State of

TRANSPORTATION PLANNING 2020

Moving People Over Cars:
Mobility for Healthy Communities

APA Transport

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We are pleased to be your publishing team for the State of Transportation Planning 2020.

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Letter from the Editors

Mark Bennett & **Cat Callaghan** AIA, AICP-C
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Every two years, the American Planning Association publishes the State of Transportation Planning, providing a platform for transportation planners, researchers and advocates to highlight innovative ideas, emerging research, current issues, and success stories.

In 2020, we find the dominant narrative is one of emerging technologies revolutionizing the transportation field and mobility. As we approached the task of identifying the state of transportation planning, our concern was that this technological hype was distracting us from a more important revolution taking place. Concerned as well that transportation planning in America has too often been a car-centric issue, we sought to center it instead on people and on health. And so, we asked planners to redefine the next era of people-focused and health-focused transportation planning.

So, how do we define health? Health is personal, it's community-wide, and it's global. A health-centered approach examines both how systems can harm and improve health. We also asked planners to consider issues of equity, advocacy, climate change, land use, goods movement and, yes, emerging technology. "Moving People Over Cars: Mobility for Healthy Communities" was the charge we sent out the transportation planning community, and we found we were far from the only ones looking for a different conversation. We received more submissions than we expected, and we're proud to present a new platform for this conversation.

The 2020 State of Transportation Planning is a collection of 35 articles by more than 60 authors from 15 states as well as from outside the US. This report spans from the deserts of the Coachella Valley, to the mountains of Oregon, to the busy streets of Chicago, to

the shores of Tampa. In this report, you will find articles from professional planners, researchers, advocates and students. This report has original research, first-hand accounts of successful planning practices, and thought pieces on community needs and the evolution of the practice. All articles went through a rigorous peer review process, but we also sought to keep each author's voice and opinions. We hope this report serves as a useful and insightful tool with lessons for transportation planners and students across the country. This report does not include every voice, so we hope that this will spark new conversations to fill those gaps.

"Mobility for All" is the first chapter, and it embodies the hope we have going forward as transportation planners. As cities and technology evolve and new challenges emerge, we believe it is more important than ever to take a people-centered, health-centered approach to create systems that provide strong, healthy, and equitable mobility for all. When we asked planners to share their visions for the state of transportation planning, we found that there is, in fact, a revolution happening. But what you'll read in this report is not a revolution fueled by technology alone, but a people-first, health-focused, equity-centered, climate-conscious revolution.

This is the state of transportation planning in 2020.

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MOBILITY FOR ALL

Defining Equity for Transportation Project Evaluations

Rachel Om

Transportation equity has been researched and written about in academia for several decades, but transportation equity guidelines and frameworks designed for implementation have grown in popularity in the last decade. Many of these guidelines and frameworks provide workflows and metrics to plug into planning processes and projects. However, setting a goal or benchmark to achieve an equity-based metric is based on how equity is defined. Therefore, clearly defining equity is important to identify meaningful goals and performance metrics for transportation project evaluations. This study provides an overview of how the role of equity has evolved over time in the United States and summarizes several equity definitions that are relevant to transportation.

In the United States, the incorporation of equity into transportation planning has received growing attention since the 1960s through several federal policies:

- Title VI of the Civil Rights Act of 1964 prevents programs and activities receiving federal funding, such as public transportation services, from discriminating against people based on race, color, or national origin.
- The Americans with Disabilities Act (ADA) of 1990 ensures equal opportunity and access, such as to a bus stop or train platform, for persons with physical or mental impairments.
- Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," of 1994 requires all federal agencies to incorporate environmental justice into their mission by identifying and addressing the adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.
- The Transportation Equity Act for the 21st Century (TEA-21) of 1998 dedicates funding to improve accessibility and enhance public involvement in planning processes (FHWA 1998).

During the same time period, technological advancements have impacted the creation and collection of data in transportation. Data collection used to be time-consuming and expensive because practitioners manually collected counts and conducted surveys. While these methods are still important, advancements in vehicle telematics (e.g., vehicle tracking), automated counts (e.g., transit passenger counters and video-based intersection counts), and data storage capabilities are expanding the possible types of tracking and analysis in transportation.

In July 2012, President Barack Obama passed the Moving Ahead for Progress in the 21st Century Act (MAP-21), which approved funding for surface transportation programs and requires metropolitan planning organizations (MPOs) to set performance measures and targets. This requirement for MPOs to develop performance metrics for metropolitan transportation plans and transportation improvement programs has trickled down to other city and county transportation projects and plans, regardless of whether they are tied to MPO-distributed funding. Performance measures are also used to efficiently and effectively track budgets that are increasingly limited due to dwindling sources for transportation funding (e.g. stagnating fuel tax revenue). The proliferation of data collection and analysis capabilities, federal policies, and limited resources have made performance measures an expected component of transportation planning.

The rising interest in incorporating equity and performance measures into transportation planning is reflected in the growing number of reports, papers, and guidelines by academic researchers, advocacy organizations, and government agencies. Many of these guidelines and frameworks provide equity-based workflows and metrics to plug in to planning processes and projects. However, a metric isn't useful if it is tracked without a clearly identified goal or benchmark. Therefore, defining equity is imperative to setting goals and identifying meaningful performance metrics for transportation project evaluations. There are multiple definitions of equity, and several that are relevant to transportation are summarized in the table below:

Equity Principle	Definition (transportation context)	Example	Shortcomings
Maximax Principle	Maximizing the average level of access to transportation while maintaining a maximum range of access. In other words, the maximax principle ensures some level of transportation is made available to everyone and the lowest level of access would adjust according to the highest level of access, and vice versa. This principle recognizes differences in the supply and demand of levels of accessibility.	A transportation agency is planning accessibility improvements with a rail station area plan: the agency makes uniform improvements (e.g., paving roads, widening sidewalks, and installing bicycle lanes) throughout the project area unless the range of accessibility exceeds a predefined range. In the latter case, the agency makes improvements in neighborhoods with the lowest level of access to the rail station until the predefined range is achieved.	Defining an acceptable range for the distribution of transportation access is challenging and subjective.
Outcome Equality Principle	Ensuring people have the same level of access to transportation and opportunities regardless of their starting level of access. Achieving outcome equality requires treating people differently for everyone to have the same outcome along a specified indicator.	A transportation agency is planning accessibility improvements with a rail station area plan: the agency ensures all residents within a specified distance from the station (e.g., a half-mile buffer) can reach the station within a specific time frame (e.g., 15 minutes) regardless of their mode (e.g., public transit, auto, walking, or biking).	Even if residents within a half-mile of the transit station can travel to the station within 15 minutes, the transit service may not take some people to their desired destinations. Individual projects exist within a transportation system so when a project is implemented, the overall system changes and the benchmark keeps adjusting.

Equity Principle	Definition (transportation context)	Example	Shortcomings
Basic Needs Principle	Providing a predetermined minimum level of transportation service.	A transportation agency is planning accessibility improvements with a rail station area plan: the agency ensures all bus routes that connect residents to the station within 15 minutes are scheduled to run at least once an hour based on a predetermined threshold that once an hour would meet all needs.	This principle fails to acknowledge that people have different and dynamic needs.
Utilitarian Principle	Achieving the greatest good for the greatest number of people through any distribution that maximizes aggregate welfare.	A transportation agency is planning accessibility improvements with a rail station area plan: the agency conducts a cost-benefit analysis for transportation infrastructure and service improvements around the station. The set of improvements that gets the highest number of people to the station is considered the equitable project.	This principle only looks at a final output (e.g. the number of people who can access a station) without looking at the distribution of access and which residents, such as people who have higher transportation costs due to their limited mobility, are overlooked in the cost-benefit calculation.
Benefit (AKA User-Pays) Principle	The individual pays for one's amount of use or impact on a transportation facility or system	There are many examples of the benefit principle in transportation finance in the United States: • Gasoline tax • Toll lanes • Distance-based transit fare systems	Low-income individuals are disproportionately impacted since the amount they pay is a larger share of their assets compared to higher-income individuals. Furthermore, given the patterns of land use and development in many parts of the United States, low-income individuals often live farther away from job centers or rely on public transit during off-peak times and as a result, travel for longer distances and times.
Ability-to-Pay Principle	The amount an individual pays to use a transportation facility or system is based on one's ability to pay, which is typically calculated based on income.	Many transit agencies in the United States implement the ability-to-pay principle with discounted fares for low-income passengers. Fares are subsidized or free for people who meet certain criteria, such as an income 200% below the Federal Poverty level or a percentage of the area median income.	Determining a "fair" price to pay is a subjective exercise. The administrative time to implement this principle can result in the principle becoming too costly to implement.

Defining equity may feel like an academic exercise, but there is inherently a theory (or combination of theories) of an ideal outcome underlying every policy, program, and metric, even if that theory isn't explicitly defined. Going through a formal exercise of identifying a definition of equity is likely not going to be part of every project. However, understanding the different definitions of equity can help communities develop meaningful metrics and evaluation frameworks that reflect stakeholder priorities and feedback.

In addition to selecting a definition of equity to identify metric benchmarks, there are several themes, or perspectives, to consider when selecting metrics and evaluating transportation projects and policies. Equity can be assessed through the lens of mobility versus accessibility (just outcomes), procedural equity (just processes), and socioeconomic and geographic characteristics (units of comparison).

Mobility and Accessibility

Transportation projects and evaluation programs have historically focused on mobility, which assesses how quickly and how far an individual can travel.[1] Mobility is tracked with indicators such as travel speed and Level of Service (LOS), which inherently favors faster modes (e.g. automobiles) and longer trips. Under a mobility-based evaluation framework, road expansion projects to speed up traffic flow are justified, which consequently makes non-auto modes, such as walking and biking, less desirable.[2] Conversely, active transportation projects, such as adding bike facilities, widening sidewalks, and implementing traffic calming elements (e.g., bulbouts), are evaluated as having a negative impact on mobility because vehicle throughput (i.e., the number of vehicles passing through per hour) decreases.

Accessibility, on the other hand, assesses an individual's ability to reach desired services and activities, and does not favor one mode over another.[3] Accessibility can be defined and evaluated as person-based and place-based. Person-based accessibility assesses the individual's potential for interaction and depends on context, such as the transportation system and land use patterns, and person attributes, such as income, physical ability, and vehicle ownership. Place-based accessibility assesses if a location can be reached by different groups of people and from other locations.[4] There are numerous factors that influence accessibility: individual mobility, connectivity and affordability of the transportation network, geographic distribution of activities, and mobility substitutes, such as telecommunications and delivery services.[5]

An evaluation framework that places more weight on accessibility over mobility is more conducive to being equitable as long as the framework evaluates access to different modes and destinations for a variety of populations at varying times. Accessibility-based analyses do not favor one mode of transportation over another; instead, they acknowledge the myriad factors that influence the ability and ease a person has in moving about the built environment.

Procedural Equity

Public engagement has traditionally taken the form of government agency staff and representatives presenting project alternatives or designs to community members. This approach does not provide meaningful opportunities for stakeholders, particularly community members,

1 Martens, Karel. 2016. Transport Justice: Designing Fair Transportation Systems.

2 Litman, Todd. 2019. "Evaluating Transportation Equity."

3 Litman.

4 Martens.

5 Litman.

to influence outcomes.[6] In the United States, an equitable transportation planning process is one that prioritizes meaningful public engagement because low-income communities and communities of color have historically suffered disproportionately from transportation-related pollution, high costs, and lack of access to safe and reliable transportation options.[7] There are several facets of community engagement that should be considered to achieve procedural equity, such as transparency, physical accessibility (of the building where the engagement event is held, and of the neighborhood relative to where marginalized populations live), and language accessibility.

Units of Comparison

There are multiple factors that shape how benefits and burdens are distributed and how people experience disadvantages in accessing and using the transportation system. Comparisons for level of access can be made through two broad themes: demographic factors and geography.

Most standard equity analyses identify target populations through demographic factors that have been identified as contributors to "neighborhood effects,"[8] such as the proportion of people of color, the number of recent immigrants and single-parent households, and income.[9] Individuals can also face barriers to accessing and using the transportation system because of their level of mobility related to car ownership and/or physical limitations, such as use of a wheelchair or visual or hearing impairment.[10]

Disadvantaged populations can also be identified through geographic comparisons within and across neighborhoods. Comparing transportation access between neighborhoods is a common approach since there are clear differences in proximity to and quality of the transportation system. Assessing intra-neighborhood differences, however, can reveal challenges specific populations face within a neighborhood and illustrate the different types of disadvantages in accessing the transportation system.[11] For example, assessing intermodal equity within a neighborhood would involve looking at car ownership, public transit affordability, quality of transit service, the number of jobs accessible by car and transit, and if residents are qualified for the jobs they can access (i.e., spatial mismatch).[12]

Meaningfully incorporating equity into transportation projects is a nuanced and very context-specific endeavor that requires collaborating with community stakeholders to develop evaluation programs that reflect the concerns and priorities of those stakeholders. The various definitions and perspectives of equity illustrate the implications of choosing one definition over another definition. Despite well-intentioned efforts to include comprehensive and meaningful metrics, a performance-oriented approach inherently has inequitable aspects because calculating and tracking metrics is a quantitative exercise to easily observe change over time. While metrics are useful to track a wide range of specific transportation project impacts, such as health outcomes and access to economic opportunities, transportation projects also have

6 Karner, Alex, and Richard A. Marcantonio. 2018. "Achieving Transportation Equity: Meaningful Public Involvement to Meet the Needs of Underserved Communities."

7 Creger, Hana, Joel Espino, and Alvaro S. Sanchez. 2018. "How to Make Transportation Work for People."

8 Sampson, Robert. 2012. "Chapter 2: Neighborhood Effects: The Evolution of an Idea," in Great American City: Chicago and the Enduring Neighborhood Effect.

9 Karner, Alex, and Deb Niemeier. 2013. "Civil Rights Guidance and Equity Analysis Methods for Regional Transportation Plans: A Critical Review of Literature and Practice."

10 Litman.

11 Karner and Marcantonio.

12 Martens, Karel, Aaron Golub, and Glenn Robinson. 2012. "A Justice-Theoretic Approach to the Distribution of Transportation Benefits: Implications for Transportation Planning Practice in the United States."

broader, intangible, and qualitative impacts on communities. A transportation project, such as a repaving program, may seem straightforward and require metrics for tracking the paving schedule and budget. However, communities that have historically received little to no engagement from their local government may perceive this project as another example of entities in power, which do not include community members, making decisions about their neighborhood. Practitioners can attempt to incorporate the qualitative impacts of a project by including more complex metrics, such as building an index using multiple indicators, to try to capture a more holistic picture of project impacts. Including another metric, regardless of the level of complexity, is still a metric; therefore, the most equitable approach is to work with the community to determine what a successful project would mean to different community members.

Incorporating equity as an inherent component of transportation projects and their evaluations will continue to gain importance as technological advancements change the transportation field. The transportation landscape is becoming increasingly multimodal with many transportation services relying on smartphones and cashless payment systems, which exclude individuals who cannot afford smartphones and data plans and/or are unable to access bank accounts. Technological advancements are also changing the locations and types of jobs and housing markets, with many low-income people having to travel farther to reach job centers. These trends highlight the importance of incorporating equity into transportation project evaluations by considering how the benefits and burdens of transportation investments are distributed across communities. The theoretical definitions of equity require someone to subjectively identify an acceptable level of access or a base level of need, which is a challenging task for transportation practitioners who have to synthesize community concerns, agency goals, and politics, with limited timelines and budgets. When it comes to equity, it is important to remember that context is always key. Each definition of equity can be relevant or appropriate depending on the situation, so there isn't necessarily one "right" or "best" definition of equity.

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Rachel Om is a transportation planner at Fehr & Peers with experience in long-range bicycle planning, transit operations, safety and complete streets, and data analysis and visualization. Prior to joining Fehr & Peers, Rachel worked for the San Francisco Municipal Transportation Agency and the Alameda County General Services Agency. She also worked at the UC Berkeley Center for Community Innovation where her research focused on the intersection between transportation and land use.

Integrating Equity into MPO Project Prioritization

Kristine M. Williams, AICP**, Jeff Kramer**, AICP**, Yaye Keita**, Ph.D. **& Tia Boyd**

Starting in the 1960s, the U.S. Congress required that a formal continuing, comprehensive, and cooperative (3-C) transportation planning process be implemented at the metropolitan level to guide the planning and programming of federal transportation funds. In the 1970s, Congress required the formation of transportation decision-making agencies (called metropolitan planning organizations or MPOs) to carry out the 3-C process. All Census-defined urbanized areas with a population greater than 50,000 are required to be covered by an MPO process. MPOs are typically comprised of representatives of local-general purpose governments (municipalities and counties), officials of public agencies that administer or operate major modes of transportation (transit, airport, seaport, expressway, etc.), and appropriate state officials. This governance structure is required in areas where the urbanized area populations exceed 200,000.

While MPOs have a variety of planning and programming responsibilities under federal (and sometimes state) law, their most significant responsibilities include developing the long-range transportation plan (LRTP) and the transportation improvement program (TIP). When developing and updating these (and other) plans and programs, MPOs prioritize and select transportation projects and services to be funded using federal (and sometimes state) funds. These prioritization and selection processes are used to identify projects and services that will be included in the cost feasible LRTP and the TIP, as well as other special programs depending on the MPO (e.g., programs focused on economic development, complete streets, safe routes to school, bicycle and pedestrian infrastructure, and more).

MPOs across the U.S. are increasingly seeking to advance equity in their planning and project selection processes. These efforts are driven both by federal laws and directives and by a moral imperative to more proactively address the transportation needs of historically underserved communities. These communities of concern relative to transportation equity include, but are not limited to, low-income communities, minority groups, persons with disabilities, and those with limited English proficiency (LEP).

Equity is being advanced by MPOs through efforts to identify and fund projects that best serve the needs of communities of concern (COCs), as well as efforts to avoid or mitigate cumulative adverse impacts or burdens of proposed projects on these communities. This is accomplished in project evaluation and prioritization through a variety of methods, such as targeted public involvement; holistic and community-based needs

assessments; evaluations of the distributional equity of investments; scoring and weighting; and comparative evaluation of performance measures and targets specific to equity objectives.

This article reviews highlights of a national study of practices used by MPOs to integrate equity into project prioritization. The study, funded by the Center for Transportation Equity Decisions and Dollars (CTEDD), is based on a review of project prioritization practices of thirty-five MPOs across the U.S., including sixteen in Florida. A goal of the study was to identify the national state of the practice, as well as current Florida practices, for advancing equity in project evaluation and prioritization. Below are some highlights from the final Integrating Equity into MPO Project Prioritization report.

Identifying the Target Populations

Although prioritization methods used by MPOs to address equity vary widely, a common first step in project prioritization typically involves defining, profiling, and mapping the locations of COCs. This step involves the use of geographic information systems (GIS) and setting thresholds or applying other analysis methods to identify where the target populations are located and areas of greatest concentration, as discussed below.

Defining Communities of Concern

Minority, low-income, and LEP populations are most commonly considered when defining COCs due to their identification as protected populations under Title VI and the Environmental Justice (EJ) and LEP Executive Orders. Persons with disabilities are also typically considered in light of the Americans with Disabilities Act. In addition to these groups, many MPOs are broadening their equity analysis to ensure that it addresses the needs of other groups that are or may be transportation disadvantaged. These groups will differ based on regional demographic conditions and may include lower income youth (<18) and seniors (65+), zero-vehicle households, female-headed households, single-parent families, and specially calculated variables, such as cost-burdened renters.

A broader definition of COCs helps achieve a more inclusive equity analysis that can demonstrate need across a variety of different populations. Because these different populations may have unique needs, it is advisable to consider profiling them separately, as well as together with other COCs. This allows MPOs to consider the unique needs of individual groups during project evaluation and prioritization.

Developing Community Profiles

Community profiles represent how a given MPO identifies disadvantaged areas or areas with a higher proportion of COCs for the equity analysis. Three main approaches to developing community profiles were identified through this research:

1. The population-weighted approach generates a dot for the weighted mean of a particular demographic variable for the entire study area, instead of by census tracts, census block groups, or traffic analysis zones (TAZs). For example, one dot is equal to fifteen low-income people based on actual locations.

2. The community-based approach is a self-identification process in which COCs identify their locations in the planning region.

To view a full copy of the Integrating Equity into MPO Project Prioritization report, visit: https://ctedd.uta.edu/wp-content/uploads/2020/01/kris_final.pdf

3. The third and most commonly used method is the threshold-based approach. This approach identifies areas with higher concentrations of COCs than the regional threshold based on rates, standard deviations, z-scores, percentages, ratios, or densities. These determinations are typically based on available decennial census tract data (census tract), American Community Survey (ACS) data (census block group), TAZ data from models, or information from travel surveys.

Mapping Communities of Concern

To visualize the distribution of COCs, GIS map(s) are produced using community profiles and other data. Areas with COCs are then considered in relation to project locations. For example, after selecting projects for the Transportation Improvement Program (TIP), the Madison Area Transportation Planning Board (MATPB) overlays mappable projects on maps showing areas with COCs (minority, low-income, and zero-vehicle households). This process enables the MPO to qualitatively assess the distribution of projects and to understand how investments may serve the needs of COCs using proximity and project types. While this step identifies the spatial distribution of projects, additional analysis is needed to determine if projects benefit COCs.

Community Engagement

Engaging community members during the prioritization and project selection processes ensures that the needs of COCs are appropriately understood and addressed. Through meaningful public involvement, underrepresented communities have opportunities for a more active role in both needs identification and project selection. Involving the various communities can uncover needs that may otherwise have been overlooked and identify adverse impacts of projects that may have otherwise been considered beneficial.

For example, the Boston Region MPO hosts a focus group-style open house with transportation equity topic stations where participants can suggest funding allocations for different programs. The Boston Region MPO also meets with organizations and groups who represent the interests of equity populations. The Polk Transportation Planning Organization (TPO), in Polk County, Florida, engages traditionally underserved communities in Neighborhood Mobility Audits - a proactive planning process aimed at identifying projects to enhance mobility in EJ areas. Neighborhood residents are interviewed and directly involved both in defining boundaries for analysis and evaluating the impacts of various projects identified during the audits.

Equity-Based Project Prioritization Practices

MPOs use a variety of methods to assess equity and prioritize projects, such as:

- Holistic approach (qualitative evaluation of individual projects);
- Scoring and weighting (quantitative evaluation of individual projects); and
- Modeling, GIS, and scenario evaluations of groups of projects.

To prioritize individual projects based on equity, some MPOs use what we termed in the study as a holistic approach as opposed to a detailed scoring and weighting system. This approach involves qualitatively evaluating projects through the lens of equity, accessibility, and connectivity. Forward Pinellas, for example, uses this approach to prioritize projects for funding in the TIP. The MPO prioritizes projects that reduce adverse impacts on human health and the environment, as well as based on how well they connect low-income and minority communities to the broader transportation network and nearby activity areas. Additionally, the MPO conducts several

outreach activities targeted at EJ areas to better understand their needs and uses this feedback to ensure that the prioritized projects have positive impacts on these communities. A benefit of this approach over other methods, such as scoring and weighting, is its flexibility in identifying and shaping projects that are of benefit to COCs.

Scoring and weighting are used by many MPOs to evaluate individual projects for prioritization, making it relatively easy to integrate equity criteria into the broader evaluation process. The scores are scaled within a defined range, as seen in Table 1, or using "Yes/No" type scores, making this method somewhat subjective.

Some MPOs use separate scoring systems depending on the project type. The San Diego Association of Governments (SANDAG), the MPO for the greater San Diego region, organizes criteria into three major categories: 1) serves travel needs, 2) develops network integration, and 3) addresses sustainability. While the three categories are used for all projects, the individual criteria vary based on project types. For example, the criteria for highway corridor projects under the sustainability category address the cost-effectiveness of congestion relief, greenhouse gas (GHG) emissions, accessibility to low-income/minority/senior areas, accessibility to federally recognized Indian reservations, and access to jobs. In comparison, the criteria for freight projects under the sustainability category address cost-effectiveness (project lifecycle), community impacts (improves safety, reduces hazards), and environmental/habitat impacts. In addition to variations in the criteria, the weights vary between project types. The sustainability category accounts for 40 percent of the total score for highway corridor projects, whereas it accounts for 35 percent of the total score for freight projects (SANDAG, 2012).

Conversely, some MPOs evaluate projects using the same criteria for different project types, but apply different weights based on the relevance of that criteria to that type of project. In other words, the more important the criterion is for a particular

Table 1: EJ and Health Equity Scoring Criteria and Points for Bike/Ped Projects

8. Environmental Justice and Public Health – 8 Points Total		
Criteria	**Points**	**Scoring Guidelines**
• Environmental Justice The project is located within or improves bicycle/pedestrian/ transit access/mobility for a MPO-defined environmental justice area. [Note: See maps in Attachment D – Environmental Justice Analysis of the Transportation Improvement Program (TIP).]	0 – 4	Maximum points will be awarded for projects located in and directly benefiting an EJ area.
• Public Health The project improves bicycle/pedestrian/transit access to parks/open space, health care or other services, healthy food resources, etc.	0 – 2	Maximum points awarded to projects that will provide improved access to healthy food resources, health care, and active recreation opportunities.
• Health Equity The project is located in or serves an area with health outcome disparities. [Note: See map of areas with high or moderate rates of asthma, childhood obesity, and/or adult diabetes at the following link: http://www.madisonareampo.org/planning/documents/Health_Metrics.pdf]	0 – 2	Maximum points for projects that provide benefits to areas where residents have health outcome disparities.

Source: MATPB, 2018

Table 2: ARC Criteria Weights by Project Type

Criteria	Bike/Ped/Trail	Roadway Asset Management	Roadway Expansion & TSM&O	Transit Expansion	Transit Asset Management & System Upgrades[5]
Asset Management & Resiliency	-	14.9 %	-	-	24.4 % / 22.1 %
Mobility & Congestion	13.7 %	13.8 %	13.0 %	13.5 %	21.6 % / 19.6 %
Safety	14.5 %	14.4 %	13.4 %	8.5 %	13.6 % / 12.3 %
Network Connectivity	14.4 %	12.9 %	12.4 %	13.5 %	-
Reliability	-	-	12.1 %	12.0 %	-
Multimodalism	12.6 %	11.8 %	11.3 %	10.2 %	-
Employment Accessibility	10.4 %	10.2 %	10.3 %	11.6 %	18.6 % / 16.8 %
Land Use Compatibility	11.5 %	-	-	10.5 %	-
Social Equity	9.7 %	8.3 %	7.0 %	9.5 %	15.2 % / 13.8 %
Air Quality & Climate Change	6.3 %	-	7.3 %	6.5 %	0.0 % / 9.4 %
Goods Movement	-	8.1 %	7.8 %	-	-
Cultural & Environmental Sensitivity	6.8 %	5.5 %	5.3 %	4.1 %	6.6 % / 6.0 %

Source: D'Onofrio, 2017

project type, the higher the weight. Table 2 shows an example from the Atlanta Regional Commission (ARC) demonstrating how criteria weights vary by project type (D'Onofrio, 2017). For example, the Social Equity criterion is weighted highest for transit asset management and system upgrades as compared to other project types. It should be noted that, while the Social Equity criterion is comparatively high for transit asset management and system upgrades, it is not the highest weighted criterion for that specific project type.

Some MPOs allocate scores depending on whether the project serves a local or regional function. Community projects tend to have localized benefits (e.g., connecting neighborhoods to nearby activity centers), whereas regional projects benefit a broader populace (e.g., commuter rail or highway expansion projects connecting exurban areas to job centers). For example, the Sarasota-Manatee MPO scores and then weights projects using several designations: community, regional, inter-regional, and active transportation plan. Although each planning goal receives the same maximum number of points for each designation, they carry different weights based on project type, as seen in Table 3. For example, the environment/livability planning goal accounts for 25% of the total score for community projects, versus 10% of the total score for regional projects. The environment/livability factors, which were being revised at the time of our study, emphasize multimodal projects

Table 3: Sarasota-Manatee MPO Revised Prioritization Weights

Goal	Weights			
	Community	Regional	Inter Regional	ATP
Safety/Security	40%	25%	25%	40%
Economy/Freight	4%	10%	15%	5%
Mobility/Congestion/Reliability	6%	30%	40%	15%
Environment/Livability	25%	10%	4%	30%
Infrastructure Condition	15%	15%	8%	5%
Project Delivery	10%	10%	8%	5%

Source: Sarasota-Manatee MPO, 2019

that provide improved access for low-income or minority communities, including improved accessibility to transit.

An issue that has been identified in previous research is a tendency by MPOs to characterize projects as having value to COCs based only on proximity. This method, while a helpful start, can overlook issues that may reduce the benefits of the project to the communities in question. To address some of the limitations of proximity-based assessments, some MPOs score projects using multiple factors. The Broward MPO in Broward County, Florida, for example, is developing a new method to score projects using a cumulative scoring process and multiple equity factors. The scores will be normalized and weighted for the MPO's six planning factors based on input from the MPO Board and advisory committees (Broward MPO, 2018). The project selection weighting criteria are shown in Figure 1, and the proposed project evaluation criteria are shown in Table 4.

To achieve compliance with EJ requirements, most MPOs now identify and discontinue projects that have significant adverse impacts on EJ communities. For example, the Lee County MPO on Florida's west coast has a project evaluation criterion called "social-cultural effects/ environmental justice" that considers the negative impacts of road widening projects. During project selection, the MPO reduces scores for any project that creates a possible barrier effect in EJ areas, as shown in Table 5.

Several MPOs also use GIS and travel demand modeling applications to evaluate the equity implications of proposed projects. This typically involves comparing outcomes of a group of projects for COCs and non-COCs using performance measures for the base year and planning horizon. North Central Texas Council

Table 4: Broward MPO Draft Project Evaluation Criteria

Equity Ensuring that benefits and impacts are shared among Broward's population. (Maximum Score = 8) Note: Scores to be normalized to account for variance in maximum points awarded in each prioritization factor group.	Distribution of Transit Service Frequency	+2	Project will add high-quality transit service to multiple new communities.
		+1	Project will add high-quality transit service to one new community.
		0	Project will not add high-quality transit to any new communities.
		-1	Project may degrade transit service to a community.
	Transit Services within Equity Areas	+2	Project will provide more direct transit service between equity area and key activity center(s).
		+1	Project will provide new transit service within equity area.
		0	Project will not provide new transit service within equity area.
		-1	Project may degrade transit service within an equity area.
	Travel Time Savings within Equity Areas	+2	Project may improve peak period travel time between equity area and key activity center(s).
		+1	Project may improve peak period travel times within equity area.
		0	Project has no impact on travel times within equity area.
		-1	Project may degrade travel times within equity area.
	Multimodal Safety within Equity Areas	+2	Project will directly improve safety through improvements at a high-crash location within an equity area.
		+1	Project may directly improve safety through improvements (regardless of existing crash situation) within an equity area.
		0	Project has no impact on safety within an equity area.
		-1	Project may introduce factors (higher speeds, higher traffic volumes, design features) that could adversely impact multimodal safety within an equity area.
	Community Impacts	0	Project has no disproportionate impacts (physical and/or economic) on existing residences or businesses.
		-1	Project may have disproportionate impacts (physical and/or economic) on existing residences or businesses.
		-2	Project may have disproportionate impacts (physical and/or economic) on existing residences or businesses with an equity area.

Source: Broward MPO, 2018 (Partial Table)

Table 5: Lee County MPO Environmental Justice Scoring

Criterion Description	Score
Exceeds 4 lanes in environmental justice area	-10
Exceeds 2 lanes in environmental justice area	-5
Does not impact environmental justice area	1

Source: Lee County MPO, 2015

of Governments (NCTCOG), for example, uses travel demand models to conduct an EJ analysis of the proposed transportation system in the plan (NCTCOG, 2017). After identifying EJ communities, the MPO calculates various accessibility indicators (access to jobs, universities, shopping centers, hospitals, etc.) and congestion metrics for various scenarios (2018 Current Network, 2045 Build Network, 2045 No-Build Network, and 2045 Priced facilities No-Build Network). NCTCOG then compares the results for EJ and non-EJ communities as shown in Table 6.

Equity Assessment of Distribution of Total Investments

After selecting projects for funding, some MPOs evaluate their entire systems and programs to ensure that total investments are serving COCs. Methods used to evaluate the distribution of investments include:

- Population use-based approach that assesses whether COCs are receiving a similar or greater share of investments relative to their share of the total population and total trips.
- Distribution of total investment in COCs and non-COCs using total funding in each area.
- Disparate impact analysis that evaluates funding per capita.
- GIS mapping to visually and qualitatively assess the distribution of projects.

The Capitol Region Council of Governments (CRCOG), for example, uses a regional GIS system

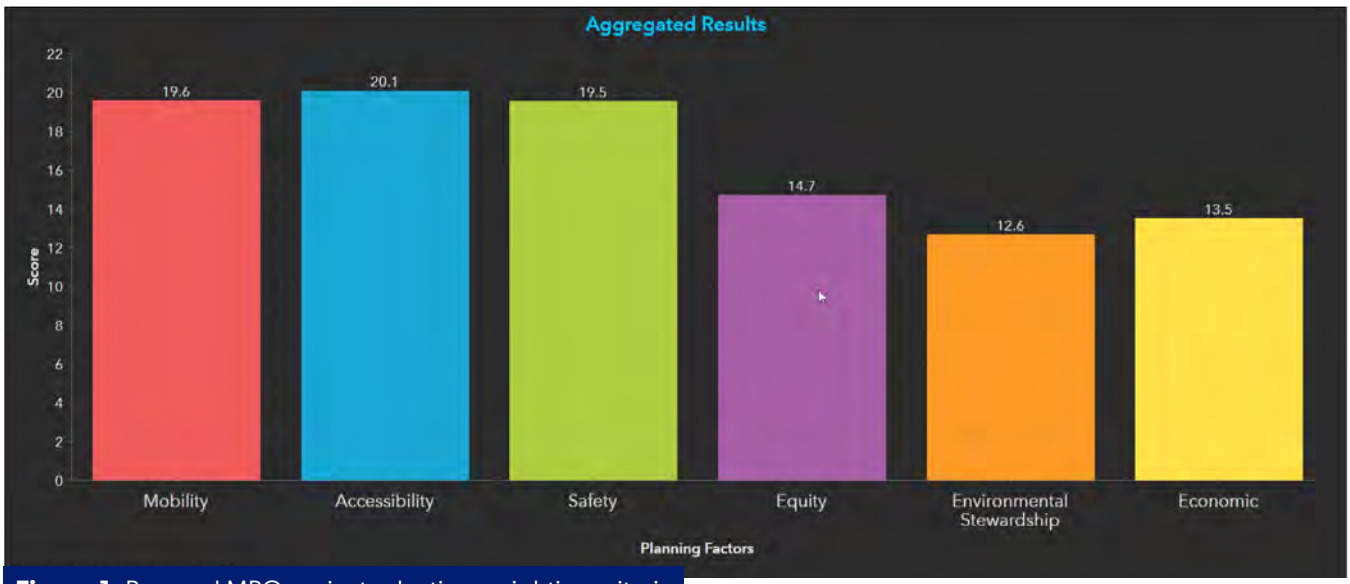

Figure 1: Broward MPO project selection weighting criteria

Source: Broward MPO, 2018

Table 6: NCTCOG Environmental Justice Analysis Results

Performance Measure	Population	2018 Current Network	2045 Build	2045 No-Build	Percent Change (Current vs Build)	Percent Change (Current vs No-Build)	Difference Between Current-Build and Current-No-Build
Protected Population vs Non-Protected Population	Protected	3,998,817	5,555,650	5,555,650			
	Non-Protected	3,430,906	5,690,881	5,690,881			
	Totals	**7,429,723**	**11,246,531**	**11,246,531**			
Number of Jobs Accessible within 30 Minutes by Auto	Protected	676,940	654,315	449,440	-3.3%	-33.6%	30.3%
	Non-Protected	479,778	376,509	244,579	-21.5%	-49.0%	27.5%
	Difference	***197,162***	***277,806***	***204,861***			
Number of Jobs Accessible within 60 Minutes by Transit	Protected	266,545	364,517	232,624	36.8%	-12.7%	49.5%
	Non-Protected	135,427	208,097	96,244	53.7%	-28.9%	82.6%
	Difference	***131,118***	***156,420***	***136,380***			
Percent of Lane Miles Congested	Protected	48%	65%	77%	35%	61%	26%
	Non-Protected	43%	59%	75%	39%	76%	37%
	Difference	***5%***	***6%***	***2%***			

to assess the distribution of funds. This analysis depends on the known service areas of various transit systems. For example, Table 7 shows the equity assessment of the FY2018-2021 TIP for transit projects (CRCOG, 2017).

Another example can be seen in the Pasco County MPO. Transit investments were identified as a priority for COCs in the region, therefore, the MPO seeks to ensure that transit investment is higher in EJ areas, as shown in Figure 2 (Pasco County MPO, 2015, Pasco County MPO, 2019).

Conclusion

Transportation investments shape communities and quality of life by influencing the ability of residents to safely and conveniently access employment, health care, recreation, shopping, and other services. When identifying needs and selecting projects for funding, metropolitan planning organizations (MPOs) must consider multiple factors and balance their investments among competing interests and priorities. Achieving an equitable balance among these factors and interests is critical because of the competitive nature of MPO planning and programming processes and the importance of each factor in enhancing the transportation system of the region. Identifying and selecting projects that promote equity and access to opportunity is essential to address the mobility and accessibility needs of historically disadvantaged populations.

MPOs use a variety of methods to prioritize projects for communities of concern (COCs), including scoring and weighting equity factors as part of prioritization formulas, holistic approaches, and equity assessments and analyses of groups of projects. Each approach has certain strengths and limitations. Mapping is an easy way to visualize projects in relation to COCs, but because all projects are not mappable, this approach cannot be applied to all project types. The holistic

Table 7: CRCOG Equity Assessment for FY2018-2021 TIP

Fund Committed	% of Funds	% of Population	
$ 258,381,055	56.0%	32.3%	Inside Target Area
$ 203,091,404	44.0%	67.7%	Outside Target Area
$ 461,472,459	100.0%		

Source: Lee County MPO, 2015

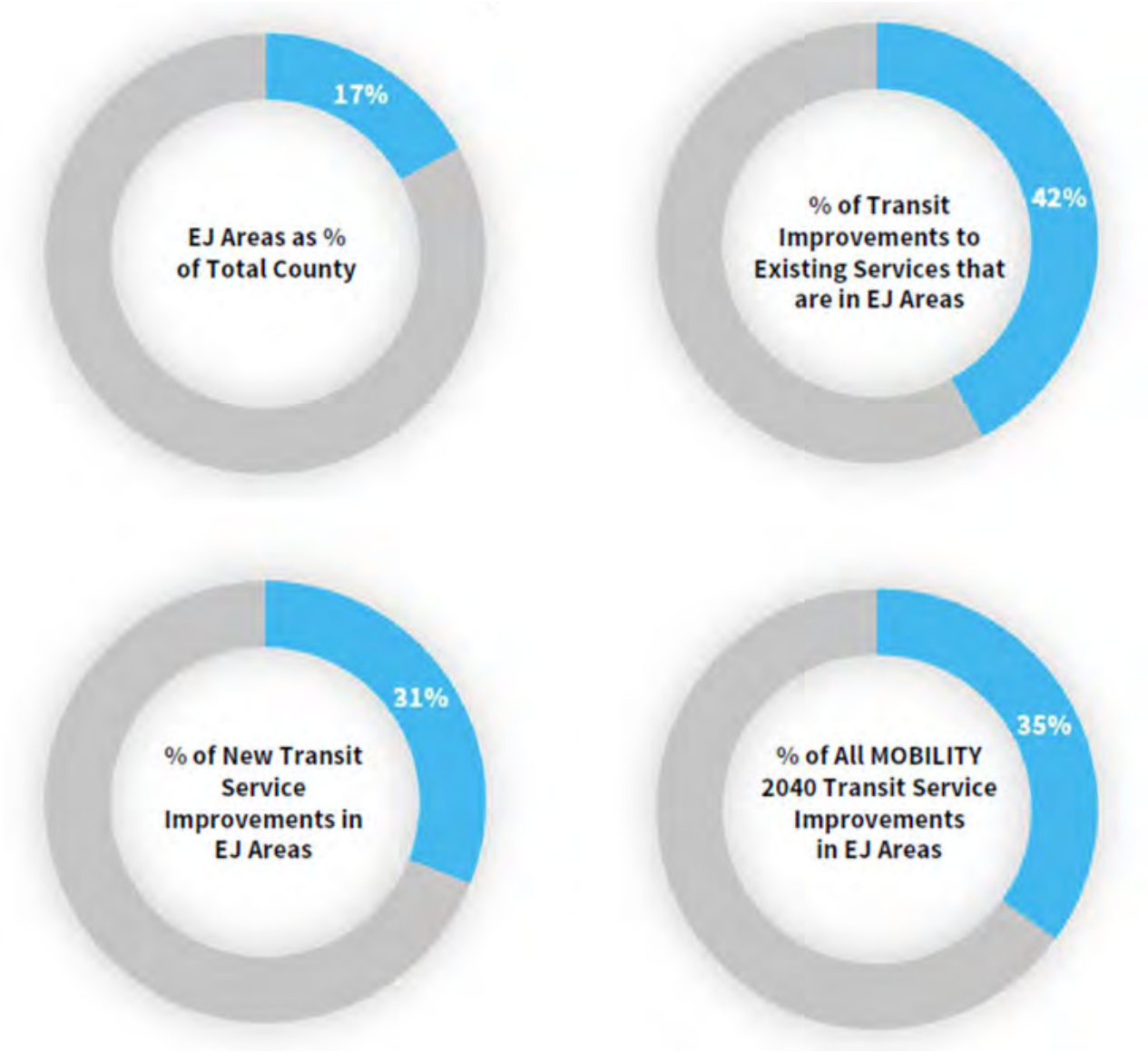

Figure 2: Pasco County MPO investment in EJ areas

Source: Pasco County MPO

approach, while flexible, does not require the use of specific performance criteria or measures, making this approach relatively subjective. Scoring and weighting uses measurable data and produces measurable inputs, but it is data-intensive and less flexible than holistic approaches. Evaluating groups of projects through modeling offers useful insights, but doing so can be challenging for MPOs with limited resources.

