American Community Survey commute to work data, local transportation surveys, etc.)?

If you have *not* set a mode share goal, is there a particular reason why? Do you anticipate setting a goal in the future? If so, how do you foresee doing so?

Appendix B: Supplemental Interview Questions

What process did they use, what data do they use to measure it? Who measures it and how often? Is it a 5 year goal or? When did they set it?

How is the goal applied - to whom – and for how long? For example: Residents, non-residents, all modes, one mode. Does the mode split goal apply to parallel jurisdictions such as University, local schools, large employers, etc?

What policies were in place at the time the mode split goal was approved? Has the jurisdiction changed or added any policies (land use, budgeting, infrastructure, trip reduction etc.) to help achieve it? What non-regulatory programs are in place that supports the goal (education, TDM, reward/incentive etc)

What benefits/consequences have the jurisdictions experienced? Are there best practices / common denominators / key elements of success that helped the jurisdictions make positive progress toward their goal?

Procedural Equity in Multimodal Transportation Planning

An Exploration of Planning Approaches in the Miami-Dade SMART Plan

Garrett S. McAllister

April, 2018

ABSTRACT

As communities shift toward more multimodal transportation options and infrastructure, achieving fair and equitable mobility outcomes is important to environmental and transportation justice. Procedural equity is a key part of the process, with the goal of ensuring that all citizens have access to participation in transportation planning. Transportation planners have a role to play in facilitating public outreach in order to advance procedural equity. This paper uses the Strategic Miami Area Rapid Transit (SMART) Plan in Miami-Dade, FL as a means to explore how different planning approaches are used in the interest of procedural equity.

Table of Contents

Introduction

Multimodal transportation planning is becoming increasingly important as cities plan for sustainable and resilient future transportation systems. Multimodal simply means expanding the focus of transportation systems beyond the single-occupancy vehicle (SOV) to include other modes of transportation such as walking, bicycling, and transit. Shifting toward multimodal transportation has a number of benefits, including managing population growth and the added stresses on the transportation system[1], reducing greenhouse gas emissions and improving air quality[2], promoting healthy habits[3], and increasing public safety[4], to name just a few.

Even with all of the great benefits of multimodal transportation, policies, programs, projects and other initiatives that are put in place to achieve higher levels of multimodal transportation, planners must be sensitive to not re-create or worsen problems caused by auto-centric planning and policy-making of the past. These problems include, but are not limited to, gentrification and displacement,[5,6] the unequal distribution of benefits and burdens,[7] socioeconomic and racial segregation,[8,9] public health inequities,[10,11,12] and environmental degradation.[13] Planners must be sensitive to issues of justice and equity when planning and

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[1] Downs, A. (2004). *Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion.* Washington D.C.: Brookings Institution Press.

[2] Xia, T., Zhang, Y., Crabb, S., & Shah, P. (2013). "Cobenefits of Replacing Car Trips with Alternative Transportation: A Review of Evidence and Methodological Issues." *Journal of Environmental and Public Health*. Vol 2013.

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[13] United States Environmental Protection Agency, Office of Policy, Planning, Evaluation. (1996). *Indicators of the Environmental Impacts of Transportation Highway, Rail, Aviation, and Maritime Transport.* United States Environmental Protection Agency. Washington, D.C.

implementing any transportation project or initiative. While inequity is a complicated issue, planners have played some role in the creation of the problem. Therefore, they are critical to the solution.

Incorporating more procedural equity in multimodal transportation planning could play an important role in mitigating these issues by providing more equitable transportation outcomes that balance the needs of all users with safe, convenient options. It is important to note that equity is not the same as equality, and it is unreasonable to suggest that transportation planning should provide an equal distribution of benefits and burdens across the community. However, an equitable transportation system would ensure that no particular group "be *unduly* burdened by a lack of access to adequate transportation nor by negative effects from proximity to transportation infrastructure."[14]

Procedural equity (or justice) is most simply defined as the fairness in process. In other words, the focus is on *how* multimodal transportation planning decisions are made, not on the *outcomes* of that process. Bullard and Johnson characterize procedural justice as, "Attention directed to the process by which transportation decisions may or may not be carried out in a uniform, fair, and consistent manner with involvement of diverse public stakeholders."[15] Including all of the diverse stakeholder voices in multimodal transportation planning is a key component in procedural equity, with special attention being paid to those groups with limited mobility that are most vulnerable and least powerful. Those with limited mobility can include low-income residents, residents with specific physical challenges, the elderly, and children, just to name a few.

While this paper does not focus on community advocates and leaders, they are nonetheless important voices in the transportation planning process. When I talk about community advocates and leaders, I loosely use cultural anthropologist and cycling advocate Adonia Lugo's definition, which is "someone who works at a community-based organization (CBO) and has insight into her/his community's needs and concerns."[16] These people can include leaders of church organizations, neighborhood councils, homeowner's associations, or school and hospital boards. The definition of community leader can also be expanded to include local developers or highly politically engaged residents.

Other key players in the planning process certainly include transportation planners, planning consultants, and the political decision makers in the particular jurisdiction or municipality, including city councilors and other elected leaders. Government officials of all varieties, from state to county to city are important stakeholders and can wield significant influence in planning and policy-making process.

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[14] Karner, A., Rowangould, D., & London, J. (2016). Pg 2.

[15] Bullard, R.D., and Johnson, G.S. (Eds.) (1997). *Just Transportation: Dismantling Race and Class Barriers to Mobility.* Gabriola Island, B.C., Canada: New Society Publishers.

[16] Lugo, A. (2013). Body-City-Machines: Human Infrastructure for Bicycling in Los Angeles. Doctoral Dissertation. Department of Anthropology. University of California, Irvine. Irvine, CA.

For the purposes of this paper, I assume that in order to have equitable outcomes in multimodal transportation planning, there needs to be a significant degree of equity in the process. Under this premise, I investigate how equity considerations are integrated into the public participation phase of a specific multimodal transportation project: The Strategic Miami Area Rapid Transit (SMART) Plan in Miami-Dade County, Florida (referred to below as the Miami-Dade SMART Plan or simply "the SMART Plan"). This paper is exploratory in nature, and I use The SMART Plan to provide insight and observations into procedural equity approaches used by Miami-Dade transportation planners. The results are not intended to set the foundation for guidance or best practices, but rather to provide observations about what approaches and techniques planners in a large, diverse city are using to achieve procedural equity.

I chose to direct my research toward Miami because of the significant challenges it faces with auto-centric development and sprawl, including issues around congestion, safety, public health, environmental health, and social cohesion. If anyone knows the problems associated with over-reliance on automobiles, it is TPO planners, as Gaslonde pointed out: "We know that we need alternative solutions to driving." In addition to serious traffic congestion, Miami has poor mobility rankings.[17] The Miami area also has large minority and low-income populations, which are both environmental justice indicators and require close attention when planning any kind of transportation development.

The paper starts by outlining the approach I used to research and explore this topic. It then moves into a background discussion about transportation equity, as well as a discussion about the two planning approaches that I use to frame my exploration about procedural equity in the SMART Plan. I then provide more detailed background on the SMART Plan itself, including a community profile of the Miami-Dade area. The bulk of the paper consists of identifying the public participation tools that I found from reviewing Miami-Dade TPO documents and discussing the results of my interviews with Miami-Dade TPO Planners. Lastly, I conclude with an acknowledgement of future work and some observations from my research.

Approach

In order to explore how procedural equity has been incorporated into the current phase of the Miami-Dade SMART Plan, my approach included:

1. Examining Miami-Dade Transportation Planning Organization (TPO) planning documents for procedural equity strategies.

2. Conducting interviews with Miami-Dade TPO Planners to better understand how planners incorporated procedural equity considerations in the SMART Plan.

3. Identifying outreach and public participation approaches that TPO Planners use.

[17] Shrank, D., Lomax, T., & Eisele, B. (2015). *2015 Urban Mobility Scorecard*. Texas A&M Transportation Institute and INRIX. College Station, TX.

4. Getting feedback from community-based organization leader(s) about their perceptions of procedural equity in the SMART Plan process.[18]

Components of Transportation Equity

This section begins with definitions and discussion about transportation equity as a general topic, and moves into more a more specific discussion about transportation equity in multimodal transportation planning. This section also includes a discussion about the two types of planning approaches that inform my exploration of procedural equity with respect to the SMART Plan. The two planning approaches are participatory planning and advocacy planning, which can be thought of as distinct paradigms.

There are a number of different terms being used to talk about the same general topic: fairness in transportation. Terms range from transportation justice[19] to transportation equity[20] to justice-oriented mobility advocacy, a term used by prominent LA streets blogger and activist Sahra Sulaiman.[21] There is even a movement known as bicycle justice.[22]

Todd Litman, executive director at the Victoria Transportation Planning Institute, has written extensively about transportation justice and equity. As Litman states, "How equity is defined and measured can significantly affect analysis results", therefore there is "no single way to evaluate transport equity; it is generally better to consider various perspectives and impacts."[23]

Other academics and researchers offer different categorizations of equity. Lee, et al. divide equity into two broad categories: social and spatial.[24] Social equity refers to the equitable treatment of individuals and spatial equity refers to the geographically equitable distribution of benefits and burdens. Benefits can include increased multimodal choices, safe and comfortable

[18] Interviews with community leaders were difficult to obtain. I used SMART Plan documents to identify groups that could qualify as EJ communities. I contacted the community-based organization Haitian Women of Miami (FANM) via email twice and received no response. I emailed Elizabeth Rockwell, Chief Communications Officer for the Miami-Dade TPO, requesting contact information of any community based organizations or leaders in the Little Haiti neighborhood and I mentioned FANM. She forwarded my request to Regina Serrano, Special Projects and Outreach Coordinator for the Miami-Dade TPO. Serrano never contacted me. Because of the difficulty in this process and the limited timeframe, I chose to forego this portion of my research. It is certainly a gap in my project and would be an important component of any future work on the topic.

[19] Bullard, R.D., and Johnson, G.S. (Eds.) (1997). *Just Transportation.*

[20] Litman, T. (2016). Evaluating Transportation Equity. *Victoria Transportation Policy Institute.* Victoria, British Columbia.

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[22] Golub, A., Hoffman, M.L., Lugo, A., Sandoval, G.F. (2016). *Bicycle Justice and Urban Transportation*: *Biking for all?* Florence, KY: Routledge Publishers.

[23] Litman, T. (2016). Pg 11.