A key, if not unexpected, finding of the study is that MPOs that include equity as a vision and explicit goal tend to have robust methods of advancing equity in their planning and prioritization processes. Engaging COCs during project prioritization is also critical to

understanding the actual versus perceived needs of various communities. Transparency of efforts to advance equity in planning and project prioritization is important to building public trust and awareness of the needs of the disadvantaged, who may lack influence in the push and pull of regional politics. Equity strategies should be made obvious in all stages of the planning and programming process. Systematically prioritizing projects for COCs and considering user benefits of projects specific to those populations (regardless of project type or mode) are important in selecting projects that benefit the target communities. Finally, equity should be evaluated from multiple perspectives and specifically with regard to access to opportunity.

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Who Needs the Bus?

Megan Owens

Uber, Lyft, Spin, Bird, Pace, Skip, Jump, Lime . . .

With so many hot four-letter "New Mobility" options popping up in recent years, a simple bus can seem downright old fashioned. And it's true that buses haven't changed much over the last century while so much in our lives has.

Some people argue that it would be cheaper to provide bus riders with their own cars or Uber vouchers than to pay the transit taxes needed to provide quality bus service, especially with autonomous vehicles supposedly right around the corner. While that fantasy may be appealing to the tax-avoidant, facts tell a different story.

Due to spatial, economic, and social realities, bus service will continue to be a vital mobility service for most communities for many decades to come. And that's great news for all of us.

This article summarizes the threat posed to transit by New Mobility, the limitations of these new modes, why buses remain essential, how New Mobility can complement traditional transit, and how to make buses the attractive option they can and should be.

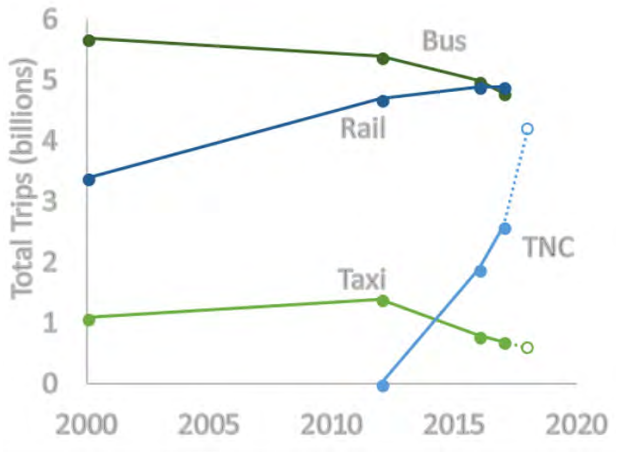
Public transit is threatened by both the fact and the myths of New Mobility.

Bus ridership across the US has been declining since its national peak in 2014, and new options are part of why [1, 2]. In many cities, people who can afford to often choose car ownership or ride-hailing over waiting on infrequent buses. Uber even stated in its Initial Public stock Offering that its growth depends on better competing with public transportation[3].

1 American Public Transit Association, "Understanding Recent Ridership Changes - Trends and Adaptations," April 2018; https://www.apta.com/research-technical-resources/research-reports/understanding-recent-ridership-changes/

2 Graehler, Mucci and Erhardt, "Understanding the Recent Transit Ridership Decline in Major US Cities: Service Cuts or Emerging Modes?", Transportation Research Board 98th Annual Meeting, 2019; https://trid.trb.org/view/1572517

3 McFarlands, Matt, "Uber wants to compete with public transit. These experts are horrified," CNN Business, April 25, 2019; https://www.cnn.com/2019/04/25/tech/uber-public-transportation/index.html



Source: Sperling, Brown & D'Agostino

Transportation network companies (TNCs) are winning market share from traditional transportation sources, according to research by Daniel Sperling and Austin Brown using data from APTA and the US Census and projections from Schaller Consulting.[4]

Even the myth of Uber can threaten transit. For twenty years, voters in suburban Macomb County (just north of Detroit) consistently supported the property tax millage that funds their local bus service. But in 2018, the Michigan Taxpayers Alliance spread a specious claim that it would be cheaper to subsidize Uber rides for every bus commuter than to pay the transit millage[5]. Given most residents' lack of personal experience with transit and the lack of a robust campaign articulating the value of transit, they almost succeeded - the millage renewal passed by just 38 votes (out of 150,000 cast). This demonstrates why transit supporters must more proactively refute false claims of transit's imminent demise.

Similarly, some people claim cities no longer need to invest in buses because autonomous vehicles (AVs) will soon be affordably and safely taking everyone wherever they want to go. While AVs are certainly coming and can be beneficial, their role as the silver bullet to all transportation problems is vastly overinflated. A great deal of change in technology, infrastructure, legal structures, liability insurance, and social acceptance will all be required before they are adopted on a widespread basis.

New Mobility continues to have major limitations.

There are many reasons why New Mobility cannot replace the good old-fashioned bus. Most simply, a bus carrying 60 people takes up far less space than 60 individual cars do and can operate at a much lower cost. In big cities where demand for road space is at a premium, cars take up a great deal of space, whether personal, autonomous, or hailed. In fact, AVs could lead cities to an average vehicle occupancy not only below today's 1.5 but even below one![6]

Source: Cycling Promotion Fund

New mobility also has major equity problems. Most new mobility modes exclude many people with disabilities, as lawsuits against Uber have spotlighted.[7] App-based services also tend to exclude people without smartphones and credit

4 Sperling, Brown, and D'Agostino, "How ride-hailing could improve public transportation instead of undercutting it," The Conversation, July 5, 2018, https://theconversation.com/how-ride-hailing-could-improve-public-transportation-instead-of-undercutting-it-96453

5 The Detroit News, "Anti-tax group urges no vote for SMART tax," July 2, 2018, https://www.detroitnews.com/story/news/local/oakland-county/2018/07/02/michigan-taxpayers-alliance-launches-campaign-against-smart-bus-tax/752168002/

6 Marshall, Wesley. (2018). The impact of ride-hailing on vehicle miles traveled. Transportation. 10.1007/s11116-018-9923-2. (For this study, the conservative percentage of deadheading miles from ride-hailing is 40.8%. The average vehicle occupancy is ... 0.8 when accounting deadheading.)

cards, who are often the very people with the greatest mobility needs[7, 8]. Even families with young kids are barred from ride-hailing services unless they bring their own carseats along, as I learned the hard way at the airport one late night last year.

Source: United Spinal Association, "United Spinal and Taxis For All Campaign Protest Uber's Discriminatory Practices"

Despite their prominence and hype, most new mobility companies are unproven start-ups that have never made a profit. For example, Uber lost $1.8 billion in 2018 and nearly $10 billion over the past 9 years. While venture capitalists are willing to pour money into them now, how much longer will that last? No city should be making long-term decisions based on a service that may vanish or quadruple in price tomorrow.

And as previously noted, fully autonomous vehicles are far from widespread use, and need not just technological but also legal, liability, infrastructure, and social changes before they can become widespread.

New Mobility Can Complement Traditional Transit.

All that said, e-scooters, ride-hailing, microtransit, autonomous vehicles, and other forms of new mobility can be a positive addition to the mobility landscape, if they can complement traditional bus and rail transit in helping people get around.

Microtransit and e-scooters can provide the first or last mile of a transit trip, making an inconvenient trip far more manageable. Bike shares and e-scooters can provide easy short trips while running errands or stopping out for lunch, especially for the 35% of private vehicle trips in the US that travel less than two miles[9].

The availability of ride-hailing alleviates many people's fears of being stuck somewhere without their car if an emergency were to arise. Many people will ride transit one way if they know they can get an easy ride-hail back home.

Autonomous electric shuttles are already replacing larger diesel buses in Detroit in a groundbreaking pilot between May Mobility and the Quicken family of companies[10]. Autonomous buses have the potential to significantly decrease the cost of providing transit if they eliminate the need for drivers. Alternatively, if drivers become "attendants" focused on customer service, AV buses could increase customer satisfaction.

7 Kerr, Dara, "Uber discriminates against people in wheelchairs, lawsuit says," CNet, February 28, 2018; https://www.cnet.com/news/uber-discriminates-against-people-in-wheelchairs-lawsuit-says/

8 United Spinal Association, "United Spinal and Taxis For All Campaign Protest Uber's Discriminatory Practices," https://www.unitedspinal.org/protest-uber/

9 Federal Highway Administration, "National Household Travel Survey - 2017 Data," https://nhts.ornl.gov/vehicle-trips

10 Muller, Joann, "May Mobility Is Deploying Self-Driving Vehicles Now, Starting In Detroit," Forbes, June 26, 2018 - https://www.forbes.com/sites/joannmuller/2018/06/26/may-mobility-is-deploying-self-driving-vehicles-block-by-block-starting-in-detroit/

Source: May Mobility

The technology that enables many new mobility improvements can also be applied for the benefit of transit users. For example, The Rapid in Grand Rapids, Michigan, is partnering with Via to allow people with disabilities to reserve a paratransit ride in real time instead of days in advance[11].

These new mobility modes can even serve as a great gateway drug for transit novices, who slowly learn that their car is less of an essential extension of themselves than they thought.

The reality is that we need buses.

Regardless of other exciting new options, old-fashioned buses remain an essential way to move a large number of people affordably and sustainably.

Cities need affordable mobility. Buses are a far more affordable way to move people around, which is increasingly essential for the 40% of Americans not making ends meet[12]. The high costs of owning, maintaining, and operating a car suck massive wealth-potential away from families who are already struggling.

Cities need less congestion. As Uber has already shown in dense urban areas, trying to move people around in individual vehicles will always be space prohibitive for most cities. Whether a single-occupancy commuter, a ride-hail, or autonomous vehicles, no city can be robust and vibrant if it makes space for everyone to ride in a personal vehicle.

Cities need efficient density, which can never be accomplished with most people utilizing their own personal vehicles. My hometown of Detroit's big comeback is threatened by a persistent expectation that everyone should be able to drive everywhere and park cheaply near their destination. The never-ending press for parking – via parking minimums, low parking taxes, building demolitions for parking lots, etc. - undermines the very density that creates the vibrancy Detroit seeks[13].

Source: Michigan Association of United Ways

11 Smith, Sandy, "Now in Grand Rapids: Paratransit That's Ready When You Are," Next City, August 7, 2019 - https://nextcity.org/daily/entry/now-in-grand-rapids-paratransit-thats-ready-when-you-are

12 United Way, "Alice Report - The Consequences of Insufficient Household Income," 2017, https://www.unitedforalice.org/all-reports

13 Schmitt, Angie, "Detroit Hurt By Too Much Parking," Streetsblog USA, Dec 3, 2018; https://usa.streetsblog.org/2018/12/03/who-benefits-from-downtown-parking-craters/

Source: Data Driven Detroit

And our world needs less climate pollution. Transportation is now the leading contributor of global warming gases, with personal vehicles producing the majority of that[14]. Even with the slow shift towards more fuel-efficient vehicles, a transportation sector led by personal cars cannot realistically cut climate pollution to the levels needed for a planet that remains habitable long-term.

Buses and other forms of sustainable shared-use mobility are essential to support the affordable density that minimizes congestion and climate pollution.

Buses work, when done right.

Buses continue to work largely the same as they always have, mostly because its an efficient way to move lots of people. But bus systems can work better, and they very much need to.

People have increasingly high expectations of their transportation providers. In today's society, it's not enough to just run buses from point A to point B.

- Today's riders expect to know precisely when their ride will get to them. If they can track every stop of their UPS package, they won't just wait around wondering where their bus is.
- Today's riders don't want to juggle with awkward, inconvenient fare payments that require eleven quarters or three different pass cards for different parts of their trip.
- Today's riders don't want to be stuck behind double-parked cars and circling cabs while pedestrians pass them by. They want a quick reliable ride.

It's totally possible to meet riders' expectations and increase bus ridership. As Transit Center's *Who's on Board? 2019* report found[15], "Transit agencies can adopt all-door boarding to speed buses, use data-driven dispatching to improve bus reliability, and build shelters to give riders a dignified experience waiting for the bus. Running more service on high-ridership routes or redesigning outdated bus networks for current travel needs will make transit more convenient for many riders. In cities including Seattle and Austin, these methods have made bus service more

14 United States Environmental Protection Agency, "Sources of Greenhouse Gas Emissions," https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

15 Transit Center, "Who's on Board 2019: How to Win Back America's Transit Riders," Feb 11, 2019 - https://transitcenter.org/publication/whos-on-board-2019/

competitive with driving, and ridership is going up."

Bus service can get significantly better when cities and systems are willing to make a few essential investments:

- **Funding** – Buses must run frequently and 24/7 to be convenient and that takes consistent investment in buses, drivers, and mechanics.
- **Space** – Buses are most competitive when they operate in their own lane with signal priority, not stuck behind a dozen other vehicles.[16]
- **Respect** – Don't treat the bus like a last-resort service, or that's just what you'll get. Invest in quality vehicles, create exciting marketing, and train employees in excellent customer service, and people will choose to ride.

Source: NACTO

If mobility matters to your city, prove it.

Don't cast your dreams on autonomous Ubers to solve transportation dilemmas. Explore how new technology can support and supplement bus service. Continually strive to make the transit experience an even better one. But never turn your back on the good old-fashioned bus.

Every city should give as much attention, investment, and respect to their bus system as they do the hottest new trend in ride-hailing, scooters, or autonomous vehicles. Do so and you'll get an effective, reliable, equitable, and affordable way to move people throughout your city for decades to come.

Who needs the bus? Every successful city does.

About the Author

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As Executive Director of Transportation Riders United (TRU), Ms. Owens has dedicated the past 14 years to pushing the Detroit region to improve and expand public transit. Committed to the belief that everyone should be able to get where they need to go, TRU is a Detroit-based nonprofit that is celebrating its 20th anniversary of transforming transportation in the Motor City.

16 Walker, Alissa, "Every bus in this country deserves its own lane, " Curbed, Oct 14, 2019; https://www.curbed.com/2019/10/14/20902256/bus-lane-emissions-climate-change

Understanding How Women Travel Study: The LA Metro Case Study

Chelsea Richer, Emily Finkel, Claudia Galicia, Meghna Khanna & Elba Higueros

Why study women's travel?

Mobility – or one's ability to get around – shapes the opportunities we can reach and the way we interact in and with our communities. Although women comprise over half of all transit ridership in Los Angeles County, their mobility needs, concerns, and preferences have not been critically accounted for in the way our transportation systems are planned. As a result, women tend to bear outsized burdens and risks in the course of their daily travel. Despite these conditions, women continue to make their way through a mobility environment that has not been designed with them in mind, navigating the transportation networks to get to school, to work, to run errands for and with their families.

Many studies have shown that, in addition to the persistent gender wage gap, women pay a "pink tax" – effectively paying more than men for a variety of goods and services. Transportation is no different. The "pink tax" applies to the added cost of finding safe means of travel at night, it includes extra costs borne by women who organize transportation for family and dependents, and it includes all the ways that women put in extra time and effort to make the transportation system work for them.

In seeking to understand how women travel, LA County Metro has taken an important first step towards easing the disproportionate efforts women put into making the transportation system work for them. Understanding How Women Travel is an effort to understand the unique and diverse mobility needs of women in LA County. For the first time in Metro's history, this study explored the experiences of women traveling by Metro through an analysis of existing data sources, such as on-board surveys, and innovative new data sources, such as ethnography on buses and trains.

Study Background

In an initiative led by Metro's Women and Girls Governing Council, CEO Phil Washington adopted several gender-specific equity initiatives in 2018 to improve women's and girls' experiences on Metro.

Metro collects and analyzes many different datasets to inform a variety of planning and operations decisions. Some data, such as those collected from the On-Board Survey, includes gender information. Other Metro data, such as ridership counts, do not. Even in cases where gender information is collected, the agency has never disaggregated its data analysis by gender to understand the unique travel patterns

and preferences of women. Despite the known gender disparities in travel behaviors, the data and analysis that inform the most important transportation planning decisions at Metro remain gender-neutral. The Women and Girls Governing Council identified this gap in Metro's work and recommended the development of this study.

This groundbreaking study is a broad, intersectional effort to identify mobility barriers and challenges that women face. This study analyzes existing data sets and activates five primary data collection methodologies to fill gaps in the existing quantitative data sets and to connect with core transit rider groups that may be difficult to reach through conventional methods. Understanding How Women Travel provides a foundation of knowledge upon which Metro can actively work toward enhancing the quality of the travel experience for women in LA County.

This study builds on several recent and ongoing efforts both to expand and improve Metro services and help ensure equitable outcomes for LA County residents. These efforts include the massive infrastructure expansions planned with local sales tax funds from Measure M and Measure R and participation with LA County transit operators in the Ridership Growth Action Plan that will feed into the NextGen Bus Restructuring study currently underway. At the same time, Metro has taken strides to be a better neighbor for the County's most vulnerable populations, including:

- Partnering with Peace Over Violence in the "It's Off Limits" and "Speak Up" campaigns to address sexual harassment on Metro services
- Providing outreach and services to Metro's homeless customers
- Actively promoting the human trafficking hotline

- Providing transit passes to foster youth through Youth on the Move
- Making low-income fares easier to access through the Low-Income Fare is Easy program

Prior to this study, Metro had limited information on how women travel, which restricts the consideration of women's unique needs during the planning, design, and operation of our system. With these efforts, further research was needed to ensure that women's issues are considered at the forefront of policy making. This will result in better information for the NextGen Study and Long-Range Transportation Plan and will lead to better, more effective, and more integrated solutions to address the mobility needs of current and potential female riders. Metro's goal for this initiative of gathering and analyzing gender-disaggregated data was to produce Metro/Los Angeles County-specific research and data that really reflects how women travel, in order to make informed decisions and ensure that applicable departments at Metro utilize gender-specific data to implement service changes and improvements.

Why should LA Metro study women's travel?

For a long time, women's needs have been invisible in part because they haven't been measured. The core finding of existing research is that women are responsible for a disproportionate share of the household's transport burden while at the same time having more limited access to available means of transport.[1] Women use the Metro system more. Women are a larger portion of the population. Women have different travel patterns than men and have different commute demands. While these findings are universal based on the literature review conducted to support this study, this report leverages LA County-specific data to justify the business need for service improvements. Without this research into gender-specific concerns, Metro would have only continued to receive glimpses of the overall issues women face. Furthermore, while some agencies like Transport for London have conducted a needs assessment of women's travel patterns, the majority of transit agencies still remain reactive rather than proactive in considering women's unique needs during the planning, design, and operation of our system.

Today, fear and safety concerns stifle and constrict access to destinations for many female Angelenos. The "pink tax" increases women's travel costs because systems and services do not meet their safety needs, and women substitute with more expensive options to fill the gaps. Women's stories of harassment and assault have upended the way that we think about public space, including the space that we share on trains, buses, and sidewalks. In holding ourselves responsible for those transportation spaces, we redefine what an inclusive mobility network could look like in the future.

To reach the goal of having world-class transportation systems that meet the needs of all Angelenos, we first need to understand the ways in which women travel, how those patterns differ, and what types of solutions might have the

1 A full literature review was conducted as part of this study, and can be found in Appendix A, at this link: http://libraryarchives.metro.net/DB_Attachments/2019-0294/HWT_AppendixA_FINAL.pdf

biggest effect in reducing the travel burdens faced by women. This study is the first major undertaking by a US transportation agency to research, analyze, and publish the findings from such an effort.

Methods

A comprehensive and creative approach was required to understand how and why women travel on transit and using other modes in Los Angeles County—and prompted consideration of both existing and new data. Framed by core social justice principles and methods, both traditional and non-traditional data collection methods were used to effectively capture "hard-to-reach" populations and embody the project's intersectional approach to gender.

Understanding How Women Travel includes:

- Conventional methods that provide statistics about women's travel behavior
  - Analysis of nine existing data sources from Metro and the National Household Travel Survey revealed gendered preferences and trends in travel behavior and transit ridership.
  - Understanding How Women Travel survey reached 2,600 respondents, oversampling women and transit riders.
  - Three focus groups allowed for open conversation around sensitive topics and added nuance to our understanding of gender differences in travel.
- Innovative methods that offer qualitative findings about the experience of women traveling by Metro
  - Over 100 hours conducting participant observations on 19 Metro routes offered insight into how women are using Metro's services.
  - Three participatory workshops creatively engaged the most loyal – and most vulnerable – core Metro riders: women with disabilities, women experiencing homelessness, and women who are immigrants with varying documentation status.
  - Three pop-up engagements expanded our data collection to catch every-day riders, in the process of using Metro's services, to hear what makes their ride easy or difficult.

Findings

Together, these methods reveal rich and significant findings about how women travel. This report organizes findings according to five themes:

- Travel Behavior Trends, including overall travel trends and transit-specific travel trends.
- Safety, including sexual harassment and crime, physical safety and injuries, presence of staff to manage safety concerns, and other issues that exacerbate safety concerns.

- Access, including financial access, physical access, and Access Services.
- Reliability, including headways, real-time information, pass-ups, and service times.
- Convenience & Comfort, including the investment of time, cleanliness, customer service, and station and vehicle design.

Travel Behavior Trends

Through the analysis in this report, key trends emerge that differentiate women's travel patterns from men's travel patterns, across all modes.

- Compared to men, more women make many trips (7 or more) per day and more women are not making any trips per day. This means on one end, women may experience more exposure to travel burdens (cost, stress, or safety risks), and on the other end may be more likely to be isolated or disconnected from the opportunities that travel affords.
- Women in Los Angeles make shorter trips than men, which is potentially driven by workforce participation rates, location of employment opportunities, and household-serving trips that tend to be more localized.
- Women's trips are more varied to a broader spread of destinations and are more likely to primarily serve the needs of someone else.
- Women are more likely to live in a car-free or car-light household, take more trips with other people, and take fewer single-occupant car trips than men.
- Women are more likely to carpool or get a ride from a family member or friend if they don't have a driver's license.

These findings show that women may need to adjust their own schedule and travel needs to accommodate others, and in doing so, give up some of their own autonomy and control over when and how they travel.

Despite these challenges and tradeoffs, women show ingenuity in arranging their schedules to meet their travel needs.

- Women are more likely to trip-chain, or make stops along the way to other destinations, and describe consolidating all their errand trips into one day where they will have access to a vehicle.
- Women in Los Angeles are more likely than men to travel mid-day, with a travel peak around 2 PM when transit service may be reduced.

In addition to these overall travel trends, some clear patterns emerge for women who ride transit. Currently, more than half of all bus riders are women, and more than half of all rail riders are women. The burdens and risks of transit travel, as well as the benefits of transit travel, are more pronounced for women, as they make up the majority of Metro's customers and ride transit frequently.

- Among female riders, almost 90% ride the system more than three days per week.
- 57% of women transit riders bring their children on transit.
- Women ride transit because they do not have a car, because they want to avoid traffic, or because they do not have a license. Two of these three reasons indicate that women who ride transit do so because they have fewer transportation options, and may have less access to economic opportunities as a result.

Still, many women use transit to access economic opportunities. Over 85% of women riders use Metro to travel to work or school, and of those women, 32% also use Metro to run errands or complete recreational trips.

Among people who make household serving trips most frequently, these trips comprise the same share for women whether they use transit or not; for men, the share of household-serving trips declines if they are transit users. This shows that while men are more likely to find alternatives to using transit to complete household-serving trips (using a different mode or taking fewer trips), women are less likely to find an alternative and instead work to make the transit system work for their needs.

Although the rate of adoption for TNCs like Uber and Lyft is the same for men and women, women are more likely than men to report that their transit use has stayed the same as they have also begun to use TNCs.

- Women are more likely than men to say they use TNCs for trips that transit does not serve, while men are more likely to say they use TNCs to reach a transit stop or station. The trips that are not served by transit may be related to time or location, as women's needs differ from men's needs by both time of day and location.

These travel behavior findings point toward many opportunities to adjust the services provided by Metro to better meet the travel needs expressed by those who are using transit. Development of a Gender Action Plan - or a tactical plan to implement policy, design, and service changes throughout the agency - would help to articulate the immediate opportunities and long-term goals that would create a system that better serves women. Adjustments to services, vehicle design, and policy would help minimize the time, cost, safety, and physical burdens of riding transit for the more than half of all riders who are women.

- The findings from Understanding How Women Travel about women's mode choices, how likely they are to travel with others in their care, and their complex trip-chaining patterns could inform adjustments to Metro's fare policy to make it more equitable towards women and more cost-competitive with driving and carpooling.
- Findings about women's trip purposes and primary responsibility for household errands could all inform the way transit vehicles, transit stations, and bus stops are designed so that space for traveling with others and carrying bags and other belongings could be better accommodated.
- Findings about when women are traveling and average trip lengths could inform new service offerings that meet a mid-day peak travel demand and provide better direct connections over long distances while minimizing transfers.

Safety

Women feel unsafe on public transit and it is impacting how often they ride, when they ride, and if they ride at all. Among women, safety on transit is a top concern voiced across every mode of data collection. Their concerns center around harassment and personal security, as well as physical safety and design of vehicles, stations, and stops. These concerns collectively obstruct women's freedom of movement.

- Women report accidents and injuries on Metro at a higher rate than men. Two-thirds of all complaints about accidents and injuries on Metro Rail or Metro buses were made by women.
- While 60% of female riders who participated in our survey feel safe riding Metro during the day, that number plummets to just 20% at night. Safety perceptions for waiting and walking to the stop or station were even lower.
- Concerns about safety are causing riders to alter their behavior – to consider their clothing choices, to change their routes or take routes that may be longer or more costly, to avoid taking a trip at all, or for those who have other options, to simply not ride transit because they prefer the safety of a car.

The concerns that emerged in the survey are substantiated by the numerous stories our project team heard from women during the focus groups, participatory workshops, and pop-up events. Women we spoke with have endured sexual harassment and witnessed violent acts while on transit. These concerns are also borne out in the Metro crime data and reports of sexual harassment.

We asked women what would make them feel safer on transit.

- Both current and prior riders agreed that more lighting at stops and along approaches to stations and the presence of security staff nearby would help them feel safer.
- Two-thirds of female riders believe there are too few transit police on board the system.
- During focus groups, workshops, and pop-up events, it was clear that riders have a more complex view of security staffing. Some felt that police were slow to react or ineffective when

issues did arise, while others felt that police were too aggressive or too quick to brandish weapons.

- The study's literature review showed that women generally preferred the presence of staff over technological solutions such as CCTV or alarms buttons.
- The effect of bus operators on women's perceptions of safety also emerged as a key theme. Women described having empathy for operators, who must perform many jobs at once, but also expressed their frustration that no one is expected to step in to manage conflict between passengers.

Similarly, women expressed empathy around how Metro responds to the needs of people experiencing homelessness and people who need additional mental health resources, but at the same time perceived these populations to be contributors to the concern about riders' unpredictable behavior on transit.

Over and over, participants in our study pointed to problems that could be solved by a deeper investment in the presence of security and other types of staff. Analysis of existing data sets revealed a preference for transit police nearby, and further investigation through our qualitative methods identified an interest in more security staff of all types, including non-law enforcement staff.

These safety findings encapsulate the need to adjust safety and security strategies and focus time and attention on this issue to address the largest concerns voiced by women. Despite Metro's investment in law enforcement over the years, safety is still a prevalent issue. Participants in our study asked for additional amenities, such as lighting at stops and along pedestrian access routes, and more frequent service to shorten long wait times at dark bus stops. These ideas and strategies also emerged in the literature review, demonstrating consistency in safety concerns and improvement ideas between other studies and this Metro study. The creation and articulation of strategies to address safety in a Gender Action Plan would be a critical first step towards addressing these concerns. In addition, adjustments to services provided by time of day,

approaches to staffing and security, and station/vehicle design changes could also help address the many safety concerns that emerged in this study.

Access

Access concerns voiced by women include the physical design of transit spaces, financial ability to pay for transit trips for themselves and those in their care, the challenges of traveling with children, and the travel needs of women with disabilities. After safety, this set of concerns were major contributors to the decisions women made about their travel choices and how they do or do not use transit to help meet their travel needs.

Access needs are substantially different for women compared to men, as a result of physical differences and preferences, household responsibilities and the burden of schlepping associated with those responsibilities, and the disproportionate impact on women who have disabilities. The physical demands of traveling are compounded when one's needs vary even the slightest bit from too-typical design standard of a healthy, fit, young man. Add a stroller or a wheelchair or children or years of age, and the system works substantially worse for its riders.

Vehicle access issues disproportionately affect women.

- Women who ride Metro are less likely to have access to a vehicle than male riders. When former female Metro riders' were asked why they used to ride transit, the top response was "I didn't own a car."

Financial access also disproportionately affects women. Low-income women, in particular, carry a disproportionate financial burden when it comes to travel.

- Female Metro riders live below the poverty line at greater rates than male riders. 59% of female bus riders are below the poverty line, compared to 50% of male bus riders. 34% of female rail riders are below the poverty line, compared to 26% of male rail riders.
- Low-income women in Los Angeles reported spending more 40% on ride-hailing services, 28% more on transit for themselves, and 90% more on transit for others compared to higher-income women.
- Women are more likely to be frequent riders, and although a monthly or weekly pass may save money in the long run, women reported that the up-front cost is too expensive.
- Women seem to prefer cash for its flexibility, as Transit Access Pass (TAP) cards are attached to only one individual and cannot be used to pay for children that may be accompanying an adult rider.
- Women comprise the majority of bus riders, and we heard from many women who do not take the train at all. Women bus riders reported that TAP cards are difficult to obtain and reload.
- Women traveling with children reported that kids' fares are confusing to understand.

The physical design of vehicle and stop/station spaces also create access challenges for women.

- Older women and women traveling with children had a difficult time maneuvering with strollers and carts on the bus. Only 20% of female riders with children say that taking their kids on transit is easy.
- Women were observed in our study traveling with bags, carts, and strollers. Negotiating the space on transit vehicles and at stops and stations appeared to be a challenge. Many women stored bags on the seats next to them or in the aisle and relied more heavily on elevators and escalators to travel between the street level and the platform.

- From women with disabilities, we heard that Access Services is a critical resource, but operates in a way that devalues women's time – hours and even an entire day could be expended on a single trip for a single purpose.
- Based on data from the National Household Travel Survey, 9% of women reported using a mobility assistance device compared to 7% of men, and 7.5% of women reported that their medical condition limits their travel, compared to 5.5% of men.
- Women are likely to be more dependent on Access Services because of differences in mobility, disability, and licensing, and will, therefore, be subject to the impacts of Access Services more than men.

The findings related to access demonstrate that the burdens of traveling are compounded by the everyday facets of women's lives: the financial burden of living in one of the most expensive cities in the country, the physical challenges faced by women with disabilities while traversing public spaces not built for them, and the responsibility women have for transporting children from place to place. The barriers to easy transit access amount to a "pink tax" on women, in the form of higher time costs for women who must maneuver the Metro system despite the challenges they face, or for women who must simply find another, more expensive, mode to carry out their everyday responsibilities. These costs fall disproportionately on women with children, women with disabilities, and low-income women, who report spending more than higher-income women on transportation for themselves and their families. To reduce this "pink tax" and improve access for women across all the dimensions discussed above, Metro can consider adjustments to fare policies, services by time of day, and the design of stations, stops, and vehicles. These steps can be developed more thoroughly and specifically through a Gender Action Plan.

Reliability

Reliable transit service means that schedule information is easily accessible, real-time updates are accurate, buses and trains run frequently throughout the day and night on weekdays and weekends, and buses and trains arrive when expected. For women in Los Angeles who rely on Metro to get to work, go to doctor's appointments, and pick kids up from school, reliable transit service is a lifeline.

- The top three complaints filed by female Metro bus riders are all related to reliability – pass-ups, no shows, late buses, and unreliable or absence of real-time information.
- At our pop-up events, in the focus groups, and in the participatory workshop discussions, we heard time and time again stories of women stuck waiting for a late bus, of being passed up and waiting an hour for the next bus, and of unreliable real-time information on station signs and cell phone apps.

These experiences cause women to alter their travel behavior – sometimes leaving hours ahead

of time due to unreliable service, using ridesharing services instead of transit due to infrequent service at night, carrying a flashlight to ensure that they are not passed up by operators while waiting in the dark, or even sleeping at the bus stop because service does not start running until several hours after they get off work.

The primary reliability concerns also exacerbate safety concerns. When headways are long, and real-time information is unreliable, women's safety concerns are amplified and women who have the financial ability switch to a different mode, such as ride-hailing. Others who do not have that luxury simply endure the exposure and stress of added wait times. Real-time information and tools designed to help ease the stress of waiting for infrequent service often fail. These challenges become even more difficult when traveling with children or trip-chaining, or for women with jobs or household responsibilities that require travel during mid-day, late night or early morning periods, or on the weekends.

For women who rely on transit, an unreliable system has real consequences. A late train can mean daycare fines, a pass-up can mean a missed medical appointment, and infrequent early morning or late night service can limit employment opportunities. Reliability issues can render a system unusable for women, render the stressors they experience intolerable, and exacerbate women's safety concerns. Reliability issues also place a disproportionate burden on women living in poverty and those who are dependent on transit. For these women, other options for travel may be limited and the consequences of being late may be more costly.

The reliability findings point to service improvements that would clearly reduce the time burden for women who rely on Metro and improve safety concerns as well. Workshop and pop-up participants pointed to increased bus and train service as a strategy that would improve women's safety and comfort. Service that is specifically timed to meet the travel needs and preferences of women would directly address the issues of infrequent service and long wait times. Women reported that more mid-day service would help them complete errands and pick up children. They also reported feeling especially

vulnerable waiting for long periods late at night, and affordable late-night travel options would help those who work night shifts. Increased service would also reduce issues of overcrowding and improve dependability, safety, and comfort. Metro can articulate reliability and service improvements through the development of a Gender Action Plan.

Convenience & Comfort

Convenience and comfort are important considerations to build a system that women want to use, enjoy using, and would continue using even as they have other options available to them. While reliability issues render the transit system usable or not; comfort and convenience issues render the transit system pleasant or not. For women on transit, issues of convenience and comfort are inextricably linked to issues of access, safety, and reliability.

Many women we spoke with for this study recognized and embraced the convenience inherent in taking transit. They described the stresses of driving in Los Angeles due to traffic and parking, and the relief they felt from those stressors by taking transit. They characterized Metro as a "lifeline" that enabled them to access work, health care, school, and errands when they did not have a vehicle available or were unable to drive.

However, many women described another type of inconvenience – the investment of time they had to make to ride transit – whether it was a daily commute that started very early in the morning or a trip that involved several transfers just to reach Union Station.

Issues of comfort on transit can run the gamut from the physical comfort of waiting for and riding transit, to the emotional comfort that can come from positive interactions and communal experiences in a public setting like riding transit.

- Fewer than 40% of female riders surveyed for this study felt that transit is comfortable or that transit vehicles have the space they need for their belongings.
- In our observations and discussions with women about the Metro system, it became clear that lack of space for carts, strollers, and bags on buses, lack of shade at stops, dirty stops and stations, and push buttons and pull-cords located too high all contributed to women's discomfort on Metro.
- While we observed that women were hesitant to sit next to men they did not know. When women sat next to each other, they often struck up conversations and many noted a sense of community they felt on transit.
- Women also described negative interactions with other riders and operators and instances where they experienced a lack of etiquette among riders, causing discomfort.
- Half of the female riders who responded to our survey described Metro operators as courteous and less than one-third felt that other riders were courteous.

The findings related to comfort and convenience directly connect to the choice some women make when deciding to take transit or not. For most women, a comfortable and convenient transit system would allow them to wait for their bus in the shade, easily load their TAP card or charge their phone while they wait, and provide ample space for their grocery bags, their strollers, or their walkers. Also, the operator will greet them and another rider may offer their seat. When they sit down, they don't feel trapped by the person sitting next to them. A system map with transfer information is easy to read from their seat. When it's time to get off the bus, the push button is easy to reach and they are able to stand and move down the aisle to the back door with ease. They get off the bus easily and their destination is just a short distance away.

Whether it's the policy that states strollers must be folded on the bus or the lack of space on board for multiple grocery bags, inconveniences and discomforts are present throughout the Metro system. When women have a choice in transportation, they are more likely to pick the one that offers the most comfort and convenience, if they can afford to. If they have limited transportation choices, a transit system that is not comfortable or convenient makes the trips taken disproportionately by women the most difficult. To attract more women to transit and better serve current female riders, Metro can prioritize changes to make these trips comfortable and convenient by providing customer service, station and stop amenities, vehicle designs, and policies that respond to how women travel and use the system.

Next Steps

This report is the first step in Metro's process to better understand and better serve the needs and preferences of women riders. With the findings from this study, Metro is equipped to begin considering policy, design, and service improvements that can improve the travel experience for women.

Metro can create a Gender Action Plan to pivot from research findings into actionable changes. Adopting a Gender Action Plan would allow Metro to align goals from its work, such as transit operations, systemwide planning, setting fares, and designing stops and stations, along with other initiatives to introduce new changes specifically intended to improve travel experiences for women.

The Gender Action Plan will focus on the following areas for implementation.

Staffing and Safety

Safety is a key concern for women who currently ride Metro and women who might

To Union Station

choose to ride Metro in the future. Metro can reassess the approach to staffing, scheduling, operations, communications, and the design of space throughout the Metro system to create an environment that prioritizes safety and customer service, reduces sexual harassment, and encourages women to report instances of harassment.

Fare Policies

From traveling with children to making household trips on the bus, the disproportionate burden that women carry in their everyday travel is amplified for lower-income women. Metro can ease this burden by exploring fare options that accommodate families and provide affordable options for trip-chaining, such as fare-capping that can minimize the daily financial burden on lower-income women.

Station, Stop, and Vehicle Design

Women's challenges in navigating buses, trains, stops, and stations are common and can be exacerbated for older women or women with disabilities. Metro can investigate changes to station, stop, and vehicle designs to address the needs and concerns of women for elements like pull cords, push buttons, seating configurations, and elevator locations. Some design concerns can also be addressed with policy changes, such as Metro's stroller policy.

Services Provided by Time of Day

Women are traveling just as often during the midday period as they are during morning and afternoon peak periods, and often trip-chaining. Women with disabilities sometimes dedicate an entire day to making a single trip because Access Services and fixed-route services do not run the direct routes or times they need. Metro can evaluate services provided by time of day to understand how services can be adjusted to meet women's travel needs.

Future Investments

In addition to the five steps identified above, Metro should consider the implications of this study on future investments. As the largest transportation provider in Los Angeles County, Metro is positioned to shape the region's future of transportation technology.

Innovation already infiltrates Metro's many offered services, from e-bikes in the Metro Bike Share fleet to the new MicroTransit pilot. As travel modes and trends shift, Metro's opportunities for investment and experimentation will expand and should take into account the needs, preferences, and concerns of women.

Through ongoing, intentional data collection and analysis, Metro can continue to gain a better understanding of the nuances and differences within the diverse and heterogeneous population of women riders. Connecting this understanding to future planning and service changes will enable Metro to build off this groundbreaking study and progress towards a system that truly meets everyone's needs.

This article is excerpted from the full Understanding How Women Travel report, available at **www.metro.net/wggc**

All photos are credited to Metro.

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Toward Universal Mobility:

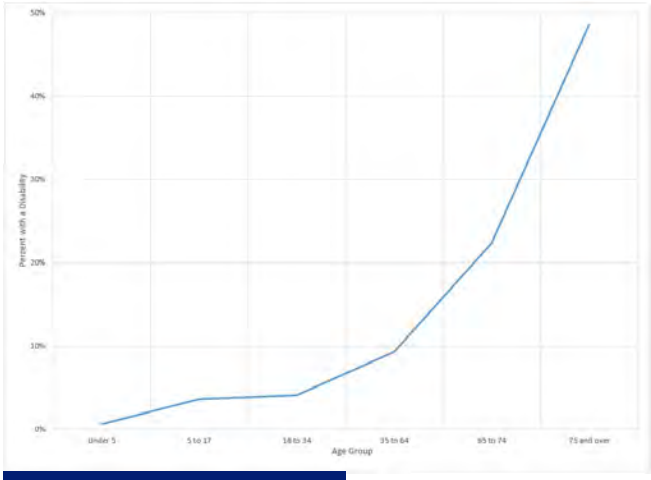
Charting a Path to Improve Transportation Accessibility

Audrey Wennink & Jeremy Glover

Many people would be surprised to learn the high number of people experiencing a disability. In the Chicago region, 7 percent of people between the ages of 18 to 64, and 33 percent of those over the age of 65, have at least one disability as defined by the American Community Survey. These includes visual, hearing and cognitive impairments, as well as disabilities affecting mobility. Moreover, while many older Americans do not meet the legal definition of having a disability, they still experience age-related conditions that can make getting around more challenging. All told, nearly everyone will experience disability at some point in their lives, either directly or as a caregiver for a friend or family member.