[24] Lee, R. J., Sener, I. N., & Jones, S. N. (2017). Understanding the Role of Equity in Active Transportation Planning in the United States. *Transport Reviews. 37*(2), 211-226.

transportation facilities, increased livability, and strengthened neighborhood relations,[25] as well as access to jobs, healthy food, and health care services.[26] Burdens include, but are not limited to, lack of multimodal choices, decreased access to services, increases in both traffic proximity and volume (which can lead to safety issues, noise nuisances, and increased exposure to air pollution), and increased transportation costs.[27]

In 2015, the Federal Highway Administration, a branch of the US Department of Transportation, published an "Environmental Justice Reference Guide" that outlined its commitment to environmental justice through three guiding principles, with one of them being "To ensure the full and fair participation by all potentially affected communities in the transportation decision making process."[28]

The definitions offered here only begin to cover all of the different ways in which we can define and measure fairness in transportation. Most evaluations and analyses of transportation equity focus on the outcomes and results of transportation planning, looking at the distribution of benefits and burdens once the transportation plans have been implemented.[29,30] Much less common is research on the equitable process of transportation planning, though I did find some research that evaluates social equity objectives in transportation planning documents.[31]

Planners of all types, not just transportation planners, face a number of issues when considering the impacts of long-range plans and projects. In David Godschalk's Sustainability Prism framework, he outlines four different objectives of community planning: Livability, Equity, Ecology, and Economy. There are tensions that arise between those four objectives. One of the challenges that multimodal transportation planners face is the tension between Livability and Equity, which Godschalk calls the Gentrification Conflict and defines as the conflict between "redevelopment and existing neighborhood preservation."[32] In this context, Godschalk means livability as quality of life. For example, features of a liveable neighborhood typically include walkable streets with easy access to services and transit, lots of public greenspaces, and

[25] Litman, T. (2016).

[26] Sandt, L., Combs, T., & Cohn, J. (2016). *Pursuing Equity in Pedestrian and Bicycle Planning.* Prepared for United States Department of Transportation, Federal Highway Administration. Washington, D.C.

[27] Karner, A., Rowangould, D., & London, J. (2016).

[28] United States Department of Transportation, Federal Highway Administration. (2015). *Health in Transportation Working Group - 2015 Annual Report.* Pg 2. Washington, D.C.

[29] Beiler, M.O. & Mohammad, M. (2016). Exploring Transportation Equity: Development and Application of a Transportation Justice Framework. *Transportation Research Part D: Transport and Environment*. 47, 285-298.

[30] Forkenbrock, D.J. & Sheeley, J. (2004). *NCHRP Report 532: Effective Methods for Environmental Justice Assessment.* National Cooperative Highway Research Program, Transportation Research Board. Washington, D.C.

[31] Manaugh, K., Badami, M., & El-Geneidy, A. (2015). Integrating Social Equity into Urban Transportation Planning: A Critical Evaluation of Equity Objectives and Measures in Transportation Plans in North America. *Transport Policy.* 37, 167-176.

[32] Godschalk, D. (2007). Land Use Planning Challenges: Coping with Conflicts in Visions of Sustainable Development and Livable Communities. *Journal of the American Planning Association.* 70(1), 5-13. Pg 8.

affordable housing options. Neighborhoods that contain these types of liveable features are often considered desirable places to live.

Multimodal transportation infrastructure development, such as bike lanes, pedestrian paths, or bus stops, can help increase a neighborhood's desirability, which can make it more attractive for new businesses and development which can in turn lead to an influx of wealthier residents. These powerful economic forces can change the neighborhood, driving up rent prices and other costs of living, and can ultimately lead to gentrification and even displacement of long-time residents. The tension between the livability (or quality/desirability) of a neighborhood and the threat of gentrification and displacement due to that livability is a common issue, particularly in urban revitalization projects. While it is difficult to prove that multimodal transportation investment and development triggers gentrification and displacement, it may be an indicator of future development patterns.[33]

This is a particularly important problem with cycling infrastructure.[34] As Adonia Lugo wrote in a blog post, "We need to work together to confront the inequality that our cities are reproducing by using bike infrastructure as a means to raise property values and push out the poor."[35] A report published by the Safe Routes to School National Partnership echoes the concern that "Bike lanes and improvements to sidewalks and crosswalks often signal that the community has the attention of elected officials and developers as a 'hot' neighborhood worth investing more public dollars in, and so current residents don't see these features as a socially valuable investment intended to benefit them."[36] Easy access to reliable public transportation is another type of public improvement that can signal further development and socioeconomic changes.

The trick is to improve a neighborhood without fundamentally changing it.

It is safe to say that the discussion around the livability and equity conflict is complicated.[37] And tensions in multimodal transportation planning do not stop with the livability/equity conflict. There are also tensions in the equal distribution of benefits and burdens. It is not difficult to find cases of unequal distribution of benefits and burdens, particularly with public transportation. In so many cases, "those in power make decisions about transportation

[33] Zuk, M., et al. (2017). Gentrification, Displacement and the Role of Public Investment. *Journal of Planning Literature.* 33(1), 31-44.

[34] Anderson, M. & Hall, M.L. (ND) *Building Equity - Race, Ethnicity, Class and Protected Bike Lanes: An Idea Book for Fairer Cities*. People for Bikes and Alliance for Biking & Walking.

[35] Lugo, A. (2013). "Dr. Martin Luther King, Jr.'s Legacy and Bicycling: How Do We Build a Coalition for Bicycle Justice?" Blog Post. Retrieved from: http://wabikes.org/2013/01/21/dr-martin-luther-king-jr-s-legacy-and-bicycling-how-do-we-build-a-coalition-for-bicycle-justice/

[36] Zimmerman, et al. (ND) *At the Intersection of Active Transportation and Equity*. Safe Routes to School National Partnership. Pg 36. Oakland, CA.

[37] Rayle, L. (2014). Investigating the Connection Between Transit-Oriented Development and Displacement: Four Hypotheses. *Housing Policy Debate.* 25(3), 531-548.

planning, resulting in ill-planned bus routes, transportation more likely to benefit those with cars than those without, and bleak environmental costs."[38]

One of the most well known cases happened in the mid-1990's when the Los Angeles Bus Riders Union took on the Los Angeles County Metropolitan Transportation Authority (LACMTA) and won a civil rights consent decree.[39] The LACMTA was using disproportionately more funding to develop a rail line that would service the wealthier, whiter suburbs, while funding was being cut for the bus system that was serving a much larger, mostly low-income and people of color population.[40] This case still serves as a classic example of the unequal distribution of transportation funding.

There are a number of issues that need to be considered very carefully when planning multimodal infrastructure and facilities. The goal for planners is to seek common solutions that provide multiple benefits for the four objectives and avoid conflicts between them.[41] While not *all* transportation planning leads to the issues discussed above, (gentrification, displacement, unequal distribution of benefits and burdens) they are all potential negative outcomes of poor transportation planning practices. Some of these poor practices include a lack of transparency, inadequate public participation, and failure to incorporate equity considerations in the planning and decision-making process.

All of the previous discussion centers on *outcomes* in transportation planning and decision-making. While it is important that attention is paid to equity outcomes in transportation planning, there is much less research, understanding, and discussion around equity as part of the *planning process*, due in part to "uncertainty in the research community as to how to conduct evaluations."[42]

The research that does exist shows how public participation strategies often fall short.[43] Some have even argued that "legally required methods of public participation in government decision making in the US – public hearings, review, and comment procedures in particular", do not work at all.[44] One researcher provides a concise review of procedural equity in the specific context of active transportation planning, which has practical applications to multimodal

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[38] Ramey, C. (2015). "America's Unfair Rules of the Road: How America's Transportation System Discriminates Against the Most Vulnerable." *Slate Online, News and Politics*. Retrieved from: http://www.slate.com/articles/news_and_politics/politics/2015/02/america_s_transportation_system_discriminates_against_minorities_and_poor.html

[39] Lucas, K. (2004). *Running on Empty: Transport, Social Exclusion, and Environmental Justice*. Bristol, United Kingdom: The Policy Press.

[40] Ibid.

[41] Randolph, J. (2012). *Environmental Land Use Planning and Management: Creating Sustainable Communities, Ecosystems, and Watersheds.* 2nd Ed. Pg 34. Washington D.C.: Island Press.

[42] Rowe, G. & Frewer, L.J. (2004). Evaluating Public-Participation Exercises: A Research Agenda. *Science, Technology & Human Values*. 29(4), 512-556. Pg 512.

[43] Bickerstaff, K., Tolley R., & Walker, G. (2002). Transport Planning and Participation: The Rhetoric and Realities of Public Involvement. *Journal of Transport Geography*. 10(1), 61-73. Pg 62.

[44] Innes, J. & Booher, D. (2004). Reframing Public Participation: Strategies for the 21st Century. *Planning Theory & Practice*. 5(4), 419-436. Pg 419.

transportation planning: "Procedural equity is not commonly evaluated by researchers or practitioners, who tend to be focused more on the equity of policy outcomes, rather than the process of policy-making itself."[45]

Aiming for procedural equity during the *process* of multimodal transportation planning can help mitigate undesirable *outcomes* of multimodal transportation development. Simply put, "an equitable transportation system would be one where participation is meaningful and effective: participants' voices are heard and respected and decisions shaped in response."[46] Transportation planners are in a unique position to help advance procedural equity through the approaches and strategies they use for public outreach and participation.

The classic planning paradigm, called the rational-comprehensive approach,[47] is based on the scientific method and tends to see the planner as the 'expert', who is responsible for making decisions, often with little community outreach or input. It is a very top-down approach to planning and decision making, which can result in the exclusion of the general public and even important stakeholders. I filter my exploration of the SMART Plan through two more modern and progressive planning approaches, known as participatory planning and advocacy planning.

The participatory planning approach challenges the rational-comprehensive paradigm in that it aims to inform and involve the public in planning and decision-making.[48] It requires that planners step back from the role of "expert" and take a more active role in community engagement, sourcing opinions and input and feedback from peers and leaders in their community. While this is a significant shift in approach from the rational-comprehensive paradigm, one of the major downsides of participatory planning is that it tends to be context neutral. In other words, the goal is more about the number of participants in the planning process, not as much the demographic or socioeconomic composition of those participants. This is important to keep in mind with procedural equity. Participatory planning may work as an approach to achieve larger numbers of participation, but if those participants are all from one specific demographic or socioeconomic group, minority groups and/or the less politically powerful may be excluded from the decision-making process.

The other, and even more progressive paradigm is called the advocacy planning approach, which was developed by Paul Davidoff and published in the Journal of the American Institute of Planners in 1965.[49] It is similar to the participatory approach in that community engagement is prioritized, yet it goes one step further by encouraging planners to seek to understand and to represent the needs of the most vulnerable groups within society. This approach is more sensitive to diverse voices and "recognizes that interested stakeholders do not speak with one

[45] Lee, R. J., Sener, I. N., & Jones, S. N. (2017). Understanding the Role of Equity in Active Transportation Planning in the United States. *Transport Reviews. 37*(2), 211-226. Pg 215.
[46] Karner, A., Rowangould, D., & London, J. (2016). Pg 2.
[47] Randolph, J. (2012). Pg 33.
[48] Ibid. Pg 34.
[49] Davidoff, P. (1965). Advocacy and Pluralism in Planning. *Journal of the American Institute of Planners*. 31(4), 331–338.

voice but often line up in entrenched camps and fight for their special interests", which can create a situation where planners might be required to advocate for "underrepresented groups (such as the poor) and values (such as nature)."[50] As one report states: "A more equitable transportation system is only possible if low-income people, people of color, and people with disabilities have meaningful representation in local decision-making bodies such as Metropolitan Planning Organizations."[51]

Both approaches are appropriate and have their value in multimodal transportation equity, but my observations will be filtered more heavily through the advocacy planning approach. Advocacy planning is an important technique for targeting specific populations in order to engage marginalized communities and to provide for a higher degree of procedural equity, which in turn sets the stage for a better chance of equity in the outcomes and results of transportation planning.