In most U.S. regions, the population's median age is forecast to increase in the coming decades. For example, the Chicago Metropolitan Agency for Planning (CMAP) projects that large increases in the number of people over 85 will draw the region's median age upward from 35.7 in 2010 to 39.4 in 2050. What does this mean for transportation? An aging population will bring an increased number of people experiencing disability – and that is likely going to affect how people get around.

A national survey by the National Aging and Disability Transportation Center found that one-third of adults age 60 or older have a disability that limits their mobility, and 71 percent use medical equipment or mobility aids. More than 60 percent of their caregivers help with transportation needs, and 68 percent said it would be difficult to find alternative transportation options if they stopped driving. Among adults under 60 with a disability, 80 percent said it would be difficult to find alternative transportation options to driving.



Disability prevalence by age

Source: American Community Survey 5-year estimate, 2013-2017. Data for Cook, Lake, DuPage, Kane, McHenry and Will Counties, Illinois.

Mobility is a human right

Universal mobility recognizes that mobility is a human right, and that high-quality accessible transportation is fundamental to exercising that right. In practice, universal mobility is achieved through a system of partnerships and policies that provide a sufficient level of mobility to allow all members of society to be fully engaged in their community. Universal mobility is closely related to universal design, which is the composition of an environment such that it can be accessed, understood, and used to the greatest extent possible by all people regardless of age or disability[1]. This is not a special requirement to benefit a small group, but a fundamental condition of good design. If an environment is accessible, usable, convenient, and a pleasure to use, everyone benefits. Unfortunately, many of our communities were not designed with these principles in mind.

Planners know all too well the relationship between land use and transportation. The built environment where someone lives or works dictates the transportation services available to them. Accessible and high-frequency fixed-route bus and rail transit is only possible in areas with enough population density. In conducting research for our report, Toward Universal Mobility: Charting a Path to Improve Transportation Accessibility, we spoke to many people with disabilities who proactively moved to denser areas to have a higher level of mobility via transit. But it is important to recognize that many people live in locations where driving is nearly mandatory, and don't have the resources or desire to move elsewhere. As they age, many will experience a disability that suddenly limits their ability to drive, significantly worsening their mobility.

Transportation's role in a person's ability to age in place is emerging as a significant concern, and a higher level of mobility should be every region's goal.

Even if a person with a disability is able to drive a vehicle, many have low incomes and cannot afford to own a car. Slightly over half of people with disabilities ages 18 to 64 live in households with annual incomes under $25,000, versus only 15 percent of people without disabilities. Twenty percent of people with disabilities age 18 to 64 who aren't in the workforce and 12 percent of those who are employed live in households without access to a vehicle[2]. Providing accessible alternatives to driving is therefore a critical equity issue.

Fixed-route transit has come far, but many gaps still exist

In the Chicago region and nationally, transit agencies have worked to improve the accessibility of their fleets. All fixed-route city and suburban buses can kneel or deploy ramps to allow people with limited mobility to board. These services provide coverage and predictability, but the frequency of buses is not very high in less dense suburban areas (often every 30 minutes at most). In more rural, low-density, outlying areas such as McHenry and Will County, there are few fixed-route buses of any kind.

On the CTA rapid transit 'L' rail network, 103 out of 145 stations are accessible to wheelchair users. The CTA has developed a 20-year All Stations Accessibility Program[3] to make all stations vertically accessible, but has not yet

1 http://universaldesign.ie/What-is-Universal-Design/

2 Issue Brief, Travel Patterns of American Adults with Disabilities. https://www.bts.gov/sites/bts.dot.gov/files/docs/explore-topics-and-geography/topics/passenger-travel/222466/travel-patterns-american-adults-disabilities-9-6-2018.pdf

3 https://www.transitchicago.com/accessibility/asap/

identified funding for full implementation. The region's commuter rail service, Metra, has 185 fully accessible stations, 13 partially accessible stations, and 44 inaccessible stations. However, simply making transit vehicles, stations or stops accessible to people with disabilities is not sufficient. People still have to get to transit. This can be quite challenging in much of the Chicago region, as we'll discuss below.

ADA Paratransit and the challenges of building a customer-focused system

ADA Paratransit is a requirement under the Americans with Disabilities Act of 1990 (ADA) that mandates a complementary transit system for people who have a disability and are unable to use local fixed-route transit service[4]. Service must be provided within three-quarters of a mile on either side of a fixed-route bus route and a three-quarter-mile radius around rapid-transit rail stations. ADA Paratransit service must function as a demand-response, door-to-door service for eligible riders, and provides a minimum level of transit service for disabled riders as defined by federal requirements. Rides are shared and must be reserved 24 hours in advance. Since no ride can be declined for qualified users, and costs must be managed, the service is a series of compromises. As an unfunded mandate with many governing rules and regulations, ADA Paratransit was not built as a customer-focused system. The system must get riders to appointments within a minimum buffer time but offers little flexibility and can be very time-consuming to use, as shared rides with multiple pickups and drop-offs can be long.

A fragmented system of services for people with disabilities and the elderly

Partly in response to the geographic and regulatory limitations of ADA Paratransit, over time many additional accessible transportation services were established in the Chicago region to address specific needs in specific communities. Rarely were they planned or operated in a coordinated way. If you zoom out and look at all the transportation services available to people with disabilities, it's immediately clear that, from a rider perspective, it is not only hard to figure out what's available, but accessing those services is often difficult. This is not uncommon in regions across the country. In greater Chicago, services may be operated by a municipality, township, county, or at a regional level. The hours of service vary depending on the operator or location. Rider eligibility and trip purpose rules vary widely. Fare structures and reservation policies also change depending on where riders live and where they're going. Critically, information on these services is not provided in a centralized location. Some non-ADA paratransit operators admit to intentionally not marketing their service because budgets are so limited that they cannot afford to serve more riders. This patchwork exists for many historical reasons. State and federal funding plays an important role, as do local and regional politics.

These discrepancies in customer experience can be dramatic. While some services are required by law to provide every ride requested, on others, rides may be declined if available slots fill up due to resource constraints. In one town a rider may be able to use the demand-response van to get to the hair salon, while in the neighboring town rides may be limited to only medical and supermarket trips. One town may offer demand-response rides

4 https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/ada-guidance

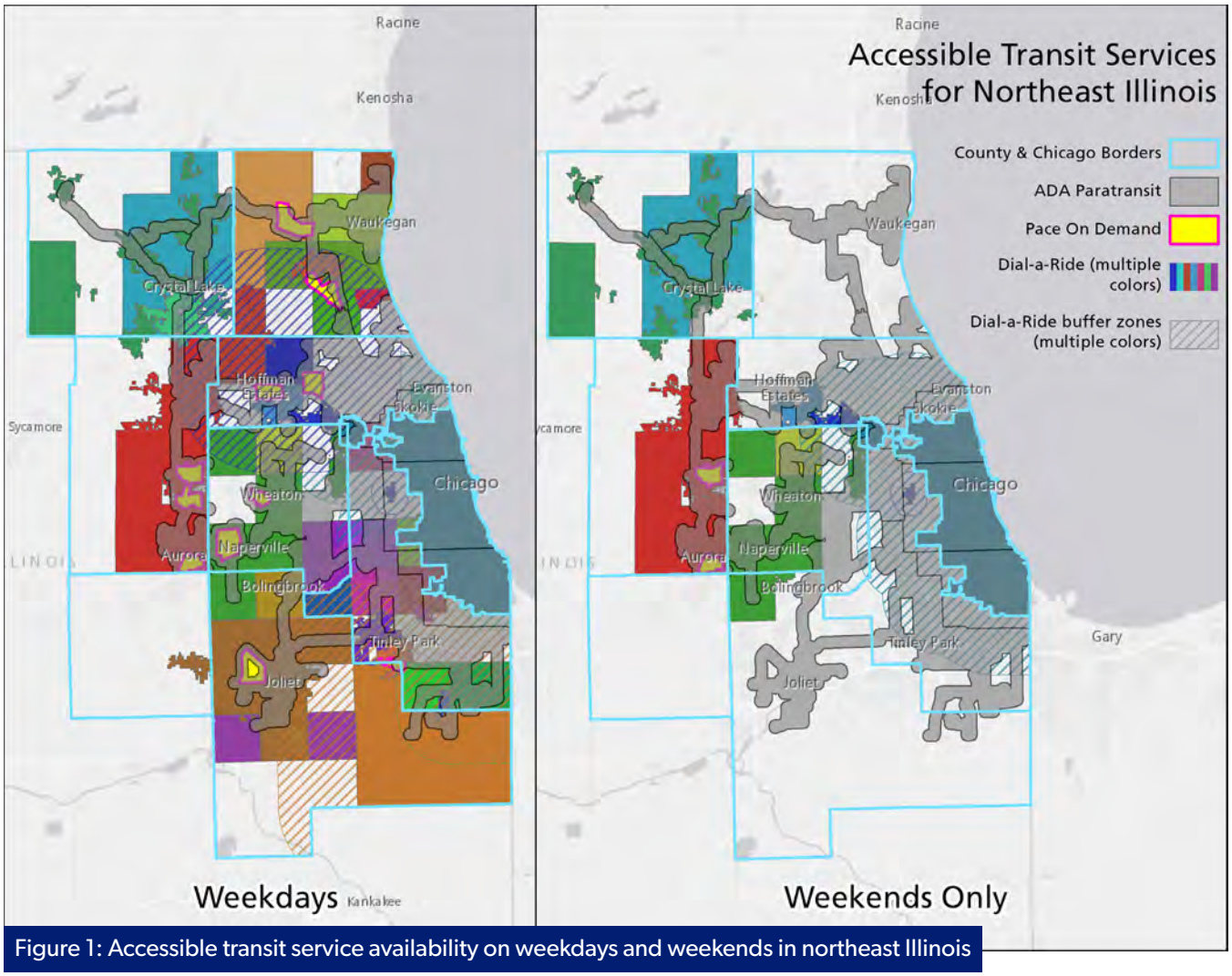


Figure 1: Accessible transit service availability on weekdays and weekends in northeast Illinois

MPC Image. Sources: Pace Suburban Bus, Regional Transit Authority, Illinois DOT

to seniors and people with disabilities and another may not, because they have not opted into a county-level program.

Several of Chicago's suburban counties run coordinated Dial-a-Ride services that have begun to consolidate local services to provide a more consistent experience. But even in these cases, significant variation exists. For participating jurisdictions in the Ride DuPage program in DuPage County, no ride is refused, but the fares are assessed based on distance, so they can be costly. Under McHenry County's integrated MCRide program for the eastern part of the county, the fare rate is flat for the first five miles, but rides can be denied if the vehicle is fully booked for the day or time requested. For many rides it is necessary to make a reservation one or more days in advance to ensure a booking. In some areas there is no service available at all. The bottom line is that the experience of getting around using this patchwork of systems ranges from fairly reliable and affordable to maddeningly frustrating and expensive.

An important facet of accessibility is the number of hours per week a person can access public transportation. In the case of on-demand paratransit, the hours of available service often do not include evenings and weekends. This can

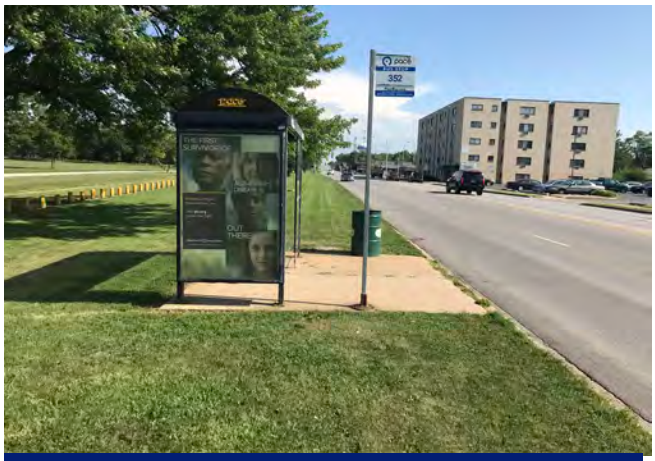


Figure 2: A bus stop island in a sea of grass. There is no meaningful access for a person with a disability.

Source: MPC image

be very limiting in terms of the ability to maintain full-time or even part-time employment. It is also important to acknowledge the social impact many people experience from being unable to get around via public transportation during nights and weekends, when many family or social activities may occur. As shown in Figure 1, the services available on weekends are much more limited than those provided during weekdays.

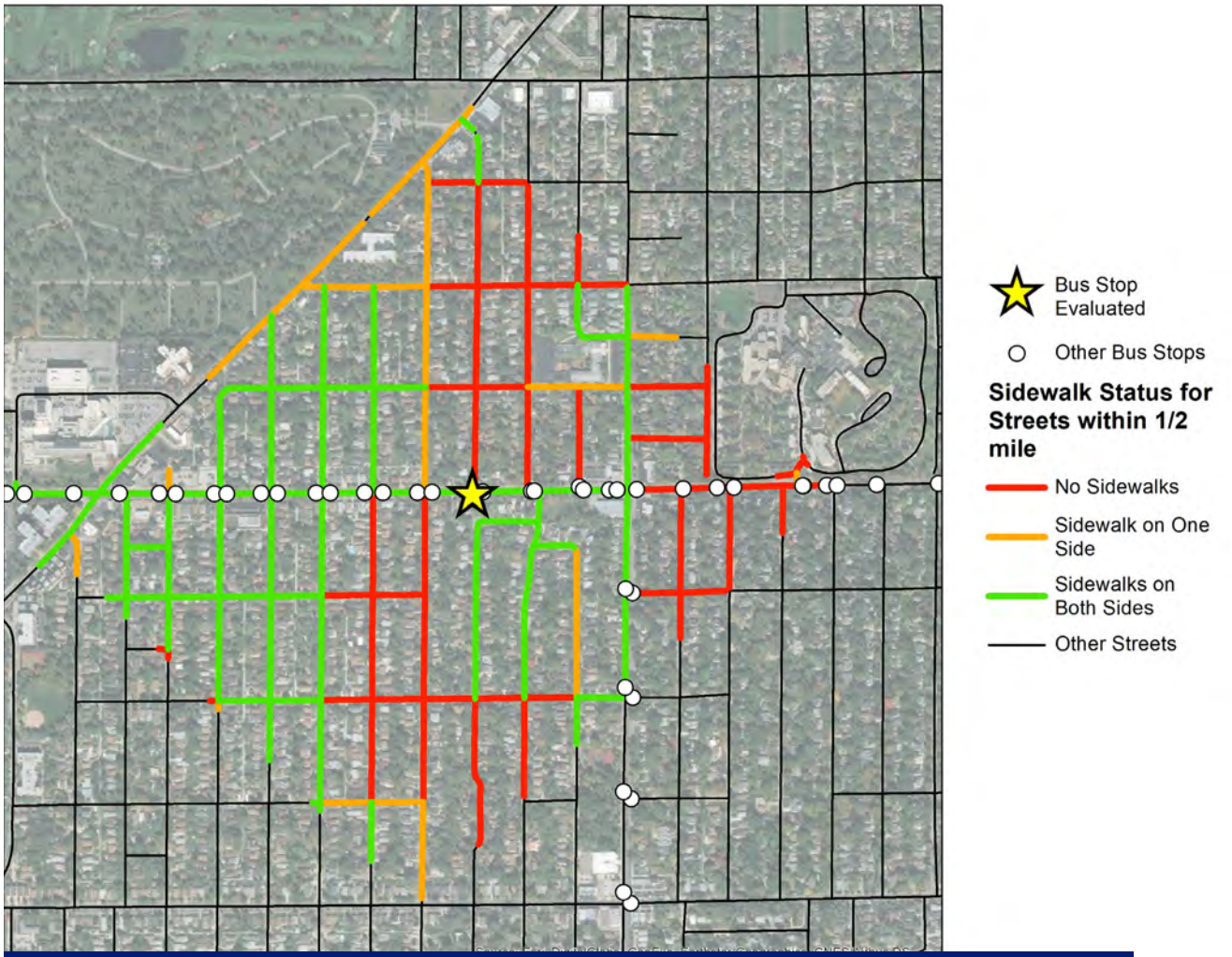


Figure 3: An example of a bus stop with 50% sidewalk network completeness for streets within a half mile

MPC analysis using CMAP and RTA data

Inconsistency in our pedestrian infrastructure impedes transit access

One of the biggest factors driving riders with disabilities to use paratransit over the fixed-route system is uncertainty. Accessibility of bus stops is a challenge in many locations in the suburbs, as many bus stops do not have concrete pads which would enable a person in a wheelchair to board using the ramp. Furthermore, in many locations the local municipality or township has not provided sidewalks adjacent to the bus stop at all, preventing any kind of safe, meaningful access, as shown in Figure 2. That means that once a person gets off the bus, they cannot get where they want to go without walking in the grass or rolling their chair in the street, which is extremely dangerous and terrifying on many of the region's roads where cars are driving at high speeds.

A few door-to-door services are available in the region, but most trips require some amount of travel to the nearest stop or pick-up location. The Chicago region's urban core has a robust network of pedestrian infrastructure to enable these connections. However, many parts of the region served by transit have surprisingly limited walkability. To better understand how the region's pedestrian infrastructure matches up with the suburban bus network, MPC conducted an analysis using a regional sidewalk inventory recently created by the Chicago Metropolitan Agency for Planning[5]. The inventory looked at every street in the region, except for limited-access highways, and recorded whether a street segment had no sidewalks, a sidewalk on one side, or a sidewalk on both sides. We combined this data with Pace bus stop locations and measured how complete the sidewalk network was along streets extending a half mile from each stop. Figure 3 shows an example of a typical suburban bus stop that has a 50 percent sidewalk network completeness.

Table 1: Extent of sidewalk availability within a half mile of Pace bus stops

Sidewalk Network Completeness	Stop Count	Percent of Total Stops
0%	385	2%
1 - 25%	1,932	10%
25 - 50%	2,841	14%
50 - 75%	4,804	24%
75 - 99%	10,003	49%
100%	271	1%
TOTAL	**20,236**	**100%**

Table 1 tabulates the results of the analysis and shows the count of bus stops under each level of sidewalk network completeness. For the purposes of the analysis, stops within 100 feet of each other were considered a single stop. Nearly 400 Pace bus stops have no sidewalks along any streets within a half mile of the stop in all directions. Twenty-six percent of stops have sidewalks on less than 50 percent of streets within a half mile. Only 1 percent of all Pace bus stops have a fully completed sidewalk network extending a half mile from the stop. This incompleteness is a major barrier to people with disabilities who would like to use the fixed-route system in the suburbs. A gap in the sidewalk network means riders have to take a longer route to get to the stop or travel in unsafe conditions.

5 https://datahub.cmap.illinois.gov/dataset/regional-sidewalk-inventory

We need better coordination with third-party transportation network companies

The growth of transportation network companies (TNCs) like Uber and Lyft has caused a major shift in mobility. These services' short response time, and the spontaneity that enables, is transformative to people with disabilities who are able to access and afford TNC service. The availability of these services is greatest in denser areas like the City of Chicago where there are many requested rides in a smaller geography. While services like Lyft and Uber are available in the suburbs and do increase options for people that are ambulatory, wheelchair-accessible vehicles (WAVs) may not be widely available through this service. Users have the ability to request a WAV, but availability is not guaranteed and wait times may be high.

Regulation of TNCs with regard to serving people with disabilities is evolving. The City of Chicago requires TNC providers to be accessible to people with disabilities, and customers have the option to request a wheelchair-accessible vehicle[6]. This means that in Chicago, TNCs must provide services to people with disabilities by either connecting them to WAVs that are a part of their own fleet, or they may provide the service through an outside vendor. According to MPC's research, Chicago-area suburbs do not have this same requirement. Advocacy groups have asked for regulations that would require providers to deliver equivalent response times for trips with WAV vehicles as those with non-WAV vehicles regionwide, and that WAV vehicles comprise a set percentage of the fleet to ensure availability when requested.

Emerging themes and best practices

So, how do we make this better? After interviews and focus groups with nearly 100 stakeholders, some themes emerged that can guide improvements moving forward. While these recommendations were tailored specifically to the Chicago region, we believe they are widely applicable.

Improve regional coordination among ADA and non-ADA transit providers

Over decades, multiple systems have been established to address very specific transportation needs, but they are rarely planned or operated in a coordinated way. There is a critical need for staff who can serve in a coordinating role and who can help streamline funding.

- Establish a regional Mobility Coordinator position to break down the silos between government agencies
- Restructure demand-response services in counties for greater consistency across service areas

Improve walkability

If one segment of a trip is impassable for a person with a disability, the whole trip is impossible. Additionally, a high share of pedestrian fatalities involve seniors, so safety improvements are critical.

- Improve regional data on sidewalks and accessibility features
- Provide technical assistance to municipalities struggling to complete ADA transition plans

6 http://library.amlegal.com/nxt/gateway.dll/Illinois/chicago_il/title9vehiclestrafficandrailtransportati/chapter9-115transportationnetworkprovide?f=templates$fn=default.htm$3.0$vid=amlegal:chicago_il$anc=JD_9-115-140

Upgrade accessibility of fixed-route systems

When riders can use the fixed-route system, they have greater flexibility and reduce demand on the more expensive ADA paratransit system.

- Prioritize making current systems accessible
- Upgrade stations and paratransit transfer points with shelters and seating
- Crowdsource data on problems from actual users to prioritize improvements
- Ensure that affordable housing requirements include accessibility considerations
- Require pedestrian-friendly site design that supports access to fixed-route transit service

Improve information on accessible transportation services for older riders and those with disabilities

It can be very difficult for riders to figure out what services are available to them. In many regions, there is no single location where information on all types of fixed-route and demand-response services is located.

- Develop centralized information hub on all fixed-route and paratransit services
- Create or expand travel training programs for people with disabilities
- Provide real-time data on accessibility outages that can be included in trip planning tools like Google Maps

Improve consistency of wayfinding throughout the region

Adapting signs and signals to work for people with disabilities can make a huge difference in transit usability.

- Ensure signage is optimized for users with visual disabilities and that audible information is provided
- Involve users with disabilities in developing wayfinding policies

Improve technology

From a rider perspective, the experience of using paratransit can be cumbersome and frequently involves long trips. Technology can help.

- Upgrade routing & dispatching software
- Introduce rider-facing tools, such as mobile apps, for all demand-response services
- Establish rigorous reporting for contractors to ensure they are meeting contractually established service standards

Improve private-sector transportation services for people with disabilities

To unlock the transformative potential of TNCs, we need to ensure equivalent service for people with and without disabilities.

- Improve training for TNC drivers serving people with disabilities and assess fines for a failure to meet appropriate service standards
- Test TNCs to complement or replace current services to get better outcomes

Empower people with disabilities and caregivers to advocate for better service

Too often, people reluctantly accept they can only travel to certain destinations and must live within restricted parameters because of physical infrastructure barriers. People whose lives are limited by the accessibility of the transportation system should be encouraged not to accept that parts of the system and region are off limits to them.

- Give people with disabilities and their caregivers the tools to effectively advocate for better service
- Proactively involve seniors and the disability communities in transportation planning

Here's the bottom line: We need to take a more holistic approach to transportation that provides improved mobility for all. A kinder, gentler transportation system that is easier to understand and easier to use will improve the lives of all residents. If we expand overall mobility for those that struggle most, we can unlock economic opportunity, allow people to better care for their health, and strengthen community bonds. Increasing mobility will also reduce social costs that result from poor transportation, allowing people to enjoy a higher quality of life. Improved coordination and smarter use of transportation resources can make a significant difference to the mobility of a large share of the population. It's time to work proactively to get our transportation system closer to universal mobility.

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→ **To view a full copy of the Toward Universal Mobility report, visit:**
http://www.metroplanning.org/universalmobility


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Tackling Racial and Class Transportation Inequities in the Wilmington, Delaware Region

Bill Swiatek, AICP

Low-income and Black residents in the Wilmington, Delaware region encounter more difficulties using the transportation system. These groups report more difficulty reaching everyday activities and are less involved in transportation planning processes. The Wilmington Area Planning Council (WILMAPCO), the region's Metropolitan Planning Organization (MPO), shed light on these and more social inequities in its 2019 Transportation Justice (TJ) Plan. This article provides highlights of the plan's findings and its recommendations.

Wilmington's Black Residents Experience Most Transportation Inequities

Black residents are the region's largest racial/ethnic minority population, comprising about 21 percent of its half-million residents. Often spatially segregated, half of Black residents live in neighborhoods where about half or more of the residents of their neighborhood (or census block group) are also Black.

More than a dozen equity indicators were analyzed in the 2019 TJ Plan. They included: average travel times, neighborhood connectivity, local traffic volumes, bicycle level of traffic stress, availability of public electric vehicle charging stations, demographic composition of local planning study areas, and knowledge of WILMAPCO.

As shown below, WILMAPCO identified concerns for Black people and residents of predominantly Black neighborhoods in seven of 13 transportation equity indicators it examined. That was more than low-income residents or those living in impoverished neighborhoods (five), or Hispanics or those living in Hispanic neighborhoods (three). Transportation improvement spending and transportation safety, two key equity concerns for Black neighborhoods, are explored below.

Overview of Transportation Equity Indicators and Concerns

	Low-income Residents	Black Residents	Hispanic Residents
Transportation Access (in General)	X	X	
Neighborhood Transportation/Housing Costs	X		
Neighborhood Connectivity			
Travel Time from Neighborhoods			
Travel Time on Public Transit (in general)		X	
Traffic Volumes	X	X	X
All Vehicle Crashes			
Pedestrian and Bike Crashes		X	
Bike Level of Traffic Stress			
Public Electric Vehicle Stations	X	X	X
Community Transportation Project Funding		X	
WILMAPCO Community Planning			
Knowledge of WILMAPCO	X	X	X

First, transportation spending patterns between 2002 and 2018 revealed that neighborhoods with double or more the regional average of Black residents received 38 percent less community transportation project funding than expected, based on their population size. Predominantly White, Hispanic, and high-poverty neighborhoods received transportation investments in line with their population size, or slightly more.

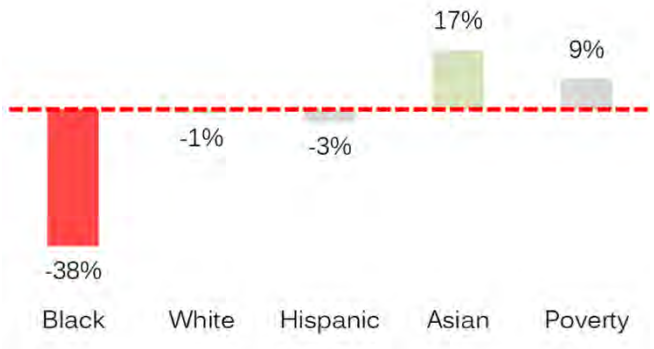
To conduct the spending analysis, WILMAPCO isolated "community transportation projects" between 2002 and 2018 from its transportation spending programs. Projects which fell within a neighborhood with a minority or low-income concentration were flagged. Exceptions included expressway projects (which have controversial impacts on TJ communities), mainline railway improvements (which often have more of a regional benefit, rather than localized), or spending along Wilmington's Riverfront (a gentrified, predominantly White district which shares block groups with racially diverse, struggling neighborhoods). Total planned community transportation projects spending within each flagged neighborhood was calculated against the total planned transportation spending for each of the years. The resulting figures were then compared to the percentage of the regional population residing within the neighborhoods, year by year. The bars in the above graph show a deviation from the expected spending with all years considered.

The TJ Plan recommends a three-pronged approach to begin addressing this inequity:

1. Adjust the project prioritization process to encourage more projects in Black neighborhoods.

2. Generate more projects by conducting transportation studies in Black neighborhoods and supporting the implementation of existing studies. These studies will utilize trauma-informed community-building and community empowerment outreach techniques[1] to develop and implement projects.

3. Address sources of structural racism through the promotion of diverse, representative voices throughout planning processes.



Deviation from Expected Community Transportation Project Funding in Neighborhood Concentrations

FY 2002–18, the Wilmington, Delaware Region

A second key indicator of concern found that Black neighborhoods were also home to a disproportionate number of vehicle crashes. Analyzing data from 2016, WILMAPCO found that, based on their population size, predominantly Black communities had a 2 percent higher-than-expected number of overall crashes, 29 percent more pedestrian crashes, and 20 percent more bicycle crashes. Many neighborhoods with a large percentage of Black residents are in the City of Wilmington, where there are relatively high walking rates but also heavy street-level car traffic. The TJ Plan recommends developing and implementing safety improvements here through follow-up studies and reducing car dependency.

1 These methods involve the long-term investment in community relationship building, the encouragement of local leadership in studies, the acknowledgment of past harm done by planning efforts, the achievement of equitable and iterative public participation, the realization of community empowerment, and more. See page 114 of the WILMAPCO 2019 TJ Plan for a full discussion. www.wilmapco.org/tj.

Car Dependency a Drag on Low-income Family Budgets

Most of the Wilmington region's residents live in car-dependent suburbs. A regional transportation connectivity analysis (more details in a separate box in this section) was completed as part of the TJ Plan. The analysis identified whether reasonable walking, biking, bus, or car connections existed from each home to a variety of destinations. While 95 percent of homes were within a reasonable car trip of destinations (such as supermarkets, low-wage job centers, and libraries), only 23 percent could take a low-stress bike trip, 19 percent a relatively easy bus trip, and 7 percent a short walking trip.

Lack of reasonable non-car transportation options impacts low-income families most. While homes in impoverished communities were often better connected to destinations than average, non-car connections from these homes were still weak. For example, only 23 percent were within easy reach of a library by walking, 50 percent within easy reach of a single low-wage job center by biking, and 52 percent were within easy reach of a medical center by bus. This makes car access indispensable for most families.

But it is expensive for a low-income family to operate a private car. As one local mother shared, "I can pay for my child's medicine this month, but I also need car insurance, gas, and rent all in the same week. And it just doesn't add up."[2]

Using data from the Center for Neighborhood Technology, WILMAPCO found that more than half of its most impoverished neighborhoods had combined housing and transportation costs considered unaffordable for a lower-income household. High transportation costs were a key driver. Transportation expenses should be lower than 18 percent of a household's budget to be considered affordable, but that was rarely the case. In Wilmington's suburbs, where the problem was worst, WILMAPCO estimated that low-income families in impoverished neighborhoods annually spend about $3,000 more than is reasonable on transportation. This is money that could likely be better spent on improved housing, medical care, and education.

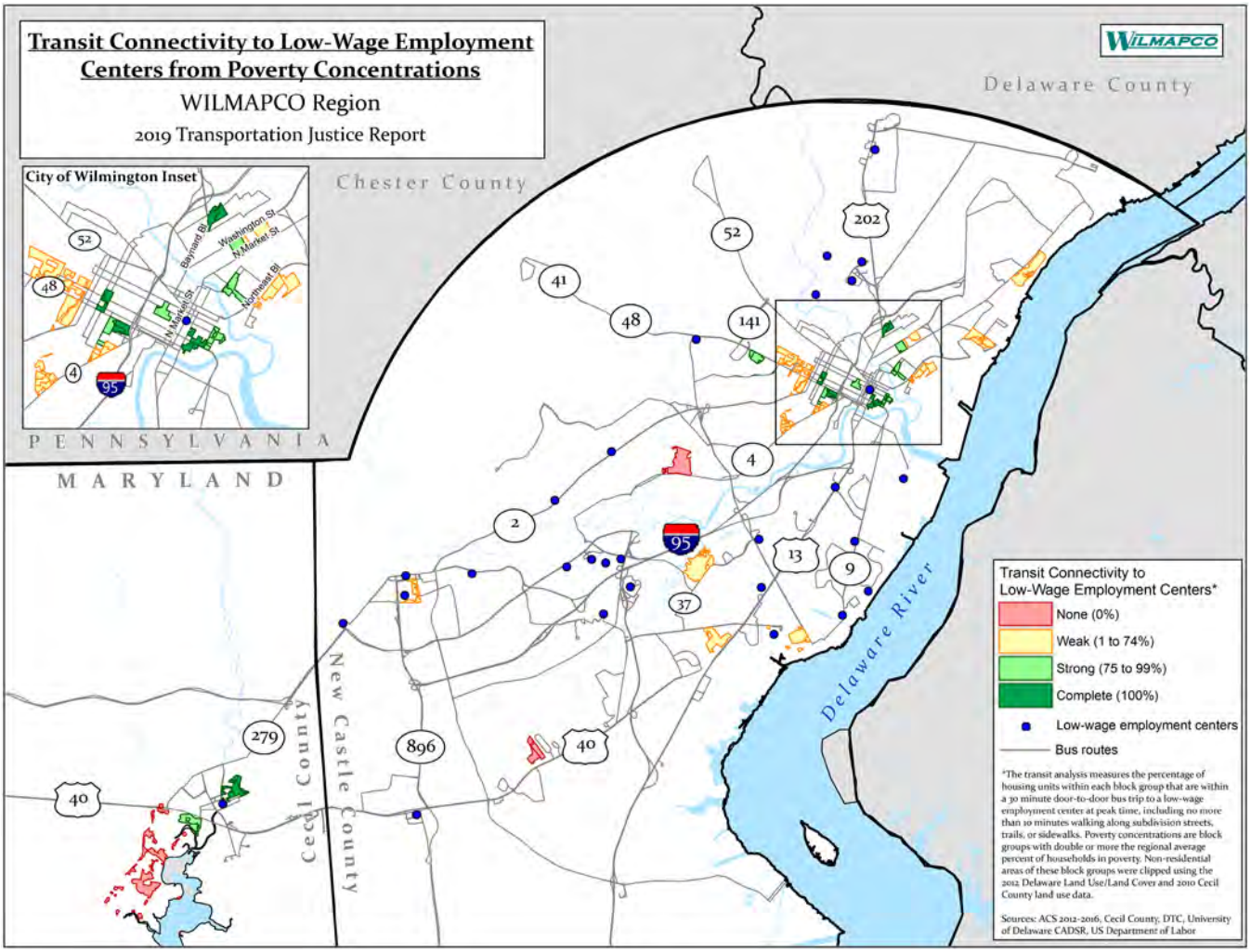
Reducing car dependency ultimately means stopping and reversing sprawl and ending decades of highway-dominated spending programs. While these goals are called for in WILMAPCO's Regional Plan, both are stubborn policy challenges for the suburban region.

The TJ Plan also offers more immediate recommendations to support connectivity from impoverished areas. As shown in the map below, for example, WILMAPCO used its connectivity analysis to measure the strength of bus connectivity from impoverished neighborhoods to low-wage job centers. Many of these neighborhoods have weak reasonable bus connections to at least one of these worksites, or they lack them entirely. A recommended follow-up study would consider how the frequency and routing of the bus system could make better connections to job centers, along with other places. Similar targeted improvements to the walking and bicycling networks were also recommended.

Final Thoughts

This article, along with professional and local media attention, has been focused on the TJ Plan's analysis of transportation inequities for low-income and racial/ethnic minority populations. The Plan is, however, much wider in scope. A separate section analyzed the needs of seniors, people with disabilities, and people who live in households without vehicles. It also examined a

2 See page 43 of the WILMAPCO 2019 TJ Plan. www.wilmapco.org/tj



strong racial and class divide in public knowledge of local transportation planning, making several recommendations for greater inclusivity in engagement processes. WILMAPCO's TJ Plan serves both as a model for identifying and working to overcome transportation equity barriers, and for how MPOs can meet and exceed their federal obligations (Title VI, Environmental Justice, Language Assistance, and the Americans with Disability Act) in a unified Plan.[3]

3 The Plan can be read in full at www.wilmapco.org/tj

Regional Connectivity Analysis

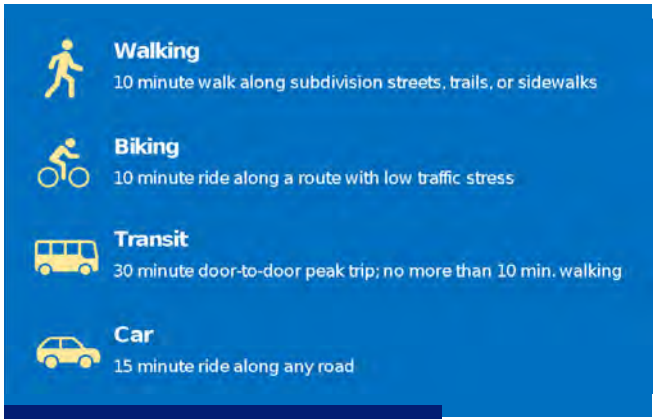
Working with the University of Delaware's Center for Applied Demography and Survey Research, WILMAPCO analyzed its region's transportation connectivity. Connectivity to nine destination types from every housing unit in the region was determined for walking, bicycling, transit, and car trips. Neighborhoods (census block groups) were then classed based on the collective level of housing unit connectivity to at least one destination within these destination types. The graphics below show the destination types and the accessibility tolerances, by mode.

At the regional level, the connectivity analysis shows just how extremely car-dependent the WILMAPCO region has become. On average 95 percent of homes are connected to all combined destination types by car. By contrast, less than a quarter of homes have good connections, on average, to destinations by other modes.

Other products of this analysis include the percentage of connected housing units, by mode and destination type, within each block group. A couple of these maps are reproduced in this article.

This connectivity analysis provided a rich survey of the Wilmington region's connectivity, or lack thereof. It also enabled WILMAPCO to consider transportation connectivity through the lens of social equity. It provided the basis for recommended connectivity improvements to low-wage job centers and supermarkets.

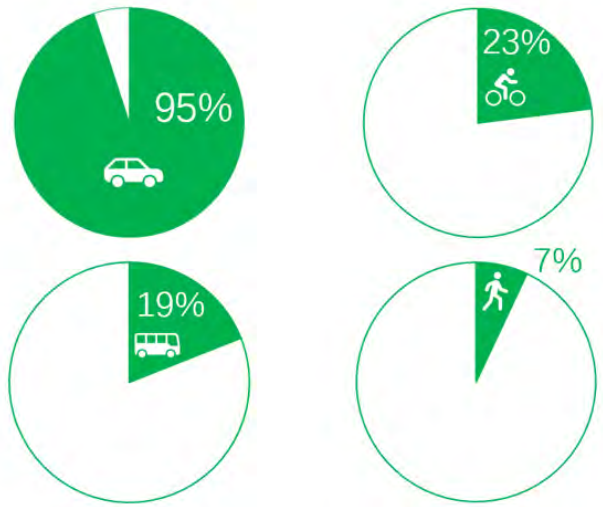
Destination Types



Connectivity Definitions, by Mode

Home to Destination Connectivity

Average Composite of Destination Types
Wilmington, Delaware Region, 2019



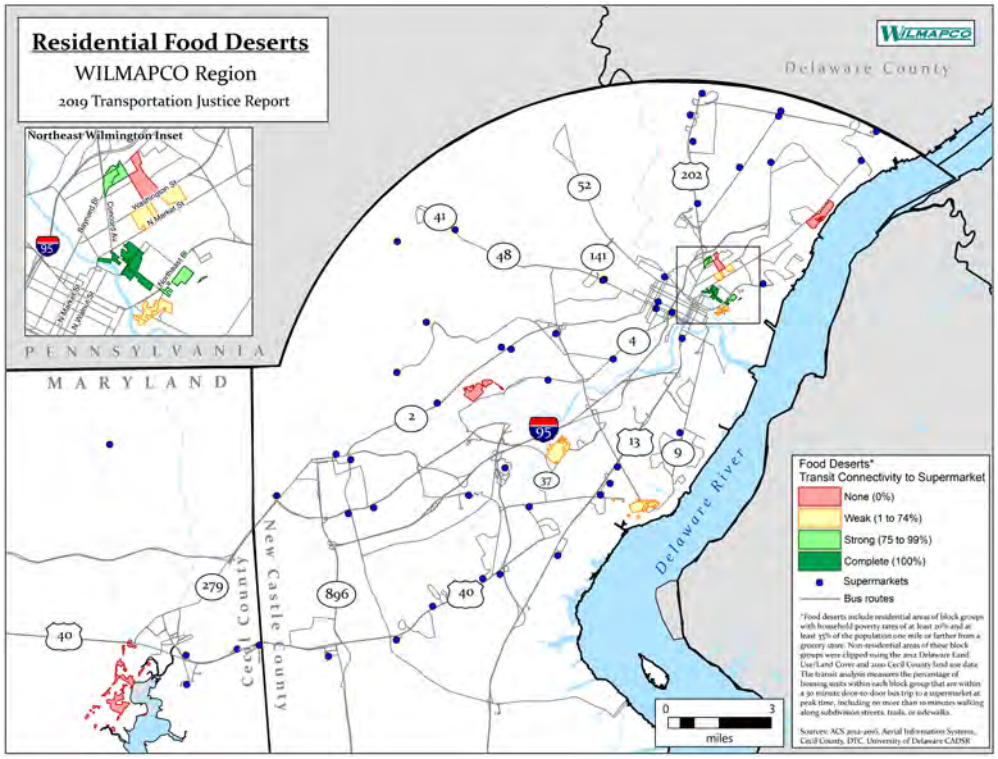
Redrawing the Wilmington, Delaware Region's Food Deserts

A food desert is an impoverished community located too far from a supermarket. WILMAPCO's 2019 TJ Plan redefined area food deserts, improving upon an official methodology by the United States Department of Agriculture (USDA).

The USDA has a few ways to identify food deserts. One common approach is to flag low-income census tracts where more than a third of residents are at least one mile from the nearest supermarket. Census tracts, however, are often quite large in suburban places like Delaware. They can house several distinctive neighborhoods and open spaces, industrial parks, and other places where people do not live. These non-residential areas are not removed with the USDA identification process. Nor does the USDA methodology consider public transit. It assumes people will only walk, bike, or drive to the supermarket.

WILMAPCO took the USDA approach and fine-turned it to redefine food deserts. Low-income census block groups (smaller than tracts) where more than a third of residents were one mile or more from the nearest supermarket were flagged. Next, unpopulated areas of those block groups were trimmed away. Finally, the resulting food deserts were classed by their level of good bus connectivity to supermarkets using the connectivity analysis featured in the previous callout box.

The map below shows the results of the food desert analysis. These WILMAPCO-defined food deserts can be found along the I-95 corridor in the north of the region, roughly stretching from Elkton to Claymont. Four food deserts were found to have poor transit connectivity to supermarkets. Other food deserts were found to have weak, strong, or complete transit connectivity to supermarkets.



Compared to the USDA methodology, which classifies large swathes of the Wilmington region as a food desert, the WILMAPCO approach is more nuanced and targeted. This, in turn, enables more focused planning and public health interventions to improve healthy and affordable food access.

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Intersection Design: I-295 Interch

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ENGAGING COMMUNITIES

Training Wheels for Active Transportation

Amelia Mansfield & Jordan Whisler

Introduction

Active transportation – that is, any mode that is people-powered such as walking, biking, and using mobility aids like wheelchairs and strollers – has been getting a lot of attention recently because of both cultural and statistical trends. The nation's population is aging at a fast pace, and a growing number of older adults no longer drive. The generation coming into adulthood is choosing to postpone getting a driver's license or maybe never getting one at all. People want to live in or visit communities with a sense of place which often translates to walk- and bike-friendly streets. This shift in demand is in response to both necessity and preference and is coming at a time when recent trends in safety, health, demographics, and demand underscore the importance of building more robust active transportation networks.

Just as a child learning to ride a bike needs training wheels before they are confidently cycling unassisted, a community needs help with their active transportation planning endeavors before they are able to confidently implement them on their own. An emphasis on providing safe, reliable, and affordable active transportation networks is seen at all jurisdictional levels from national to small town. Planners, engineers, decision-makers, advocates, and residents see the need, but they don't necessarily have all of the tools and knowledge to provide safe and equitable active transportation options in their communities. As a response, nationally-influential entities – both public and nonprofit – have created technical assistance programs, funding streams, publications, guides, and other resources to better enable planning and engineering professionals, local decision makers, and advocates to help create and support much-needed active transportation infrastructure and systems. Smart Growth America, the National Safe Routes to School Partnership, AARP, and the Federal Highway Administration (FHWA) are some of these entities, to name only a few.

The same sorts of efforts are seen at the state level, especially through the Local Technical Assistance Programs (LTAP). LTAP Centers are one way that the FHWA provides low-cost or no-cost technical assistance and "technology transfer services" to local and rural road agencies. There are 51 LTAP Centers across the US and in Puerto Rico[1]. LTAPs' efforts can be more easily tailored to the needs and political structure of each state. LTAPs are commonly housed in a university, and they focus mostly on the training of planning

1 https://www.fhwa.dot.gov/clas/ltap/

and engineering professionals and providing technical assistance to communities related to roadway management and maintenance. Walking, biking, and other non-motorized modes and infrastructure aren't typically addressed in LTAP programming and services. In Ohio, however, the LTAP is housed with the Ohio Department of Transportation (ODOT), and the program provides training and technical assistance specifically focused on planning, design, and implementation of active transportation networks, in addition to the more common LTAP subject matter.

ODOT's LTAP provides training and technical assistance to help local governments that manage and maintain public roadways throughout the state. These agencies include counties, cities, villages, townships, Metropolitan Planning Organizations (MPOs), and Rural Transportation Planning Organizations (RTPOs). Co-funded by ODOT and FHWA, the Ohio LTAP Center currently delivers more than 300 training sessions per year in the areas of safety, workforce development, infrastructure management and organizational excellence.

Local jurisdictions – their planners, engineers, decision-makers, advocates, and residents – are asking for help learning how to foster a walking- and biking-friendly atmosphere in their communities. They might need extra assistance to comprehensively plan for, fund, build, maintain, and promote their active transportation networks. LTAP Centers can serve that important role – they can be the training wheels – by offering technical assistance programs tailored to the local jurisdictions' planning and engineering needs. Ultimately, the efforts put forth by LTAP Centers will bolster the abilities of jurisdictions so that they are equipped with the knowledge and skills to continue integrating walking, biking, and other active transportation modes into their planning efforts and way of life. The Ohio LTAP Center does just this through the Active Transportation Academy (ATA).

Trainees test traffic calming countermeasures with toy cars and dry erase markers during a Traffic Calming Programs training in Clinton County, Ohio.

ODOT LTAP Active Transportation Academy

In 2013, ODOT LTAP started the Active Transportation Academy (ATA) in collaboration with the Ohio chapter of the Safe Routes to School (SRTS) National Partnership. The ATA is geared toward improving the safety of bicyclists and pedestrians near schools in response to crashes involving school-aged children, gaps in school bus services, childhood obesity from inactivity, and truancy rates. The ATA was focused on educating trainers of adult school crossing guards, walking school bus[2] leaders, bike-riding classes for school-aged children, and inventorying bicycle and pedestrian-related environmental concerns via school walk audits in order to create School Travel Plans which are tied to funding to build SRTS-related projects.

Over time, ODOT LTAP began to hear about a new need from their constituents: training related to pedestrian and bicycle planning and implementation in general. In 2017, ODOT LTAP responded to this need by expanding the subject matter content and audience of the ATA. Currently in 2019, ODOT LTAP is further expanding the ATA to include direct technical assistance to local jurisdictions who want and/or need help planning and implementing programs and projects that improve the safety of bicyclists, pedestrians, and all other roadway users.

The need for safe, reliable, and sustainable active transportation networks across Ohio is realized when looking at the numbers. ODOT LTAP formed the focus of the ATA based on statistics related to pedestrian and bicyclist safety, health and demographics, and user demand.

Safety

Between 2008 and 2018, over 10,000 Ohioans were killed or seriously injured walking or biking. The year 2018 marked the worst year for pedestrian deaths in the country in nearly 30 years, and nearly the highest number of annual pedestrian deaths in the state in the last 20 years. In 2018 alone, 135 people walking and 22 people biking were killed on Ohio roads — many in economically depressed areas with limited transportation options.

Health and Demographics

A lack of safe options for walking and biking inhibits healthy lifestyles for Ohioans. In 2018, 1 in 3 Ohioans were physically inactive and Ohio's adult obesity rate hit an all-time high of 33.8% (40th out of the 50 states). By 2020, 18% of Ohio's population will be 65 or older, exacerbating the need for safe alternative forms of transportation.

Demand

ODOT's 2016 Travel Preference Survey documented a sharp increase in demand for walking and biking, where 75% of respondents identified providing bicycle and pedestrian facilities as important. Despite the current demand, Ohio was ranked 19th out of 50 for most bicycle friendly state according to the 2018 League of American Bicyclists' report card. While Ohio is the 10th most densely populated state, it ranks 35th out of 50 in bicycle ridership.

2 A "Walking School Bus" is a Safe Routes to School program where an assigned and trained adult walks a pre-planned route to/from a school every day picking up school-aged children along the way. The adult ensure their safety as they walk.

ATA Course Offerings

The ATA offers 17 courses that are either focused on educating trainers or providing technical skills and assistance to planning and engineering professionals. The courses and their foci are included in Table 1. Courses are listed in alphabetical order.

The ATA offers this training via either in-person or online formats depending on the demand, necessary interactivity, and relevance of the topic (i.e., courses that were once in-person can be converted to an online archived format so that they are still accessible to interested parties). The most common format is an in-person training workshop with an instructor and a combination of lecture-style instruction and group activities. The in-person training is either focused on educating-the-trainer or developing and implementing active transportation-related plans. Online training is self-guided via an online-learning platform complete with quizzes and interactive components as well as recordings of webinars and past in-person training workshops.

Table 1: ATA Course Offerings

Course Name	Focus
Advocating for Active Transportation	Skills-based
Complete Streets Implementation	Skills-based
Community Traffic Calming Programs	Skills-based
Conducting a School Walk Audit	Train the trainer
Conducting Walk and Bike Audits	Skills-based
Creating a Rural Active Transportation Plan	Skills-based
Creating a Vision Zero Action Plan	Skills-based
Crossing Guard Training	Train the trainer
Girls in Gear training	Train the trainer
Health and Equity in Transportation	Skills-based
Incorporating SRTS into Wellness, School, and Community Planning	Skills-based
Mobility Solutions: Transit's First and Last Mile	Skills-based
Non-Infrastructure Implementation	Skills-based
Safe Routes to School Lesson Plans	Skills-based
Safety in Active Transportation: School and Community Planning	Skills-based
School Travel Plan Development	Skills-based
Walking School Bus Training	Train the trainer

Trainees discuss learnings during a Health and Equity in Transportation training in the Youngstown, Ohio area.

ATA Statistics: 2017 through 2019

- 17 topics
- More than 50 training activities
- Nearly 700 trainees representing planning, engineering, parks & recreation, public health sectors, police, and firefighting professionals, volunteers, and advocates
- A variety of jurisdictional types have hosted training: townships, villages, cities, counties, Metropolitan Planning Organizations, Rural Planning Organizations, Regional Planning Organizations, urban, suburban, and rural communities, nonprofits, and school districts

ATA Administration

The Active Transportation Academy is 100% funded through ODOT's Highway Safety Program with the goal of eliminating all traffic fatalities and serious injuries within Ohio. ODOT LTAP staff provide oversight, guidance, and promotional support for the ATA, working closely with a consultant who manages the program.

ODOT LTAP selects a consultant through a formal publicly-advertised process each year. The consultant is responsible for course development, instruction, promotional activities, and program evaluation. Course development activities include researching best practices, writing content, creating instructional materials and workbooks, and utilizing a combination of media such as printed documents, PowerPoint presentations, webinars, and online learning platforms.

Course instruction is arguably the most time-consuming responsibility of the consultant. This work involves communicating directly with the point of contact for the jurisdiction hosting the training, ensuring that logistical details are arranged for a seamless training event, assisting

Trainees take it to the streets of Youngstown, Ohio, to learn how to conduct a walk audit.

the host and ODOT LTAP with promoting each training, customizing training materials for the specific audience, preparing the instructor, debriefing with the host and instructor after the training, disseminating post-training materials to the trainees including, but not limited to, an electronic copy of presentation materials and a Certificate of Participation, and reporting back to ODOT LTAP on attendance and the attendees' evaluation of the training.

The consultant also promotes the ATA through webinars and in-person presentations. Webinars are coordinated directly through ODOT LTAP and offer insight about course content for specific training topics with the goal of attracting communities to host training and provide cursory education on a topic to a wide audience. In-person promotion occurs in the form of presentations at conferences or to special audiences by request. Consultants also staff informational booths at conferences and other events where targeted audiences can get information about the program and how to host or attend training.

Burton Planning Services (BPS) has been the consultant for the ATA for three contract periods in a row (2017 – 2018, 2018 – 2019, and 2019 – 2020). BPS is a small planning and engineering firm based out of Westerville, Ohio. Much of BPS' work is focused on active transportation and best practices research. The BPS team has project management expertise and a working relationship with ODOT via various types of projects.

The Active Transportation Academy serves as "training wheels" for planners, engineers, decision makers, advocates, and residents of communities across Ohio as they strive to plan, design, fund, build, and promote walking- and biking-friendly environments; the goal is for the communities to be able to master these efforts on their own, just like riding a bike unassisted. The structure of the ATA allows for flexibility in course offerings – topic, type, location – and the

administrative structure allows for Ohio LTAP to choose a consultant with active transportation expertise and project management skills to fit the needs of the program on a cyclical basis. The ongoing efforts of Ohio LTAP and the consultant to evaluate the ATA ensures that the needs of the trainees are being met, and that their participation is meaningful. The ATA is teaching communities how to plan and implement programs, projects, and policies related to providing safe and equitable active transportation options first with guidance, and then on their own.

Next Steps

This article has provided a glimpse into how one LTAP Center is helping communities acquire the tools and knowledge to plan, design, fund, build, and promote an active transportation network and culture. The crux of the ATA is a focus on serving the needs of Ohio LTAP's constituents. The ATA will continue to change in response to safety and health data, and community demand. Here are a couple of recommendations for others seeking to start a similar program:

Start Small

See what resources exist that you can promote to your constituents; refer to national, state, and local public, private, and nonprofit entities. If you borrow a training from one of them, or create your own, start with one topic or audience (i.e., ATA's initial focus was on Safe Routes to School in-person educate-the-trainer courses).

Be Flexible

The ATA wouldn't be as successful as it is if it weren't for continuous program evaluation, best practices research, and customization for each training audience. No matter how big or small your active transportation technical assistance efforts, be sure to integrate them with flexibility, updates, and responsiveness to feedback from your constituents.

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Amelia is a Planning Manager with Burton Planning Services and has over twelve years of experience in multi-modal transportation, community, sustainability, and environmental planning. She is adept at developing and managing programs and projects, and has extensive experience working with public and private entities to create and implement successful plans. She has worked on a wide range of active transportation projects and initiatives, including safe routes to school, complete streets, bike and walk audits, traffic calming, traffic safety, active transportation plans, and related training for professionals. Additionally, she is skilled in the facilitation of public involvement activities and professional trainings. Amelia is an AICP certified planner.

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The Missing Link in Planning for the Transportation Needs of Marginalized Seniors

Robert L. Grant III, MPA

Professional urban planners are engaged in the business of envisioning, creating, maintaining, and adapting elements of their communities' built environment to meet the needs of our wider society. No urban-planning project should be considered a success unless social justice is a key consideration throughout the planning process. This is especially true in transportation planning. In this context, "justice" can best be defined as who has a voice in "decision-making" on transportation plans (access to justice), and the process of determining how these voices reach equitable decisions and outcomes (procedural justice) (Grossardt & Bailey, 2018; Taylor, 1991; Rawls 1973). Diverse stakeholders and community members have ample opportunities to share their perspectives on numerous transportation matters in their various communities. However, the current public participation process could be improved while still working within the constraints of time, resources and available funding. Thus, planners should ask themselves with more scrutiny, whether we are truly providing this opportunity to all citizens.

Planners will be forced to confront this question head-on in the coming years, especially with the retirement of the Baby Boomer generation rapidly approaching. Merriam-Webster (2020) defines the Baby Boomer as a person born in the USA following World War II, usually between the years 1946-1964. Municipalities and regions must be prepared to assist these emerging seniors with mobility and accessibility in a way that promotes equity among the diverse membership of this demographic group. While it is true that all Baby Boomers will not require the same needs regarding mobility and accessibility, a certain element of this group is in danger of slipping under the radar of planners and society as a whole. This article will discuss "Incorporating Marginalized Senior Participation into the Transportation Planning Process", a training program that I have created as a PhD student in the Public Policy and Administration program at Virginia Commonwealth University. This program aims to ensure seniors remain active participants in the transportation-planning process at a time when planners could all too easily forget about the unique needs and perspectives of this group.

Think for a moment about the last community forum that you attended or hosted. Perhaps it was a meeting about possible changes to bus routes, increasing subsidies for light rail, or maybe a charrette regarding creating a bicycle path in a particular area of your city. Who was in attendance? Were there various ages, races, and genders there? Diversity and collaboration are crucial to good planning. Now think about some demographics of the population who were not in attendance. It does not mean that a planner or

a municipality is uncaring because a group is not well represented in a public forum. However, if a particular group is consistently missing out on decision-making opportunities in transportation planning, it is the responsibility of the public sector to investigate and mitigate these repeated occurrences.

Does the particular individual or group being excluded from decision-making processes have one or more of the following characteristics?

- Primarily Minority (Ethnic, religious, etc.)
- Transit Dependent (Reliant completely on family, friends, or perhaps even do without certain essentials such as fresh foods and medications when transit routes do not serve their neighborhoods)
- High poverty (Low income, fixed income, etc.)
- Reside(s) in areas of city with a greater potential risk for environmental justice concerns (Noise pollution, air pollution, water pollution, soil pollution, vehicular accidents, etc.)
- Little formal education (Lack of opportunity for secondary or post-secondary education)
- Reside(s) in areas of city with a higher potential risk for crime, illegal drug use, and/or older infrastructure
- At a higher risk for malnutrition and malnutrition related illnesses such as Corcoran et al. (2019) describes as "nutrient deficiencies, osteoporosis, and immune dysfunctions" (p. 175-76)
- At a higher risk for social isolation and lack of affection, and a lack of access to civic, community, and leisure activities enjoyed by others (Donini et al., 2013)
- Perhaps at a greater risk of falling when walking long distances and recovering slowly (Ex. traveling to a bus stop far from home)

For the purposes of this article, any individual falling into any two or more of these categories will be termed "marginalized". Marginalized refers to being outside of the normal experiences enjoyed by the average resident of the municipality or region in question. Now think back to the transportation public planning processes discussed a few paragraphs ago. Is it possible that our current forms of planning processes may actually place the marginalized with more burdens than benefits, in comparison to other groups in our cities? Are we, as public servants, doing all we can reasonably do to ensure that the marginalized are truly represented in transportation planning?

What does this have to do with the Baby Boomers and their impending retirement?

First, one of the most vulnerable marginalized groups matching the description above is the elderly or emerging elderly (those about to become seniors). They are the main group that the "Incorporating Marginalized Senior Participation into the Transportation Planning Process" program seeks to empower and represent with equity.

Second, retirement signals a change in life that includes changes in income, travel habits, and age. Those that reach this stage of life will continue to mature and will require the support of the very communities that they supported by working (both paid employment and volunteering) until they reached retirement age. This new phase of life ought to reward the Baby Boomers and other seniors by allowing them to benefit from their past acts of good citizenship, industriousness, and charity. No matter how difficult it may be, planners should be dedicated to addressing the emerging concerns and needs of this population.

Third, public transportation has the unique opportunity to serve as a potential means of meeting this groups particular needs. Beatty et al. (2017) states "Transit can be especially important

for older residents who are '"aging out"' of driving as their mobility, vision, and hearing decline" (p.2). Likewise, Bliss (2017) informs us that "nearly a quarter of Americans over 65 don't drive - a share that increases as the years add up." As the Baby Boomers grow older the percentage of seniors in our society will increase. Certainly, using family or paratransit as mobility solutions has its place, but seniors need to maintain autonomy and the ability to make spontaneous trips as long as possible. Dahan-Oliel et al. (2010) states it powerfully: "Older individuals who primarily use spontaneous and accessible modes of transportation and do not depend on other individuals or service providers - that is, those who drive, walk, or use public transportation - have higher levels of overall participation" (p.499). This participation refers to everything from grocery shopping and religious worship, to recreational events and civic meetings.

How does public transportation tie into this?

Beatty et al. (2017) mentions that having transit that offers "increased all-day and weekend service can improve service for older riders while also attracting more riders of all ages" (p.15). However, we must remember as planners that such services must be available in all parts of the city. There is evidence in cities nationwide of disparities in such services among marginalized individuals as Wellman (2014) mentions: "Entire populations are prevented access to key quality of life indicators like healthcare, employment opportunities, education, and cultural and social outlets through no fault of their own" (p.337). Now think back to the access to justice and procedural justice elements addressed by our current transportation planning structures (Grossardt & Bailey, 2018; Taylor, 1991; Rawls 1973). Could communication procedures with marginalized elderly communities be improved in our cities and regions? Do we think that marginalized seniors are represented adequately in our current participatory planning events? Are we confident that the mechanisms we are providing for this group to gain access to decision makers are accommodating and not burdensome to the marginalized themselves? If we are honest and open our eyes to the realities of our ever changing society, the answer must be that we are not certain. How can we gain clarity? How might we prepare ourselves to serve this often forgotten segment of our society? How can we communicate with our marginalized seniors effectively, without resorting to ideas such as "silence equals agreement" or that a certain level of education is needed to be a meaningful part of the transportation planning decision-making process as Grossardt & Bailey (2018) so adamantly caution us against?

I have developed a training program that can assist planning departments in particular and municipal governments in general with achieving this goal. After this training program, the planners will be equipped with the skills, knowledge, and abilities needed to complement their existing skill set to produce a public transportation system (and decision-making process) that accommodates the needs of marginalized seniors. This is accomplished through activities to be completed in both the training sessions and workplace. In other words, this program will provide seniors and emerging seniors with a more active role in transportation planning and decision-making by increasing professional planners' sensitivity to the needs of this population.

Program Title:

Incorporating Marginalized Senior Participation into the Transportation Planning Process

Program Rationale:

As the Baby Boomer generation moves toward retirement and has greater dependence on alternative forms of transportation in the coming decades, planners should seize the opportunity to include this demographic in transportation planning decisions; so that, municipalities and regions are prepared to be as diverse and inclusive as possible.

Five Program Themes:

1. Participation
2. Interaction
3. Experience
4. Intersectionality
5. Community Collaboration

These themes are intentionally not defined. The definition will be crafted by the trainer and participants collectively as the themes are addressed in the training sessions.

Program Objectives:

1. Planners will address the needs of marginalized seniors by having representation from this group attend and participate in transportation planning events.
2. Planners will conduct needs assessments of marginalized seniors prior to official plan submittals.
3. Planners will demonstrate an appreciation of diverse forms of experience by inviting diverse stakeholders (including representation from low-income areas) to periodic meetings to share ideas and build camaraderie.
4. Planners will demonstrate an understanding of intersectional approaches to problem-solving and incorporate these approaches when making decisions for their communities.
5. Planners will attend a community association or nonprofit organization meeting that addresses the needs and concerns of senior citizens such as mobility, access to affordable and nutritious food, access to healthcare facilities, and transportation options.

Although it may appear that these objectives are already being met in many cities' current planning and outreach processes, after completing this training program, many planners will discover that there remains much work to be done (and that they are now ready to meet the challenge).

Additional Program Bonuses

The training sessions in this program are designed to be engaging, exciting, and informative. This is not a lecture oriented program at all. Each session has a speaker specializing in one of the five program themes. These speakers are resources from organizations that interact with marginalized populations daily and have critical insights and creative strategies to promote engagement, clarity, and cooperation with communities that have long felt isolated from decision- making.

The nature of the program also enables presenters to have the flexibility to align the training sessions with the most pressing needs of the municipality hosting the training. The final products of each training session can and should be utilized in the work environment. This will require coordination between agency leadership, supervisors, and participants. This will not be a notebook that gathers dust on your bookshelf. It will engage all elements of your agency/department. This program will lead to new relationships, trust, and creative cooperation between elements of the community that have felt isolated in the past. This program will also foster opportunities to form bonds with other agencies and institutions that could solve community matters beyond transportation. The level of dedication a department/agency has to including marginalized seniors in the transportation planning decision-making process over the long term, will determine how effective the results of the training are. This program will take planners' current level of social equity awareness and transform it in ways beneficial to their municipality, their career, and their consciousness. Its ultimate purpose is to invoke questions, arouse curiosity, and open the door to a dialogue on the skills and experiences that nontraditional stakeholders "bring to the table".

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The People Factor:

How Strong Relationships Lead to Effective Regional Active Transportation Efforts and Health Equity

Mojgan (Mo) Sami Ph.D**, Lila Burgos & Arturo Garcia**

Introduction

People are at the heart of the planning and public health professions. Both professions have goals related to participation and collaboration for community development projects; however, the complexity of these relationships in regional active transportation efforts is rarely addressed. It was this opportunity that inspired our interdisciplinary team of public health and urban planning research and evaluation professionals to explore how strong relationships lead to the development of projects and policies that aim to increase active transportation. Our study aimed to unpack the complexity of relationships in the context of a cross-jurisdictional active transportation project in Orange County, California through the Orange County Partnerships to Improve Community Health (OC PICH).

OC PICH was a three-year (2014-2017) initiative funded (no. U58DP005861) by the Centers for Disease Control and Prevention (CDC) that used a combination of changes to policy, systems and environment (PSE) to increase health equity in the region. Although the perception of Orange County is that it is an affluent county, health disparities exist among the 34 cities that make up the region. For example, cities in the central and northern part of the county, such as Garden Grove, Anaheim, and Santa Ana, experience higher rates of chronic disease, have low educational attainment, and higher unemployment and poverty rates than cities in south Orange County, such as Newport Beach and Laguna Hills.[1]. Out of 39 PICH projects funded by the CDC, OC PICH was the only cross-jurisdictional project approved as a partnership between the cities of Anaheim, Garden Grove, and Santa Ana. The cities of Anaheim and Garden Grove received funding to make park improvements, and the city of Santa Ana received funding to improve its active transportation infrastructure, such as shared road markings (or "sharrows") and traffic calming amenities in a downtown corridor.

In order to coordinate the cross-jurisdictional partnership, the Community Action Partnership of Orange County (CAPOC) acted as both the fiscal agent and the program coordinator responsible to manage the funds, partnership, evaluation, and communication/marketing. All in all, 15 partner organizations were involved in OC PICH (see Table 1 for a complete list of funded and non-

1 Data available on our community data dashboard at http://www.ochealthiertogether.org/.

funded partners).[2,3,4] The partnership included two evaluators (University of California, Irvine [UCI] and Special Service for Groups [SSG]) who conducted separate impact evaluations of the infrastructure improvements.[5]

Methods: How Can You Study Working Together?

OC PICH partners represented a wide variety of stakeholders, including technical experts and agency decision makers within city departments such as Community Development, Public Works, City Planning, Parks and Recreation and Community Services. Other stakeholders included local school districts, elected officials, law enforcement and community advocacy organizations. Of the 15 official partners within the initiative, there were seven partners across

Table 1: OC PICH Partner List, Funded and Non-funded

	Organization	Lead Contact
Funded Partners		
1	Community Action Partnership of Orange County (CAPOC) – Lead Agency	Dolores Barret, Principal Investigator and Director of Community Services
2	Alliance for a Healthy Orange County *	Michele Martinez, Executive Director
3	City of Anaheim*	Pamela Galera, Principal Project Planner, Community Services Department
4	City of Garden Grove*	John Montanchez, Recreation Manager, Community Services Department
5	City of Santa Ana*	Cory Wilkerson, Active Transportation Coordinator, Public Works
6	Kid Healthy	Linda Franks, Executive Director
7	Orange County Department of Education (OCDE)	Chris Corliss, Program Coordinator for Health, Physical Education and Physical Activity
8	Orange County Food Access Coalition (OCFAC)	Christina Hall, Executive Director
9	Special Service for Groups (SSG)*	Erica Shehane, Director, Research & Evaluation
10	University of California, Irvine (UCI)*	Dr. Oladele Ogunseitan (Dele), Chair of the Department of Population Health and Disease Prevention, and Dr. Mojgan Sami, Project Scientist
11	YMCA of Anaheim	Javier Gonzalez, Healthy Communities Director
Non-Funded Partners		
12	Orange County Health Care Agency (OCHCA)*	Megan Beard, Health Educator, Safe Routes to School (SRTS)
13	Orange County Transportation Authority (OCTA)	Paul Martin, Active Transportation Coordinator
14	Santa Ana Unified School District	Angela Allen-Hess, School Wellness Coordinator
15	St. Joseph Health	Cecilia Bustamante-Pixa, Community Benefit Director

*Those organizations with an asterisk were part of the OC PICH Active Transportation Strategy.

2 OC PICH had 11 funded partners, 4 unfunded partners and an open invitation policy for informal (unfunded) partners who came to the table to network, advocate and support active transportation efforts in Orange County, CA.

3 The 15-member partnership was co-led by CAPOC and a team of researchers from the University of California, Irvine (UCI).

4 As the evaluation lead, UCI worked closely with CAPOC and SSG to provide an opportunity for the evaluators to keep track of the progress to facilitate the planning of the pre-post observation periods for impact evaluation and process evaluation.

5 Sami, M., Smith, M., & Ogunseitan, O. A. (2018). Peer Reviewed: Changes in Physical Activity After Installation of a Fitness Zone in a Community Park. Preventing chronic disease, 15.

What is Social Network Analysis?

Social network analysis (SNA) is a methodology that combines visual and statistical components for analyzing and understanding individuals and their relationships. It's been used to understand how influence and power shape the sharing of ideas, information and resources within a network. Understanding social networks can help planners and evaluators achieve desired community outcomes by seeing how social influence is generated, the factors that accelerate or cause a barrier to behavior change, and how partnerships can perform more effectively.

What are factors for successful collaborations?

Researchers at the Wilder Research Center identified 19 factors that influence successful collaborations formed by government and nonprofits organizations. The six categories of factors include: (1) Group Environment, (2) Group Membership Characteristics, (3) Group Process/ Structure, (4) Group Communication, (5) Group Purpose, and (6) Group Resources.

the active transportation intervention activities that represented three categories: (a) policy development and advocacy; (b) community engagement and programming; and (c) active transportation infrastructure design and intervention. There were two impact evaluations of the active transportation projects: (1) evaluation of the impact of collaboration; and (2) evaluation of the immediate impact on biking, walking and micro-mobility use after the installation of bicycle infrastructure in Santa Ana.

The collaboration evaluation used a qualitative descriptive design and collected data through focus groups, interviews, and a partner network analysis using methods and principles from ***social network analysis*** [6, 7, 8] and ***factors for successful collaborations***.[9, 10]

To understand the impact of the OC PICH partnership on active transportation policy, planning, and implementation in the target cities of Anaheim, Garden Grove, and Santa Ana, CA, SSG conducted focus groups and interviews of partners in Years 1 and 2. The participants were a mix of official OC PICH partners and other key active transportation stakeholders in Orange County, CA (see Tables 2 and 3 for a list of participating organizations for years 1 and 2). SSG also conducted interviews with OC PICH partners who could not attend the focus groups and with partners who were not directly involved in active transportation but were implementing activities supporting active transportation (such as park improvements).

Our questions for focus groups and interviews were developed using elements of successful

9 Mattesich, P.W. and Monsey, B.R. (1992). Collaboration: What makes it work. A review of research literature on factors influencing successful collaboration. Amherst H. Wilder Foundation, St. Paul, MN.

10 Perrault, E., McClelland, R., Austin, C. and Sieppert, J. (2011). Working together in collaborations. Successful Process Factors for Community Collaboration, Administration in Social Work, 35:3, 282-298.

collaborations[6, 7] as well as our previous assessments of other collaborations using a developmental evaluation approach and social ecological model.[11] We asked participants with whom they collaborated on active transportation activities, the impact these collaborations had in the community (e.g., changes in knowledge, behavior, and/or policies), and their successes in active transportation to date. Additionally, the Year 2 focus groups and interviews asked about opportunities for more collaboration in active transportation, if there were any benefits or challenges to participating or being connected with OC PICH, and if OC PICH active transportation partners had plans to sustain their work after OC PICH. See Figures 1 and 2 for a copy of the focus group and interview protocols. We created themes and produced quotes from focus group and interview data.

SSG also conducted OC PICH partner surveys at two points during years 1 and 2. These surveys were developed using elements of social network analysis[3,5] and adapted from a tool used by Provan et al. (2005).[4] The partner network surveys assessed each OC PICH partner's level of involvement with each organization or agency with whom they partner on active transportation in

11 Centers for Disease Control & Prevention. Social Ecological Model: A framework for prevention. Retrieved on August 5, 2015 from https://www.cdc.gov/violenceprevention/publichealthissue/social-ecologicalmodel.html.

Table 2: List of Organizations Participating in Year 1 Focus Groups

	Organization
1	City of Anaheim, Community Services Department
2	City of Anaheim, Community Development Department
3	City of Anaheim, Public Works
4	City of Anaheim, Public Works
5	City of Anaheim, Union High School District
6	City of Garden Grove, Community and Economic Development
7	City of Garden Grove, Community and Economic Development
8	City of Garden Grove, Community Services Department
9	City of Santa Ana, City Council Member
10	City of Santa Ana, Parks, Recreation and Community Services
11	City of Santa Ana, Public Works
12	City of Santa Ana, Public Works
13	City of Santa Ana Police Department
14	City of Santa Ana Unified School District
15	Santa Ana Active Streets Coalition

Table 3: List of Organizations Participating in Year 2 Focus Groups and Key Informant Interviews

	Organization
1	Alliance for a Healthy Orange County
2	California Department of Transportation
3	City of Anaheim, Community Services Department
4	City of Anaheim, Public Works
5	City of Anaheim, Public Works
6	City of Anaheim, Public Works
7	City of Garden Grove, Community and Economic Development
8	City of Santa Ana, Parks, Recreation and Arts Commission
9	City of Santa Ana, Parks, Recreation and Community Services
10	City of Santa Ana, Public Works
11	City of Santa Ana, Public Works
12	City of Santa Ana Unified School District
13	KidHealthy
14	Orange County Health Care Agency
15	Orange County Transportation Authority
16	Santa Ana Active Streets Coalition
17	Safe Routes to School Regional Partnership
18	Southern California Association of Governments

Figure 1: OC PICH Year 1 Focus Group and Key Informant Interview Protocol

OC PICH Year 1 Focus Group and Key Informant Interview Protocol

1. First, can you start out by stating your title, the organization or city you work for, and the length of time you've been in your position?
2. Can you briefly describe the work you do supporting active transportation?
3. In the past year, who have you collaborated with on active transportation activities? (i.e. programs, infrastructure changes, master plan)
4. What does this collaboration look like?
    a. Level of interaction
    b. length of relationship
5. What impact have these collaborations had?
    a. Increased knowledge
    b. Changes in behavior
    c. New or changed policies
6. Where do you see more opportunities for collaboration?
7. What plans are being made for the three cities to create a more comprehensive active transportation plan or to connect Orange County with an integrated master active transportation plan?
    a. Who are the key players in helping to move the master active transportation plan forward?
8. How do you envision active transportation looking in your city?
    a. How do you envision active transportation looking in Orange County?
9. What is your biggest success with active transportation efforts? Are any of you involved or know of OC-PICH?
    a. If so, in what capacity?
10. Have there been any challenges or benefits to your organization being linked with OC-PICH or other active transportation partners?
11. How can OC-PICH support your active transportation activities? Or how can OC-PICH support the development or implementation of active transportation infrastructure?

Figure 2: OC PICH Year 2 Focus Group and Key Informant Interview Protocol

OC PICH Year 2 Focus Group and Key Informant Interview Protocol

1. In a circle, can we start by stating:
    a. Your title
    b. the organization or city you work for, and
    c. the length of time you've been in your position
2. Can you briefly describe (about 1 minute) the work you do supporting active transportation?
3. Within this past year, who have you collaborated with on active transportation activities? This can be anything from programs, infrastructure changes, master plan, etc. Additionally, the work can be formal or it can be through informal means like thought partnership.
4. What does this collaboration look like?
    a. How often do you interact? What's the depth or level of this interaction (e.g., planning, sharing information, bi-directional, mutual trust and respect)?
    b. (If a specific department or person) How long have you had this relationship?
5. What impact have these collaborations had?
    a. Increased knowledge
    b. Changes in behavior
    c. Changes in built environment
    d. New or changed policies
6. In the context of planning and implementing active transportation work, where do you see more opportunities for collaboration?
    a. Between cities? (intra-city)
    b. Between different departments, community groups or entities within the same city?
    c. Between the city and the county?
    d. Involving more community residents?
7. What does your ideal vision of active transportation look like for your city?
    a. How do you envision active transportation looking Orange County-wide?
8. What are your biggest successes with active transportation efforts?
9. Have there been any challenges or benefits to your organization being linked with OC PICH or other active transportation partners?
10. How can OC-PICH support your active transportation activities? Or how can OC-PICH support the development or implementation of active transportation infrastructure?

If time permits:

11. If your city has implemented an active transportation intervention, do you know if the community has been utilizing it?

their respective city or county. We considered the 4 primary areas of collaboration:

1. How groups come together to share information on best practices for active transportation or built environment modifications to encourage physical activity (shared information);
2. How groups share resources to promote active transportation and built environment modifications which encourage physical activity (shared resources);
3. How groups collectively make decisions that impact the direction of a program or policy and negotiate to ensure shared benefits and costs (decision making); and
4. How groups collectively troubleshoot problems in the development or implementation of a project (problem solving).

The partners ranked their perceived quality of each relationship on a scale from 1 to 4 with 1 having a poor relationship, 2 having a fair relationship, 3 having a good relationship, and 4 having an excellent relationship with their partner agency. Partner network survey data was analyzed using Excel and drawing network maps by hand for each level of interaction. The analysis of focus groups, interviews and partner network surveys provided key themes.

How Collaboration Can Be Used As A Driver For Change

Quality of Relationships Improved Over Time

At the end of Year 1, all OC PICH partners said they shared information with all the internal partners. Yet by Year 3, partners evolved from sharing information to decision-making with most organizations who were directly involved in active transportation policies or improvements to the built environment.

> *"Internally, we've been writing the bicycle master plan, meeting with public works, city planning, parks and recreation. So we've all been contributing our different expertise into the plan."- City Staff*

Partners increasingly named regional active transportation stakeholders as part of their core network, even if they had not originated relationships with these stakeholders prior to OC PICH. In addition, there was an increase in the quality of relationships between OC PICH active transportation partners and the external organizations and agencies with whom they interacted. We witnessed within the final year of the initiative that there was more of an intentional effort to organize and develop buy-in across elected officials and an intentional effort to push cities to collaborate to apply for active transportation-related funding and projects. Overall, the improvement in the level of interaction and quality of relationships demonstrates OC PICH active transportation partners working more closely with their partner organizations and agencies over time, cultivating trust and mutual respect, and establishing more successful and sustainable collaborations. However, it must be noted that these relationships evolved over time with intentional coordination and consultation.

Increased Collaboration Within and Across Municipalities Facilitated Regional Impact

While staff in city or county agencies often express difficulties working within their cities or county agencies, OC PICH partners from city and municipal agencies shared that collaboration within their municipalities was different. Partners did not state that collaboration was "easy," but investing time and resources in coordinating the collaboration between all stakeholders was worth the results. Partners also shared a strong desire to increase collaboration and collaborative efforts within and across cities that hadn't existed at the beginning of the project.

We also found that the monthly, formal OC PICH partnership meetings cultivated informal regional relationships that led to deeper engagement in formal active transportation efforts and deepened community engagement across the three cities. As OC PICH stakeholders started to strengthen new and existing relationships over time, they evolved from merely sharing ideas to sharing resources, collaborating on events, and co-developing regional active transportation policy with county agencies and other organizations that were not originally part of OC PICH. Partners also reported engaging counterparts in cities they met through OC PICH to get input and feedback on improving their city's General Plan and developing bicycle and pedestrian master plans.

> *"An active transportation network, pedestrian and bicycle connections across any lines are important. For example, how a bike lane network in Santa Ana connects with the network in Garden Grove, which then connects with the network in Anaheim is important because people don't always live, work and play in the same city." – City Staff*

OC PICH partners felt aware that regional government and quasi-governmental agencies, such as the Southern California Association of Governments (SCAG) and the Orange County Transit Authority (OCTA), are not the only actors actively working to foster collaboration on active transportation initiatives. As OC PICH's funding began to run out in year 3, partners expressed a desire to join (or form) cross-municipality coalitions that were in the nascent stages of development. All the partners expressed the importance of relationships built during the OC PICH project. In addition to understanding the value of relationships, stakeholders also recognized the

direct relationship between physical health and active transportation infrastructure. While partners understood that barriers to collaboration are often political, OC PICH provided an opportunity to work across municipalities and connect intercity transit activities and programming in a non-partisan manner. In fact, the involvement of non-governmental stakeholders and coalitions provided more diverse perspectives for OC PICH partners.

Passion & Urgency Facilitate Achieving Results

Active transportation and community engagement champions were key stakeholders in OC PICH. While they did not necessarily participate as formal members of the OC PICH partnership, they were an essential ingredient in the success of active transportation efforts. We characterize 'champions' as enthusiastic or passionate participants that brought innovative ideas and practices to the partnership. One example of a champion for community engagement was a planner from an OC PICH partner city that shared the importance of engaging young people in active transportation efforts. The planner led the development of an active transportation leadership program with high school students that focused on building student capacity to understand active transportation issues, how local government works, and advocate for policy and walk audits. Students in the program also presented at city council meetings to advocate for improvements to streets near their schools.

> *"A lot of people know about active transportation and want to participate and secure funds for their community." – City Staff*

This ***champion*** planner also helped local high school students write a successful grant to address active transportation equity in the city.

These '***champions***' within city departments, elected offices, and from within the community were vital to elevate the urgency for active transportation policy and implementation of interventions. When champions are organized on active transportation interventions and programming, elected officials prioritized and were more likely to see through the process of interventions. While some passionate individuals may participate in advocacy groups on health equity or transportation issues outside of their working hours, we found that many of these champions do become connected through efforts that fund stakeholder collaboration like OC PICH.