The Miami-Dade SMART Plan

The Strategic Miami Area Rapid Transit Plan is "a bold infrastructure investment program of projects that will significantly improve transportation mobility, providing a word-class transit system that will support economic growth and competitiveness in the global arena"[52] by expanding transit options along six corridors in Miami-Dade County. (See Appendix D for map). The project came out of preliminary traffic studies, resulting in the 2002 People's Transportation Plan, which targeted these six highly congested corridors as high-priority zones for transit development.[53] The project will serve an estimated 1.7 million people that are living within a two mile radius of the SMART Plan alignments, representing approximately 63% of the most populous county in Florida.[54] The Miami-Dade TPO Governing board unanimously adopted the project on April 21, 2016 and the preferred mode of rapid transit for each corridor is currently being explored.[55]

At this time, the project is in the research and development phase, which is comprised of two major components: The Land Use and Visioning component headed by the Miami-Dade TPO, and the Project Development and Environment (PD&E) component, which is being led by the Florida Department of Transportation (FDOT) and the Miami-Dade County Department of Transportation and Public Works (DTPW).[56] The City of Miami is also a partner in the project and the preferred alternatives for each corridor should be released sometime this spring.[57]

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[50] Randolph, J. (2012). Pg 34.

[51] The Leadership Conference Education Fund. (2011). *Where We Need to Go: A Civil Rights Roadmap for Transportation Equity.* LCEF. Pg 7. Washington, D.C.

[52] Miami-Dade Transportation Planning Organization. (2017). SMART: Strategic Miami Area Rapid Transit Plan. Informational Handout. Pg 1. Miami, FL.

[53] Lisa Colmenares, Mobility Manager, Personal Interview. 10.24.17. Miami, FL.

[54] Miami-Dade TPO. (2017). SMART Plan Informational Handout. Pg 2.

[55] Miami-Dade Transportation Planning Organization. (2018). Strategic Miami Area Rapid Transit Plan. SMART Plan website homepage. Miami, FL. Retrieved from: http://www.miamidadetpo.org/smartplan.asp

[56] Ibid.

[57] Miami-Dade TPO. (2018). SMART Plan website homepage.

There are a multitude of other partners in the project and the Smart Plan Implementation Flowchart contains a full list. (See Appendix E).

In the SMART Plan informational hand out, there are short sections about each of the six corridors that explain why that particular corridor is important, what services currently exist in the corridor, and what the transit improvements will do for the corridor.[58] In addition to the possibility of light rail options, there will also be a network of fixed-route express bus services, known as Bus Express Rapid Transit (BERT).[59] Jeannine Gaslonde, Planner III, also informed me that the TPO is also using a GIS-based accessibility tool to conduct a small study that will help determine First-Last Mile needs in the corridors. The results of this accessibility tool will show planners the major gaps in bicycle/pedestrian infrastructure, particularly sidewalk connectivity.

Miami-Dade County Community Profile

As of the 2010 Census, Miami-Dade County's population was roughly 2.5 million people.[60] 2016 population estimates show Miami-Dade's population increasing to 2.7 million people.[61] The median household income for Miami-Dade County in 2016 dollars is $44,224 and the poverty level is 18.2%.[62] The poverty rate in Florida is 14.7%[63] and the national poverty rate is 12.7%.[64]

According to the 2016 Census estimates, Miami-Dade County is 78.3% White and 18.5% Black or African American.[65] Not surprisingly, 67.7% of the population identifies as Hispanic or Latino.[66] According to a Brookings Institute study from 2005, Haitians are the second largest immigrant population in Miami-Dade County behind Cubans, with the highest concentration of Haitians in the Northeast corner of the County.[67] Over half, 54%, of the Hispanic population in the Miami metro area is Cuban, with Puerto Ricans and Dominicans as the next closest group by national origin.[68] The remaining percentage is a mix of Mexican, Salvadoran, Guatemalan and "other."[69]

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[58] Miami-Dade TPO. (2017). SMART Plan Informational Handout.
[59] Ibid.
[60] United States Census Bureau. "Quick Facts: Miami-Dade County Florida." Retrieved on 1.25.18 from: https://www.census.gov/quickfacts/fact/table/miamidadecountyflorida/POP060210
[61] Ibid.
[62] Ibid.
[63] United States Census Bureau. "Quick Facts: State of Florida." Retrieved on 1.25.18 from: https://www.census.gov/quickfacts/fact/table/FL/PST045216
[64] United States Census Bureau. "Quick Facts: United States." Retrieved on 1.25.18 from: https://www.census.gov/quickfacts/fact/table/US/PST045217
[65] United States Census Bureau. "Quick Facts: Miami-Dade County Florida." Retrieved on 1.25.18 from: https://www.census.gov/quickfacts/fact/table/miamidadecountyflorida/POP060210
[66] Ibid.
[67] Sohmer, R. (2005). The Haitian Community in Miami-Dade: A Growing Middle Class Supplement. Brookings Institution Metropolitan Policy Program. Washington, D.C.
[68] Brown, A. & Lopez M.H. (2013). "Mapping the Latino Population by State, County, and City." Pew Research Center. Washington, D.C. Retrieved from: http://www.pewhispanic.org/2013/08/29/mapping-the-latino-population-by-state-county-and-city/
[69] Ibid.

The 2015 Urban Mobility Scorecard ranks Miami as 6th out of 15 for very large urban areas (over 3 million people) in number of hours delayed in traffic.[70] It also ranks Miami 12th in the category of yearly delay per auto commuter (in hours).[71] As of 2014, Smart Growth America had Miami ranked poorly in walkability, 23rd among the 30 largest U.S. metro areas.[72] In the updated 2016 report, Miami was making big shifts toward improving the walkable urban environment.[73] The efforts were significant enough to catch the attention of City Lab, which published a 2015 article featuring Miami's efforts to improve walkability through a more pedestrian-friendly street-makeover project in downtown Miami called Biscayne Green.[74]

With these increased efforts by Miami-Dade planners and decision-makers to improve walkability and multimodal transportation options, it is important to look at existing planning documents to see what policies and practices are in place that address procedural equity.

Miami-Dade Planning Documents

I started by looking at the Miami-Dade Long Range Transportation Plan, which was approved by the MPO Governing Board on October 23, 2014. Equity is only mentioned six times in the 282-page document, mostly in the context of the Federal Highway Administration's 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), which has since been replaced by the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21).[75] I also searched the term environmental justice, which is mentioned 13 times in the document. A section on Environmental Justice and Title VI is incorporated into Chapter 4: Public Involvement. The section outlines the federal requirements set forth by President Bill Clinton's 1994 Executive Order 12898. It also includes a table listing low-income and transit dependent populations, which serves as the foundation for the Public Involvement Plan, discussed further below. Lastly, EJ is mentioned in Chapter 7: Sustaining our Environment and Communities as part of the discussion of sustainability pillar number three (of 3): social responsibility.[76]

To find out more about the public outreach process, I turned to the Public Involvement Plan (PIP), which was published as part of the 2014 LRTP. This 20-page document outlines the process and strategies for public outreach in the 2014 update of the Long Range Transportation Plan, complete with dates and timelines for carrying out the Plan. I found that planners identified key groups by planning area, of which there are six in Miami-Dade County. Some of the key groups that were identified that could potentially qualify as EJ stakeholders included

[70] Shrank, D., Lomax, T., & Eisele, B. (2015). *2015 Urban Mobility Scorecard*. Texas A&M Transportation Institute and INRIX. College Station, TX.

[71] Ibid.

[72] Leinberger, C. & Lynch, P. (2014). "Foot Traffic Ahead: Ranking Walkable Urbanism in America's Largest Metros." The George Washington University School of Business, written for Smart Growth America. Washington, D.C.

[73] Ibid.

[74] Jaffe, E. (2015). "Miami Takes a Big Step Toward Walkability." City Lab Blog. Retrieved from: https://www.citylab.com/design/2015/03/miamis-massive-road-diet-plan-takes-a-big-step-toward-walkability/388640/

[75] Miami-Dade Transportation Planning Organization. (2014). *2040 Miami-Dade Long Range Transportation Plan: Eyes on the Future*. Miami, FL.

[76] Miami-Dade TPO. (2014). *2040 Miami-Dade Long Range Transportation Plan.*

the Latin Chamber of Commerce, the Underrepresented People Positive Action Council, and the Homestead Mexican American Council.[77]

In addition to these stakeholders, the PIP identified a number of "transit dependent communities", which are defined as "populations most reliant on public transportation services but least likely to participate in the transportation planning process."[78] Planners identified Community Based Organizations (CBOs) in those transit dependent communities and targeted these CBOs to help distribute information to their community members. CBOs included groups such as the Coalition of Farmworkers Organization, Hispanic Coalition, Miccosukee Tribe of Indians of South Florida, and Haitian Women of Miami.[79]

The Miami-Dade TPO also has a more general Public Participation Plan (PPP), last updated in 2017. From what I can tell, it is intended to be a stand-alone document that generally defines the TPO's process for providing "interested parties with reasonable opportunities to be involved in the Metropolitan transportation planning process."[80] In it there is a section titled "Working with Environmental Justice (EJ) Populations."[81] In this section, EJ communities are defined, EJ principles are listed, and three approaches for outreach are listed:

- Contact social agencies and private organizations
- Advertise in target publications and community newsletters, other than in English
- Provide opportunities for public input utilizing all outreach opportunities

The TPO also publishes federally required Title VI reports, which tracks information like Citizen Transportation Advisory Committee (CTAC) minority membership and the participation of Minority and Female Consultants in MPO contracts.[82] The 2011-2014 Report also reviews the MPO's public outreach and community participation strategies, programs, and tools, such as the PPP, the Transportation Outreach Planner, the Citizen's Guide, the Community Action Agency, various community outreach events, and media relations and press releases.[83]

One resource that I found quite useful for this research is the interactive web-based GIS mapping tool called the Transportation Outreach Planner (TOP). Using 2010 Census data and 2009 American Community Survey (ACS) data, the TOP can be used to generate social, economic, and geographic reports of any selected area in Miami-Dade, Broward, and Palm Beach counties.[84] The 2011-2014 Title VI Report explains how planners use the TOP to generate Community Background Reports before any public outreach is initiated, and then use the "How

[77] Miami-Dade Transportation Planning Organization. (ND). *Miami-Dade 2040 Public Involvement Plan*. Miami, FL.
[78] Ibid. Pg 9.
[79] Ibid. Pg 9-10.
[80] Miami-Dade Transportation Planning Organization. (2017). *Public Participation Plan*. Pg 1. Miami, FL.
[81] Ibid. Pg 13.
[82] Miami-Dade Transportation Planning Organization. (ND). *Title VI: 2011-2014 Report*. Miami, FL.
[83] Ibid.
[84] Miami-Dade Transportation Planning Organization. (ND). "Transportation Outreach Planner" Home Page. Retrieved from: http://mpotransportationoutreachplanner.org/mpotop/

to Reach Out to the Community" Guide[85] to develop public outreach strategies that are tailored to community characteristics. The public outreach strategies are published as PDF documents on the Miami TPO website and categorized into three different types: educational, promotional, and civic engagement.[86] A number of the strategies overlap and examples include Telephone Techniques, Negotiation and Mediation, Small Group Techniques, Youth Outreach Strategies, Games and Contests, Charettes, and Key Informant Interviews, just to name a few.[87]

I was interested in learning more about Key Informant Interviews as a public outreach strategy. The document describes this strategy as a way to connect with "community leaders, business people, project stakeholders, or others who may offer a unique perspective or understanding of a specific topic or issue."[88] The document also says that this strategy is "particularly useful during the early stages of a public involvement effort for a proposed project."[89]

All of these planning documents helped me better understand the resources and tools available to TPO planners for outreach and public participation and provided important background information before my interview.

My interview methods followed guidelines to ensure compliance with ethical standards in the protection of human subjects. (See Appendix A for informed consent statement). For my interview with Miami TPO planners, I ensured their verbal informed consent to participate. For all other interviews I received written informed consent. The method for interview sampling was limited to individuals with whom I thought to contact or found during my research, also known as a convenience sample.

I contacted Transportation Planning Organization (TPO) planners in Miami and we agreed to an interview on Tuesday, October 24th 2017. I met with Miami TPO Planners Lisa Colmenares, Program Development Manager and Jeannine Gaslonde, Mobility Planner III. I left the interview location to the determination of the interviewees. The interview occurred in a TPO office space in downtown Miami and lasted roughly 60 minutes. I recorded the interview with the recording application on my phone. I also took notes on my computer as we talked. (See Appendix B for full interview transcription).

In my interview with planners, I tried to gain a better understanding of if and how procedural equity considerations were made. I was interested in looking for indications of both participatory and advocacy planning approaches in the interview responses.

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[85] Miami-Dade Transportation Planning Organization. (ND). *Title VI: 2011-2014 Report*. Pg 19. Miami, FL.

[86] Miami-Dade Transportation Planning Organization. (ND). "Public Outreach Strategies" Page. Retrieved from: http://mpotransportationoutreachplanner.org/mpotop/strategies

[87] Ibid.

[88] Miami-Dade Transportation Planning Organization. (ND). *Public Outreach Strategies: Key Informant Interviews.* Pg 2. Retrieved from: http://mpotransportationoutreachplanner.org/mpotop/sites/default/files/outreach_strategies/key-informant-interviews.pdf

[89] Ibid. Pg 2.

Interview Results and Discussion

What I found is that planners seemed to use more of a participatory planning approach in their outreach. The participatory planning approach is revealed in answers like, "We have a comprehensive public involvement plan that accompanies the project development phase in order to be compliant with the NEPA process. As part of the public involvement there is extensive outreach, not only to advocacy groups and neighborhood associations, but to the general public."[90]

Participatory planning is good, of course, in the sense that it seeks to reach a wide audience and brings in as many voices as possible to the planning process, but it can fall short in terms of targeting the most vulnerable and underrepresented groups. This is because, as discussed earlier, participatory planning tends to be context neutral, focusing more on the *number* of people involved in the process as a benchmark for success, rather than the *types* of people involved. This is where advocacy planning has the potential to make up for the deficiencies of participatory planning.

There certainly is an understanding of environmental justice. Jeannine Gaslonde addressed that topic directly at one point in the interview, when I asked if the socioeconomic and demographic differences of each corridor changed her approach to outreach and collaboration. She responded by saying that:

> *"We are always very careful in our environmental justice, making sure that we are giving opportunity to every single community for their input. The South corridor is a good case: On this side of the corridor (east) you have a socioeconomic level that is higher than on the west side. So we are being very careful to not divide the corridor, because that could count as an environmental justice issue, splitting the corridor. Additionally, in all of our studies (and outreach) we try to be fair and we do all of our outreach in multiple languages, from Spanish to Creole or whatever we need. I think we go beyond. We talk with Title VI officers that come and visit from FHA and they really get impressed with the level of outreach that we do to comply with Title VI requirements. We are so diverse as a city we have to take into account that multicultural reality."*

Near the end of the interview, I asked about other ways in which the TPO reaches out to the public, besides just social media, newspapers, mailing lists and other general forms of communication. I was hoping to find out more about how or if specifically marginalized neighborhoods or vulnerable groups are informed and involved in the planning process. One of the important ways in which planners interact with neighborhoods is through Study Advisory Committees (SACs).

Colmenares explained how these SACs are formed and the role that they play in the planning and outreach process: "We pick representatives for each of the communities; leaders of

[90] Colmenares, L. Mobility Manager, Miami TPO. Personal Interview. (10.24.17). Miami, FL.

homeowners associations or developers or college (higher education) representatives or church leaders and we make a group. They act as a steering committee. That group gives us input and at the same time helps us to distribute information because each one of those people represents an organization in the community."

In my follow up research about these SACs, I found it difficult to find consistency in the terms used to describe these groups. I exchanged a series of emails with the TPO's Transit and Regional Manager, Mary-Tery Vilches, who helped further clarify the definition of these committees and the role they play. TPO planners use multiple different terms to refer to the same type of group, including Project Advisory Committees, Study Advisory Committees, Project Advisory Groups, and Study Advisory Groups.[91] Vilches defined them as "groups of key stakeholders, municipal/cities' staff, and state/county agencies' staff involved along the corridor/project/study underway." She went on to further elaborate that "SAC members were appointed by their agencies or invited to participate depending on the location [in the SMART Plan Corridor]." For example, each municipal public works department along a specific corridor was asked to appoint a staff member to the SAC. Furthermore, Vilches said that "Key stakeholders (universities, hospitals, major malls, etc.) were identified along these corridors and invited to be part of the group."

The SACs seemed to be the closest thing I could find in my search for involving community leaders in a sustained way. Certainly not everyone on the SACs is interested in or aware of procedural equity, but this opened the door for more exploration to see who is serving on the SACs and what kind of representation there is for marginalized and vulnerable groups or neighborhoods. I was not particularly hopeful with some of the stakeholder examples (malls, hospitals, universities, homeowner associations, developers, etc.) but I hoped that further research would reveal some stakeholders that represent more marginalized and underserved segments of the population along any given corridor of the project. I requested that TPO planners help connect with some of the SAC members, but due to privacy issues, I was unable to obtain any contact information.

Because of my unsuccessful attempts to get information on SAC members, I had to change my method. Instead, I essentially practiced advocacy planning and used the resources available to me to try to pinpoint EJ communities in any of the SMART Plan corridors. I started by using the "transit based community" list in the PPP to help me identify Community Based Organizations that could possibly represent EJ communities or neighborhoods. I found the group Haitian Women of Miami (FANM), which is a non-profit community based organization whose mission is to "empower Haitian women and their families socially and politically, and to facilitate their adjustments to South Florida."[92]

[91] Vilches, M.T. Transit and Regional Manager, Miami TPO. Email. (1.22.18). Miami, FL.
[92] Haitian Women of Miami. (ND). "About" page. Retrieved from: http://www.fanm.org/index.php?page=about

The organization is located "in the heart of Little Haiti"[93], so I located the FAHM address on the SMART Plan corridor map and found that the Northeast Corridor of the SMART Plan serves Little Haiti at the very south end. (See Appendix E for map). I used the Transportation Outreach Planner tool, located Little Haiti on the "Community Reports List", and then generated a Community Background Report based on the neighborhood boundary information. (See Appendix F for report). I found that the Little Haiti neighborhood has strong EJ characteristics. This area is a predominantly Haitian community where 74% of the people are black, 44% are foreign born, and almost 83% are from the Caribbean.[94] In addition, the unemployment rate is nearly 11% and the poverty rate is over 40%, both of which are roughly double the rate of the rest of Miami-Dade County.[95] Unfortunately, due to time constraints, I was unable to obtain interviews with representatives from FAHM, but this could be important follow-up work in the future.

What I found in the process of seeking out EJ communities is that the Miami-Dade TPO as an organization has a number of resources and tools that can be used to practice advocacy planning, from the PPP document to the TOP tool to the Title VI reports.

Unfortunately, it was difficult to tell to what degree planners utilize these resources. I did not mention these resources in my interview with planners for a couple of reasons: 1) I did not know about some of the resources available to them, such as the PPP, which is a brand new document to be finished and published very soon and 2) I wanted TPO planners to tell me about what resources they use, *how* they use these resources, *how* they practice public outreach, and *how* they identify and work with EJ populations. I did not want to already have EJ populations identified and "give the planners their answers" so to speak.

One of the downsides to my interviews was that planners were unable to provide specific examples of outreach targeted at low-income communities, communities of color, or other vulnerable groups, like low-mobility individuals including the elderly or physically disabled. When I asked this question explicitly in a series of emails later on, the response I received from Mary-Tery Vilches, Transit and Regional Manager, was that the "SMART Plan Corridors do not fall into the categories you are looking for." When asked, planners did not specifically identify potential EJ communities along any of the six project corridors. It is still unclear to me why this was the case.

This is not to say that planners do not practice advocacy-type planning, they were just unable to provide specific examples in my interviews and in my follow-up correspondence. This is particularly concerning considering I used TPO resources to locate and identify the possibility of an EJ community (Little Haiti) in the South end of one of the project corridors. Certainly this cannot be the only potential EJ community in the entire SMART Plan corridor network.

[93] ibid.
[94] Miami-Dade Transportation Planning Organization. (ND). "Transportation Outreach Planner." Customized Demographic Reports. Generated on 2.25.18.
[95] Ibid.

Comments on Assessing Procedural Equity

It is one thing to have these tools and strategies available to planners, but it is another thing for planners to actually utilize these resources to their fullest extent in the public outreach process. While I tried to understand to some degree how much planners utilized the resources available to them, additional research and observation would be required to obtain a more complete picture.

A related limitation to this paper was mentioned briefly before, and that is a lack of qualitative analysis regarding public outreach in transportation planning processes. It is beyond the scope of this paper to do a rigorous assessment of procedural equity in the SMART Plan; this paper simply explores the approaches that planners have available to them for public outreach and participation. But that is only the first step. A more detailed and in-depth analysis of the *quality* of those public outreach initiatives is an extremely important missing piece. Following up and analyzing the quality of that outreach process is vital to a more holistic and comprehensive understanding of procedural equity. This would most likely require numerous interviews with community leaders that have been closely involved in the SMART Plan.

While this paper focused specifically on equity in the planning process, it is also worth mentioning that follow up work on this project could include an analysis of the planning outcomes to see to what degree the final SMART Plan represents the desires of the communities that the project serves. Essentially, it would be about measuring the planning outcomes against the planning process. Because the SMART plan is still in the project development and evaluation phase, there is no way to assess the equity impacts from the project due to its incompletion. At this point in time, all that can be done is to explore how planners approach procedural equity in their public outreach strategy.

Conclusions

For this paper, I have focused on equity in the process of multimodal transportation planning (procedural equity). The premise of this paper is that in order to have equitable outcomes in multimodal transportation planning, there needs to be a significant degree of equity in the process. This paper is simply a first step in testing that premise by attempting to gain a better understanding of what resources planners have available to them, what approaches planners actually take in the outreach process, and how they implement those approaches.