> *"We have a lot of very active local nonprofits that are invested in wellness and in active transportation. Latino Health Access, Neighborhood Works, KidWorks, Santa Ana Active Streets, Bicycle Truth – we [the city] work with them very frequently." – City Staff*

Collaboration Influences Community Change

OC PICH partners shared initiatives that were part of or influenced across the three target cities as a result of the forming and/or strengthening of the collaboration and relationships:

- **The Santa Ana Vision Zero Plan** was adopted in 2016 – the first of its kind –with the goal of zero fatalities from walking and biking collisions.
- The **Garden Grove Bike and Pedestrian Master Plan and Active Streets Plan** with the goal of creating healthier, more active, and more sustainable living for residents and the first active streets policy for the city. Garden Grove also recently implemented their 2nd Open Streets event and the Re-Imagine Garden Grove Community Plan, working with SCAG's Go Human Campaign to get residents more active in the city.
- **City of Anaheim street improvements** – The city made improvements to the 2004 Bike Master Plan to improve bike safety and accessibility and improve the multi-modal connectivity to increase active modes of transportation. Also, the Alliance for a Healthy Orange County (AHOC), who was funded by OC PICH to help change the landscape of active transportation in Orange County, implemented their Active Transportation Leadership Program (ATLP) in Anaheim and Garden Grove to get more youth active in improving their communities. In one program, AHOC trained students at Anaheim Union High School to advocate for active transportation policy changes. One big success was that students presented recommendations to city council, and the students were recognized by city council for their efforts.
- **Safe Routes to School (OC Health Care Agency)** – This is a countywide effort to create safer environments to support walking and biking to and from schools. Walk to School Day events during the past three years were partially supported by OC PICH through promotional materials. OC HCA, separate from OC PICH support, also trained students to conduct walkability audits around their schools and make recommendations to key stakeholders and parents to improve the walkability, bikeability, and pedestrian safety around schools.
- **Go Human campaign (SCAG)** – A regional campaign to encourage more Southern California residents to use more active modes of transportation, such as walking and biking.

Recommendations

We developed four recommendations for planning professionals based on our experiences with OC PICH as well as our experiences with other place-based initiatives in Southern California.

Cross-jurisdictional and multi-sector collaborations are key to designing effective solutions for community health issues, but they require a coordinating agency/ organization.

It takes many partners across multiple municipalities and sectors to address complex social factors at multiple levels of society (the individual, community, institution and systems/ policy level). It is the collective expertise, perspectives, experiences and energy of diverse partners to develop robust solutions and inspire engagement and collaboration. We found that collaboration within municipalities is a key component to the implementation of any active transportation policy while cross-jurisdictional collaboration is needed for a far-reaching impact. We witnessed this within OC PICH where the

three target cities began connecting with county and regional transportation agencies to inform and pass policy, implement active transportation initiatives, and influence funding requirements for the region.

Complex partnerships require a lead coordinating agency/organization that is funded to ensure partners have regular meetings, coordinate information and schedules, provide resources to facilitate monitoring and evaluation, facilitate community engagement, and manage other ongoing needs of the partnership. Relationships are built through intentional coordination, which requires a lead agency or organization.

Engage communities early in the process to develop viable and sustainable solutions

There are many community factors that must taken into consideration for active transportation initiatives to have buy-in and be successful, such as historical events, social/community norms, and community priorities. In addition, it is important to engage in conversations about race, equity, and disparities. As professionals, we must learn and be comfortable with authentically engaging community throughout the entire policy-making, plan development, and implementation processes. Trust is the foundation of collaboration and thus also necessary for effective and sustainable partnerships. For example, issues of gentrification and equity in the built environment are being raised throughout the country and in Southern California. The OC PICH target city of Santa Ana has experienced community activism in response to gentrification issues in their downtown area. This was something we had to be aware of as we conducted surveys with the public. In response to community voices, Senator Connie Leyva (D-Chino) introduced SB1000, incorporating elements of environment justice into city General Plans.[12] We can also point to the work of Dr. Camara Phyllis Jones discussing how our environment and policies knowingly or unknowingly perpetuate racial discrimination producing health disparities in our communities.[13]

12 Senator Connie M. Leyva. Leyva environmental justice bill signed into law. Retrieved on November, 20, 2016, from https://sd20.senate.ca.gov/news/2016-09-26-leyva-environmental-justice-bill-signed-law.

13 Jones, C.P. (2000). Levels of Racism: A Theoretic Framework and a Gardener's Tale. American Journal of Public Health, 90(8), 1212-1215.

Allow ample time to develop, implement and maintain active transportation initiatives.

Time is a significant factor that leads to a successful collaboration.[14, 15] The investment of time, staff and resources demonstrates commitment. Building personal connections and cultivating relationships takes time. Partnerships require time to form, coalesce, build trust, and thrive. Shared decision-making within a partnership requires time for dialogue and to come to an agreement on problems and solutions. Specifically, in a partnership like OC PICH, shared decision-making means there's a joint or shared consultation from city agencies and key stakeholders on a strategic direction. This means that all parties must understand the situation and negotiate the parameters of an action or decision so that they can collectively reach a decision.

Projects that result in changes to the built environment take time. This is important to recognize as city and funding processes have time constraints, which may not coincide with the amount of time required to gather community input, gather the appropriate approvals and permits, and to do construction. For example, while improving park space in one of the target cities, the timeline to start construction and make improvements was continuously pushed as different considerations from several city departments were added. Weather also caused delays as improvements were being made in the late fall. Moreover, more time allows initiatives to happen organically while incorporating community input.

Measurement and evaluation contribute to learning within active transportation initiatives

To measure the impact of such designs requires interdisciplinary evaluation teams. It also requires a mix of different methods and tools to measure various components of our interventions, to capture the causes and conditions for change, and to demonstrate the impact our interventions are having on the community. Collaborating with multiple partners in our evaluation efforts helped the OC PICH evaluation team make connections to other active transportation initiatives happening in the region and to interpret findings from our focus groups, interviews, and surveys. It helped us have a comprehensive understanding of why we were seeing certain trends emerge or provide a broader context in which these interventions were happening.

Conclusion

Grants for health equity and active transportation interventions aimed at creating systemic change must ensure that adequate funding is allocated to incentivize cross-municipal and diverse, cross-sectoral partners to meet frequently over the lifespan of the grant or intervention. While many different factors can influence relationships among stakeholders, time spent together can lead to effective coordination and longer lasting impacts. Intervention leaders or evaluators can actively examine collaboration and relationships through facilitating systematic activities that explicitly look at the relationship strength and dynamics via social network analysis, systems mapping and qualitative methods.

When evaluators fed back data on these issues to OC PICH partners, they shared that it reinforced the need to continue cultivating strong relationships and work through challenges to see continued benefits during complex and multi-year interventions. Explicitly recognizing collaboration

14 Valente, T.W. (2012). Network interventions. Science, 337, 49-53

15 Provan, K.G., Veazie, M.A., Staten, L.K. and Teufel-Shone, N.I. (2005). The use of network analysis to strengthen community partnerships. Public Administration Review, 65 (5), 601-613.

created more energy around continuing to do so despite the challenges.

Collaborating through everything from project planning challenges to learning from partners how to develop culturally relevant health promotion facilitated strong relationships between partners and improved regional coordination and problem-solving. Achieving health equity in transportation funding and activities is going to be fraught with systematic and institutional barriers, yet examples like OC PICH demonstrate how fostering high-quality connections in communities with health disparities result in more responsive efforts to implement active transportation policies, translating into more walkable and bikeable communities.

About the Authors

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Land Use, Transportation, and Health Workshops in Ohio:

Cross-Sector Conversations Centered on Equity

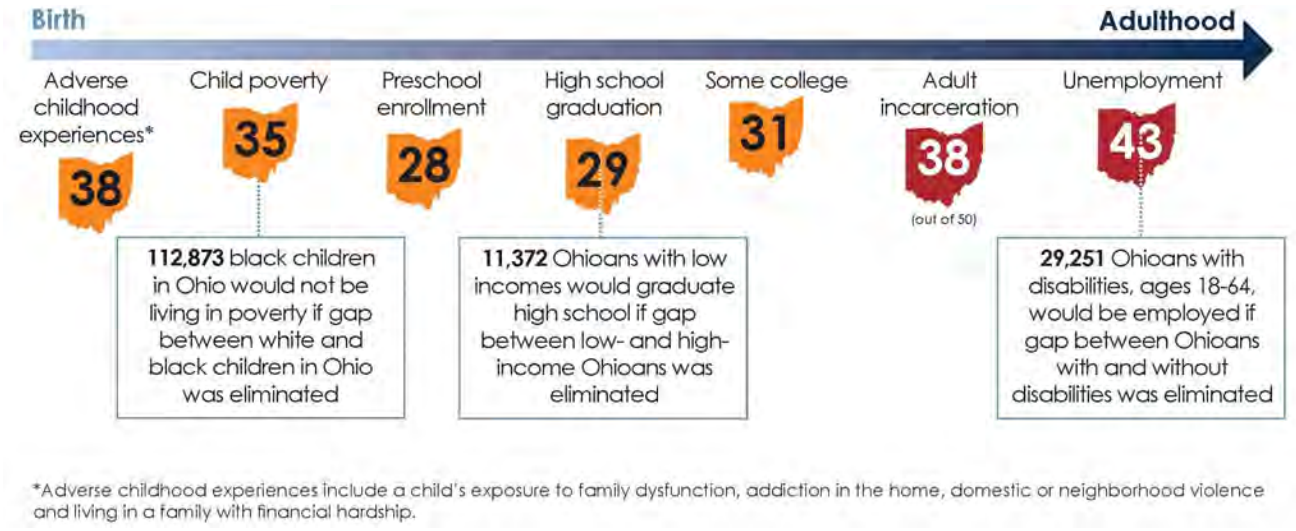
Michael Blau

Transportation and land use are inextricably linked. Working in tandem, they have a dramatic effect on community health, which is especially true for issues of equity and health disparities. The Ohio Department of Health (ODH), with support from the Centers for Disease Control (CDC), is taking steps to address these issues through a series of workshops, webinars, and other educational initiatives across the state.

Land Use and Transportation-Related Health Inequities

In the past decade, planners, public health practitioners, and policy makers have become increasingly aware of the connections between land use, transportation, and health outcomes. Local policies and regulations can improve public health by encouraging physical activity. Creating walkable built environments through pedestrian-oriented site layout and design, reducing or eliminating parking minimums, shortening block lengths, promoting mixed use and infill development, and other land use and environmental design strategies make it easier for people to use active transportation – walking, biking, and transit. Conversely, residents of auto-oriented communities suffer from the negative

Transportation planning decisions often put marginalized groups at greater risk of traffic violence than the general population.



Ohio's rankings compared to other states in various health disparities, and the adverse consequences for underserved groups

(source: Health Policy Institute of Ohio).

health effects of sedentary lifestyles. Long distances between destinations, big box retail and drive-thru restaurants, an oversupply of parking, and lack of pedestrian and bicycle infrastructure engender a number of systemic problems, from air pollution to obesity.

Transportation and land use planning shape public health outcomes in all communities, but historically, marginalized groups have felt the negative impacts of planning decisions more strongly, particularly in low-income and communities of color. For example, major roads and highways are often routed through historically black and brown neighborhoods, whose residents suffer disproportionately from the negative health effects of traffic violence and air pollution.[1] At the same time, these hazardous travel environments discourage people from using active transportation to meet their physical activity needs, which contributes to higher chronic disease rates in underserved communities.[2] As a result, low-income and people of color – who rely on biking and walking more than the general population[3] – are exposed to the dual effects of polluted, dangerous transportation networks and increased risk of chronic disease due to sedentary lifestyles.

On the other hand, white affluent communities typically have more sidewalks, bike lanes, street lighting, and other infrastructure that encourages active transportation, which allows residents to incorporate physical activity into their daily routines.[4] These communities face far less traffic violence than black, brown, and low-income

1 Zimmerman, S., Lieberman, M., Kramer, K., and Sadler, B. (2015). At the Intersection of Active Transportation and Equity. Safe Routes to School National Partnership. https://www.saferoutespartnership.org/resources/report/intersection-active-transportation-equity%20

2 Hornbeck, C., Kollman, J., Payne, T., & Sobotka, H. (2015). The Impact of Chronic Disease in Ohio: 2015. Ohio Department of Health. https://odh.ohio.gov/wps/wcm/connect/gov/b15bfd2e-a543-4c08-83ec-37378d10fb2d/CD+Burden+Final_Web.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDDM3000-b15bfd2e-a543-4c08-83ec-37378d10fb2d-mthHMug

3 Ibid

4 Bridging the Gap, "Using Local Land Use Laws to Facilitate Physical Activity," Research Brief March 2012, http://www.bridgingthegapresearch.org/_asset/5q86hg/btg_land_use_pa_FINAL_03-09-12.pdf

neighborhoods[5] and are exposed to less pollution and other toxic externalities of auto-oriented transportation systems. Residents of walkable communities are twice as likely to meet physical activity guidelines as those who do not live in walkable neighborhoods,[6] and they are more likely to attain the concomitant health benefits that are out of reach for less privileged communities.

The Challenge for Ohio

These disparities are widespread across the United States, and Ohio is no exception. Ohio ranks 46 out of 50 states on health value, an index that measures the state's performance on population health outcomes and healthcare spending.[7] It also ranks 40th in adult insufficient activity and 41st in adult obesity.[8] Compared to other states, Ohio faces greater health disparities related to race, income, education, ability, sexual orientation, gender, gender identity, and geography across a number of health measures. For example, infant mortality rates are three times higher for Black people than white people in Ohio; access to healthcare is also worse for Black Ohioans.[9] Land use and transportation systems often perpetuate these disparities: for example, Black mothers who live in auto-oriented communities with no vehicle access face immense hurdles in accessing healthcare, which can endanger their health and that of their infants.[10]

State agencies in Ohio are aware of the public health challenges born out of decades of racist and discriminatory land use and transportation planning practices, and are taking active steps to dismantle this legacy. However, in many local communities, there is less awareness about the connections between land use, transportation, and health, and fewer instances of dialogue between sectors to address these problems.

Through its State Physical Activity and Nutrition (SPAN) Program and several other funding streams, the CDC supports state and local initiatives to improve nutrition and physical activity. Active living strategies are central to this approach, and in 2018, the CDC introduced land use interventions as an additional strategy, encouraging dialogue between planners and health professionals about the connections between public health outcomes and the built environment's development patterns. This strategy aims to make it safe, easy, and comfortable to walk or bicycle for recreation and transportation by increasing activity-friendly routes to everyday destinations. Employing these strategies in an equitable and culturally sensitive way can help reduce the dramatic health disparities between low-income and communities of color and affluent white communities found in Ohio and across the country.[11]

5 M. Maciag. (2014). Pedestrians Dying at Disproportionate Rates in America's Poorer Neighborhoods. Governing. https://www.governing.com/topics/public-justice-safety/gov-pedestrian-deaths-analysis.html

6 Sallis JF, et al. (2009). Neighborhood environments and physical activity among adults in 11 countries. American Journal of Preventive Medicine. 36(6):484–490. https://www.ajpmonline.org/article/S0749-3797(09)00145-7/fulltext

7 Aly, R., & Stevens, A. (2019). 2019 Health Value Dashboard. Health Policy Institute of Ohio. https://www.healthpolicyohio.org/wp-content/uploads/2019/04/2019__HealthValueDashboard.pdf

8 Ibid

9 United Health Foundation. (2019). America's Health Rankings. Annual Report. https://www.americashealthrankings.org/explore/annual/measure/Sedentary/state/OH

10 Gentes, K., & Zabala, A. (2019). Franklin County Fetal-Infant Mortality Review (FIMR) Case Review Team Findings: 2018 (January–December 2018. https://www.columbus.gov/celebrate-one/8---2018-FIMR-Report/

11 Ansell, D. A. (2017). The death gap: How inequality kills.

Land Use and Health Workshops

The Ohio Department of Health is one of 16 states to receive CDC funding to implement its Creating Healthy Communities (CHC) program. The program supports 23 local health coordinators across the state to implement a number of active living strategies, from parks and playgrounds to active transportation planning. ODH contracts with Toole Design Group, an active transportation planning and design firm, to provide technical assistance to CHC coordinators. In 2019, Ohio's CHC program launched a Land Use and Health Workshop and webinar series with Toole Design's assistance. The series began with the simple mission of educating health professionals about the connections between transportation, land use planning, and public health, which was achieved through two strategies: presenting basic land use and transportation history and concepts, and situating them within a public health context; and inviting land use and transportation planners to workshops with public health professionals to spark cross-sector dialogue. However, workshop content and scope quickly evolved as it became evident that communities were eager to discuss myriad land use related health challenges they face, from chronic disease to environmental justice.

Ohio's Rural and Urban Health Transportation and Health Challenges

In addition to a dearth of funding resources and political support for active living strategies, many workshop participants shared challenges around displacement and housing affordability, drug addiction, racism, and health disparities present in their communities. Workshops provided a much-needed space to engage in candid conversations about the detrimental

Toole Design staff and workshop participants

Results from workshop registration surveys

Workshop participants doing a mapping activity

effect that land use and transportation decisions often have on marginalized groups. Leading the workshop, Toole Design staff emphasized the overlooked fact that land use and environmental design strategies that improve health outcomes can result in displacement and marginalization of people of color and low-income people. This is a widespread problem in urban areas created by historically racist housing policies and current revitalization strategies that are often intentionally harmful to longtime residents.[12] Participants from rural communities grappled with equity issues as well – however, their challenges stemmed not from displacement of underserved groups in redeveloping neighborhoods, but a virtual absence of any development or investment in their communities. Equity conversations in these communities revolved around poverty, job loss, brain drain, drug addiction, and a dire need for government investment in public health, transit, education, and employment.

The transportation system plays a prominent role in many of these challenges. For example, auto-oriented rural transportation networks with few pedestrian or bicycle amenities discourage active transportation. They also make it more difficult for zero-vehicle households to access healthy foods, healthcare, employment, and other essential needs. This reduces physical activity and is one reason why death by chronic disease is more

12 Golub, A., Hoffmann, M., Lugo, A., & Sandoval, G. (2016). Bicycle Justice and Urban Transformation: Biking for all?; Lugo, A. (2018). Bicycle/Race: Transportation, Culture, and Resistance.

prevalent in rural areas.[13] In urban neighborhoods experiencing redevelopment, increased police presence on the streets creates threatening travel environments for longtime Black and brown residents, who are much more likely to experience police brutality and racial profiling than white people.[14] This, in turn, reduces access to safe and comfortable active transportation options for oppressed groups. While the story is different in rural and urban areas, systemic transportation inequities are at the heart of many communities' public health challenges.

Finding Solutions Through Cross-Sector Conversations

Workshops provided an opportunity for cross-sector conversations about land use and health, centered around equity issues. Content was tailored for each workshop depending on local context, which varied widely due to Ohio's diverse built environments. Workshop content covered land use and environmental design strategies to improve health while incorporating equity considerations to mitigate land use related health disparities. These workshops provided space for discussions about health inequities and disparities, healthy foods access in rural and urban areas, the role of drug addiction in health outcomes, lack of funding and other resources to implement land use strategies, and many other challenges. Instructors presented solutions and case studies and led discussions on how to apply these ideas to participants' communities.

In addition to group discussions, workshop facilitators used several other strategies to explore equity issues with participants. Real-time polling, guest speakers, and activities encouraged participants to teach and learn from one another, across disciplines and communities. During one activity, groups were given aerial maps of various industrial and brownfield sites around Ohio and asked to redevelop them using strategies from the workshop presentation. They used paper cutouts symbolizing different land uses (e.g. multifamily housing, healthcare/medical, retail, arts/entertainment, green space, etc.) to reconfigure the sites, drawing in bicycle and pedestrian accommodations, traffic calming, and other roadway improvements. Groups presented their site plans, which were critiqued by facilitators and other participants.

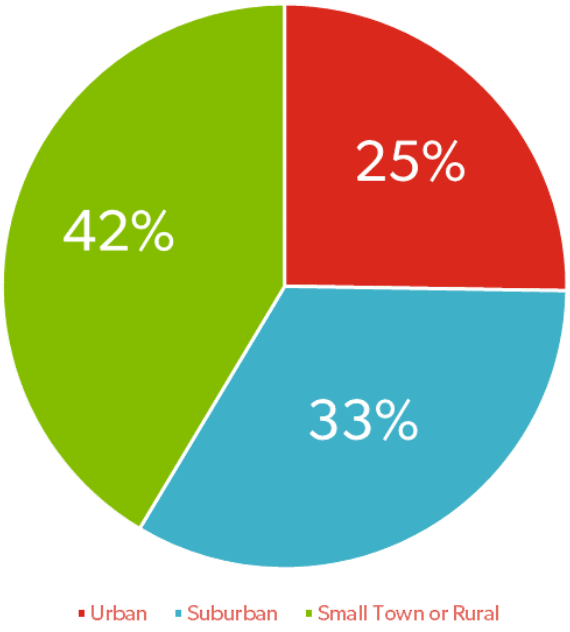
At the end of each workshop, a final role-playing activity synthesized all of the strategies, health challenges, and other workshop content and built upon the infill development activity. The site plans designed during the first activity were put up for review by local planning staff and health department officials to ensure that they encouraged active living. It was also time to gain the support of the larger community.

Participants were divided into two groups: Group 1 consisted of developers, whose job was to convince a group of stakeholders that their developments were worth building and that they improved health equity for underserved groups. Group 2 members were assigned various stakeholder roles: NIMBY Resident, Minority Business Owner, Mayor, AARP Chapter President, Parks and Recreation Director, Bicycle Advocacy Group Director, Hipster, Grocery Store Operator,

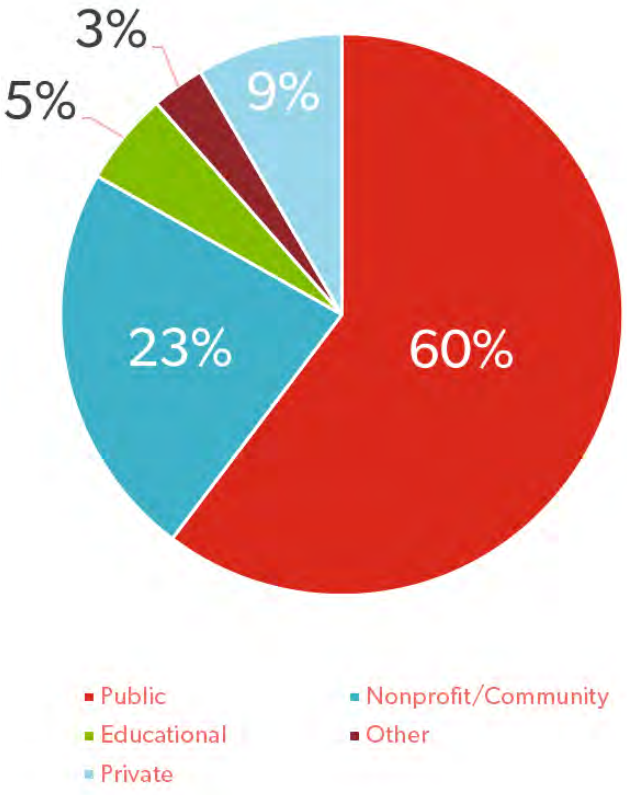
13 Hornbeck, C., Kollman, J., Payne, T., & Sobotka, H. (2015). The Impact of Chronic Disease in Ohio: 2015. Ohio Department of Health. https://odh.ohio.gov/wps/wcm/connect/gov/b15bfd2e-a543-4c08-83ec-37378d10fb2d/CD+Burden+Final_Web.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDDM3000-b15bfd2e-a543-4c08-83ec-37378d10fb2d-mthHMug

14 Zimmerman, S., Lieberman, M., Kramer, K., and Sadler, B. (2015). At the Intersection of Active Transportation and Equity. Safe Routes to School National Partnership. https://www.saferoutespartnership.org/resources/report/intersection-active-transportation-equity%20; Zayas, A., Stanley, K. "How riding your bike can land you in trouble with the cops — if you're black." Tampa Bay Times. April 17, 2015. Retrieved from: http://www.tampabay.com/news/publicsafety/how-riding-your-bike-can-land-you-in-trouble-with-the-cops---if-youre-black/2225966

Workshop Attendance by Community Type



Workshop Attendance by Organization



Chief of Police, and Public Housing Resident; each character had different goals and priorities, and developers had to use a variety of methods to engage with and understand stakeholders' concerns. Developers employed strategies and knowledge gained from the workshop to convince stakeholders that they should support their redevelopment projects.

Workshop participants took full ownership of their roles, using creative license to embellish and expand upon their assigned characters. Due to the mix of stakeholders involved, equity issues inevitably rose to the fore during this activity. Participants engaged in heated but constructive exchanges over police harassment and racial profiling, transit accessibility for seniors, access to healthy foods, traffic violence, and affordable housing. Through this process, what may have been abstract or irrelevant issues for workshop attendees were brought to life on a personal level.

Workshop Results

Workshop Series Reach

In partnership with regional planning organizations, ODH and Toole Design hosted seven workshops across the state, attended by over 200 people representing more than 130 organizations. An additional 150 people participated in the three-part webinar series. Representatives from growing and shrinking cities, sprawling suburbs and small villages, and urban and rural counties attended the workshops. Government officials from across the political spectrum and professionals from a variety of fields participated, leading to meaningful dialogues across sectors and between communities. Ohioans from 32 counties attended the workshop series, with strong public sector representation among participants: 60 percent represented government agencies from health, planning, transportation, development, law enforcement, and other fields.

Reactions to the Workshops

The Land Use and Health workshops consistently received high praise for content and organization, as well as for instructors' presentation skills and knowledge. Eighty-five percent of respondents to a post-workshop evaluation survey agreed or strongly agreed that workshops were well organized; and roughly three quarters agreed or strongly agreed that workshop content was interesting and that training time was used well. Two-thirds of all participants agreed or strongly agreed that they received skills and knowledge that they can apply to their jobs and professional goals.

Workshop participants

Not all those who attended the workshops walked away satisfied. At times there was a disconnect between participants from rural areas and the strategies and case studies that facilitators offered. For example, pedestrian-oriented zoning districts are hardly a useful tool in communities without zoning, and urban stories that do not reflect the unique history and culture of rural areas sometimes fell flat. One person from rural Appalachia "felt talked down to. People here have a lot of issues, that is an epidemic across the region. It's overwhelmingly poor and disadvantaged! Equity is hardly applicable when we can't even afford to take care of 'privileged' communities." Comments like this one are a clarion call for the CDC, ODH, Toole Design, and other organizations to think critically about engaging these communities, creating spaces for productive dialogue, and ensuring that equity issues remain at the fore, but are sensitive to community contexts.

Effecting Change: What Comes After the Workshops?

For many, the workshops provided a space to broach important topics around land use, transportation, health, and equity; but one-time events are not a sustainable way to continue these conversations. Workshop participants should maintain ongoing dialogue within their communities, with ODH and the CHC program playing a facilitating role where possible and appropriate. Many participants were eager to learn about anti-displacement strategies, solutions to rural brain drain, subdivision regulations that promote walkability, and other land use and health-related topics covered during the workshops. Bringing these ideas back to their communities and adapting them to meet local needs is the first step in effecting long-term change.

Workshop participants

The majority of workshop participants displayed a clear desire to continue conversations about land use and transportation-related health disparities and equity issues, and ODH will continue supporting these dialogues. In 2020, the CHC program will fund research on the inequitable distribution of active transportation infrastructure and land use interventions as they relate to housing prices and displacement of low-income and communities of color. The research will include recommendations for collaboration between ODH, the Ohio Housing Finance Agency, and regional housing authorities. This and other ODH-led initiatives will continue to promote cross-sector conversations centered around equity.

There is no one-size-fits-all strategy for addressing transportation and land use related health issues. Communities across Ohio are confronting a variety of challenges. Common problems may require different solutions based on local contexts. For example, chronic disease and lack of healthy food access is a problem in rural and urban communities alike. Creating a healthy neighborhood zoning overlay to control the proliferation of discount stores with unhealthy food options resonated in urban communities; but in some small towns and rural areas, participants explained that a local dollar store is better than the alternatives: traveling 30 miles to access a full-service grocery store with healthy food options, or becoming a food desert. Workshop facilitators quickly learned that everything from land use and environmental design solutions to health challenges must be firmly situated in a local context to resonate with intended audiences. Health challenges, strategies, and case studies that facilitators shared changed accordingly, so that no two workshops were exactly the same.

While solutions will always vary depending on the local context, the basic fact that transportation and land use work together to impact health outcomes will always be a reality. Participants and organizers at each workshop developed an understanding of how this dynamic works across Ohio's wide variety of communities. As more practitioners across the country do the same, we will continue to move toward a healthier future.

About the Author

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Michael is a senior planner at Toole Design Group based in New York City. He brings a unique lens to his work thanks to an interdisciplinary background in city planning, public health, and social justice. Michael was the project manager for Toole Design's Active Living Services contract with the Ohio Department of Health and played a leading role in exploring land use, transportation, and public health issues in communities across the state.

Empowering Low-Resourced Communities to Envision Their Active Transportation Network

Courtney Banker, Sam Corbett & Julia Lippe-Klien

Disadvantaged Communities Active Transportation Planning Initiative

Building a complete active transportation network takes vision, persistence, and community support. In communities with historic disinvestment where resources are strained, planning for active transportation is typically not the highest priority. However, when we evaluate collision data in the region, we see that fatalities and serious injuries are mostly occurring on a subset of streets and that fatalities and serious injuries are increasing - disproportionately impacting people walking and bicycling. Moreso, fatalities and serious injuries are mostly occurring in Disadvantaged Communities (DAC) and Communities of Concern (CoC). Specifically, between 2012 and 2016, 68 percent of fatalities and serious injuries in our region occurred on local streets and arterials and 32 percent of fatal and serious injuries occurred on state highways. Sixty-five percent of fatalities and serious injuries occurred on less than 1.5 percent of the roadway network; most importantly, 66 percent of the High Injury Network is in disadvantaged communities[1]. To address safety, equity, and accessibility, active transportation plans are essential.

Better active transportation networks can be life-changing; they help increase safety, affordability, access, and are critical to reducing greenhouse gas emissions. The transportation interventions that come out of active transportation plans are particularly vital for people living in disadvantaged communities. In 2012, the California Senate passed SB 535 requiring that a portion of all revenue from the state's Greenhouse Gas Reduction Fund be spent on projects that benefit disadvantaged communities, and charged the California Environmental Protection Agency (CalEPA) with determining which communities qualify as "disadvantaged." CalEPA developed CalEnviroScreen, an online tool that ranks census tracts in California based on potential exposures to pollutants, adverse environmental conditions, socioeconomic factors, and prevalence of certain health conditions. Census tracts scoring in the top 25 percent qualify as disadvantaged. The largest source of state funding for active transportation projects, Caltrans's Active Transportation Program (ATP), also defines communities with median

1 SCAG, "Transportation Safety and Security," accessed January 2, 2020, https://www.connectsocal.org/Documents/Draft/dConnectSoCal_Transportation-Safety-And-Security.pdf

household incomes at or below 80 percent of the state median as disadvantaged.

In January 2019, the Southern California Association of Governments (SCAG) set out to make active transportation plans accessible to all jurisdictions. The nation's largest metropolitan planning organization, SCAG represents six counties, 191 cities, and more than 19 million residents. More than 56 percent of jurisdictions within SCAG's planning area meet the thresholds for disadvantaged status. Of these communities, less than 26 percent have existing active transportation plans[2]. To address this inequity, SCAG launched the Disadvantaged Communities Active Transportation Planning Initiative (DCPI). The initiative involves developing an active transportation plan toolkit, piloting it in six disadvantaged communities to develop six unique, local plans, and refining the toolkit before public launch in 2021. After a request for proposals, SCAG selected a consultant project team to implement the initiative.

2 CalEPA, OEHHA, "CalEnvironScreen 3.0," accessed January 2, 2020, https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30; SCAG, "Active Transportation," accessed January 2, 2020, https://www.connectsocal.org/Documents/Draft/dConnectSoCal_Active-Transportation.pdf

Preparing the Active Transportation Toolkit

Understanding Best Practices

In order to build an active transportation plan toolkit, the project team analyzed best practices and emerging trends in the field. We reviewed pedestrian and bicycle master plans, first/last mile plans, and Vision Zero strategies from across the country. Considering that the ultimate toolkit is intended to better empower under-resourced, disadvantaged communities, our analysis included plans with an explicit emphasis on equity that were completed in underserved and disadvantaged communities. Efforts such as Los Angeles County Metropolitan Transportation Authority's (Metro) Blue Line First/Last Mile Plan and Oakland's Bicycle Master Plan, Let's Bike Oakland, demonstrated the importance of establishing an equity framework at the outset of the planning process; of incorporating historical and cultural context to ensure marginalization is documented and not perpetuated; of highlighting harmful demographic trends in transportation-related policing and survey results; and of actively listening and engaging with the community as they direct the development of priorities.

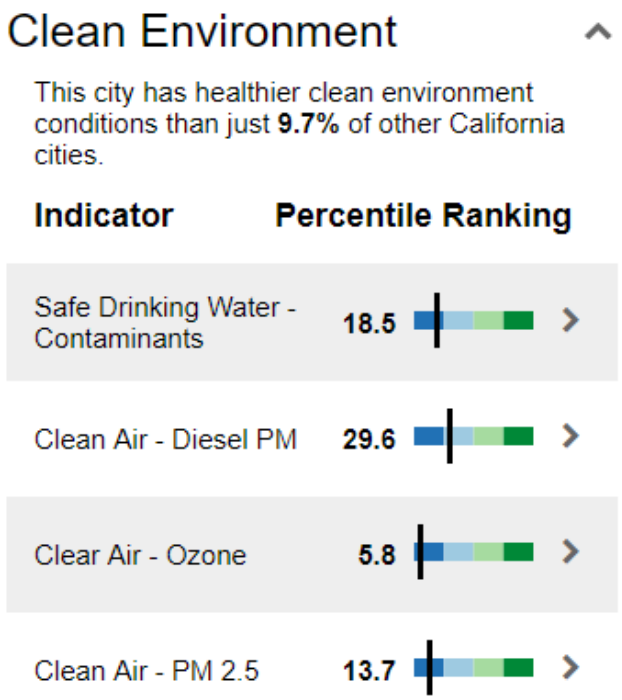
A focus group of practitioners shared invaluable insights about ways the toolkit could best benefit local agencies and clients.

In addition to the scan of national best practices, the project team also leveraged knowledge from local experts. We convened a focus group of practitioners from public agencies, nonprofits, and private firms with first-hand knowledge in planning and implementing active transportation networks. We also conducted an online survey of communities in Southern California that had recently completed an active transportation plan to gain targeted input on best practices related to community engagement. Both efforts fed into an Outreach and Equity Framework which provided the foundation for drafting the toolkit.

Data Analytics and Automation

Another important component of preparing for the toolkit was understanding the data needed to create plans and mechanisms to streamline corresponding data analysis. After reviewing existing public tools and data sources, we developed a framework for conducting transportation-related health assessments and an automated process for analyzing other data sets to incorporate into the template. The health assessment utilizes the California Healthy Places Index (HPI), developed by the Public Health Alliance of Southern California to aggregate local factors that predict life expectancy and community conditions throughout the state. The health assessment allows users to establish a baseline of their community's health and better understand the relationship between active transportation and health. Users can then create goals, actions, and performance measures that respond to the findings and advance holistic wellbeing.

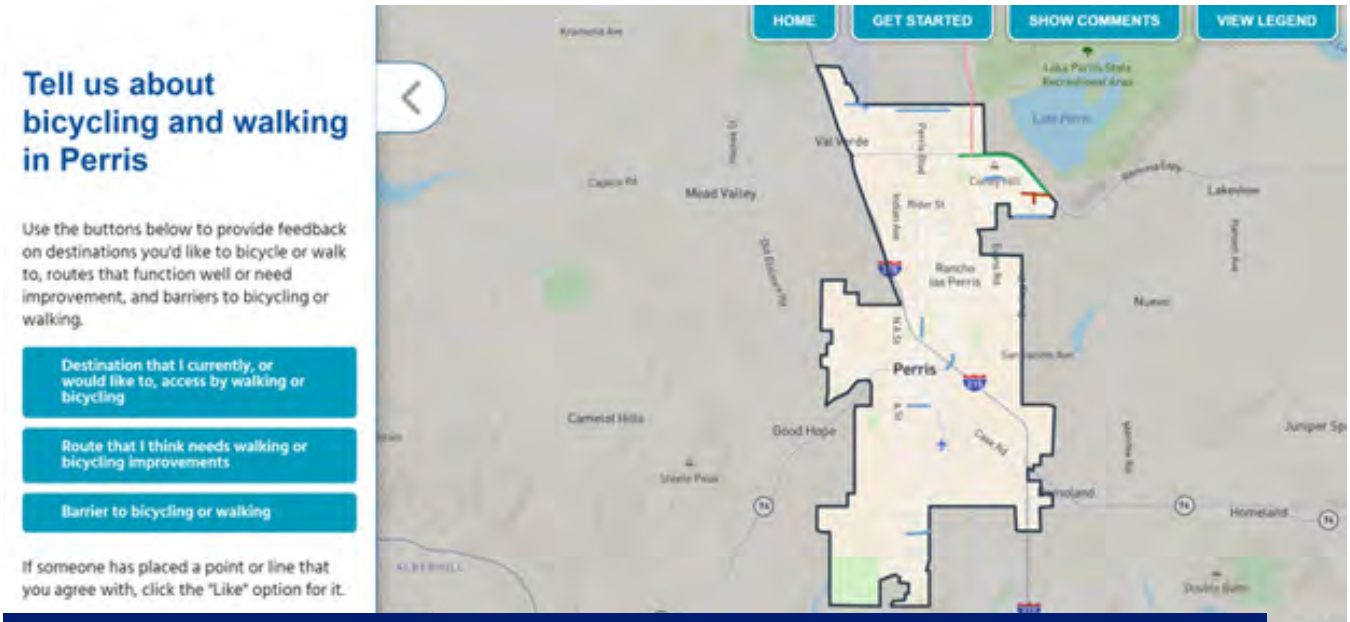
To help offset staffing and financial limitations in lower-resourced communities, the project team developed an automated data analysis process for evaluating existing conditions and prioritizing recommended projects. The tool helps communities assess transportation safety, connectivity, equity and addresses the following questions: What is the current level of transportation safety risk and how can it be improved? What is the level of traffic stress experienced by bicyclists riding throughout the city? How does the current active transportation network support trips to work, school, shopping, and others? How do demand, safety, and connectivity vary by the people served? The tool is accompanied by corresponding ArcMap document files (.MXD templates), geodatabases, and Excel files that help facilitate visualizing and interpreting the data.



The Health Assessment utilizes the California Healthy Places Index (HPI) to assess transportation-related health conditions such as air pollution. Incorporating health-related data in the plans helps cities like Perris (featured above) work towards enhancing active transportation as a means of improving air quality.

Community Engagement

The national scan of best practices, focus group, and practitioner survey all stressed the importance of conducting meaningful and sustained community engagement throughout the planning process. Using the Outreach and Equity Framework, the project team developed a robust



Web-based tools such as public input maps increase opportunities for community members to provide feedback on existing conditions

Community Engagement Plan (CEP) to augment the toolkit. The first step in the CEP is to convene a Community Advisory Committee (CAC). Intended to represent a variety of community perspectives, the CAC is comprised of stakeholders such as staff from the local jurisdiction (e.g., city or county), school district(s), business representatives, residents, students, advocates, tenants, and any other interested community members. The CAC continues throughout the planning process and can help maintain momentum and community connections needed for implementation once the plan is completed.

The CEP also includes walking/biking audits with community partners to better understand existing conditions; web-based tools such as a public input map; and targeted outreach to local businesses and organizations. Designed for communities within the SCAG region, the DCPI also makes use of the agency's Go Human initiative, a community outreach and advertising campaign to reduce traffic collisions in Southern California and encourage people to walk and bike more. Go Human events frequently include tactical urbanism components (or temporary safety demonstration projects) in which residents experience a corridor redesign or "complete street" in a live setting. The CEP incorporates multiple Go Human toolbox trainings and events in conjunction with existing community efforts to connect with community champions and better inform the final plan.

Another critical element of the CEP involves engaging and compensating a Community-Based Organization (CBO) to lead public engagement efforts. Findings from our research, focus group, and survey demonstrated the importance and immense benefits of partnering with a CBO. In reflecting local knowledge, languages, and backgrounds, CBOs help get more out of planned outreach events by increasing local perspective and insights into the planning process. For the DCPI, participating CBOs will also contribute to valuable data collection by conducting pedestrian and bicycle counts. Following the Outreach and Equity Framework, the project team has been sure to conduct all engagement efforts in each community's primary spoken languages, predominantly English and Spanish. Language accessibility allows for greater access to and inclusion in the planning process.

Piloting the Template

Utilizing findings from the research stage of the DCPI, the project team developed a preliminary active transportation plan toolkit and began putting it to the test locally. SCAG and its partner agencies worked to identify disadvantaged communities within the region that did not yet have an active transportation plan and were interested in developing one. Pilot communities were prioritized based on scores for the following criteria: SB 535/CalEnviroScreen score, Environmental Justice Area Score, Communities of Concern Score, and Median Income Score. SCAG discussed scores and feasibility with county representatives and explored interest and capacity with selected jurisdictions. Six communities were selected to participate; the communities represent both urban and rural settings, incorporated and unincorporated status, and each of the six counties within the SCAG region. Together, the communities bring diverse contexts and facility considerations that help ensure the toolkit can be customized to meet the needs of disadvantaged communities throughout the area. Each of the six finished plans will be included in the toolkit as a reference to demonstrate how to adapt the toolkit.

Following the CEP, we began by convening CACs within each of the six communities. Using the data automation process, we developed needs assessments for each of the six communities. Comprised of the first four chapters of the plan template (e.g., introduction, vision, local context, and existing conditions), the needs assessment included feedback from the community, received

Activities within the art installation allow for community members to talk about how they currently get around, and transportation options they would prefer to use.