If our cities continue to move toward the prioritization of multi-modal transportation options and away from infrastructure designed around single occupancy vehicles, equity in all forms must be considered with increasing importance. Thankfully, there is work being done to address the general topic of equity in multimodal transportation planning. While most of the research focuses on spatially equitable outcome analysis, assessing equity in the transportation planning process is becoming more and more important and accepted as a best practice. Advocacy and participatory planning paradigms can play a significant role if procedural equity is considered valuable as an important precursor to equitable outcomes.

I was able to get a sense that Miami-Dade TPO planners do understand the concepts of transportation equity and environmental justice. I was also able to identify tools and resources

that TPO planners have available to them in the SMART Plan public outreach process. Generally speaking, there does appear to be a strong commitment to procedural equity from TPO planners. And all of the documents and tools that support TPO planners and provide guidance in the public outreach process seem to indicate that planners are actively engaged in participatory planning. There are even hints of what looks like advocacy planning in the outreach process, such as distributing information and holding outreach events in multiple languages, which specifically locates and serves linguistically isolated groups that might be impacted by the SMART Plan and allows them the opportunity to be a part of the process. Still, I would argue that the planning profession has a long way to go in the advancement of procedural equity and embracing it as best practice.

I started this project with the hopes of gaining additional insight into how planners approach the topic of procedural equity. The point of the paper was not necessarily to critique current planning practices, though there is a fair amount of that in this paper, but rather to develop my own personal understanding of how planners approach procedural equity. I was looking for useful and unique public outreach strategies and tactics, as well as innovative tools and resources, and the SMART Plan is certainly not lacking in those categories. As a result of my work on this project, I have gained a greater appreciation of the array of public outreach and participation approaches used by planners. As a practicing planner myself, this exploratory paper was useful in helping me develop my own ways of thinking about public participation and how I, as an individual, can practice my own form of advocacy planning in the interest of advancing procedural equity.

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Appendices

Appendix A

Informed Consent Statement

My name is Garrett McAllister and I am a graduate student in the University of Montana's Environmental Studies Program. The purpose of my research is to better understand how transportation planners and community leaders are working to advance transportation equity and address the social and environmental impacts of transportation systems. For this research, I am using the Strategic Miami Area Rapid Transit (SMART) Plan as a case study.

Information in this interview may be used as part of my graduate portfolio project. I do not intend to publish this research, other than on ScholarWorks through the University of Montana. The goal of these interviews is to fulfill the requirements of my graduate program and for my own professional development.

Do I have your permission to record this interview and use your answers in my portfolio project? If you wish to remain anonymous, please indicate so.

Appendix B

Miami TPO Planner Interview Transcription and Analysis

Planners
Jeannine Gaslonde, E.I. - TPO Mobility Planner III
Lisa Colmenares, AICP - Program Development Manager

Read opening statement and received permission from interviewees to record.

Me: Can you tell me about a specific active transportation project or initiative where you worked (or are working) closely with community advocates?

Lisa: The major priority right now in transportation planning in Miami is the Strategic Miami Area Rapid Transit (SMART) program. It is a network of 6 corridors throughout Miami-Dade county with bus express rapid transit (BERT). It is in the project development phase and is a partnership between 3 different agencies: Department of Public Transportation Works (DPTW), Florida Department of Transportation (FDOT) and the City of Miami.

Follow up: Are there any non-profit or advocacy groups you are working with on this or is it all government agencies?

Lisa: Government agencies lead the studies, but we have a comprehensive public involvement plan that accompanies the project development phase in order to be compliant with the NEPA process. So as part of the public involvement there is extensive outreach, not only to advocacy groups and neighborhood associations, but to the general public. In addition, the municipalities along these corridors work in partnership together in the process, participating in the public involvement process and hosting project advisory team meetings where the municipalities participate together with the project managers for the different corridors.

Follow up: How did these areas get prioritized? Were there traffic studies that showed area where Level of Service was really bad and that is just kind of how these areas were chosen?

Lisa: These areas have been prioritized for quite a while. We have a People's Transportation Plan which was completed in 2002. Preliminary studies were done and now we are in the project development phase. We are soon looking to move into the design and construction phases.

Jeannine: We had previous studies that showed the need, mostly because the population has been growing West and South. And Miami only used to be in the East.

Lisa: And yes, these are highly congested corridors. Highly congested. Level of Service "F." And we have a population that is expected to continue growing.

(Showed me a population growth statistics)

Follow up: In addition to mass transit, do you see active transportation infrastructure (sidewalks, bike paths, bike lanes, etc) as being part of the plan and solution?

Lisa: We are doing a "First-Last Mile" study as part of the SMART plan.

Jeannine: We have a small study going for a specific corridor to find out more about First-Last Mile needs. We use a tool called the accessibility tool, which is based on GIS and it can show the missing link in connectivity. Not only does it show missing links in roadways, but it also shows missing links in pedestrian facilities or bicycle facilities. For example, we can see where a sidewalk just ends suddenly and how far it might be from a bus station. So we are trying to find all of those missing links and making recommendations to connect them.

Lisa: And we are using that accessibility tool is part of the work for our 2045 Long Range Transportation Plan.

Me: What are the different neighborhoods like (in these corridors)? In terms of demographics and socioeconomic differences?

Lisa: The communities are very diverse. For example the Northeast corridor, we have cities like Aventura. Very dense and developed area. And then we have the North Miami Beach area that is more developing. But in terms of social scale, they are very diverse. Different income levels, different demographics all throughout the corridor.

Me: Does that change how you approach planning for the project or the process?

Jennine: No. We are always very careful in our environmental justice, making sure that we are giving opportunity to every single community for their input. The South corridor is a good case: On this side of the corridor (east) you have a socioeconomic level that is higher than on the west side. So we are being very careful to not divide the corridor, because that could count as an environmental justice issue, splitting the corridor. (Especially if we favor one side and) we put mass transit options over here (pointing to east) and not over here. Additionally, in all of our studies (and outreach) we try to be fair and we do all of our outreach in multiple languages, from Spanish to Creole or whatever we need. I think we go beyond. We talk with Title VI officers that come and visit from FHA and they really get impressed with the level of outreach that we do to comply with Title VI requirements. We are so diverse as a city we have to take into account that multicultural reality.

Me: So you perceive yourselves as having a strong commitment to environmental justice, and making sure that communities that are historically underserved are being taken care of in the same way?

Jeannine: This is a big deal for us. It is our Mayor's bread and butter. We don't do anything first without consultation with Title VI officers all the time. For every project we have to make sure

that we are following the requirements and not getting into one of those environmental justice issues.

Title VI Act definition: (FHWA discrimination requirement) <Jeannine reads definition> This is a federal act. It is different than EJ, but it goes together and we follow both. We take it very seriously here.

Me: What is the distribution in Miami in terms of active transportation infrastructure? Where do most of the bike lanes exist? Or where are the sidewalks really bad?

Lisa: Miami Beach has the highest ridership for bicycles, pedestrians, and transit use. It is higher than the rest of Miami-Dade County. The city of Miami is also a location where (these modes) are getting pretty high. People want to take the Metro rail, ride their bikes, walk, so a lot of people don't even own cars. They don't want to anymore. They even have building that have very minimal or no parking spaces.

Jeannine: And City Bike has started a bike share initiative.

Me: So would you say it is a cultural shift a little bit? People are choosing to do this?

Jeannine: Depends on the area. Miami Beach or City of Miami, yes people are choosing to do this more and more. Any other place in the county, no.

Lisa: But it is coming, little by little.

Jeannine: A big problem is the connectivity to transit, which is why we need this (point to SMART plan). This will help create that cultural shift.

Lisa: I think what we are seeing is more isolated examples. Like out west, the City of Doral is building their downtown to be more walkable. So we need to complete the network (to get people to those centers where they can access services by walking or cycling).

Me: Land use development and transportation are related of course. So are you collaborating with Land Use planners as well to try and limit sprawl?

Lisa: Yes, and that's part of the task for the Land Use Envisioning piece of the SMART Plan. So we collaborate with land use planners.

Jeannine: In fact, this is a flyer for an upcoming charrette in the South Corridor and every single corridor of the SMART plan is going to have a charrette for the full plan and we will be asking the community their input about how the land use should go together with the transportation plan.

Me: And how are these distributed? How do you get the word out?

Jeannine: This is a 20-mile corridor, so we are doing 3 locations to make sure that we can get people here. We work through social media, regular newspaper, municipality newspapers, and our mailing list.

Me: Are there other ways that you reach out besides the charrettes? Are there task forces or scoping meetings or listening sessions?

Jeannine: We have PACS, which are Project Advisory Committees. We pick representatives from each community; leaders of homeowners associations, developers, college (higher ed) representatives, or church leaders and we make a group. They act as a steering committee. That group gives us input and at the same time helps us to distribute information because each one of those people represents an organization in the community. And that is in addition to the public workshops we do. For example, last night we did one in the mall. (Not sure which mall or where) We had presentation boards and informational flyers and surveys they could fill out. We do so much outreach.

Me: So the people in these PACS, you really rely on them to get the word out to the rest of their neighborhood or community?

Jeannine: We do. In addition to our own media outreach.

Me: Do you think that you often have shared goals and priorities with these PACS? Are they coming back to you and saying "we don't like this plan, we have very different ideas"?

Lisa: Well, everybody wants a different solution to the problem. And some of them want technology (I assume she means autonomous vehicles). But everybody wants a solution to driving their car. Mobility and safety is really the shared goal, and that is what we are all trying to work together to promote and achieve.

Jeannine: We know that we need alternative solutions to driving.

Me: Do you have some neighborhoods that are saying different things about what they want? Like, "we want more cycling." Or, "our sidewalks are really bad and we want them fixed." Or, "we really need a bus, we don't care about cycling."

Jeannine: I know that most communities don't want higher density. However, they do want transportation (mobility). So it is kind of a trade-off. If you want to have mass transit you have to justify it with numbers. But there are some communities that want accessibility (things closer together, thus density). A lot is happening with accessibility with downtown. They want a way to get easily to the bus station.

Me: I'm interested in the history of this outreach with the PACs. Is this a new tool that has been developed or something you have been doing for a while?

Jeannine: It has been back and forth for many years. Since 2002. We have been trying to get a couple of these corridors done for nearly 20 years. It has been a lot of back and forth with

different people in these communities and different elected officials. And every time we have new elected officials they have different priorities so sometimes this project gets put aside.

This whole project has been a really good example of collaboration. I don't remember working really close like this before with so many people.

Me: What specific bicycle/pedestrian advocacy groups can you identify that are important to this collaborative process?

Lisa: The intermodal manager here would know.

Jeannine: Anytime I do outreach I always include them. I always include a bicycle or pedestrian advocacy group in the neighborhood. But I go to Dave (Intermodal Manager) to find out what groups and leaders are in what neighborhoods and then I contact them. Friends of the Underline and Cycle 305 are a couple of groups that I've worked with in the past.

Appendix C

Interview Questions for Community Based Organization Leaders

1) Briefly tell me about yourself and the community where you live. (Please try to include what your neighborhood is like socioeconomically, demographically, etc.)

2) What part of the community do you feel like you speak for? In other words, what stakeholder group do you most closely represent? (Homeowners, contractors, business owners, community organizers, religious institutions, concerned citizen, etc.)

3) How, when, and why did you get involved with the SMART Plan? In what capacity are you involved?

4) What do you see as the overall objective or purpose of your role as a public participant in the planning process?

5) Tell me about your interactions with TPO planners. Setting? Type of contact? How often? How did you interactions develop over time?

6) How well do your goals and priorities line up with the goals and priorities of Miami TPO planners?

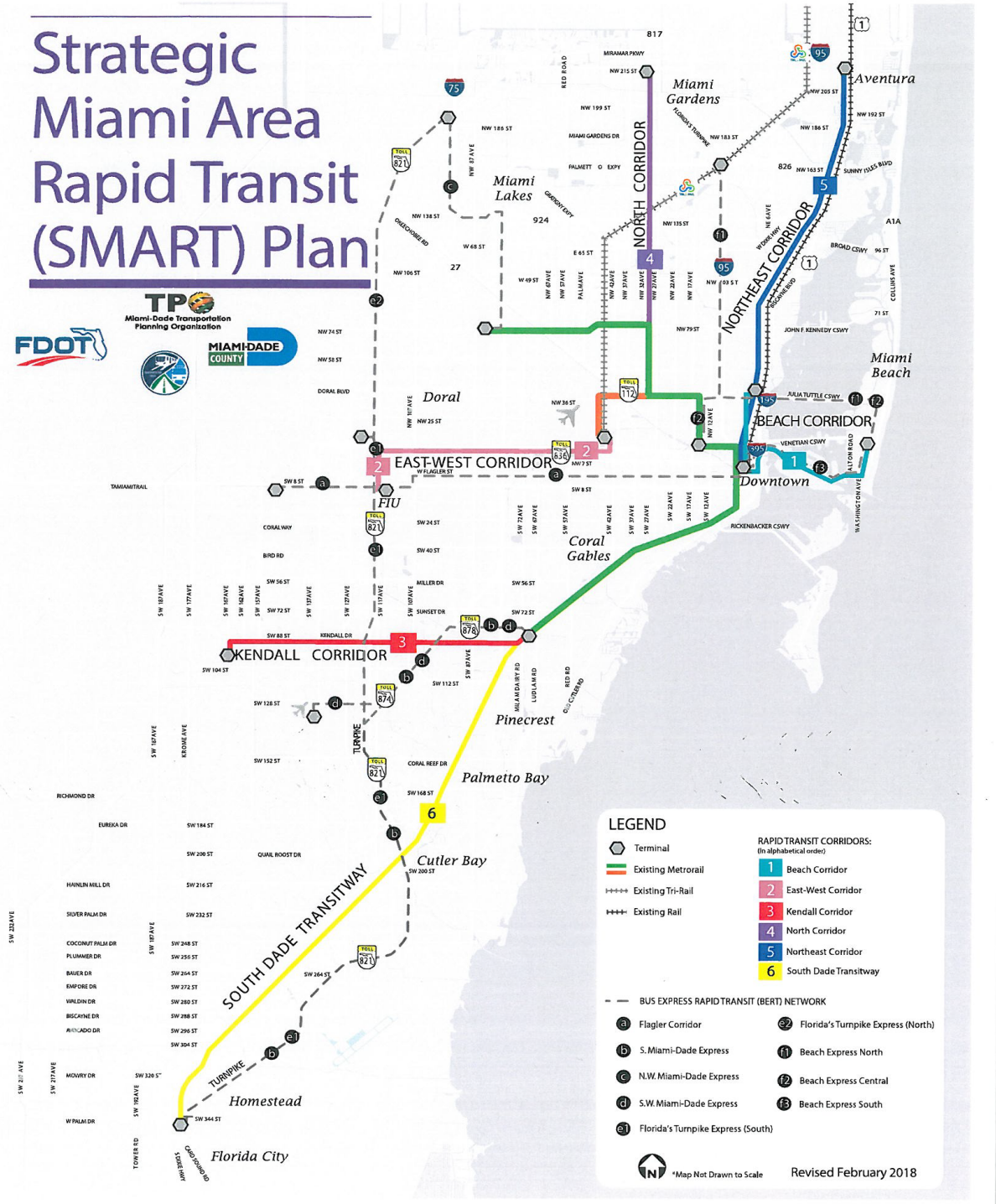
7) Have you discussed social equity as a key topic at any time during the planning process? Was there any part of the SMART plan that focused specifically on justice and/or equity?

8) Do you think enough is being done to serve historically underserved and/or marginalized neighborhoods and to bring representatives from those areas to the table for discussions regarding the SMART plan? If not, what could be done better?

9) Do you think there was/is is a fair and transparent communication process? Why or why not?

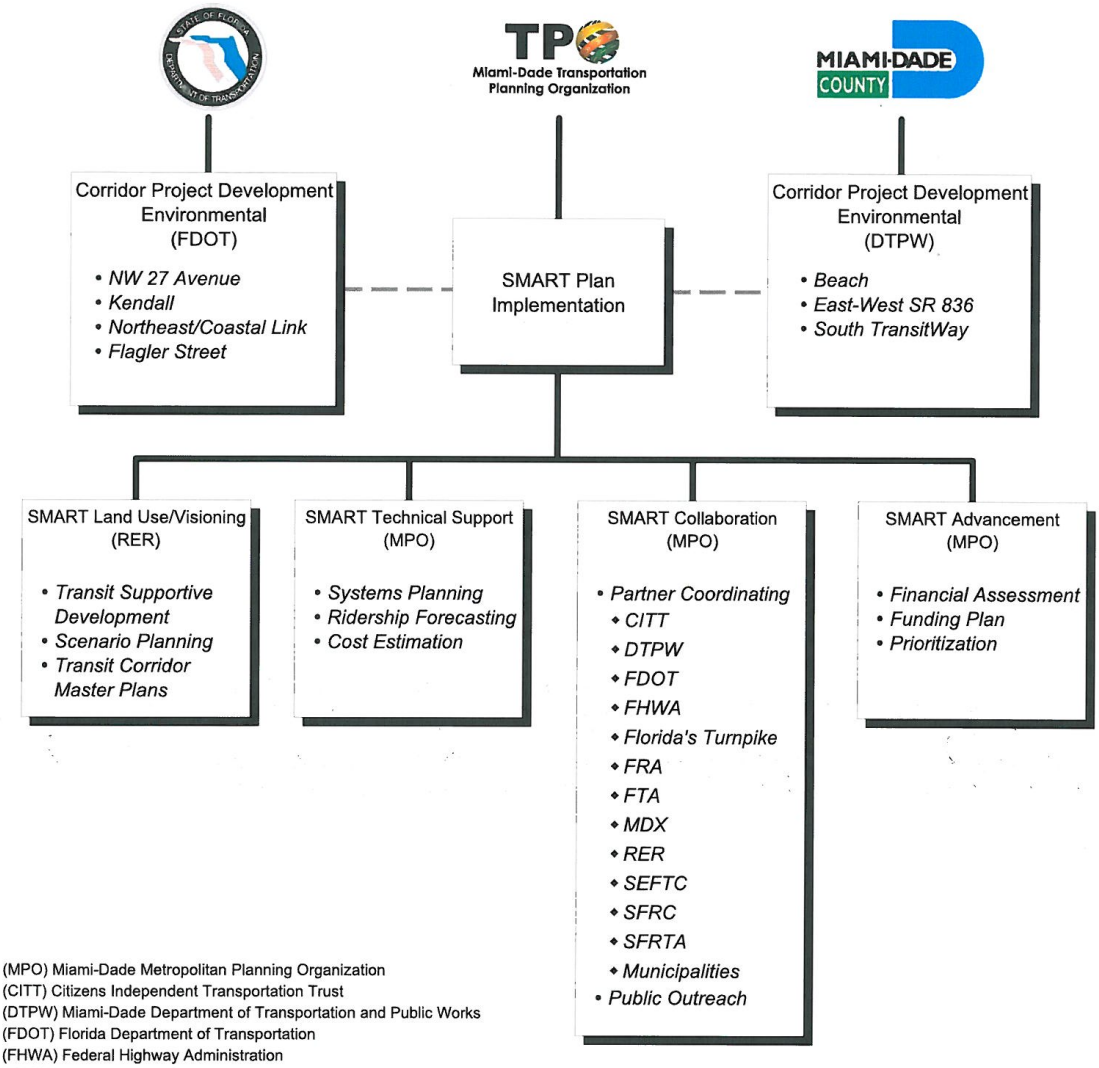
10) Do you feel your input and participation is useful or not? In other words, how well do you think planners have incorporated your views/opinions/goals into the SMART Plan?

Appendix D


Strategic Miami Area Rapid Transit (SMART) Plan
TPO Miami-Dade Transportation Planning Organization
FDOT
MIAMI-DADE COUNTY
NORTH CORRIDOR
NORTHEAST CORRIDOR
BEACH CORRIDOR
EAST-WEST CORRIDOR
KENDALL CORRIDOR
SOUTH DADE TRANSITWAY
Miami Gardens
Aventura
Miami Lakes
Doral
Miami Beach
Downtown
FIU
Coral Gables
Pinecrest
Palmetto Bay
Cutler Bay
Homestead
Florida City
LEGEND
Terminal
Existing Metrorail
Existing Tri-Rail
Existing Rail
RAPID TRANSIT CORRIDORS: (In alphabetical order)
1 Beach Corridor
2 East-West Corridor
3 Kendall Corridor
4 North Corridor
5 Northeast Corridor
6 South Dade Transitway
BUS EXPRESS RAPID TRANSIT (BERT) NETWORK
a Flagler Corridor
b S. Miami-Dade Express
c N.W. Miami-Dade Express
d S.W. Miami-Dade Express
e1 Florida's Turnpike Express (South)
e2 Florida's Turnpike Express (North)
f1 Beach Express North
f2 Beach Express Central
f3 Beach Express South
*Map Not Drawn to Scale
Revised February 2018