One of the Go Human events includes an interactive art installation which provides a fun way for participants to provide valuable feedback to the planning process.

during CAC meetings and from the first of the Go Human events. The needs assessment and corresponding template are currently being refined using feedback from the participating communities. Next up, the project team will release the web-based outreach tools and conduct the walking/biking audits in each of the communities before developing preliminary recommendations. We will also collaborate with community resident leaders on planning, staging, and deploying a tactical urbanism demonstration so they can assist with the Living Preview event.

While developing a customizable and responsive active transportation plan toolkit is a challenge, piloting it in six unique communities has already helped expose some of the gaps within our preliminary draft, and the many opportunities for improvement. We are excited to see how the active transportation toolkit, template, and corresponding resources continue to take shape over the next year before public launch in 2021. Ultimately, at the end of this project, it is our hope that one more barrier to creating safer, healthier, and more accessible communities has been removed.

About the Team

Managed by SCAG, the DCPI is supported by Alta Planning + Design, Studio 111, and Urban Design for Health.

About the Authors

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Courtney Banker joined Alta in the Los Angeles office just in time for the launch of the DCPI, and has been a planner on the project since. Facilitating a walking tour in the high desert for one of the participating communities has been one of her favorite Alta memories yet. She holds a Bachelor of Arts in Environmental Studies from Rollins College and previously worked for the Florida Department of Transportation's reThink Your Commute program in her home state of Florida.

Sam Corbett
ALTA PLANNING + DESIGN

Sam Corbett is a Principal at Alta Planning + Design in Los Angeles and leads the firm's planning practice. Sam has more than 20 years of experience working in the planning field, including nearly six years working as a transportation planner in Auckland, New Zealand. Sam has a Bachelor of Science in Environmental Planning and Policy Analysis from the University of California, Davis and a Master of City Planning from the University of California, Berkeley.

Julia Lippe-Klein
SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS (SCAG)

Julia Lippe-Klein, Acting Program Manager at the Southern California Association of Governments (SCAG), has more than 12 years of community engagement and programming experience. She manages SCAG's award-winning active transportation safety and encouragement campaign, Go Human, which includes advertising, education, tactical urbanism projects and open streets events. With experience in both the planning and public health fields, she is committed to participatory planning strategies that support health, equity and access.

3

TODAY'S PLANNING PROCESS

The Power of Participatory Processes:

Developing Mobility Plans in California's Eastern Coachella Valley

Lauren Elachi & Paola Mendez

The Eastern Coachella Valley (ECV) lies two-and-a-half hours southeast of Los Angeles. Nestled between Joshua Tree National Park, the Salton Sea, and the San Jacinto Mountains, this desert region is home to vast fields of wind turbines, date trees, and some of the country's most productive agricultural land. The names of the ECV's four unincorporated communities—Thermal, Oasis, North Shore, and Mecca—evoke the region's legacy as a hub for tourists and retirees. Yet while the annual Coachella Music Festival takes place a short drive away, these four communities are in many ways a world apart.

More than one in three ECV residents lives below the poverty line, over 95 percent of the population are members of primarily Spanish-speaking households, and 67 percent possess limited proficiency in English. Only a small handful of the area's roads have sidewalks or bike lanes, leaving pedestrians to share the right-of-way with a steady stream of tractor trailers and freight traffic driving at highway speeds to and from nearby fields. The two public bus lines that serve the area operate once an hour, forcing residents to wait in heat that often hits 110 degrees—usually without shelter.

Since 2017 Kounkuey Design Initiative (KDI), a Los Angeles-based design and planning nonprofit, has been partnering with ECV residents to create a set of multimodal transportation plans to improve mobility, increase cyclist and pedestrian safety,

Existing conditions within the Eastern Coachella Valley

The KDI mobile research beacon stationed in front of a market, creating a quick and easy way for people to engage with the planning process on their terms.

enhance environmental and public health, and strengthen communications between transit agencies and residents. Through a California Department of Transportation Sustainable Communities Grant, KDI teamed up with Riverside County and other local nonprofits to create a set of three mobility plans—one serving Thermal and Oasis, one for North Shore and Mecca, and one tying the ECV to its broader region. In some ways, these mobility plans follow a standard template: they assess existing conditions, propose new locations for infrastructure, and identify potential funding sources for implementation. What sets this work apart is the deep and committed engagement strategy that enabled residents—most of whom were participating in a transportation planning process for the first time—to co-design and prioritize mobility infrastructure within the ECV, serving as key experts throughout the entire planning process.

In order to engage as many people as possible, KDI took the approach of meeting people where they were, not just relying on public workshop attendance. To that end, the planning team went to popular community destinations such as churches, markets, and food-distribution sites to ask people how they currently move around the ECV and, if new infrastructure were built to make other forms of mobility safe and accessible, how they would ideally like to be able to travel. To make it easier to catch people's attention and facilitate fast conversations, we built a "mobile research beacon"—a brightly colored, highly visible mobile unit to enable quick dialogue.

It came as no surprise that, though the ECV is currently heavily car-dependent, many people expressed interest in being able to bike or safely walk to school, get groceries, fill prescriptions, or run errands. The face-to-face interactions that

Residents created their own maps through a participatory budgeting exercise to determine the types of infrastructure they wanted to see in their communities.

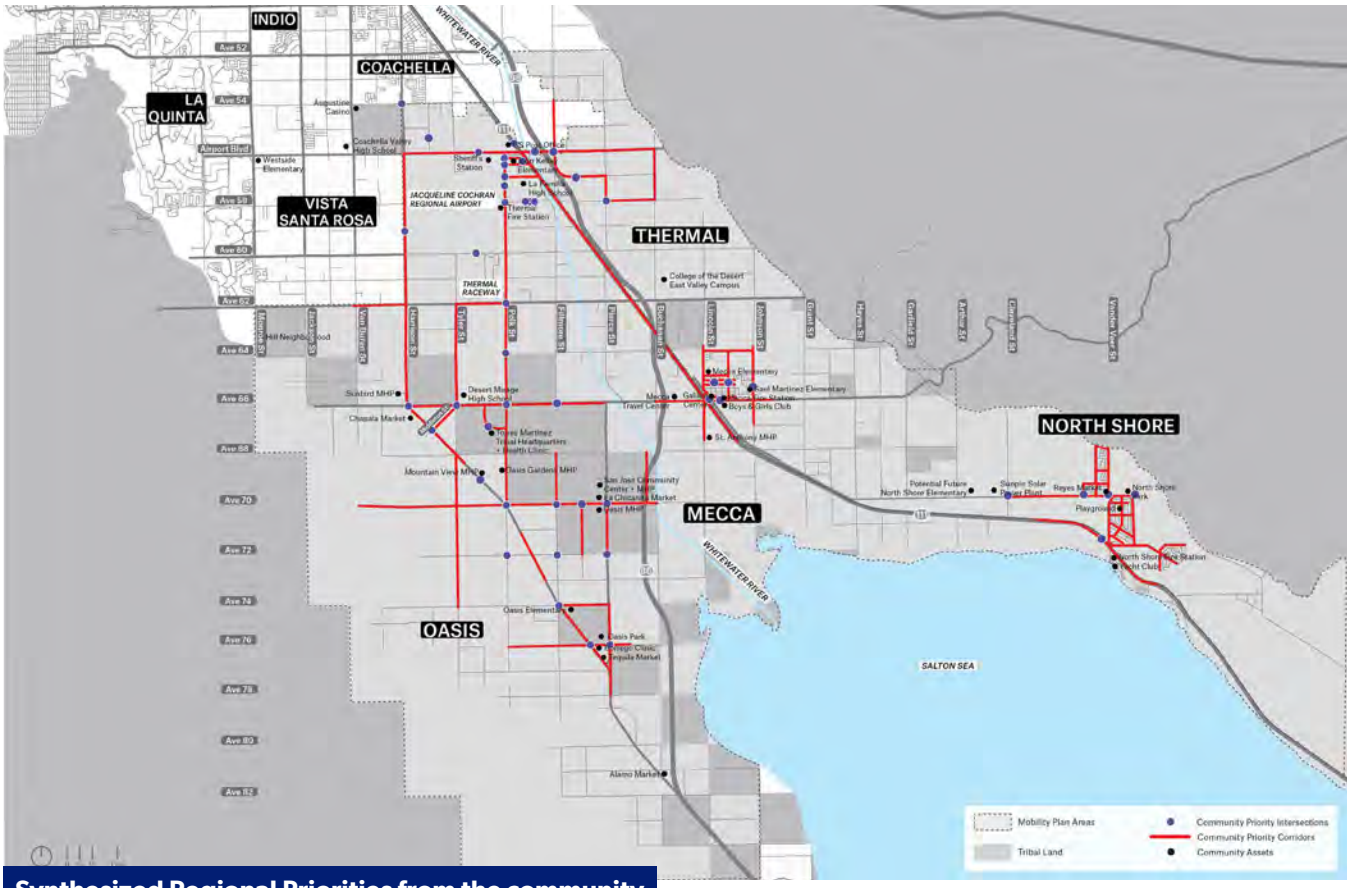
characterized the engagement process also allowed for a more nuanced picture of people's mobility to emerge. For example, the planning team learned by talking to children in the area that they often walk in groups in the middle of the street, rather than in the dusty shoulders of the road or along the narrow 5-foot sidewalks in the few places where these exist. This makes them more visible to drivers—particularly at night as there are no street lights—and facilitates social interaction. This information conveyed the urgent need to improve active transportation infrastructure in a way that numbers alone could not have done.

Starting with a baseline understanding of the existing conditions and the mobility challenges residents had previously discussed with local organizations, we collaborated with community members to make decisions about how to improve mobility and which improvements to prioritize. We developed a participatory budgeting exercise that allowed community members to choose the location and type of infrastructure they wanted to see in their neighborhoods.

We presented residents with a menu of infrastructure options, ranging from protected bike lanes, to raised crosswalks, to simple concrete sidewalks with a curb and gutter. We assigned each option a different poker chip value corresponding to the improvement's relative cost. Residents could then trade in their limited poker chips for a mile of the infrastructure that they wanted to buy and make their own map of where they wanted to see these improvements. Some residents pooled resources with others to be able to create a collaborative map, and in some cases, residents even wrote a formal letter to advocate for additional funding. These community-driven maps became the basis for the three mobility plans, with further engagement workshops focusing on solidifying and refining these infrastructural priorities.

To guide the vision for the three plans as a whole, participants came to consensus around four major priorities:

1. More transportation options that encourage safe multimodal use;

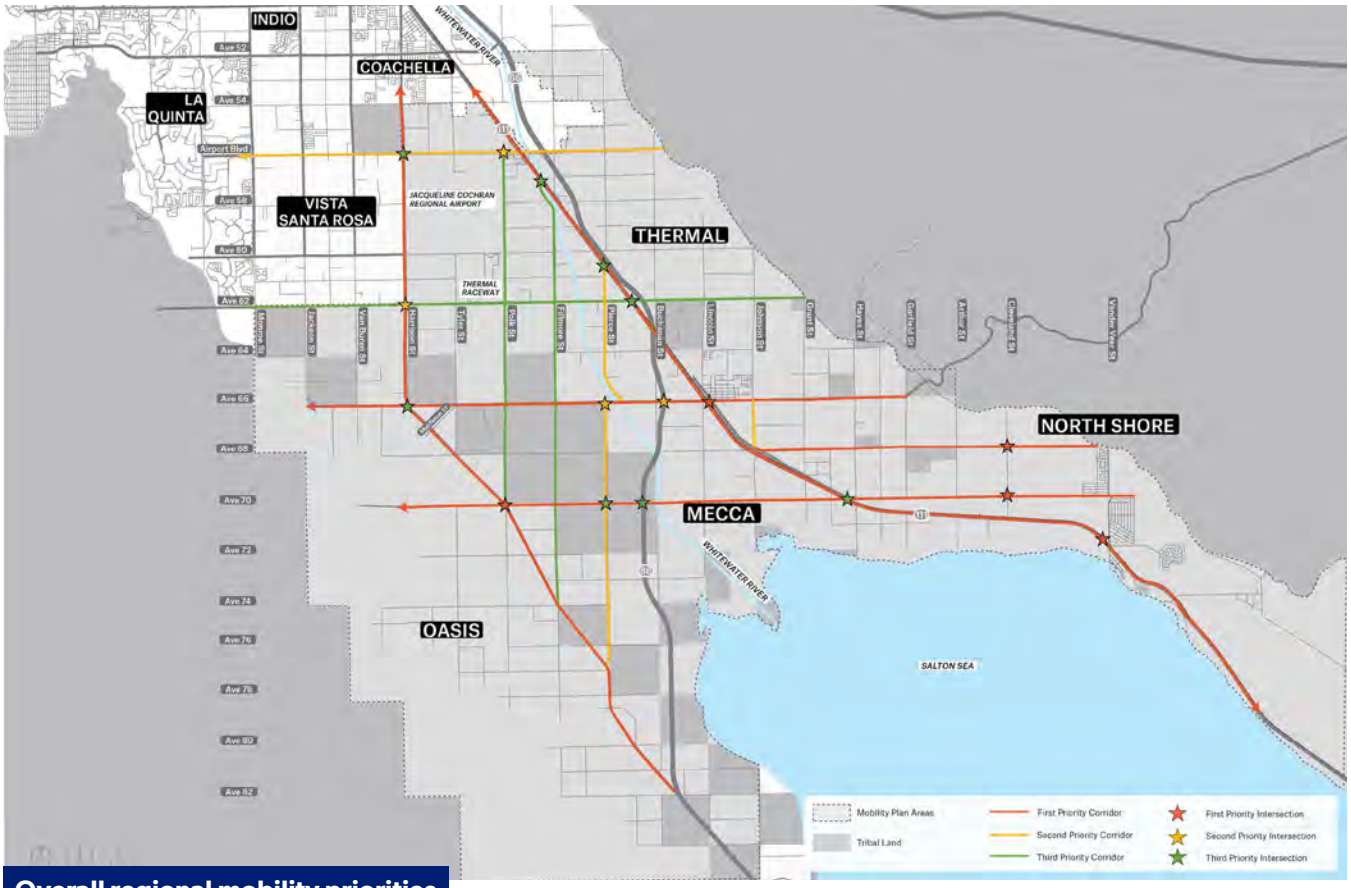


Synthesized Regional Priorities from the community

2. Improved connections between the communities of the ECV and the broader Coachella Valley region;
3. Connectivity to schools; and
4. Transportation options that promote social cohesion by allowing residents to spend time with friends and family while being active.

There are multiple barriers to achieving these goals. The ECV is a low-density rural region with little existing transportation infrastructure. The places people need and want to go (medical clinics, government offices, schools, shopping centers, etc.) are dispersed. It's extremely difficult and often unsafe to access these destinations without a car, but many families that do own a car are only able to afford one, which is used by the primary breadwinner to travel to work. Meanwhile, the rest of the family is left to travel to school, run errands, and attend medical appointments by other modes of travel which may be less reliable, accessible, or safe. Residents were especially interested in connecting their communities to each other. For instance, as the easternmost community in the region, North Shore residents expressed feeling particularly isolated, as there are only two entry points to their community and almost no commercial or municipal infrastructure.

Based on these challenges and priorities, the planning team, in collaboration with residents, decided to focus on developing multimodal infrastructure that could serve both pedestrians and bicyclists at once. We established a set of neighborhood- and regional-level mobility priorities, starting with the direct community input received and then layering considerations stemming from local conditions, existing policies and planning, best-practices research,

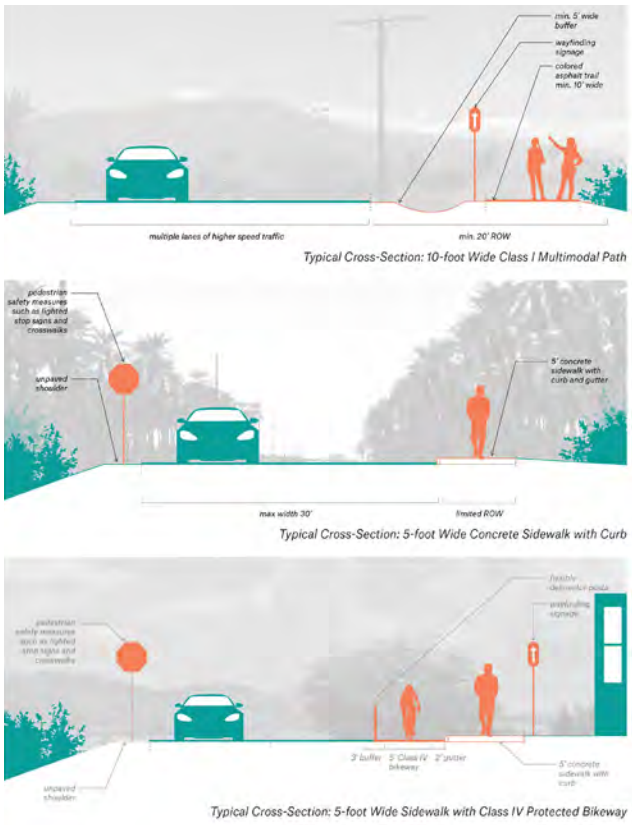


Overall regional mobility priorities

and stakeholder and agency guidance. The recommendations in the three plans are aimed at helping the four communities feel less isolated from one another and prioritizing corridors that support local amenities such as schools, clinics, and commercial areas.

We recommended facilities intended to create an expansive network throughout the ECV that specifically facilitates pedestrian and bicycle trips, particularly for children traveling to and from school. Drawing on the ECV's spacious, rural character, we recommended wide, paved, multimodal Class 1 paths to allow for safe, simultaneous use by pedestrians, bicyclists, and other means of active transportation. To ensure that all types of pedestrians and bicyclists (experienced riders, commuters, families, etc.) will be safe and comfortable, the proposed facilities need to be protected from high-speed traffic as much as possible. Residents expressed strong preference for paths and trails that are paved for comfortable usage not only by bicycles, but also by other wheeled vehicles such as strollers, carts, and wheelchairs. We also recommended additional improvements such as shade structures and benches for creating public gathering spaces and opportunities for rest, as well as improvements at street intersections to improve connectivity and safety.

The final set of plans recommends more than 140 miles of multimodal paths, sidewalks, and bike lanes. The Thermal-Oasis Mobility Plan was adopted by the Riverside County Board of Supervisors in early 2018. The first phase of improvements identified in that plan has since been awarded $6.8 million in California's competitive Active Transportation Program (ATP) funding, and has also won a California APA



Typical cross-sections of suggested multimodal improvements

Transportation Planning Award. The North Shore-Mecca Mobility Plan and the ECV Regional Mobility Plan are anticipated to be adopted in early 2020 by the County, completing the planning framework necessary for the mobility improvements community members want to see and setting the stage for further funding opportunities.

In the end, residents in a historically underserved community were able to effectively shape the County's planning to be inclusive and equitable. Residents were able to serve the role that they should in all planning processes—that of respected local experts. We hope these three plans and the strong buy-in and support from community members that was built during their creation can be a model demonstrating that a highly participatory approach in planning can create socially inclusive and equitable solutions to mobility and transportation projects.

About the Authors

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Lauren Elachi is the Senior Design Coordinator and landscape architect at Kounkuey Design Initiative's Los Angeles office. She manages a number of KDI projects, focusing on environmental justice and mobility and helping to build consensus between a broad range of stakeholders to achieve community goals. Lauren is a LEED-accredited professional with a Master of Landscape Architecture from Harvard University, and BA in Ecology and Evolutionary Biology from Princeton University.

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Placing Equitable Engagement at the Heart of Transportation Planning

Lily Brown, Clarissa Cabansagan & Jeff Knowles

Introduction

Oakland's equitable community outreach and partnership model, used successfully in developing the 2019 Bicycle Plan Update, Let's Bike Oakland, is a trailblazing approach that tosses out the old playbook on public outreach[1]. In this new model the City directly engaged more than 3,500 Oaklanders in person and received more than 2,300 comments online. Engagement focused on hearing from Oaklanders in underserved communities, whose voices have historically been overlooked. Oakland's previous bike planning efforts, like most around the country, tended to attract interest from organized advocates and others who identified themselves within the bicycling community. Large geographic areas of Oakland, particularly the disadvantaged communities of East Oakland and West Oakland, have been underrepresented. For Let's Bike Oakland, City of Oakland Department of Transportation (OakDOT) staff made an intentional decision to focus on these areas with a community partnership model of outreach. OakDOT incorporated it into the procurement process. Five community organization partners were identified and added to the project consultant team. The consultant team was selected based on their geographic focus and depth of knowledge and experience with transportation, housing, equity, and other social justice issues within these underserved areas of Oakland. While not the only national model, Let's Bike Oakland illustrates how sharing decision-making power with communities through more community-led engagement practices helped build stronger community relationships across government and produced a planning document that is swiftly being implemented. This article will outline what led OakDOT to develop an equity-centered engagement model, the process of selecting and working with community organizations as paid consultants, and how this new model of partnership outreach can be replicated in other communities.

LET'S OAKLAND

1 City of Oakland, CA, Department of Transportation, Let's Bike Oakland - Oakland's 2019 Bike Plan (Oakland, 2019), https://www.oaklandca.gov/projects/lets-bike-oakland-oaklands-bike-plan.

Oakland, California, home of the Black Panther Party, has a legacy of community organizing to fight against racist policies that negatively and disproportionately impact communities of color. Over the past decade, housing supply has not kept pace with explosive job growth in Silicon Valley and San Francisco. For Oakland, this has meant higher housing costs, gentrification, and the displacement of long-time residents, mostly in the black and brown communities in West and East Oakland. In 2015, Oakland's City Council voted to establish the Department of Race and Equity, the first department of this nature in the country, whose vision is to maintain Oakland's diversity and create a city where racial disparities have been eliminated and racial equity has been achieved[2]. At the very same Council meeting, the City Council also voted to establish the City's first-ever Department of Transportation, "dedicated to studying, managing and improving the safe movement of goods and people on Oakland's city streets, sidewalks, highways and bridges."[3] Informed by the Department of Race and Equity, OakDOT produced a strategic plan for the department in 2016 that made explicit a process for broad system change. As one of its first tasks, the strategic plan charged OakDOT with adopting "equitable transportation decision-making frameworks for planning and project development."[4] With this directive, staff assembled a Racial Equity Team, adopted an Equity Charter, and developed a Racial Equity Action Plan to institutionalize policies and practices that end systemic disparities[5]. A core tenet of this work is to increase the department's commitment to and investment in robust public engagement that prioritizes Oakland's most underserved communities. This commitment helped guide the first two citywide planning efforts undertaken by OakDOT - the Repaving Plan and an update to the City's 2007 Bicycle Plan.

The Precursor

The City's 3-Year Repaving Plan established a process for distributing $100 million based on equity, road condition, and safety metrics. Historically, Oakland has been forced to allocate limited paving resources to the major roads that carry the most traffic. The result was that 60% of local neighborhood streets were in poor condition; many had not been paved in a generation[6]. The Repaving Plan used neighborhood planning areas to identify local streets needs based on street condition, population density, and equity factors. In each neighborhood area, staff analyzed the share of local streets in poor condition as compared to the share of underserved populations and distributed funding for local streets by the share of underserved populations and of local street miles in poor condition. For example, the Central/East Oakland planning area contains 18% of Oakland's poor quality pavement streets and is home to 29% of Oakland's underserved communities. The Repaving Plan proposed that this area receive 24% of the $75 million in funding earmarked for local streets. As the plan was released for public comment, OakDOT explained that it "aimed to create a fair process for prioritizing streets for repaving that did not depend on someone attending a meeting, calling their councilmember,

2 To learn more about the creation of Oakland's Department of Race and Equity, download resources, and follow current projects, visit: https://www.oaklandca.gov/departments/race-and-equitym

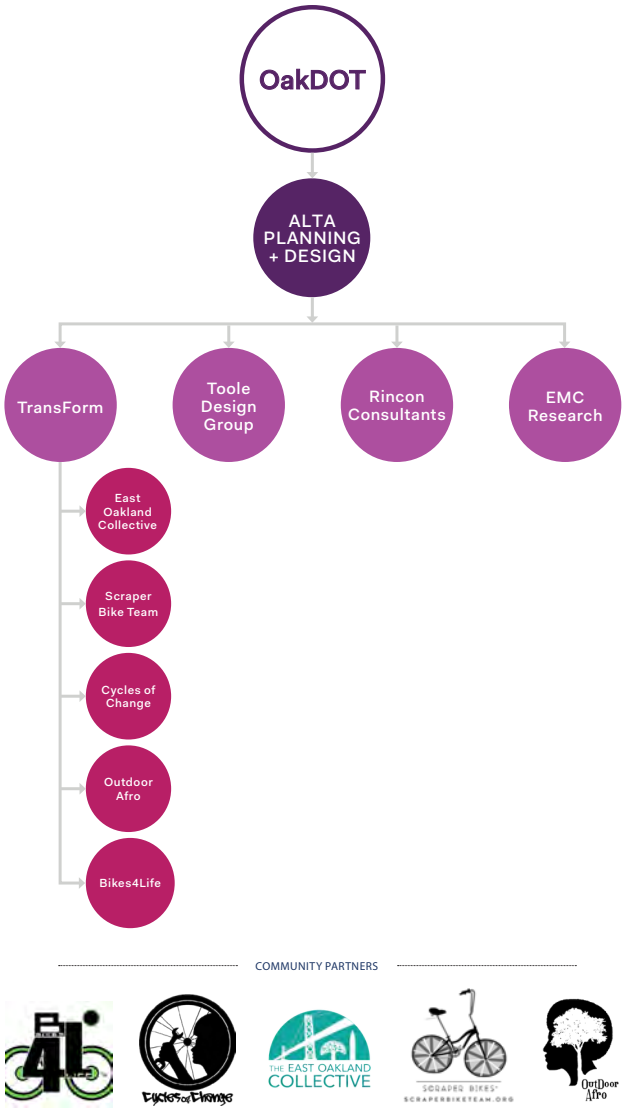
3 City of Oakland, CA, Department of Transportation, Strategic Plan (Oakland, 2016), 2, http://www2.oaklandnet.com/w/oak060949.

4 City of Oakland, CA, Department of Transportation, Strategic Plan (Oakland, 2016), 11, http://www2.oaklandnet.com/w/oak060949.

5 To read OakDOT's Racial Equity Charter, visit: https://cao-94612.s3.amazonaws.com/documents/Final-Charter-signed-12-11-2018.pdf

6 City of Oakland, CA, Department of Transportation, "OakDOT Celebrates Kickoff of Oakland's Three-Year, $100 Million, Equity-Focused Paving Plan," (Oakland, 2019), https://www.oaklandca.gov/news/2019/oakdot-kicks-off-three-year-100-million-equity-focused-paving-plan.

or writing a petition."[7] Let's Bike Oakland was underway as the Repaving Plan was being completed. The process for prioritizing bikeway projects in underserved communities borrowed heavily from the Repaving Plan, though the public engagement process was much more extensive.



Let's Bike Oakland Team Members

Not Your Typical Bicycle Plan

In 2016, the City of Oakland put out a Request for Proposals to update the City's 2007 Bicycle Plan. The selected team was led by Alta Planning + Design, and included TransForm, Toole Design Group, EMC Research, Rincon Consultants and five community-based organizations (CBOs).

Team member roles are described in the following sections:

TransForm, a sustainable transportation and land use advocacy organization based in Oakland, offered strategic equity guidance on how the city and consultant team could prioritize the needs of black and brown residents in bike planning and how OakDOT could apply cultural sensitivity to providing bike amenities in communities that have seen virtually no bike investment. After working through the challenges of conducting bikeshare outreach with little funding, TransForm encouraged the City to directly resource grassroots groups to lead outreach in the city's disadvantaged communities. Initially, OakDOT planned for three CBOs to each host three rounds of workshops. Two groups were selected by councilmembers: Bikes4Life and Outdoor Afro. TransForm selected East Oakland Collective, a social service organization in East Oakland, that enabledOakDOT to reach residents less aware of transportation planning processes. TransForm also recommended that OakDOT build on the existing efforts to engage the city's black and brown communities on bikes by including two additional community partners: the Scraper Bike Team and Cycles of Change. Both people-of-color-led bike groups had just completed hundreds of outreach hours with low-income Oaklanders about access to bikeshare.

7 City of Oakland, Department of Transportation, "3-Year Paving Plan Development Process," (Oakland, 2019), https://www.oaklandca.gov/resources/draft-final-3-year-paving-plan.

Once under contract, the 20-month long engagement process followed three phases:

1. Listen. Asking people how a more bike-friendly Oakland would serve them.
2. Collaborate. Developing ideas iWn partnership with the community.
3. Refine. Delivering proposals for community feedback and revision.

Community Engagement Process used in Let's Bike Oakland

In each of these phases, community partners had autonomy to structure outreach in the most relevant format for their communities and provided direct input into the plan's vision, policies, and recommendations to ensure it reflected authentic community voices. Building trust with CBOs meant that OakDOT was intentionally creating space for disenfranchised community members to have access to power and decision makers. For each workshop, TransForm asked CBO partners to identify which city officials and councilmembers they wanted to invite. This practice throughout the plan fostered deep listening and accountability by city officials at the highest levels of influence over transportation and planning budgets. OakDOT also made a point to invite its whole team of planners to each of the workshops and community rides. In traditional planning practice, professional consultant teams have become an additional buffer or cushion between city staff and the community. For this plan, OakDOT embraced more transparency and connection with CBOs. One of the most salient moments was at the first East Oakland workshop where community members were able to vent

Notification collateral designed and created by Bikes4Life to communicate directly to their constituency.

Scraper Bike Tour

The Scraper Bike Team lead a bike tour through East Oakland with OakDOT staff, consultants, and community members to evaluate ideal routes and challenges.

their pent up frustrations and anger against government and its neglect of East Oakland to both Ryan Russo, Director of OakDOT, and Bill Gilchrist, the Director of the Planning Department. In real time both directors owned up to the City's failure to prioritize the needs of black and brown communities. This admission of neglect, and commitment to prioritize the city's black and brown communities by the directors, opened up space for community members to understand the opportunity here. Even if their immediate needs were well outside the jurisdiction of a bike plan, the intention in that space created a path forward to collaborate. As trust was built along the way, community members more readily called for meetings with OakDOT staff, leading to more transparency and less reliance on a hierarchical chain of communications. This process, largely focused on building trust and ground-truthing the proposed network with those who actually live in the community, is a profound shift in the way bike planning normally happens.

Design Lab

Resident providing feedback on program ideas and bikeway designs on key corridors at the East Oakland Collective hosted Design Lab.

Bikes4Life, a nonprofit based in West Oakland that doubles as a storefront drop-in bicycle repair shop, community organizing space, and a cafe, hosted a listening session in their space.

Outdoor Afro, a national nonprofit network that celebrates and inspires African American connections and leadership in nature, held a roundtable discussion and organized a bike tour through West Oakland. Cycles of Change, a collectively operated nonprofit that provides bicycle education and repair skills to Oakland youth, held a community workshop in the Fruitvale neighborhood and a feedback session with OakDOT staff. The Scraper Bike Team, a nonprofit

Pop-up Workshop

OakDOT staff tabled at the Lunar New Year Bazaar Oakland's Chinatown neighborhood.

in East Oakland, works to expand and enlighten young peoples' perspectives on life through fixing and painting bicycles. The Scraper Bike Team led two bike tours through deep East Oakland. The first tour route was planned to draw attention to the challenges facing bicyclists in East Oakland, namely potholes, and culminated in a picnic. The second tour evaluated neighborhood bike routes that had been proposed in an early draft of the plan.

The East Oakland Collective is a member-based community organizing group invested in serving the communities of deep East Oakland by working towards racial and economic equity. Members hosted two community workshops and an all-day "Design Lab" that functioned as part design charrette, part mini-conference with breakout sessions on policing and enforcement policies, the City's capital improvement budget process, and program initiatives for supporting the local bicycle economy and existing bike cultures.

Engagement By the Numbers

Engagement was expansive across the city and deep in communities often overlooked by decision-makers.

Professional consultants and OakDOT staff played supporting roles in the outreach, documenting feedback and responding directly to community concerns and ideas. This level of engagement with communities, often overlooked by a typical outreach process, generated ideas that were refined in the planning process and resounded with residents in the final plan document. Many of the priorities in the plan (both problems and solutions) came from community partners. For example, the community noted a lack of bicycle repair shops and suggested OakDOT work alongside Oakland's library branches to lend bike repair tools and hire staff that can perform bike repairs.

OakDOT staff and consultants also worked to reach a large number of residents by attending dozens of community events and pop-ups spread geographically across the City, such as at the Art and Soul Festival, Oakland First Fridays, and Malcolm X JazzArts Festival, as well as in front of BART transit stations, libraries, and several farmers markets.

EMC Research developed a statistically valid public survey to capture Oakland residents' opinions of bicycling. Alta Planning + Design created an interactive online map where users could identify needs and issues bicycling in Oakland. By the end of the process, OakDOT staff had logged 576 staff hours engaging 3,644 people in-person, and the online map had received over 2,300 comments.

The strategy of thoroughly engaging disadvantaged communities by providing multiple opportunities and venues for in-person and online engagement helped produce a plan that more accurately reflects the needs of people bicycling in Oakland. The Plan was unanimously adopted by City Council in the fall of 2019 and OakDOT is swiftly moving to implement projects and programs prioritized in the plan.

Early Outcomes

Even before the plan was adopted, the engagement process used in Let's Bike Oakland helped build strong relationships in East and West Oakland that have enabled closer collaboration for project delivery. While developing Let's Bike Oakland, one of the community partners in East Oakland joined the City's Bicycle and Pedestrian Advisory Commission (BPAC), adding a community voice to an important advisory body shaping decisions for all cyclists.

OakDOT again hired the East Oakland Collective to design and facilitate engagement for the East Oakland Community Based Transportation Plan. OakDOT also established an on-call bench of community based organizations for direct contracting in the future.

Sharing Oakland Police Department data on bicycle stops allowed the plan to capture and acknowledge how enforcement was disproportionately affecting African-Amercans (60% of people bicycling that are stopped by the Oakland Police Department are African-American, but this group only makes up 25% of the city's population)[8]. Thanks to this analysis, the BPAC has established a Policing Subcommittee to build closer relationships and accountability with the Oakland Police Department and address this barrier to bicycling.

Because of the groups OakDOT chose to work with, the City was able to bring to life ideas that enable self-determination and cultural expression in bike infrastructure. For example, plans to convert the center lane on 90th Avenue into a bikeway formalize how community members are currently riding and celebrates the Scraper Bike Teams' tradition of riding in the center of the street, though planners might say it is "unsafe." Oakland is not forcing the usual curbside protected bikeway concept on a street where

Let's Bike Oakland Outcomes

Let's Bike Oakland worked to reflect voices from people who bicycle by choice and by those who bicycle as an economic necessity.

there is already a popular way to ride — it is using infrastructure to make how people already ride safer. Recently installed, the center lane is filled with a street mural inspired by the decorative wheels of a Scraper Bike and functions as a multi-use lane. This project demonstrated that OakDOT is willing to collaborate and engage in a creative, custom process not only in the master planning phase, but throughout the project design and implementation phases, as well[9].

Work Left Undone

Who are we planning for?

Here in Oakland, OakDOT and its partners are working to ensure future investments in bicycling and other transportation modes remedy the historic and ongoing injustices that have been perpetuated in the past. Yet, even after all this work on Let's Bike Oakland, the city continues to attract more and more newcomers that are whiter and wealthier, while long-standing Oaklanders remain at risk of being priced out of their neighborhoods. Let's Bike Oakland, if fully implemented, will go far in undoing today's disparate access to bike amenities and even provides a roadmap to enable black and brown communities to economically benefit from the biking economy. However, it is unclear if the people planned for will be able to stay in Oakland long enough to reap the benefits of the plan. OakDOT's main challenge is in swift implementation; so much still hinges on traditional funding sources and grant cycles. Ideally, we have sustained engagement of our CBO partners to keep the city accountable to deliver on the plan. However, our grassroots groups remain cash-strapped with limited or no ability to be the watchdog on implementation.

How can a bicycle plan improve the lives of the most vulnerable?

The housing affordability crisis remains the top concern of most of our vulnerable populations, with homelessness at an all-time high. Bike resources are still not the priority of most vulnerable residents for which we aim to prioritize improvements. Implementation is still an uphill battle that can be a project by project political fight. Without community support, which takes time and resources, the city may be challenged to deliver.

How can the planning process be streamlined to avoid engagement fatigue?

With all this attention on how to plan for equitable outcomes, community stakeholders are continuously tapped for their knowledge and insight. These populations that continue to experience trauma and are barely making ends meet do not have as much leisure time to chime in on government processes. For community members, interacting with the City on the bike plan was their way of expressing their needs. Yet the way planning is configured, we expect vulnerable populations to spend more of their precious non-work hours on each plan or project rehashing to government the same issues and needs they have been communicating. Community members often express they have survey fatigue or community engagement fatigue, often describing this manner of interaction as extractive. Planners need to find more compassionate and effective ways to receive input from key populations without our processes causing people to constantly relive or recount their traumas. We need to be sensitive to how our practice interacts with our low-income people and minimize instances in which people

9 To see images of the 90th Avenue "Scraper Bike Way," visit: https://www.eastbaytimes.com/2019/10/15/photos-scraper-bike-lane-part-of-90th-avenue-repaving-redesign-project-in-oakland/

EOC Staff

Members of the East Oakland Collective, a key partner in helping OakDOT effectively reach East Oakland communities.

feel like test subjects and their communities a laboratory. This extends well beyond the planning process. Months after the plan was adopted, we learned of two University of California, Berkeley, efforts to study transportation issues in East Oakland alongside OakDOT, which is leading a community-based transportation plan. Coordinating engagement activities internally and across departments can help reduce this fatigue.

Lessons Learned

The inequities that exist in bicycle infrastructure between affluent and low-income communities are stark. Much of this is a result of our industry's poor engagement of low-income communities of color, and the lack of prioritizing their needs where they have been articulated/documented. Black and brown communities have not been adequately engaged in the planning process and their needs have been on the periphery of traditional bicycle advocacy efforts. These trends have perpetuated the inequalities black and brown communities continue to endure (disproportionate exposure to harm and lack of high quality infrastructure). While bicycling, which offers a healthy, low-cost way to increase access to opportunities, can and should be a critical lifeline for communities of color most at risk of displacement, instead new bike infrastructure is often seen as the harbinger of gentrification and displacement. New methods of engagement are required to address these concerns, create honest dialogue that can be addressed in the master plan, and start to build more collaborative relationships from trust and accountability. How can you do this?

1. Collaborate with community based organizations

To help open much needed lines of communication, collaborate with local neighborhoods and leaders of color to unlock the potential of community-driven ideas. Work with elected and community leaders to help identify the right organizations and have them

→ **For more information on Let's Bike Oakland, please visit:** https://www.oaklandca.gov/projects/lets-bike-oakland-oaklands-bike-plan

make introductions. Expect skepticism if you have not worked with CBOs before. Several preliminary meetings may be needed to establish a collaborative working relationship. Be prepared to share decision-making responsibility.

2. Understand the unique strengths and abilities of your partners

OakDOT remained flexible to add or pivot from the scopes of work along the way when they heard feedback that something was not working or when some groups expressed they wanted to be doing more on the plan. OakDOT tested new ways of conducting outreach designed to meet people where they are, empower local ideas, and deeply understand the barriers to biking in black and brown communities. That included community-led bike rides with planners and residents, listening sessions, a design lab, and more that is detailed in the plan.

3. Fairly compensate community based organizations as experts

Find ways to pay CBOs and pay them quickly. The level of engagement provided in Let's Bike Oakland was not free. Too often, organizations on a shoe-string budget are expected to participate in community engagement processes without any compensation. The City of Oakland did this by setting aside funding in the project for community organizations and later established an on-call bench with CBOs and nonprofits that the City can contract with as projects come up. OakDOT is earmarking funds that would typically be given solely to planning, engineering, or outreach firms for this on-call.

About the Authors

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CITY OF OAKLAND DEPARTMENT OF TRANSPORTATION

Lily Brown is a Transportation Planner on the Planning and Project Development team at the City of Oakland's Department of Transportation. Lily was the project manager of Let's Bike Oakland, Oakland's citywide bike plan update and also serves as Co-Chair of OakDOT's Racial Equity Team, whose mission is to address racial disparity both in Oakland and in the City workplace. Lily's work is guided by the belief that inclusive community engagement is the foundation for transformative transportation improvements.

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TRANSFORM

Clarrissa Cabansagan is the New Mobility Policy Director at TransForm, a non-profit transportation advocacy organization based in Oakland, that combines high-quality policy analysis with coalition building. She currently leads TransForm's efforts to ensure disadvantaged communities benefit from tech-enabled shared mobility options and bicycle/pedestrian infrastructure. Clarrissa coordinated the community based outreach partnerships for Let's Bike Oakland.

Jeff Knowles AICP
ALTA PLANNING + DESIGN

Jeff is a Senior Associate Planner and Oakland Office Manager at Alta Planning + Design where he works in partnership to create active, healthy, and just communities. Committed to authentic and inclusive community engagement, Jeff has co-created planning activities with community-based organizations that have served thousands of residents in the form of workshops, charrettes, open-streets events, and temporary pilot projects. Jeff served as the consultant project manager for Let's Bike Oakland.

Managing Transit Through Data and People

Fabian Gallardo

How Things Used to Get Done

The SFMTA Transit Division operates 76 bus lines, utilizes 1,181 buses, trolleys, LRV's, and oversees 493 miles of their subway, bus, and light rail networks. As is quite often true for most transit lines, ridership patterns shift and so must the transit lines that serve them. The process for how an agency shifts transit lines and reimagines them has changed greatly and that is the focus of this story.