Appendix E

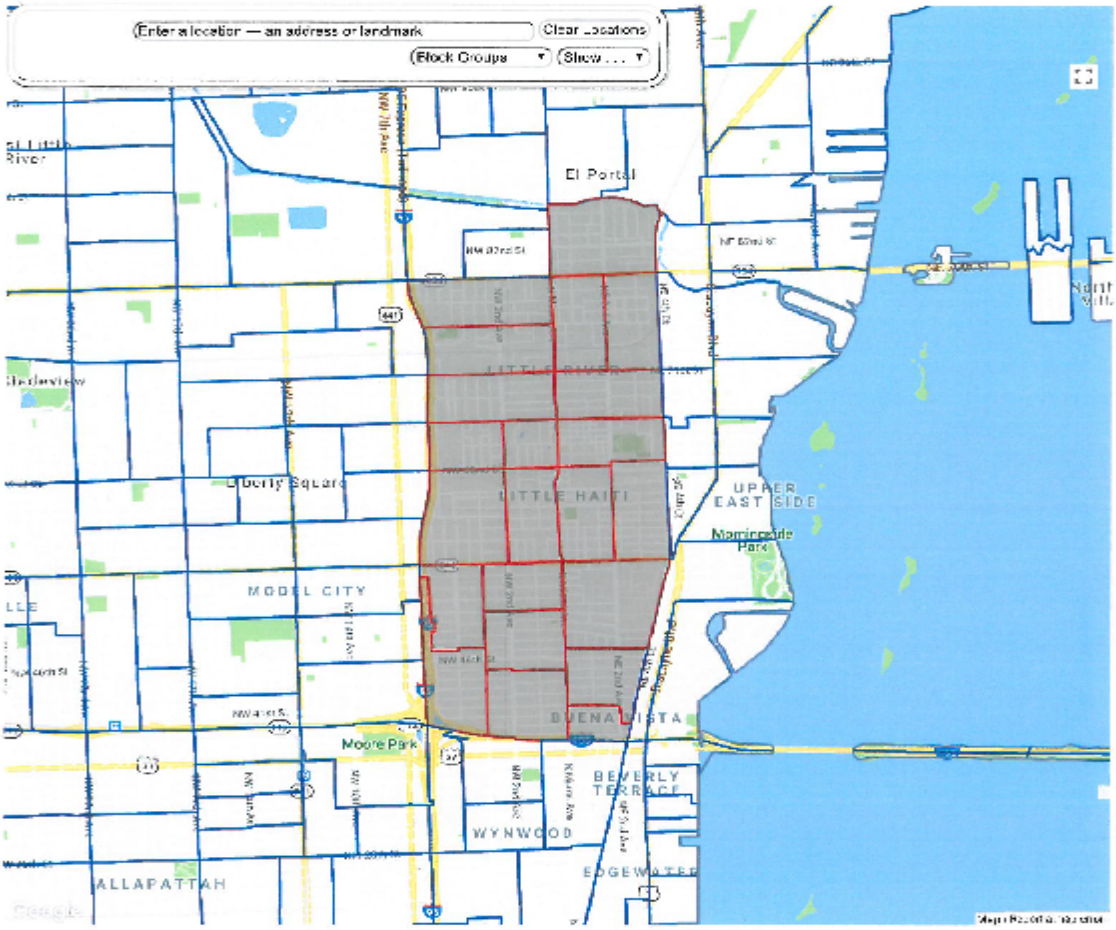
Strategic Miami Area Rapid Transit (SMART) Plan
Table of Organization



(MPO) Miami-Dade Metropolitan Planning Organization
(CITT) Citizens Independent Transportation Trust
(DTPW) Miami-Dade Department of Transportation and Public Works
(FDOT) Florida Department of Transportation
(FHWA) Federal Highway Administration
(FRA) Federal Railroad Administration
(FTA) Federal Transit Administration
(MDX) Miami-Dade Expressway Authority
(RER) Miami-Dade Regulatory & Economic Resources
(SEFTC) Southeast Florida Transportation Council
(SFRC) South Florida Regional Council
(SFRTA) South Florida Regional Transportation Authority

Appendix F

Little Haiti Neighborhood Map



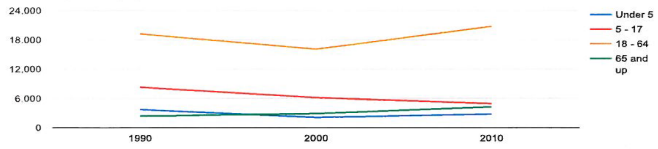
Appendix G

Customized Community Background Report – Little Haiti

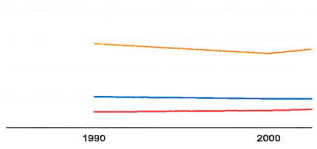
Demographics

Miami-Dade County Block Groups: 120860022011, 120860020032, 120860020031, 120860020042, 120860014011, 120860014023, 120860014021, 120860022023, 120860022022, 120860022021, 120860022025, 120860020041, 120860020011, 120860014012, 120860014013, 120860022013, 120860022024, 120860022012, 120860020014, 120860020013, 120860020012, 120860014022

Population by Age



Housing Units



Age * Race Ethnicity Education Tenure Income Nativity

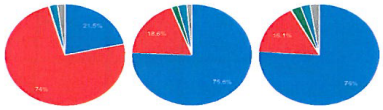
Housing Units * Households Vehicle Ava

Data from 2010 Census, unless otherwise noted.
Race and Ethnicity in the 2010 Census

Statistic	Area of Interest	Miami-Dade County	Florida
Total Population	32547	2639042	19645772
Land Area (sq. mi.)	2.93	1897.72	53668.20
Water Area (sq. mi.)	0.01	533.47	8017.07
Population per Square Mile	11065.51	1085.50	318.48
Households	10215	842153	7300494

	Area of Interest	County	Florida
	1.23% of County	13.43% of Florida	
	0.15% of County	3.54% of Florida	
	0% of County	6.65% of Florida	

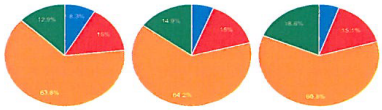
Race	Area of Interest	Miami-Dade County	Florida
White	6983 (21.46%)	1999090 (75.75%)	14934702 (76.02%)
Black	24075 (73.97%)	491978 (18.64%)	3171108 (16.14%)
Native	48 (0.15%)	4001 (0.15%)	54569 (0.28%)
Asian	36 (0.11%)	41871 (1.59%)	509085 (2.59%)
Pacific	0 (0%)	612 (0.02%)	11024 (0.06%)
Other	740 (2.27%)	64010 (2.43%)	493202 (2.51%)
Multiple Races	665 (2.04%)	37480 (1.42%)	472082 (2.4%)



Ethnicity	Area of Interest	Miami-Dade County	Florida
Not Hispanic	25578 (78.59%)	907309 (34.38%)	14985039 (76.28%)
Hispanic	6969 (21.41%)	1731733 (65.62%)	4660733 (23.72%)
Diversity Index	60.58	66.54	61.34

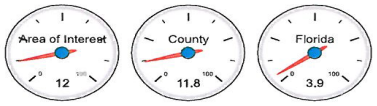
Hispanic Percent

Age	Area of Interest	Miami-Dade County	Florida
Age 0 to 4	2706 (8.31%)	154842 (5.87%)	1081057 (5.5%)
Age 5 to 17	4878 (14.99%)	395858 (15%)	2960066 (15.07%)
Age 18 to 64	20765 (63.8%)	1694868 (64.22%)	11953658 (60.85%)
Age 65 and Over	4198 (12.9%)	393474 (14.91%)	3650991 (18.58%)

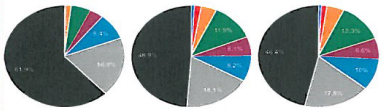


Language 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE
Non English speaking over 5 years old	3595 (12.05%)	536 (3.00)	294109 (11.84%)	38113 (3.20)	731038 (3.94%)	209314 (1.07)
N.E. Spanish speaking	1432 (4.8%)	570 (1.65)	273085 (10.99%)	77255 (1.70)	598746 (3.22%)	305224 (1.62)
N.E. Other Indo-European	2958 (9.91%)	996 (2.69)	24316 (0.98%)	30676 (1.21)	109108 (0.59%)	203825 (1.10)

Non English speaking Percent



Education 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE
Doctorate	9 (0.03%)	287 (0.88)	21291 (0.81%)	36623 (1.39)	154629 (0.79%)	251737 (1.28)
Professional	111 (0.34%)	332 (1.02)	48356 (1.83%)	52832 (2.00)	274741 (1.4%)	320412 (1.63)
Master	467 (1.43%)	645 (1.98)	110663 (4.19%)	85799 (3.25)	932223 (4.75%)	621327 (3.16)
Bachelor	1733 (5.32%)	1407 (4.32)	314713 (11.93%)	168090 (6.35)	2418555 (12.31%)	1110789 (5.64)
Associates	1171 (3.6%)	1049 (3.22)	160206 (6.07%)	117363 (4.44)	1296844 (6.6%)	828511 (4.21)
Some College	2750 (8.45%)	1638 (5.03)	217658 (8.25%)	142525 (5.39)	1969869 (10.03%)	1071680 (5.44)
High School	6155 (18.91%)	2736 (8.39)	476658 (18.06%)	234806 (8.87)	3491793 (17.77%)	1542201 (7.82)
Below High School	20151 (61.91%)	652 (0.56)	1289497 (48.86%)	40388 (2.47)	9107118 (46.36%)	244415 (2.10)

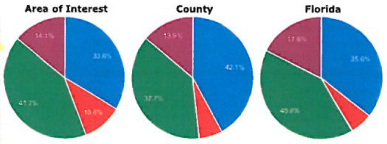


Income 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE
Average Per Capita Income	$ 15991.28	5671.84	$ 28823.6	9733.98	$ 32305.06	9072.42
Poverty (Population earning less than $21286 or less than 1.25 times poverty threshold)	12770	5813	530006	327461	3180109	2046494
Poverty Percent (of total population)	40.31%	15.05	20.4%	11.41	16.54%	9.96

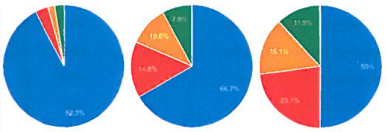
Poverty Percent

Employment 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE

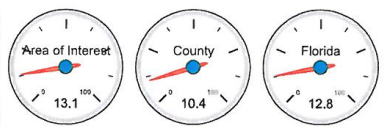
Statistic	Area of Interest		Miami-Dade County		Florida	
Civilian Employed	8605 (33.59%)	4223 (14.13)	905282 (42.06%)	379598 (13.99)	5719260 (35.57%)	2436953 (13.05)
Unemployed	2725 (10.64%)	286 (2.91)	133338 (6.19%)	22250 (1.89)	915976 (5.7%)	178704 (1.66)
Armed Forces	0 (0%)		1770 (0.08%)	108860 (5.06)	53414 (0.33%)	737685 (4.59)
Not in Labor Force 16 - 64	10680 (41.7%)	3745 (10.12)	812417 (37.74%)	295230 (9.76)	6567097 (40.85%)	2026912 (8.97)
Not in Labor Force 65 up	3604 (14.07%)	1064 (2.14)	299589 (13.92%)	2514 (3.56)	2822031 (17.55%)	7087 (3.81)

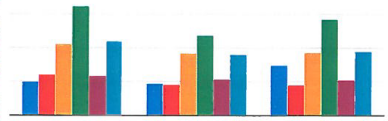


Employed By 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE
For Profit Company	30048 (92.32%)	2345 (6.42)	547814 (66.67%)	6496 (9.97)	626784 (50%)	1351453 (107.24)
Government Agency	1119 (3.44%)	264 (0.80)	121299 (14.76%)	31946 (3.21)	289391 (23.09%)	75611 (3.20)
Self Employed	573 (1.76%)	172 (0.52)	86910 (10.58%)	22467 (2.23)	188991 (15.08%)	49155 (2.06)
Non Profit	784 (2.41%)	243 (0.74)	63972 (7.79%)	16959 (1.71)	144486 (11.53%)	37514 (1.56)
Unpaid Family Worker	23 (0.07%)	1 (0.00)	1726 (0.21%)	343 (0.03)	3916 (0.31%)	274 (0.07)