In the past, a transit agency wanting to change an existing line of service would do several things: 1) examine ridership numbers (manual counts of on/offs or APC system estimates) – what do current ridership numbers look like now, what can historical numbers tell us, etc., 2) conduct some type of survey – on-board or at a station, 3) assess data alongside professional judgement, and 4) announce new alignment through a notice at a bus shelter a few days before change is supposed to happen. For a long time, this is how things were done. However, now with an abundance of data being collected by agencies, a much more diverse group of riders, and an overall desire by supporters and detractors for transparency, the task has become more nuanced. It still requires technical analysis – as I will show – but it also requires listening to real critiques of the system by transit users, being honest about the goals and expectations of the specific exercise at hand and establishing long-lasting partnerships with neighborhood groups (instead of only meeting with groups when the agency requires something from them). In 2018, SFMTA Transit Division was proposing a service change on the 22-Fillmore line and creation of a replacement service for the existing tail-end. This is a description of the new approach they took through a partnership with the SFMTA Planning Division, how we involved the neighborhoods and riders, and how SFMTA worked well together, across divisions to create a better project with input from those we are meant to serve. It involves SFMTA staff from Transit, Communications, and Planning breaking down internal silos and external patterns to connecting with riders with transparency and improved communications.

The Planning Division at SFMTA is focused on a multitude of planning projects at different stages of the planning process. We create plans (they go by the usual suspect names, such as Long Range Transportation Plan, Community Based Transportation Plan, Bicycle Plan, etc.,) that then sometimes – depending on funding and the political atmosphere- get implemented by other departments (other times they gracefully collect dust). This project was not like those. Planning

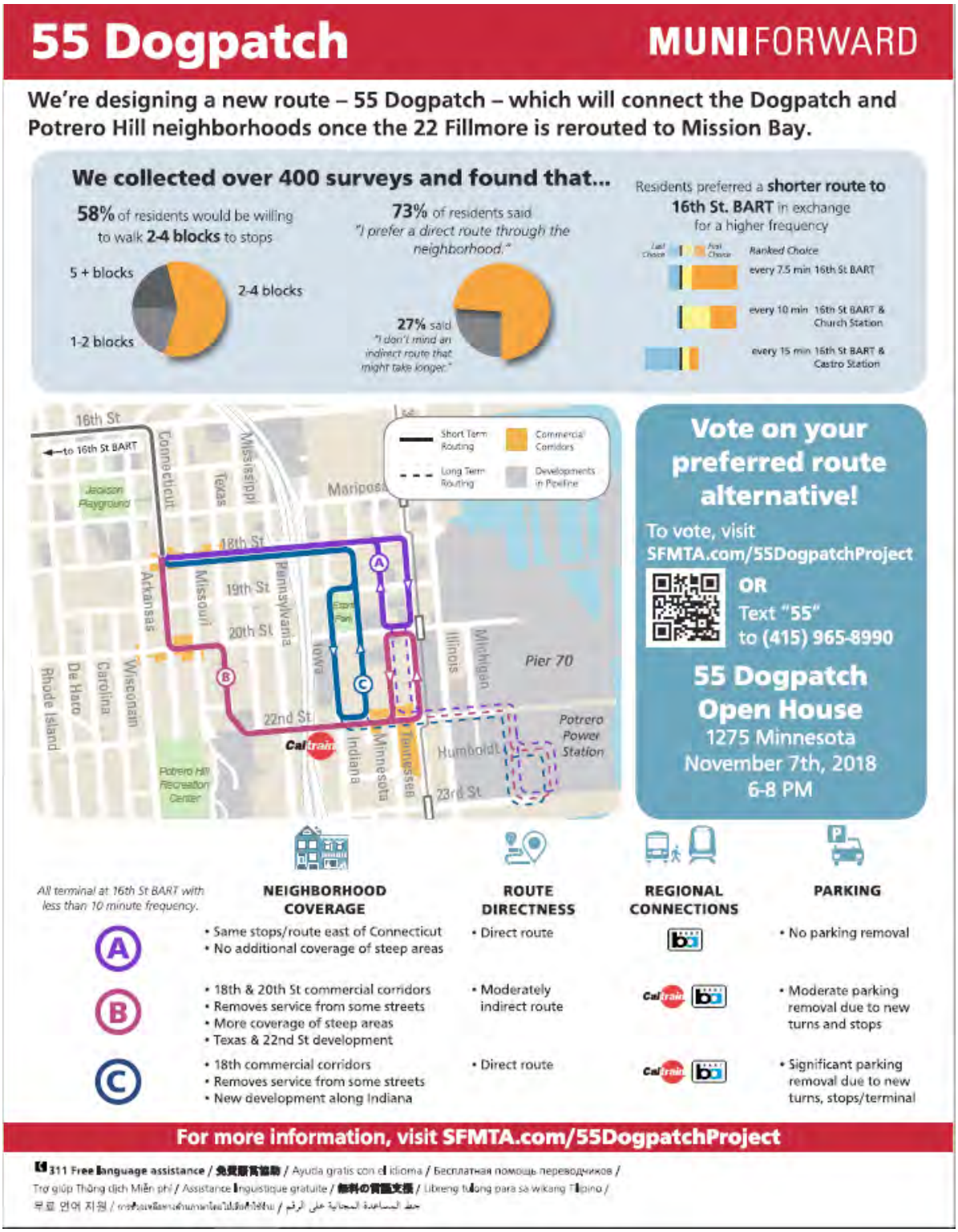


Figure 1

New 55 Dogpatch route flyer asked for public input on which of the options listed they prefered to replace the existing 22 Fillmore route

was brought into the project mid-game after the SFMTA Transit Division (operations sub-group) had already conducted some initial assessments on a 22-Fillmore realignment. Transit knew they would have to change the existing route because of some new, high ridership uses coming online toward the terminus. While they were expecting to replace the existing service being lost with an almost identical route, they received immediate pushback from community members who felt that their current needs were not being met and a replacement service with the same level of service would not suffice. That is where I, and the rest of the Planning team came in – our task was to conduct a robust planning analysis of existing/future transportation conditions in the

Figure 2

After assessing the best quantitative data available to us, this map was created to highlight expected ridership potential in the Dogpatch neighborhood and utilized heavily during the first round of public outreach

Dogpatch-Central Waterfront neighborhoods to better inform the Transit Division on its upcoming replacement service for the existing 22-Fillmore (eventually the replacement route was named 55 Dogpatch). Figure 1 is the flyer created by SFMTA Communications to gather input on preferences by the community on the three final route options created towards the end of our public outreach and data gathering process. While the flyer contains a lot of important information, it highlights our key messaging extremely well, provides great visuals to quickly focus the reader on what is being asked, and links users to more information via a quick to access QR code or texting option. How we conduct the analysis is key, but how we explain it is equally as important.

Initial Data Assessment

This was one of the first projects I had the opportunity to lead and my other Planning team members were eager to do a quality assessment. We took a "best practices" approach and conducted an initial street level assessment to measure existing and future demand based solely on existing ridership numbers, existing census information, and current/near-future land uses. Sources included:

- Existing ridership and network data
- The San Francisco Planning Department's 2017 Third Quarter Planning Development Pipeline
- Demographic data from the American Community Survey (ACS)

We analyzed the data to establish existing baseline transit conditions, estimate the potential future transit demand, gather public opinion, and to produce planning recommendations to assist with final recommendation for replacing the existing 22-Fillmore bus service. The initial data assessment focused on highly quantitative information – so to best communicate the data, our findings here were illustrated using a map (Figure 2) highlighting future ridership hotspots into three categories- low, moderate, and high. After vetting the data internally, we took our initial data assessment on a roadshow to the groups the Transit Division had begun having conversations with earlier on, who had requested additional analysis.

Typically, what will happen during a study of this nature is that an agency will conduct an initial assessment but will keep the findings to themselves. This allows them to continue moving forward with a public outreach process while having some idea of what the final findings "should" be. Our thinking was perhaps a little different. Our Planning team understood the importance of being transparent with the community, given the somewhat checkered past between the agency and some local neighborhood groups. We wanted our data-driven approach to be fact-checked by the residents and people who live and work in the areas we were studying. We called this our roadshow and considered it our first round of outreach.

Round 1, Initial Survey Distribution and Community Outreach

- 2/27/2018 – Potrero Boosters Neighborhood Association
- Feb 2018 – On-board bus survey by Civic Edge
- 3/6/2018 – Open House, Minnesota Street Project
- 4/10/2018 – Dogpatch Neighborhood Association, Potrero Dogpatch Merchants Association
- 4/15/2018 – Sunday Streets – Dogpatch
- 4/17/2018 – Dogpatch Business Association
- 4/27/2018 – Building Manager Outreach for New Development
- April 2018 – Pop-ups multiple locations Mission Bay, Dogpatch, Potrero Hill

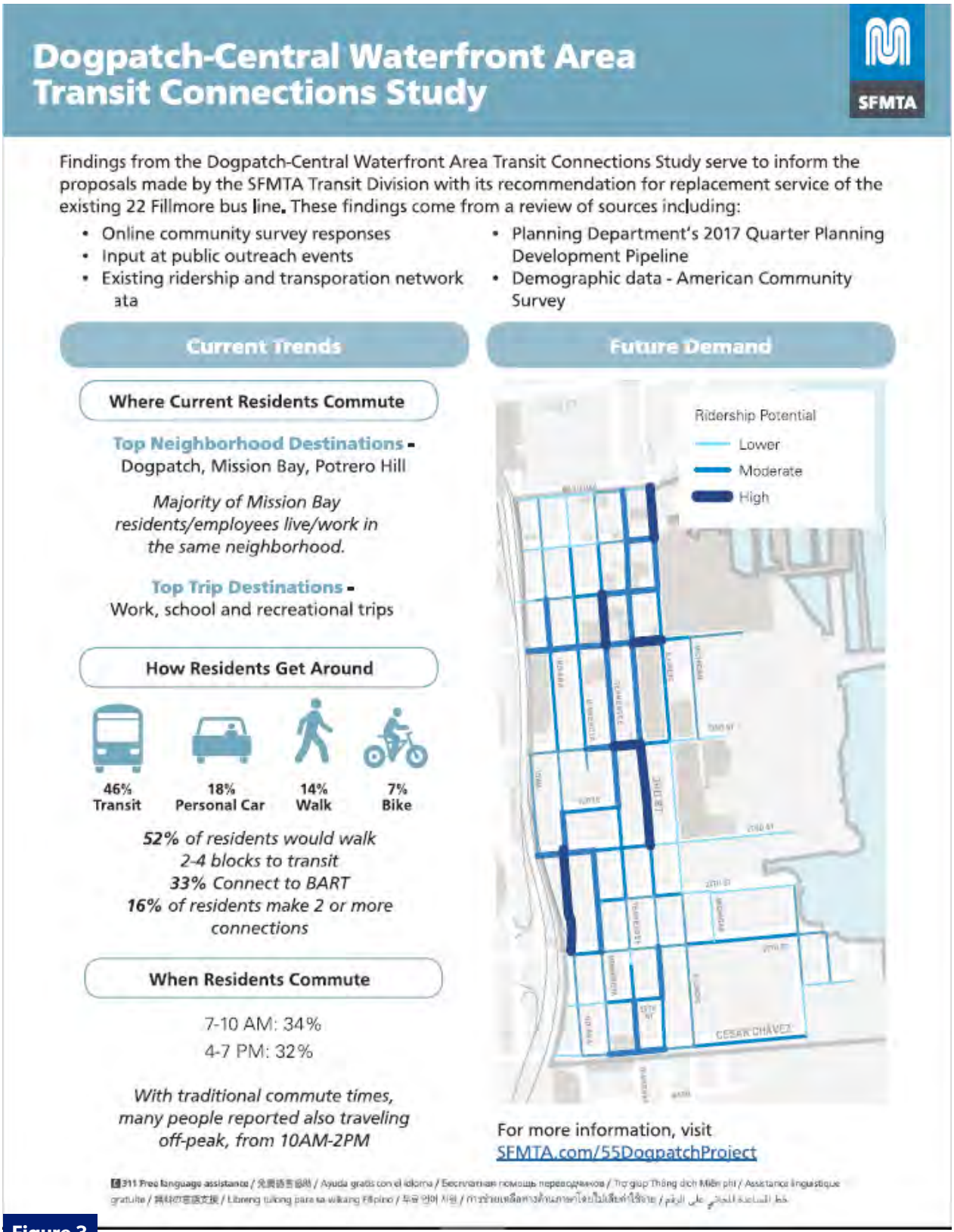


Figure 3

The key takeaway handout for the Planning study was effective in communicating what analysis we had carried out, how we did it, what we had heard, and what our recommendations to transit were for their future alternative

Key Takeaways

After our initial roadshow to gather input on our quantitative assessment, staff worked internally to refine our final assessments and produce a succinct, easy to read, Key Takeaways (Figure 3) handout.

The key takeaways were the Planning team's report out of what analysis we had carried out, how we did it, what we had heard, and what our recommendations to transit were for their future alternative. Having a "Key Takeaways" handout instead of a final report (we did create a final report and post to our website) was much more helpful to everyone. At two pages (Figure 1 and 2 combined) the handout was short enough that anyone could understand in less than three minutes what our project goal was, how we had carried out our work, the extensive outreach process involved, how we had concluded our findings, and how the Transit team took our findings and incorporated them into their alternatives. Because we had been continuously meeting with stakeholders and updating our online content, by the time we got to our key takeaways we had complaints from some people that they really knew everything we had said – which was our intended goal. The key takeaways should have not presented anything new because we were continuously communicating with stakeholders throughout the entire study and continuously updating our findings as additional stakeholder input was incorporated. The "Key Takeaways" represented our summary of the process.

Alternatives Analysis and Second Round of Outreach

As the Planning team was crafting its key takeaways, the transit team was busy taking our findings and creating three separate route alternatives for the replacement service based off a mix of what our revised data assessment showed and what we had heard from residents during our initial roadshow. In late August through November, the combined project teams began a second round of outreach centered on follow-up presentations with all the merchant/ neighborhood association meetings we had circled with our initial assessment and began adding new events, such as community events, pop-ups at key neighborhood locations, and re-distribution of our online survey to gather community feedback on proposed route alternatives.

- Survey Distribution
  - Online – We continued use of the website established immediately following the project kick-off meeting to incorporate new alternatives and solicit input – use of Facebook for zip code targeted outreach, email listservs of various NGOs, neighborhood merchant groups and associations, grassroots organizations, local elected officials and candidates (it was an election season).
  - Pop-up locations (i.e. show up handouts, surveys, etc., along popular commercial corridors and residential areas in study area) to get users where they are at – Whole

Foods, local bakeries, neighborhood shops, pizzerias, neighborhood recreation centers, children's parks, transit stations. Anywhere people congregated within the study boundaries, we visited and solicited input.

- Intercept survey via bus – consistent with online surveying, we surveyed transit riders on the bus.

- Community event outreach (i.e. Sunday Streets) – participated in organized community events.
- Targeted high rises in the study area – meeting with building staff and using their team to assist our small staff with ongoing outreach.
- Presentations at local merchant and neighborhood associations – we looped back with all of our round one community outreach efforts and presented alternatives at each.

Our second round of meetings with the different neighborhood groups went much more smoothly than the initial ones. At each meeting we provided an overview of the original data-driven assessment, the outreach process we had followed over the last six to eight months, how we had refined the assessment based on input, and a summary of key takeaways (recommendations) the Transit Division should closely evaluate as they established a new route. Transit Division would then pick up right where Planning left off and show their three alternatives and how they each aligned with our findings. From the public point of view, we were behaving as we should – as one agency. For example, we all wore the same format for our nametags and badges. Internally, we knew how difficult it usually is for different teams to be able to collaborate and work together and to show the public that we are one agency team.

Note

Working in a large transit agency, with separate teams for operations, planning, implementation, curb management, etc., sometimes means that you are routinely looped into projects being carried out by another team at a point in time when you believe you should have been brought in sooner. Sometimes this exclusion is by choice – the project manager on a different team is the classic "my way or the highway type" or "we aren't technically interfering with this other group's work, so maybe we just share a draft with them later." But, other times someone (typically a manager on the team carrying out the project) recognizes that their team is lacking in a specific skillset and chooses to act to proactively recruit experts. Thankfully, this story is that of the latter.

I am here to share about our positive experience- a case in which members of the Transit Division, the Planning Division, and Communications all worked together to listen, gather, analyze, share, and repeat. However, this type of collaboration – "matrixing" for proper planner jargon – is still not the usual case. Unfortunately, many of the public agencies we work for are strongly committed to preserving a hierarchy and culture that is centered on checking boxes instead of focusing on delivering the best projects possible. I urge planners to continue to meet the basic requirements emphasized by checking boxes and to move beyond them. Do more. Think bigger.

About the Author

Fabian Gallardo
LA METRO

Fabian Gallardo is Principal Transportation Planner at LA Metro. He specializes in synthesizing big data and community input to create safe, multi-modal streetscapes that allow all users to move through the network safely and comfortably, in the mode that most suits their needs. My goal is to help communities become more walkable and transit friendly through equitable infrastructure investment and the creation of policies that transform community ideas into actions.

Moving Beyond the Automobile in Bellingham, WA

Chris Comeau, AICP-CTP

The City of Bellingham (Pop. 95,000), located in northwest Washington, has a long history of being a progressive leader in multimodal transportation planning and has taken many strategic steps to prioritize moving people over cars while also trying to balance the needs of all transportation users.

Bellingham began its transition to people-centered transportation planning in the mid-2000's at the same time that the national Complete Streets movement emerged. Having completely embraced Complete Streets principals, Bellingham has since taken further steps by creating integrated land use and transportation plans, practices, and implementation strategies in a Complete Networks Program.

In 2007-2008, in an effort to support compact, higher-density, mixed-use areas served by multiple modes of transportation, Bellingham adopted a progressive Multimodal Transportation Concurrency Program[1]. This program included performance metrics for walking, biking, and transit rather than only the typical auto-centric Highway Capacity Manual level of service (LOS) standards used by most other cities. The work was quite controversial at the time,

as documented in the 2009 APA Practicing Planner case study titled Moving Beyond the Automobile[2], but it opened the door to several other multi-modal transportation planning programs (See "Bellingham's Evolution to a

1 https://www.cob.org/services/planning/transportation/Pages/multi-modal-trac.aspx

2 https://www.cob.org/documents/pw/transportation/practicing-planner-case-study.pdf

Complete Networks Program," below) that are truly integrated with the wide variety of land use contexts throughout the city.

Bellingham's Complete Networks Program revolves around an annual transportation planning cycle that includes a series of comprehensive processes, actions, and opportunistic efforts to partner with other agencies, as well as private development, to maximize the amount of multimodal transportation funding and construction each year. The annual transportation planning cycle begins with the preparation and publication of the Transportation Report on Annual Mobility (TRAM)[3] during the first two months of each year. The TRAM documents the overall state of the citywide multimodal transportation network, including City compliance with GMA requirements for transportation concurrency, pedestrian network completeness and bicycle network completeness, tracks and measures progress on transportation mode shares, and demonstrates the success of the Urban Village TIF Reduction Program to incentivize infill development in compact, mixed-use Urban Villages.

Publishing the TRAM informs the public, elected officials, and developers of the state of Bellingham's transportation network and helps Public Works staff prepare a draft Transportation Improvement Program (TIP). The TIP is then reviewed by the Transportation Commission followed by a public hearing before the City Council to present and discuss funding for citywide multimodal transportation investments. Council adoption of transportation improvements in the 6-Year TIP allows Bellingham transportation planners to seek state and federal grant funding to make limited local funding go further.

Bellingham's annual public process for deciding how to fund multimodal transportation projects:

- The TRAM is prepared and published (January to early-March);
- Public Works preliminary draft of the TIP (late-April);
- Draft TIP posted to City website; public notice provided (early-May);
- Transportation Commission public meeting to review/make recommendations on TIP (mid-May);
- Bellingham City Council public hearing (late-May);
- Bellingham City Council work session to adopt TIP (early-June); and
- Submit adopted TIP to State by July 1 per RCW.

3 https://www.cob.org/services/planning/transportation/Pages/Transportation-Reports-on-Annual-Mobility.aspx

Annual Multimodal Transportation Planning Cycle in Bellingham, WA											
January	February	March	April	May	June	July	August	September	October	November	December
Multimodal Transportation Impact Fee (TIF) rate change[1]											
Year Round: Development application review; Transportation Concurrency evaluation; TIF assessments; Code updates; Feasibility studies and other transportation planning efforts											
Transportation Report on Annual Mobility (TRAM) prepared		TRAM published	Draft Transportation Improvement Program (TIP) prepared	Draft TIP published; Transportation Commission review; City Council public hearing	Final TIP review & adoption by City Council	TIP sent to WCOG (MPO/RTPO) and WSDOT					
Design Completion & Permitting		Ads, Bids, & Awards		Construction of Transportation Improvement Projects						Project Closeout	
State TIB Complete Street grant awards (odd years)[2]	WSDOT Ped-Bike & Safe School Route grant project call (even years)[2]	WSDOT Safety grant applications due (even years)[2]	Federal STBG & TA grant project call (2-3 year cycle)[2]	WSDOT Ped-Bike & Safe School Route grant applications due (even years)[2]	State TIB project call (annual)[2] Federal STBG & TA grant awards (2-3 year cycle)[2]	WSDOT Ped-Bike & Safe School Route grant awards (Odd years)[2]	State TIB UAP & Sidewalk grant applications due[2]	State TIB Complete Street grant nominators (even years)[2]	WSDOT Safety grant project call (odd years)[2]	State TIB UAP & Sidewalk grants awarded[2]	WSDOT Ped-Bike Safety; Safe School Route grant ranking lists (even years)[2]

NOTES:
1.) TIF rate is based on adopted TIF rate study to determine development's proportionate share of transportation improvements needed to accommodate growth.
2.) State and federal grant funding is limited in availability, extremely competitive, has a wide variety of scoring criteria, and is uncertain at all times.

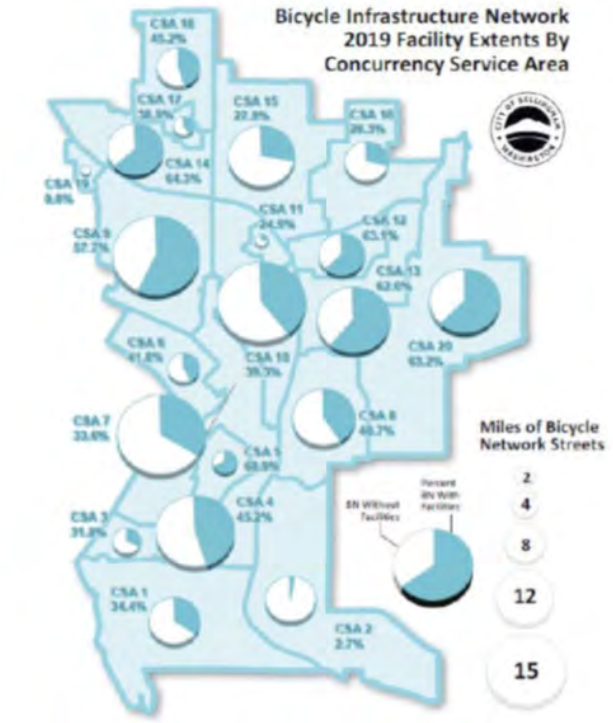
Based on knowledge of where development is occurring through transportation impact fee assessments, transportation planners look for opportunities to extend privately funded improvements or support important public services, such as WTA transit or public schools, through opportunities for various state and federal grant funds that may be available for transportation improvements. Staff then produces a DRAFT 6-Year Transportation Improvement Program (TIP), which lists all of the multimodal transportation projects throughout the City, as well as funding sources, and takes it through a public process with the Transportation Commission, the public, and the City Council. Once the 6-Year TIP is adopted and sent to the State, then construction commences on funded projects and state and federal grant funding applications can be written for unfunded projects. The necessary funding applications are then ideally completed in partnership with public agencies, non-profits, and private development in hopes of extending the City's local funding to maximize pedestrian and bicycle connectivity throughout the City of Bellingham.

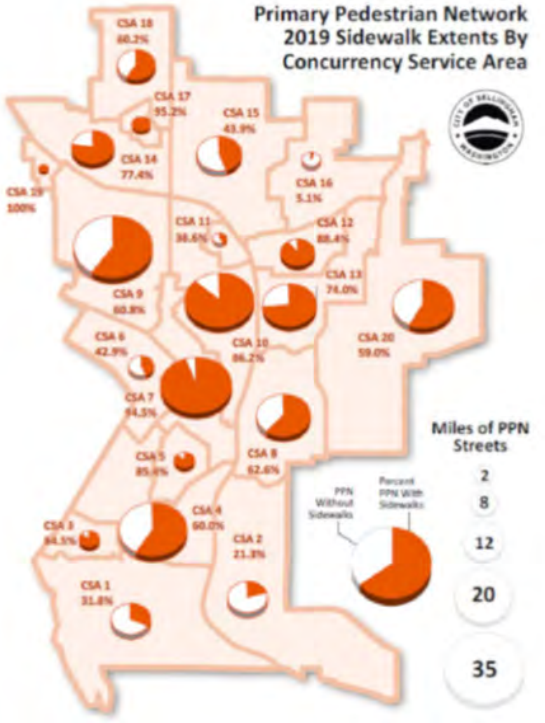
Bellingham's Evolution to a Complete Networks Program

Bellingham has engaged citizens in extensive public land use and transportation planning processes that have cumulatively evolved into the Complete Networks Program with major milestones, as follows:

- In **2003-2004**, Bellingham transportation planners worked directly with Whatcom Transportation Authority (WTA) to establish and adopt a WTA Primary Transit Network with high-frequency "GO Lines" serving Bellingham Urban Villages.
- In **2004-2006**, Public Works and the Bicycle and Pedestrian Advisory Committee (BPAC) developed multimodal transportation goals, policies, and an improvement list that included over 100 pedestrian and bicycle projects adopted in the 2006 Bellingham Transportation Element.

Completeness of Bicycle and Pedestrian Networks in Bellingham





- In **2007-2008**, Bellingham created innovative multimodal metrics and methodology to adopt a Multimodal Transportation Concurrency Program, which integrated level of service (LOS) standards for sidewalks, bikeways, transit, and vehicles with various land use contexts to move beyond traditional auto-oriented LOS standards in the Highway Capacity Manual.
- In **2010**, the Bellingham City Council formed Transportation Benefit District No. 1 (TBD) which voters approved in the November 2010 general election by 58%. The Bellingham TBD provides dedicated funding for arterial resurfacing and bicycle and pedestrian improvements.
- In **2010-2011**, Bellingham transportation planners created the Urban Village Transportation Impact Fee (TIF) Reduction Program to provide financial incentives of up to 50% reduction in TIFs for development in compact, mixed use Urban Villages well-served with sidewalks, bicycle facilities, and high-frequency transit service. Since its implementation in March 2011, developers have saved over $750,000 in reduced TIF for constructing infill development in Bellingham's compact, mixed use Urban Villages served by high-frequency WTA transit.
- In **2012**, Bellingham adopted a citywide Primary Pedestrian Network and Pedestrian Master Plan with a prioritized list of 343 individual sidewalk and 58 crossing improvement projects.
- In **2014**, Bellingham adopted a citywide Primary Bicycle Network and Bicycle Master Plan with a prioritized list of 215 individual bicycle facility and crossing improvement projects.
- In **2015**, Bellingham transportation planners worked directly with WTA to integrate City land use and transportation plans with the Primary

Transit Network in WTA's 2016 Strategic Transit Plan[4].

- In **2016**, Bellingham updated its Multimodal Transportation Chapter establishing the Complete Networks Program with a Transportation Modal Hierarchy, Transportation Mode Shift Goals, the innovative Multimodal Transportation Concurrency Program, and annual transportation system performance measurements in the Transportation Report on Annual Mobility (TRAM)[5].
- In **2018**, Bellingham took another major step in its evolution from vehicle-trip-based transportation planning to all mode-inclusive person-trip-based transportation planning with the development and adoption of Multimodal Transportation Impact Fees (MTIF). Implementation of MTIF began on January 1, 2019.
- In **2019**, five years after adopting the Bicycle Master Plan, Bellingham has implemented 111 (52%) of 215 individual bicycle network and bicycle crossing improvements, creating an unprecedented amount of bicycle connectivity for a community of its size in Washington. This earned Bellingham both the 2019 Governor's Smart Project Award as well as the 2019 APA Washington Implementation Award for Rapid Implementation of the Bike Master Plan.

Funding for Multimodal Transportation Improvements

In 2010, the citizens of Bellingham voted to approve a local Transportation Benefit District (TBD)[6], which has provided the City of Bellingham with dedicated sales tax funding for bicycle and pedestrian infrastructure, arterial resurfacing, and supplemental public transit service. In addition to funding stand-alone bicycle and pedestrian infrastructure projects, almost all of Bellingham's arterial resurfacing projects include rechannelization and removal of excess vehicle or parking lanes for the installation of bicycle lanes. The current TBD will expire at the end of December 2020, but it will be placed on the general election ballot in November 2020 and can be renewed by voters for another 10 years.

4 http://www.ridewta.com/business/reports/strategic-plan

5 https://www.cob.org/services/planning/transportation/Pages/Transportation-Reports-on-Annual-Mobility.aspx

6 https://www.cob.org/gov/tbd/Pages/default.aspx

How to Build Bicycle Network Connectivity
At Relatively Low Cost
by Using Existing Arterial Street Space

- **Road Diets** (multi-lane streets)
  - Removing excess vehicle lane(s) to add bike lanes
- **Rechannelization**
  - Reorganize / narrow lane markings to add bike lanes
- **Resurfacing & Repair**
  - Add bike lanes via normal repair and maintenance
  - Utility repair funding extended to install bikeways on surface
- **Removal of Parking**
  - On-street parking utilization studies
  - Remove low use parking on one side to add bike lanes

In addition to TBD funding, Bellingham Public Works has been very successful at writing grant applications to leverage local funding for millions of dollars in state and federal grants for multimodal transportation projects, all of which include pedestrian and bicycle facilities. In 2011, the Washington legislature passed the Complete Streets Act and funded a Complete Streets Grant Award program through the Washington Transportation Improvement Board (TIB). Bellingham has received this grant each time it has been offered in recognition of all it has been doing to make walking and biking safer and more comfortable for people. Bellingham has also created successful funding partnerships with other agencies, institutions, non-profit organizations, and private businesses. Understanding where new development is occurring and where other agencies, non-profits, and community service providers are expanding services has allowed Public Works to successfully create symbiotic funding partnerships with multiple benefits for all parties.

Implementation: Translating Plans to Construction Projects

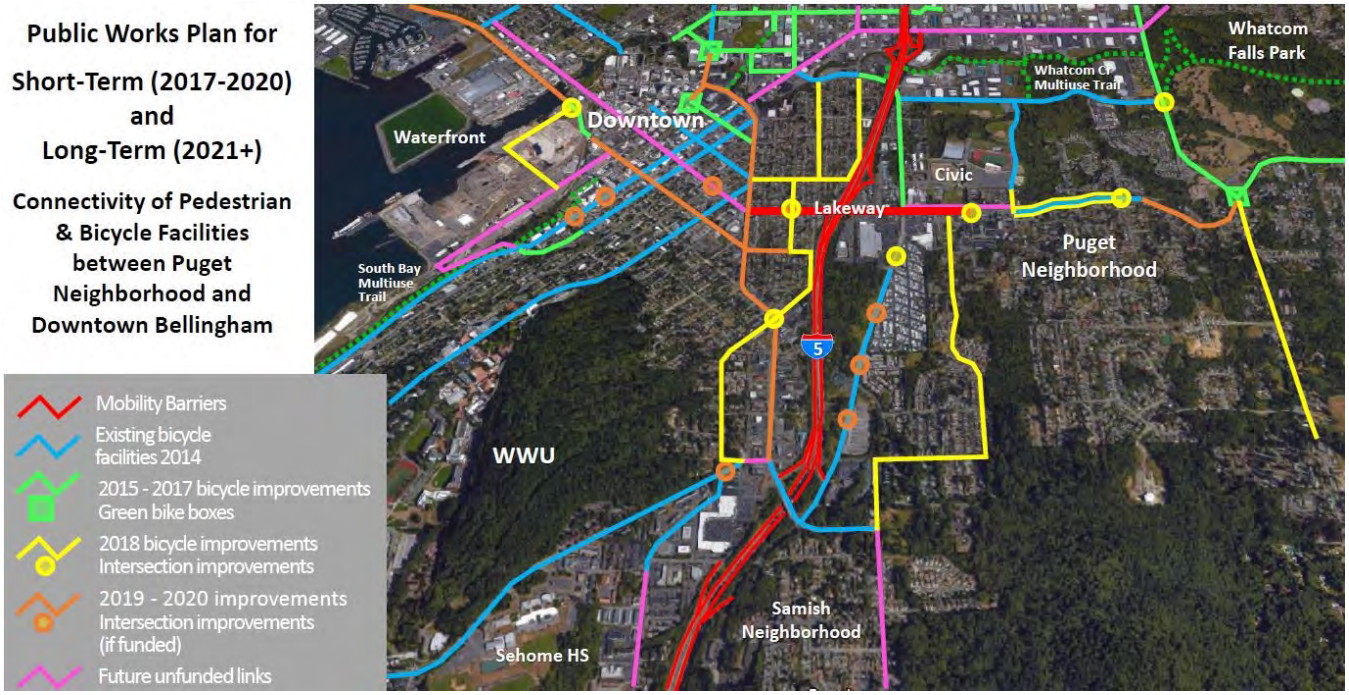
Bellingham has been very busy implementing the 2012 Pedestrian Master Plan and the 2014 Bicycle Master Plan (BMP). Sidewalks are far more expensive to construct than on-street bicycle facilities, and the pedestrian plan has twice as many prioritized projects (357 sidewalks and 57 crossings) as the bike plan (185 bikeways and 30 crossings). However, Bellingham has made great progress implementing both. Since 2012, Bellingham has completed 72 sidewalk and crossing improvement projects.

Bellingham's rapid implementation of the 2014 Bicycle Master Plan (BMP) has created more citywide bicycle connectivity than in any other city of a similar size (95,000) in Washington – the most bike-friendly state in the U.S. for the past 9 years. In the past 5 years, Bellingham Public Works has

Pedestrian Crossing Improvements	Tier 1	Tier 2	Tier 3	Total
Percent Completed	71%	27%	52%	51%
Projects Completed	12	4	13	29
Projects Not Yet Completed	5	11	12	26
Total Crossing Projects	17	15	25	57

Sidewalk Improvements	Tier 1	Tier 2	Tier 3	Total
Percent Completed	35%	20%	7%	12%
Projects Completed	15	7	21	43
Projects Not Yet Completed	28	28	260	314
Total Sidewalk Projects	43	35	279	357

Bicycle Network Improvements	Tier 1	Tier 2	Tier 3	Crossings	Total
Percent Completed	64%	56%	38%	79%	52%
Projects Completed	14	30	43	24	111
Projects Not Yet Completed	8	24	70	2	104
Total Bike Projects	22	54	113	26	215



completed over 111 (52%) of the 215 individual projects in the plan, which makes Bellingham one of the most bike-friendly cities in Washington. In recognition of this success, Bellingham was honored to be the recipient of both the 2019 Governor's Smart Project Award and the 2019 APA Washington Implementation Award.

Washington's Growth Management Act (GMA) requires the adoption of Comprehensive Plans documenting how to accommodate population growth and development over a 20-year period with periodic updates. GMA requires the Transportation Element of a Comprehensive Plan to include bicycle and pedestrian plans and to promote goals for multimodal transportation.

Bellingham updated its 2006 Comprehensive Plan and the Multimodal Transportation Chapter of the 2016 Bellingham Comprehensive Plan goes far beyond the GMA requirements by including all of the following:

- Bellingham's Complete Networks approach to multimodal transportation planning;
- Transportation Mode Shift Goals;
- Multimodal Transportation Concurrency Performance Measures;
- Multimodal Transportation Impact Fees (based on person trips rather than vehicle trips);
- Incorporation of the 2012 Pedestrian Master Plan and the 2014 Bicycle Master Plan; and
- An annual citywide progress report called the Transportation Report on Annual Mobility (TRAM).

Five categories form the organizational basis for the goals and policies of the Transportation chapter:

- Integration of Land Use and Transportation Planning
- Complete Networks
- Non-Motorized Transportation
- Transit and Single-Occupancy Vehicles
- Transportation Planning Requirements

Six goals emphasize the interdependence of the environment, economy and society:

Bellingham Comprehensive Plan 2016
Multimodal Transportation Chapter

Complete Networks

Prior to the popular rise of the national "Complete Streets" movement, Bellingham expanded its Citywide focus of transportation planning to include multiple modes of transportation with goals, policies, and project recommendations to accommodate pedestrians, bicyclists, and transit riders, as well as vehicle drivers on all arterial streets. In 2004, Bellingham worked with WTA to establish a Primary Transit Network and with the Bicycle and Pedestrian Advisory Committee (BPAC) to develop the 2006 Bellingham Transportation Element. Since then, Bellingham has created both Primary Pedestrian and Bicycle Networks through a 2012 Pedestrian Master Plan and a 2014 Bicycle Master Plan.

Bellingham's multimodal transportation planning has evolved into a **Complete Networks** approach, which incorporates the principles of the Complete Streets movement, but also provides an annual assessment of the progress made toward the completion and improvements to each modal network.

Bicyclist uses green bike boxes on Ohio Street.

The Transportation Report on Annual Mobility (TRAM) provides an annual inventory and assessment of progress for Bellingham's Complete Networks approach to multimodal transportation planning. The TRAM includes individual chapters on Bellingham's pedestrian, bicycle, transit, automobile, and freight truck networks, with performance measures and status reports for each modal network, as well as an annual update on transportation mode shares to track progress toward Bellingham's transportation mode shift goals. The TRAM also includes a chapter on Bellingham's Transportation Benefit District No. 1 (TBD), which serves as the annual TBD Report to the TBD Board of Directors. TBD sales tax revenue provides dedicated funding for arterial street resurfacing

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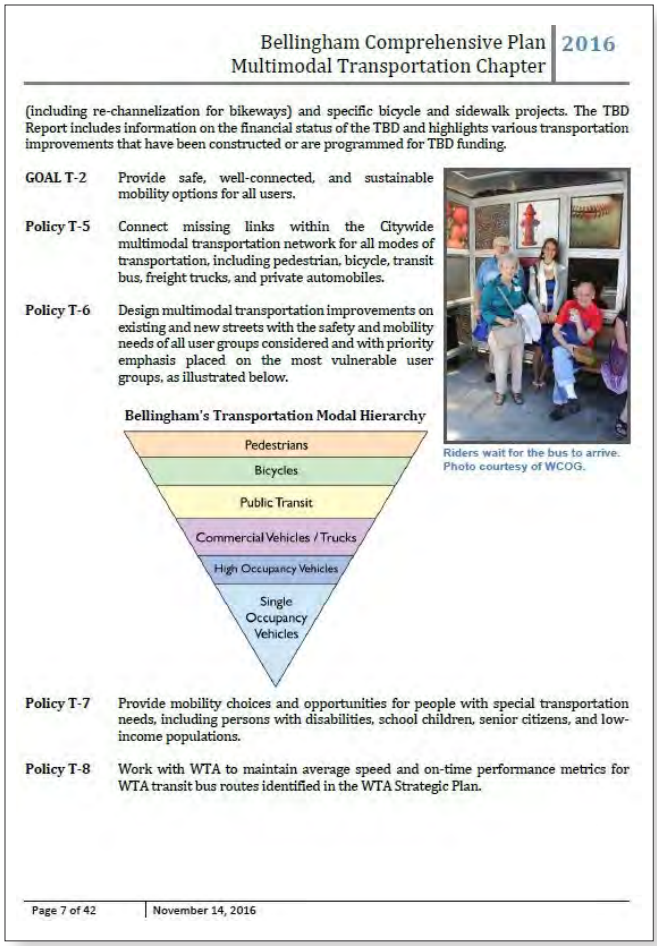

Bellingham Comprehensive Plan 2016
Multimodal Transportation Chapter

(including re-channelization for bikeways) and specific bicycle and sidewalk projects. The TBD Report includes information on the financial status of the TBD and highlights various transportation improvements that have been constructed or are programmed for TBD funding.

GOAL T-2 Provide safe, well-connected, and sustainable mobility options for all users.

Policy T-5 Connect missing links within the Citywide multimodal transportation network for all modes of transportation, including pedestrian, bicycle, transit bus, freight trucks, and private automobiles.

Policy T-6 Design multimodal transportation improvements on existing and new streets with the safety and mobility needs of all user groups considered and with priority emphasis placed on the most vulnerable user groups, as illustrated below.

Bellingham's Transportation Modal Hierarchy

Riders wait for the bus to arrive. Photo courtesy of WCOG.

Policy T-7 Provide mobility choices and opportunities for people with special transportation needs, including persons with disabilities, school children, senior citizens, and low-income populations.

Policy T-8 Work with WTA to maintain average speed and on-time performance metrics for WTA transit bus routes identified in the WTA Strategic Plan.

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- GOAL T-1 Limit urban sprawl by linking land use and transportation planning.
- GOAL T-2 Provide safe, well-connected, and sustainable mobility options for all users.
- GOAL T-3 Increase infrastructure for bicycles, pedestrian, and non-single-occupancy vehicles.
- GOAL T-4 Reduce dependence on single-occupancy vehicles.
- GOAL T-5 Maintain and improve streets, trails, and other infrastructure.
- GOAL T-6 Ensure that social equity needs are addressed in all transportation projects.