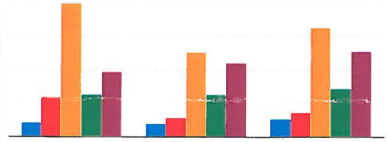


Disabilities 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE
With a disability (civilian noninstitutionalized population)	3759 (13.11%)	1072 (3.30)	258617 (10.44%)	3443 (0.14)	2373359 (12.78%)	10349 (0.06)
With a hearing difficulty	704 (2.45%)	545 (1.87)	57996 (2.34%)	1786 (0.07)	682355 (3.67%)	5908 (0.03)
With a vision difficulty	870 (3.03%)	581 (1.98)	56069 (2.26%)	1856 (0.07)	420867 (2.27%)	4940 (0.03)
With a cognitive difficulty	1512 (5.27%)	750 (2.52)	113486 (4.58%)	2537 (0.10)	862718 (4.65%)	7397 (0.04)
With an ambulatory difficulty	2306 (8.04%)	851 (2.77)	145923 (5.89%)	2640 (0.11)	1319393 (7.1%)	7706 (0.04)
With a self-care difficulty	832 (2.9%)	540 (1.84)	65935 (2.66%)	1951 (0.08)	489545 (2.64%)	5377 (0.03)
With an independent living difficulty	1565 (5.46%)	725 (2.42)	110971 (4.48%)	2356 (0.10)	872255 (4.7%)	6688 (0.04)

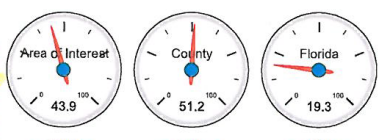


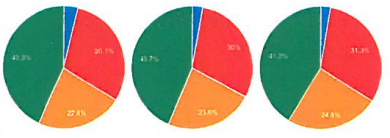


Age 5 to 17 with a disability	171 (0.6%)	246 (0.85)	14083 (0.57%)	931 (0.04)	148496 (0.8%)	3253 (0.02)
Age 18 to 34 with a disability	505 (1.76%)	442 (1.52)	21085 (0.85%)	1274 (0.05)	204258 (1.1%)	4139 (0.02)
Age 35 to 64 with a disability	1710 (5.96%)	699 (2.30)	94125 (3.8%)	2297 (0.09)	908328 (4.89%)	6531 (0.04)
Age 65 to 74 with a disability	542 (1.89%)	373 (1.28)	46425 (1.87%)	1345 (0.05)	396214 (2.15%)	3938 (0.02)
Age 75 and Over with a disability	829 (2.89%)	450 (1.52)	82204 (3.32%)	1493 (0.06)	706762 (3.81%)	4564 (0.02)

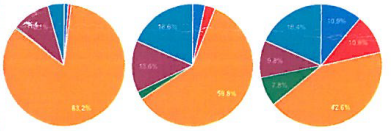


Foreign Born 2008-2012 ACS	Area of Interest	MOE	County	MOE	Florida	MOE
Foreign Born	12857 (43.86%)	2890 (7.93)	1286234 (51.2%)	7127	3644332 (19.3%)	13313
Naturalized Citizens	4785 (37.22%)	1390 (6.85)	652584 (50.74%)	6547 (0.42)	1795709 (49.27%)	12091 (0.28)
Not US Citizens	8070 (62.77%)	2646 (14.98)	633650 (49.26%)	8840 (0.63)	1848623 (50.73%)	15619 (0.39)
Under 18	875 (6.81%)	607 (4.47)	68882 (5.36%)	2159 (0.17)	217673 (5.97%)	3869 (0.10)
18 and up	11981 (93.19%)	2147 (26.79)	1217352 (94.64%)	5411 (0.67)	3426659 (94.03%)	11176 (0.46)
Entered 2010 or later	490 (3.81%)	537 (4.09)	34450 (2.68%)	2308 (0.18)	97255 (2.67%)	4044 (0.11)
Entered 2000 - 2009	3864 (30.05%)	1896 (13.11)	386102 (30.02%)	7459 (0.56)	1141269 (31.32%)	12410 (0.32)
Entered 1990 - 1999	2937 (22.84%)	1213 (7.91)	303677 (23.61%)	6078 (0.45)	902732 (24.77%)	10497 (0.27)
Entered Before 1990	5563 (43.27%)	1416 (5.17)	562005 (43.69%)	6137 (0.41)	1503076 (41.24%)	9563 (0.21)

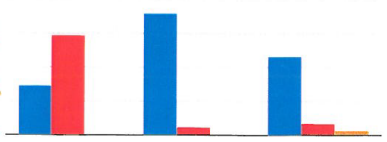




from Europe	151 (1.17%)	184 (1.41)	40532 (3.15%)	1725 (0.13)	379850 (10.4%)	5782 (0.15)
from Asia	98 (0.76%)	180 (1.39)	34794 (2.71%)	1164 (0.09)	366049 (10.04%)	4467 (0.12)
from the Caribbean	10603 (82.47%)	2622 (8.50)	760713 (59.14%)	7295 (0.46)	1477732 (40.55%)	10322 (0.24)
from Mexico	51 (0.4%)	159 (1.23)	26850 (2.09%)	2098 (0.16)	270146 (7.41%)	6476 (0.18)
from other Central America	1289 (10.03%)	806 (5.85)	173714 (13.51%)	4985 (0.38)	339671 (9.32%)	7416 (0.20)
from South America	557 (4.33%)	439 (3.27)	236165 (18.36%)	5221 (0.39)	637134 (17.48%)	9001 (0.24)



LEP Spanish speaking	1858 (14.48%)	872 (5.97)	459462 (35.85%)	6325 (0.45)	839423 (23.13%)	9489 (0.25)
LEP Other Indo-European	3780 (29.46%)	1406 (8.73)	30189 (2.36%)	1860 (0.14)	127162 (3.5%)	3688 (0.10)
LEP Other	0 (0%)		3727 (0.29%)	574 (0.04)	47582 (1.31%)	2209 (0.06)
below poverty Naturalized	1733 (6.07%)	828 (2.78)	95207 (3.86%)	2953 (0.12)	225422 (1.22%)	4477 (0.02)
below poverty Not US Citizen	3855 (13.5%)	1969 (6.66)	153964 (6.25%)	5778 (0.23)	433964 (2.35%)	9137 (0.05)



Housing	Area of Interest	Miami-Dade County	Florida
Total Housing Units	12023	998833	9094999

Portfolio Conclusion

I am grateful for the broad range of environmental topics that I learned about in the EVST program. My studies at UM led me toward a more focused professional goal, which is to be involved in creating resilient and sustainable transportation systems at the local or regional levels through long range transportation and land use planning. Going forward into the professional world, I would like to enhance my education with some specific skills training, such as improving my GIS skills and eventually, with the proper amount of experience, achieving American Institute of Certified Planners (AICP) certification.

In November 2017, I was hired by the City of The Dalles, Oregon as a Land Use Planner. I spent six months learning as much as possible about land use planning. The majority of my work was current planning, such as reviewing and issuing residential building permits and commercial sign permits, as well as reviewing applications for minor partitions, property line adjustments, conditional use permits, home business permits, and vacation rental permits. It helped me gain a much better understanding of how land use planning interacts with transportation planning. It has been a very important experience in my professional development and has provided a foundational understanding of land use planning. In May of 2018, I was hired as a Planner for the Broward County Planning Council in Fort Lauderdale, Florida. The focus of my new job will be long range planning, more along the lines of the work I did for the Missoula MPO.

My work on this portfolio project, and in the EVST program in general, has set me up for success in ways I never could have imagined. My foundational understanding of environmental issues serves as the bedrock for all of my current and future professional work. Because of the EVST program, I will always look at the world through the lens of environmentalism and what I learned in my time in Missoula.

In reflecting on specific takeaways from each portfolio piece, the number one skill that I learned and honed in the literature review that I wrote for Len Broberg's Scientific Approaches class was interpreting and understanding scientific research. I do not have a strong science background (I am more of a policy wonk) so this paper really challenged my ability to read technical scientific papers and synthesize the information into a digestible format for the consumption of "non-scientists". I very much enjoyed the challenge and I think that this paper alone has done wonders for my ability to be a science communicator.

The Russell Street environmental justice critique was the first big paper I wrote in graduate school and the first paper I wrote after an 8-year gap in my academic life. The learning curve was steep, and getting back into the academic frame of mind was not easy. My biggest takeaway from the project was the exposure to the profound complexity of environmental and social impacts due to transportation development. Concepts like induced demand and level of service and road diets were all learned in the writing of this paper. I credit much of my education on these technical transportation terms to Bob Giordano of the Missoula Institute for Sustainable Transportation.

The Missoula MPO internship and the mode share project is what made me curious about a future in the field of planning. The big takeaway from this experience is that it made me believe in the possibility of change being affected from the "inside". As an active transportation advocate, I'd always felt like I was on the outside looking in, unable to make any real decisions that would impact peoples lives in a way that was more far-reaching than just one individual at a time. With the discovery of transportation planning, I was optimistic about the possibility of creating change. It inspired me to learn more about the planning profession and really set me on the path I find myself today.

The Miami case study seems to me a logical movement forward, considering the three previous papers. After writing the Russell Street paper in particular, I could not help but wonder what public outreach strategies *actually worked.* If a large and influential group of citizens could not influence the appropriate decision-making agencies, well then what could? And as I worked on the Mode Share White Paper for the Missoula MPO, I found myself thinking about what role the public had in the development of mode share goals. But it was a question that I never asked, nor did any of my supervisors. It seemed to me that procedural equity was always missing to some degree, and never really prioritized. The Miami piece is an attempt to understand how planners reach out to the public and what techniques they use in the pursuit of procedural equity. I learned that procedural equity is very hard to qualify and evaluate. But as a practicing planner myself, this exploratory paper was useful in helping me develop my own ways of thinking about public participation and how I, as an individual, can practice my own form of advocacy planning in the interest of advancing procedural equity.

This portfolio project has helped me crystallize a number of important themes and concepts on transportation equity. I believe that this portfolio also demonstrates a sound understanding of the social and environmental issues we face in our current (and future) transportation systems and offers reasonable and thoughtful, collaborative, and equitable approaches to solving these problems via multimodal transportation options. I also think it is important to note that this portfolio by no means comprehensive. One could spend a life's work exploring the subject of transportation equity and justice.

I think it is also important to briefly address the elephant in the room, and that is the rapid advancement of technology that has led to innovations like electric and autonomous vehicles, as well as the ridesharing economy. These emerging technologies will no doubt have profound impacts on the way we travel, not to mention unanticipated secondary and cumulative impacts that even the best planners and researches are unable to predict. However, no matter what the future of transportation looks like, one thing that I believe will remain constant is the need for voices speaking truth to power and seeking fairness in our transportation systems. Thus, equity and justice remain timeless values in the face of an uncertain transportation future in the United States.

If this portfolio can contribute in any way to highlighting the importance of transportation equity and justice in the United States, my time will have been well spent.