Bellingham's Complete Networks Program and strategic implementation practices allow both residents and visitors to increasingly choose walking and bicycling as a safe, comfortable, and legitimate means of transportation to many destinations throughout Bellingham. It also helps the City achieve its goals for transportation mode shift from vehicles to active transportation modes, which contributes to a virtuous cycle that helps to provide social equity, improve public health, and reduce greenhouse gas emissions. In addition to creating unprecedented connectivity in the short-term, Bellingham's rapid implementation of the citywide pedestrian and bicycle networks is also increasing the quality of life for all of its residents in the long-term.

About the Author

Chris Comeau AICP-CTP
CITY OF BELLINGHAM

Chris Comeau is the City of Bellingham's Transportation Planner and manages many of the transportation plans and programs that are highlighted on the City of Bellingham Transportation Planning web site. Chris has helped transform Bellingham's transportation policies, programs, and implementation practices into some of the most multimodal-oriented in Washington. Since 2006, Chris has secured over $35 million in state and federal grant funding for sidewalks, bikeways, traffic signals, roundabouts, and multimodal street projects throughout Bellingham.

Washington State Ferries 2040 Long Range Plan

Carmen Bendixen & Stephanie Cirkovich

Introduction

Carrying close to 25 million passengers a year, Washington State Ferries (WSF)—a division of the Washington State Department of Transportation (WSDOT)—operates the largest, most diverse ferry system in the United States. WSF's fleet of 22 ferries crosses Puget Sound and its inland waterways, serving as a marine highway that carries people and goods from Tacoma, Washington, to Sidney, British Columbia.

Once a decade, WSF revises and renews its 20-year Long Range Plan (plan) within the parameters of several (and sometimes competing) legislative, executive, budgetary, administrative, and public policy considerations. The purpose of this article is to provide a brief overview of how the plan was updated with stakeholder input, the community's response to the plan, and next steps for plan implementation.

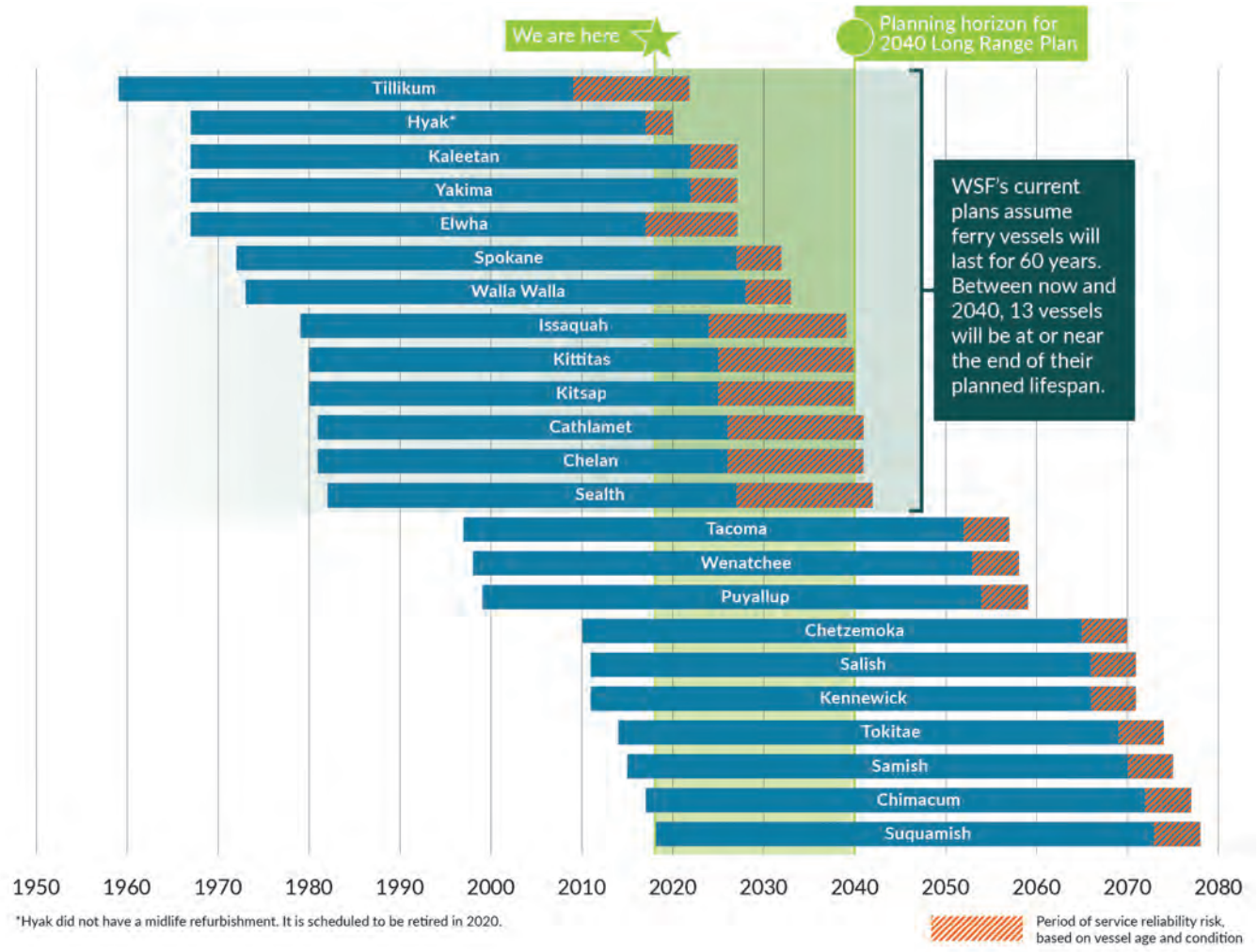
Plan Description

The Washington State Ferries (WSF) 2040 Long Range Plan is the product of an intensive 18-month planning and community engagement process. The final product, delivered to the Washington State Legislature on January 4, 2019, involved the successful completion of multiple parallel tasks, including ridership forecasting, modeling, naval architecture, and engineering. The plan also addressed a number of critical issues facing the agency:

1. WSF's aging fleet of vessels was experiencing a record number of breakdowns;
2. Its skilled mariner workforce was retiring without a deep bench of successors;
3. The system lacked the resources to upgrade outdated infrastructure and technology; and
4. Service disruptions and poor on-time performance challenged riders' trust and the public's confidence in their ferry system overall.

The cornerstone of the plan is an extensive community engagement effort that considered the input of more than 7,000 ferry riders; specialized user groups, such as bicyclists or riders with disabilities; transit agencies; elected officials; business and economic development interests; Native American tribes; and other interested partners.

Well before the plan was drafted, WSF staff assembled three key advisory committees (in 2017) and conducted a preliminary round of public outreach (in Spring of 2018) to talk about the agency's challenges and the difficult trade-offs that must be made. Staff traveled far and wide



Within the 2040 horizon of this plan, over half of the agency's fleet is due for retirement.

to community centers, schools, and town halls to meet people one-on-one and talk about what aspects of the ferry system were most important to them. To reach those that could not attend a community meeting, WSF also hosted online "open houses," which asked specific questions about areas of concern and allowed for the public to also write in their top concerns and comments.

By listening to thousands of people and reading comments running the gamut from protecting the environment to the quality of food onboard the vessels, WSF was able to organize the Long Range Plan around four key themes that seemed to matter most to everyone:

1. Reliable Service—Minimal disruption and on-time performance, with vessels, terminals, and other WSF facilities in proper working order and well-maintained. An adequately trained workforce to operate the ferry system.

2. Customer Experience—Accurate, real-time information using modern technologies. Seamlessly accommodating a variety of customers and modes, including bicyclists, pedestrians, and people with disabilities. Providing amenities at busy terminals.

3. Manage Growth—Prioritizing the movement of people across the system. Measuring the

ferry system's performance using meaningful metrics.

4. Sustainability and Resilience—Investments in technology and infrastructure that minimize negative impacts on the environment. Developing a ferry system that can be a flexible, responsive lifeline in times of emergency.

The plan offers realistic, innovative recommendations under each of these themes that directly address the community's needs and the changing landscape of the region served by the ferry system. Some of the plan's forward-looking recommendations include:

- Electrifying ferries and terminals to save energy, public dollars, and reduce the system's carbon footprint;
- Easing congestion through adaptive management strategies such as expanding the system's wildly popular reservation program;
- Increasing passenger capacity on routes most used by pedestrians and bicyclists;
- Creating a workforce development plan that ensures a stable and skilled maritime workforce;
- Promoting mode shift through investments in technology and infrastructure that promote walk-on and bike-on passengers and improve multimodal connections; and
- Investing in technology that enhances the customer experience, including vessels and terminals that adapt to emerging technology and demographics.

After a draft plan was produced, the WSF planning team once again conducted an intensive round of community outreach to review the recommendations with the public and get their feedback. Some recommendations were eliminated because they did not sit well with user groups, and several others were amended and improved. Every week for six weeks in the fall of 2018, the WSF planning team would visit two or three ferry-served communities, collect comments and information through a variety of formats, and sit down and review each comment that was submitted to them, discussing and refining the plan as the community outreach progressed.

The result is a living document with widespread public support. The final plan is not only a pragmatic and incremental roadmap for Washington State Ferries to follow for the next two decades, but it is also a faithful reflection of the community it serves. In addition to its favorable reception at the Washington State Legislature, WSF's Ferry Advisory Committees, local media, and others are speaking up about how important the ferries are to Washington's economy and quality of life. As a result, the Governor signed a 2019-21 transportation budget that will add hybrid electric ferries to the fleet and change the way WSF does business for good.

The Long Range Plan includes a focus on encouraging passengers to walk and bike onto the ferries. Some of the recommended strategies included in the plan are prioritizing the loading and movement of people and bicycles, improving multi-modal connections at terminals, and incorporating improved bike and

Community Engagement and Getting the Word Out for Final Long Range Plan

pedestrian infrastructure in terminal preservation and improvement projects by connecting to local trail and path systems. The focus on walk-on and bike-on passengers is carried into the future with the addition of a level of service standard that all passenger ridership will be served, and vessel design standards that incorporate flexibility so that vehicle spaces can be adapted to passenger spaces as transportation needs change.

One major component of the Long Range Plan that demonstrates a commitment to improving multimodal networks is the terminal capital program. WSF currently has two major multimodal terminals under construction, with several projects in the pipeline that would improve connectivity. For example, the increase in walk-on passenger ridership, as well as adhering to seismic standards, will require a replacement to the current overhead loading ramp at the Bainbridge Island terminal. This project will enable the route with the highest ridership in the WSF system to more easily connect to transit and other last-mile modes. These connections will only be possible through WSF's coordination with partners such as Kitsap Transit, King County Metro, and Sound Transit.

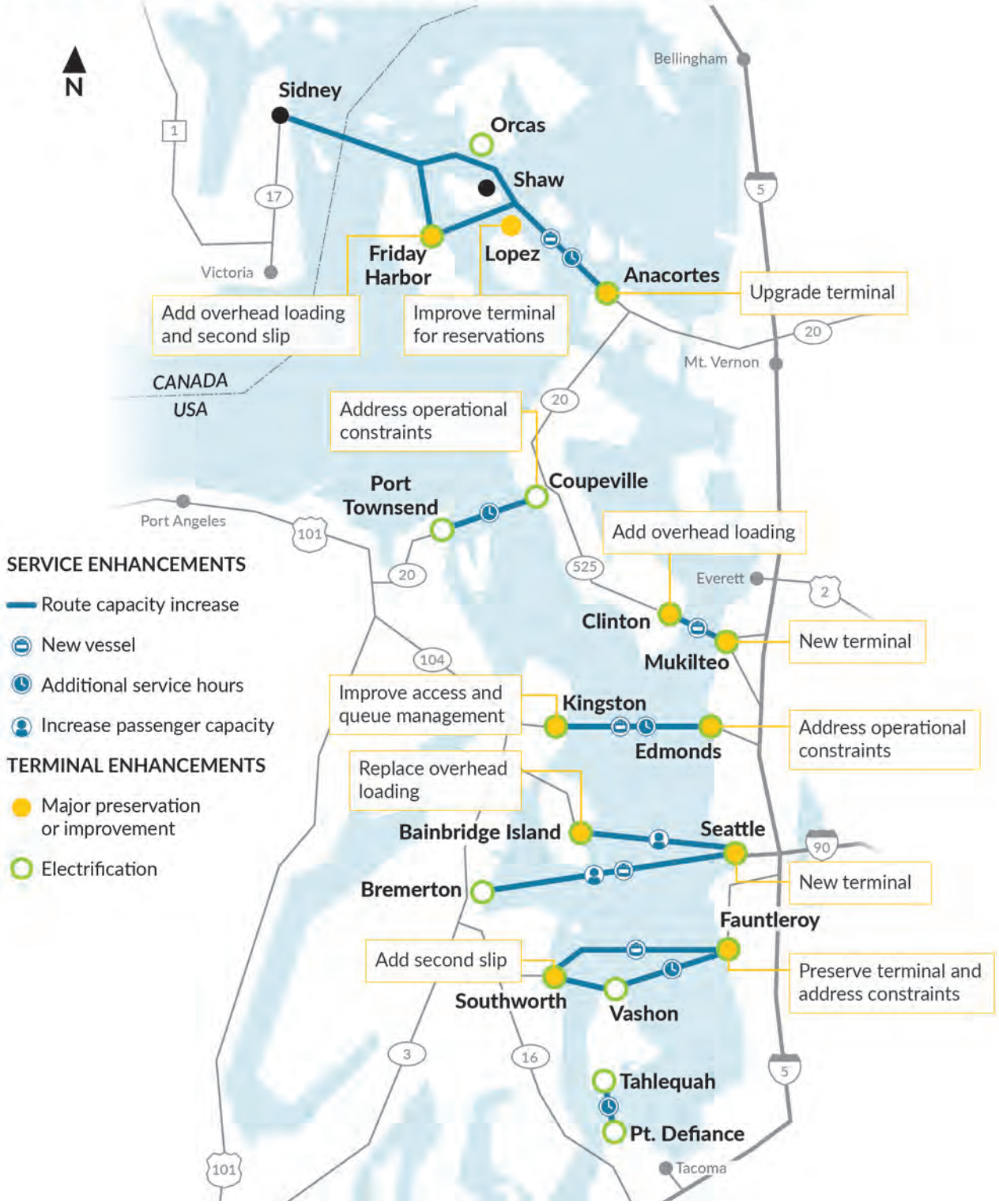
The Long Range Plan also aimed to encourage multi-modal connections at terminals through partnering with local transit organizations to align service schedules and improving real-time user information and customer alerts to make transit connections easier for passengers.

Response to the Plan

The plan was recognized for its diversity and inclusion by the Women's Transportation Seminar because so many of the planning principals are women. The American Association of State Highway and Transportation Officials presented its President's Transportation Award for Planning to the WSF planning team for its work on the Long Range Plan. Local media outlets featured stories on the plan's release. Most recently, Seattle Met Magazine dedicated an entire issue to the ferry system, citing how "once every decade Washington takes a hard look at the future of waterway transportation." Additionally, as mentioned above, the Washington State Legislature acted on multiple recommendations from the Long Range Plan in its 2019 session. Overall, the trust and confidence in WSF is building.

WSF is very proud to have produced a plan that will not only help Washington's legislators make sound transportation investments for decades to come, but also a plan that is getting attention because, at its core, it's all about the people WSF serves.

Service and terminal enhancements in 2040



Implementation and What's Next

The Long Range Plan's call for immediate action to preserve the aging fleet was clearly heard by community members and policy makers. Recently signed into law by Governor Inslee, the Washington State Legislature passed a budget that allows the agency to extend a vessel construction contract that will build five new hybrid electric vessels over the next several years. Additionally, upcoming terminal improvement projects will incorporate Long Range Plan recommendations for efficient use of technology and existing capital infrastructure, as well as sustainability and access improvements.

WSF has made other progress on implementing the Long Range Plan since it was completed. Other accomplishments include completing a Sustainability Action Plan and a fare simplification study. Several other recommended projects are underway, such as developing a workforce development plan, and estimating costs and developing plans for electrification of many of WSF's terminals. The latter project will facilitate the success of WSF's hybrid electric fleet when those vessels begin serving passengers.

The Long Range Plan provides WSF with a clear blueprint for the next 20 years—one that is attainable, fiscally responsible, and invests in the ferry system and employees to ensure that WSF continues to provide a reliable transportation service to support the development of healthy, equitable, and sustainable communities.

About the Authors

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WASHINGTON STATE FERRIES (WSF)

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STREETS, PLACES & URBAN DESIGN

Innovative Curbside Management in the Nation's Capital

Benito O. Pérez, David C. Lipscomb, Dennis Ayuk, Cameron Stokes, & Evian Patterson

In the midst of the federal government managing the nation's business, Washington, DC has over 700,000 residents and nearly as many commuters. An additional 125,000 tourists traverse the Nation's Capital daily[1]. Much like many other major cities in the United States, Washington is experiencing a major upheaval in its transportation network, which is being seen and felt most profoundly at the curb. As the District grows, there is increasing innovation in mobility and technology and a cultural shift in how residents and visitors travel. Traditional mobility is being disrupted by the proliferation of technology-catalyzed shared mobility, mobile vending, and on-demand delivery services. Consequently, cities like the District have been caught off-guard in curbside management. The public curbside has emerged as a hot commodity, and managing it properly will allow dynamic, rapid turnover, access to key resources, and an opportunity to quickly innovate and improve accessibility for all.

In the District, the District Department of Transportation's (DDOT) Parking and Ground Transportation Division (PGTD) is charged with regulating, operating, maintaining, and managing the curbside. This ranges from curbside signage, hardware (such as parking meters), and operational and regulatory policy, to messaging and coordination with parking enforcement and the public. In this environment of mobility innovation and increasing demands on curb access, PGTD has charted a course to better manage and organize this key resource. Initial work has involved scoping and enhancing the regulatory framework for curbside management. That, in turn, has facilitated reimagining the curb to facilitate pick-up and drop-off of people and goods from transportation network companies (TNCs) such as Uber, Lyft, and Via; on-demand deliveries (ODDs) from companies like Postmates, Grubhub, and UberEats; and increased urban package delivery from UPS, FedEx, and the U.S. Postal Service.

Curbside Management in the Nation's Capital

1 *moveDC*. Washington: District Department of Transportation. 2015. http://www.wemovedc.org/

With this reuse of the curb, PGTD has also used data to rethink holistically and objectively about how to program and message the curbside in the neighborhood framework. Upon reprogramming the curbside holistically, there is consideration of how to improve accessibility of the curb not only for individuals with mobility impairments but also for those with limited language access. The District, which has a diversifying language population, recognizes six primary languages other than English, and parking signage is historically text-based. Lastly, amid all of this mobility innovation, there is a need to be more "asset-lite," where the District can manage the curb with the minimum viable hardware and infrastructure.

Enhancing the District's Curbside Regulatory Framework

Transportation officials know that there is often a disconnect between what they would like to do to improve conditions within their jurisdiction and what they can do under the regulatory framework governing their municipality. While DDOT is subject to many of these same external constraints, the agency is working to simplify internal legal requirements for greater flexibility and quicker rollouts of innovative curbside solutions.

Due to the District of Columbia's unique status as an all-in-one state, county, and city for transportation governance purposes, the requirements for setting and changing laws and regulations are somewhat different from those of any other city. In many ways, it's a simpler structure in that there are only two non-federal actors that set and change transportation law and policy—the District of Columbia Council, which is the legislative body for the District, and the Executive Office, which is headed by the mayor and houses DDOT. The Council combines the attributes of a state legislature and a city council, while the Mayor functions both as a city's mayor and a state's governor in one.

DDOT only became a standalone agency in 2002, when it separated from the umbrella of the Department of Public Works. As a result, the agency is still coming into its own. Part of this ongoing development is a continuing review and modernization of the regulatory framework that governs curbside management within the District. This review is particularly important as curbside needs are changing almost daily with the increasing digitization of modern life. In many areas, long-term parking needs are being replaced by demand for short-term access for loading, passenger pickup, on-demand delivery services, or active transportation storage.

As regulations are modernized, DDOT's objective is to use a light touch and provide a flexible framework within which planners and operations teams can function as freely as possible. The idea is that the agency contains personnel with subject-matter expertise in designing and operationalizing the District's transportation programs. Rigid, top-down mandates in how those operations must function can often slow innovation and bog those same subject-matter experts down in red tape.

DDOT's regulatory goals moving into 2020 include further simplification of this framework. Reorganizing the existing performance parking program to allow curbside occupancy fees to truly rise and fall with market demand is one priority. The current legislative structure of the District's performance parking program set an artificially low price cap and constrains the frequency of pricing changes, which prohibits the agency from setting meter rates at a market level to achieve optimal occupancy.

A decade of performance-parking operations in the District have made it clear that rigidity and onerous mandates are counterproductive to the purposes of a functioning performance-parking

program and even to curbside management policies at large. By working with the Council to simplify this structure, DDOT hopes to more flexibly manage curbside use through pricing strategies to reduce congestion, increase parking turnover, and encourage the use of sustainable transportation modes.

Additionally, a nimbler regulatory framework governing curbside management will allow DDOT to continue reimagining curb use to move away from vehicle storage and towards short-term access needs such as loading of passengers or goods. With a growing and densifying city to move, DDOT is moving away from a 20th-century auto-first mentality into a 21st-century mentality focused on a more accessible, equitable, and livable form of mobility by setting up a progressive and permissive regulatory framework.

Reimagining the Curb for Pickup/Drop-Off Needs

As the population of the District of Columbia grows and neighborhoods continue to redevelop, the District's transportation network has been challenged to meet new needs. Changes to transportation and freight precipitated by recent technological advances have created unanticipated demands at the curbside. Consequently, the District's curbsides are in higher demand than ever both by traditional automobiles and new modes of transportation. Between 2010 and 2019, the District saw the arrival of bikeshare, app-based mobile roadway vending (typically food trucks), transportation network companies (TNCs), point-to-point carsharing, on-demand delivery services (ODDS),

Multi-use Pick-Up/Drop-off Zone at The Wharf, SW DC

dockless bike and scooter sharing, and moped sharing. Each of these services has specific curbside needs that often conflict, causing negative impacts on safety and efficiency.

Those impacts have reached a critical mass, but the District, its residents, and businesses have taken a proactive approach to addressing them. Two notable examples are the Dupont Circle Nightlife Curbside Restriction pilot and the Pickup/Drop-off Zone pilot programs.

In 2016, the Golden Triangle Business Improvement District (GTBID) engaged several District agencies including DDOT to address safety and congestion issues in Dupont Circle, a popular area for nightlife activity. The rise in popularity of TNCs brought ever-increasing passenger loading activity to a section of the neighborhood on top of existing taxi traffic. The same area was programmed for cheap and free on-street parking which ensured nearly 100 percent occupancy. During the most active evening hours, drivers were bringing passengers to the area but had no clear curbs at which to safely load and unload. This resulted in unsafe behavior including loading and unloading in travel lanes, congestion as drivers attempted to maneuver around stopped vehicles, and passengers standing in the street to hail rides.

DDOT and GTBID, in collaboration with the Metropolitan Police Department (MPD), the Department of Public Works (DPW), the Alcoholic Beverage Regulation Administration (ABRA), and neighborhood stakeholders, launched the Dupont Circle Nightlife Curbside Restriction pilot in October 2017. Under this pilot, DDOT restricted parking in the evening on Thursday-Sunday during peak activity to create clear curbs for loading. DDOT engaged the community with on-street informational signage, outreach to nightlife establishments, and promotional materials for patrons of those establishments.

After six months of small improvements, DDOT requested additional towing enforcement from DPW and enhanced monitoring from MPD. Early feedback and observations have been positive as the clear curbs better facilitate safer loading and quicker matchmaking as drivers and passengers try to find each other.

The success of this pilot gave way to DDOT's Pickup/Drop-Off (PUDO) Zone pilot, which sought to expand the concept of clearing curbs to busy areas with varied demand including parcel delivery, commercial loading, and ODDS all day. Building on lessons from the Dupont Circle pilot, DDOT developed PUDO zones which replace parking with 24-hour zones in which active loading of passengers or goods is allowed by any user, not just TNCs. Using taxicab data and TNC data from SharedStreets, a data-sharing partnership, DDOT identified high-priority areas and launched the first PUDO zones at the

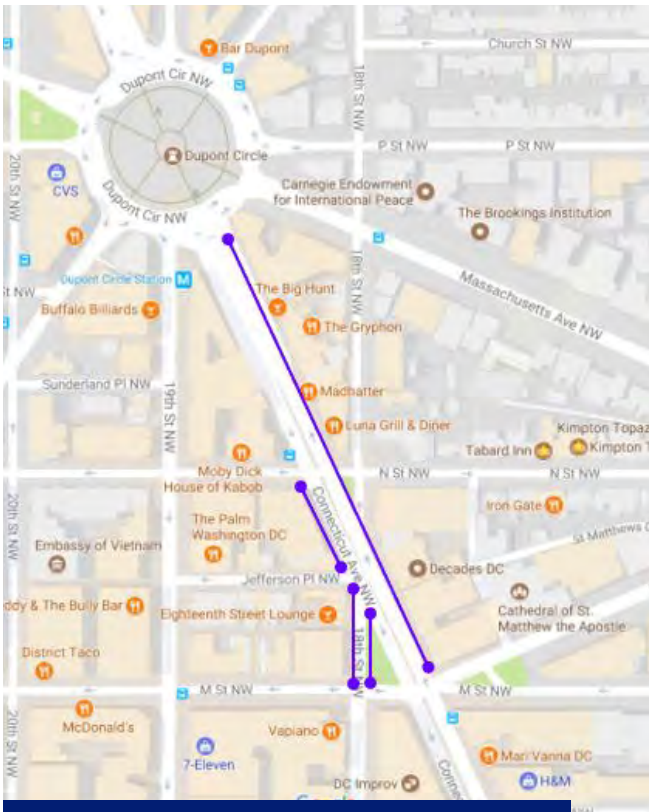


Figure 1: Connecticut Avenue Nightlife Curbside Restriction Pilot

intersection of 14th and U Streets NW, where two well-established and growing corridors for commercial activity meet.

Using this location as a model, DDOT established criteria for evaluating locations for new PUDO zones focusing on land-use patterns, transit availability, off-street parking options, and safety data. In coordination with key stakeholders, DDOT has successfully deployed two dozen zones with another dozen in various stages of development.

Holistic and Objective Neighborhood Curbside Management

The District's PUDO zone pilot is just one tool in the toolbox of neighborhood curbside management planning. As new neighborhoods are developed and old ones undergo changes, the weaknesses of auto-centric design are exposed by evolving forms of mobility. This has begun to create conflicts among modes, and the District must respond by updating policy and infrastructure to ensure neighborhoods are successful and livable.

The District has the privilege and the challenge of being a metropolitan employment, tourism, and entertainment center that also is woven into diverse residential neighborhoods. To deal with these challenges, the District has developed a framework based on a 2014 Curbside Management Study. The three major points of the vision laid forth in the study are:

- Ensuring the District's curbsides can support diverse commercial areas;
- Making possible the reasonable expectation that residents can park within walking distance of home; and
- Making all modes of access safe, comfortable, efficient, and attractive.

To help achieve this vision, DDOT focuses its efforts on developing context-sensitive solutions to its challenges. That context is determined by four neighborhood typologies: Downtown Core/High Intensity, Mixed-Use/High-Intensity, Neighborhood Centers (commercial corridors adjacent to residential neighborhoods), and Residential/Low-Intensity. Each typology has a hierarchy for curbside programming and policy that is designed to support the land uses in each. For example, the hierarchy for the Downtown Core makes commercial loading and transit higher priorities than visitor parking permits.

In participatory outreach with communities, DDOT scopes out the holistic, neighborhood curbside management issues; collects, aggregates, and analyzes data pertinent to those identified issues; provides open access to the data and analysis for community stakeholders to be informed advocates in community curbside management discussions; and frames the short- and long-term opportunities alongside stakeholder roles and responsibilities for optimized neighborhood curbside management.

As part of this approach, DDOT is exploring ways to encourage mode shift from personal vehicles to transit, micromobility, and active transportation. As the freight industry evolves, DDOT is also studying how curbsides can be repurposed for the movement of goods rather than vehicle storage where appropriate. DDOT is engaging residents on curbside management to marry their visions to the goals the District has set for supporting safe, vibrant, inclusive, and accessible communities.

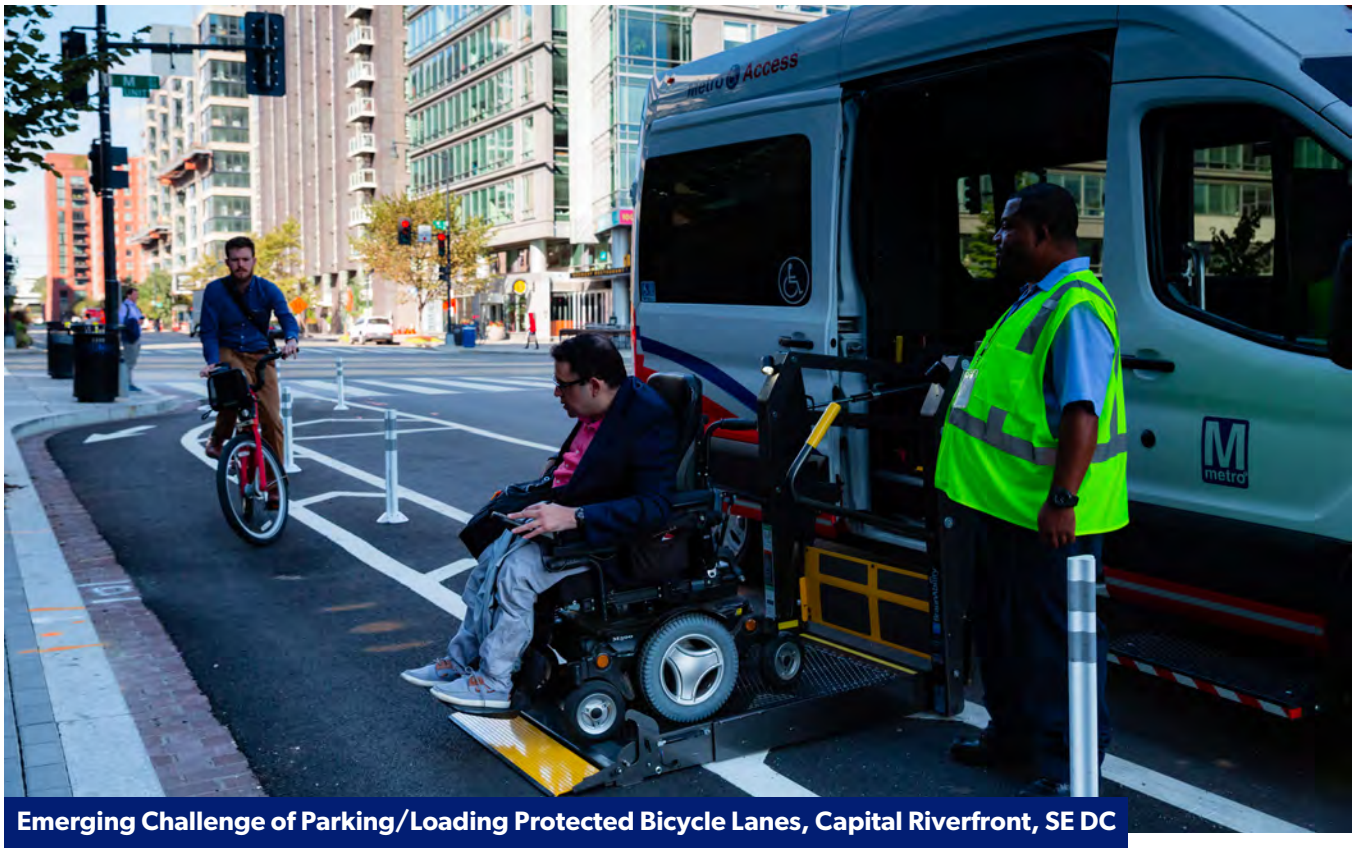
The District recognizes that it is not alone in these efforts in both regional and national senses. Locally, DDOT has formed a regional working group to cohesively tackle issues such as accessibility and regional curbside policy and

has engaged other jurisdictions on research and service-contracting opportunities. This stemmed from previous coordination missteps in the District, including the roll-out of out point-to-point carsharing to and issues adjusting the base parking meter rate that had a significant impact on neighboring jurisdictions' own curbside-management strategies.

Nationally, DDOT has continually built relationships with other jurisdictions to exchange knowledge and best practices and work through new challenges together. DDOT has been in contact with municipal agencies around the country to build consensus around the high-level priorities for large transportation networks and offer knowledge to developing jurisdictions that are facing certain challenges for the first time.

Accessible Curbside Management

Curbside accessibility is the ability for all persons, regardless of ability, to have equal access to the curbside for their specific needs. When developing and implementing multiple programs dealing with curbside utilization including parking, pick-up/drop-off, micromobility, and commercial loading, agencies must always have a plan developed to accommodate curb access not only for able-bodied individuals but also persons with mobility challenges. Through trial and error over the past two decades, DDOT has established model practice in equally accommodating persons with mobility challenges through various programs. Some existing programs designed for mobility-challenged curbside customers include:



Emerging Challenge of Parking/Loading Protected Bicycle Lanes, Capital Riverfront, SE DC

Accessible Meter Parking, Farragut West, NW DC

- **Accessible Parking Meters:** consisting of 350+ distinct, red-domed parking meters that are reserved and accessible for the exclusive use of persons with disabilities in the Central Business District (CBD). These meters demarcate an accessible parking space cleared from adjacent sidewalk obstructions and close to an accessible curb ramp.
- **Reserved Disability Parking Program (RDPP):** consisting of 2,300+ designated parking spaces to assist residents with disabilities in having consistent access to the curbside from their home.

With the unique position of the District being the seat of the U.S. federal government, DDOT has the opportunity to interface with subject-matter experts not only from the Federal side but also from national accessibility organizations. DDOT, in concert with the District Office of Disability Rights, has collaborated extensively with the U.S. Access Board in order to establish and refine guidance on curbside accessibility in this period of mobility and curbside disruption.

Initial actions have involved reengineered accessible parking-meter siting standards and follow-up site inspections in the central business district. DDOT has also experimented with asset-lite accessible parking, which entails signing the paid, accessible space and using an existing pay station, duly installed to accessible siting standards. This is in contrast with the existing best practice, which entails installing an accessible, single space meter for the accessible parking space. The experiment, if successful, would unify the parking experience for all parking users at the parking meter, regardless of each person's particular mobility circumstances. That program is due to roll out in the District's Stadium Event Zone in early 2020.

Learning from siting accessible parking spaces, DDOT is revisiting its Reserved Disabled Parking Program in residential areas. With intensifying curbside demands, densifying neighborhoods, and a regulatory framework that dates back nearly 50 years, the program in its current form (reserving a parking space in front of a home for a resident with mobility challenges) is unsustainable. Furthermore, existing spaces do not conform to stringent accessible siting and engineering standards. DDOT has begun conversations with stakeholders to explore devolving the program into an unreserved parking space on each block in the District that is accessible to established siting and engineering standards. This intends to provide equitable access to the curb on every block for persons with mobility challenges, regardless of being a resident in a low- or high-density residential area, or a visitor.

With the proliferation of the PUDO zone pilot program noted earlier, alongside the rise of parking-protected bicycle lanes (PPBL) throughout the District, DDOT has experienced new challenges with road design. In particular, while the disability community has appreciated the diversification of the curb, many stakeholders have also raised concerns that newer curb uses should (1) meet their accessibility needs and (2) not infringe on their safe access to the curb. Solving that problem has involved using techniques from tactical urbanism design to develop a reasonable, accessible design solution to better facilitate accessible PUDOs and PPBLs. Starting in 2020, DDOT will be out in the field applying various tactical urbanism solutions to improve accessibility and safety of all users.

It is imperative that accessibility remain one of the forefront priorities when implementing and renovating curbside programs.

Effective Multilingual Curbside Communication through Signage

Before parking a vehicle, the driver needs to know: Is parking allowed? At what times? Are there any other curbside uses? Historically, the District has been noted for having some of the most confusing signs due to the need to answer all these questions and more. Curbside functions are constantly changing over time, resulting in signage conflicts, illegible signage, and confusing messages. Adding to the complication is that these issues are most likely to occur when dealing with complicated curb restrictions and special curb uses that are not defined in the Manual of Uniform Traffic Control Devices (MUTCD).

This signage culture in the District is only complicated by the rise of innovative mobility services and competing demands on the curbside. DDOT has taken the initiative to rethink sign design concepts in an effort to bridge the gap between message conveyance and sign simplicity. Because the District is an international destination for visitors, and also contains a sizeable population of Limited English-speaking Persons (LEP) across six identified languages, DDOT is experimenting with the use of heavier pictorial representations in newer developed signage.

Such signs not only convey the same message as standard legend and in a simpler format, but also assist the visual receptors of drivers by associating an image with certain commands/actions. Symbology is a common language that can be used to communicate across individuals of different backgrounds without showing bias to a specific group. This process requires the strategic use of MUTCD-approved symbols and colors in order to convey a clear-cut message through a combination of pictures, colors, and the use of minimal to no legend. The expected

outcomes of this experiment will be to decrease perception-reaction time of drivers through the use of imagery, in turn decreasing sign confusion and increasing safety and vehicle throughput in the corridors.

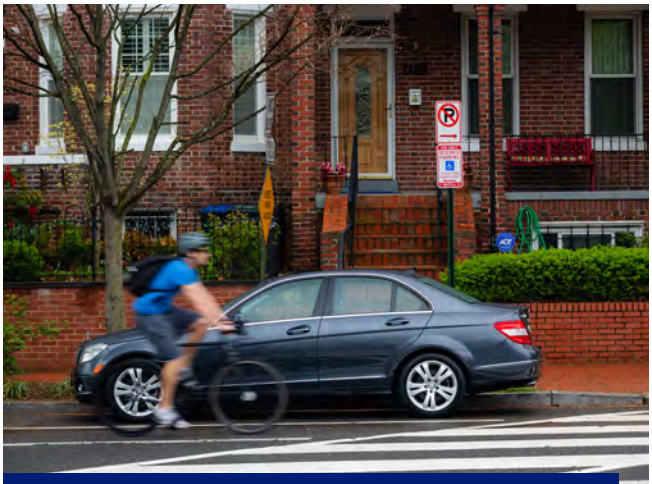
Two recent examples of signage design pertain to two of our emerging curbside programs:

- **PUDO:** The upper portion of the sign restricts parking on the block at all times through the use of the international "P" and red colors, while the bottom portion of the sign uses yellow and black to warn drivers they are entering a passenger pickup/drop-off location so they must be on alert for changes in vehicle movements. Community members have given positive feedback to sign simplicity; this response has been supported by declining citation data in the three months since the PUDO program's inception.

- **Asset-Lite Accessible Meter Parking:** The upper portion of the sign reserves the space exclusively for persons with disabilities. The middle portion conveys the necessary parking information: 4 HOUR, PAY TO PARK. Finally, the bottom portion conveys the information needed for mobile payment. This sign attempts to reduce conflicts by aggregating key parking information into commonly applied symbols. It also deviates from standard design by using the MUTCD Blue as a restrictive color for persons with disabilities only, instead of using multiple colors which could add to confusion.

As DDOT progresses in sign redesign, it will continue to develop innovative ideas that may challenge the hegemony of MUTCD guidelines, all in attempts to increase sign simplicity and communication between drivers and curbside regulations. In the future, PGTD plans to conduct research on the effectiveness of both sign types in attempts to further gauge the advantages and disadvantages of each sign design. With resources near the District including the Turner Fair-Bank Highway Research Center and multiple local universities, DDOT plans to expand on this project in attempts to determine the best standard practice for sign design and provide data to support this theory.

Moving forward in curbside management, it is imperative that accessibility remain one of the forefront priorities when implementing and renovating curbside programs. These efforts ensure the PGTD remains consistent with DDOT's vision for equitable and accessible transportation options, improved traffic safety, and traffic-congestion mitigation in the District's roadway network.



Reserved Residential Accessible Parking, Capitol Hill, SE DC

Asset-Lite Curbside Management

Managing the District's dynamic, demand-intensive curbside for all users is a delicate balance. Within this work, there is a need for quite a bit of hardware to best communicate and manage the use of the curb. However, along with this hardware comes the need for an asset management/ lifecycle-replacement plan. Public agencies also require capital to procure and maintain all of this hardware, from meters and signs to parking detection sensors. What if DDOT could manage the curbside just as effectively, but with less hardware and resources?

This philosophy of asset-lite management was instilled at DDOT within the first and second iteration of bikeshare. The first bikeshare system in the District (SmartBikeDC, circa 2008) required hard-wiring of stations into an electrical source to operate. That led to limited siting opportunities, and thus a limited system that eventually folded. In the current iteration of bikeshare (Capital Bikeshare, circa 2010), the system was designed to be a nearly self-sufficient station, harnessing solar power. Since that rollout, the regional system has surpassed 500 stations and 4,000 bikes.

In the curbside arena, the key management tool that is responsive to curbside need is demand-responsive pricing, also known as Performance Pricing. The earliest iteration of a successful program was SFPark (circa 2009), but that system relied on a single-space meter and sensor for every parking space (at a cost of $20 million for the SFPark program). The District has similar curbside challenges as San Francisco but wanted to accomplish the same task for less.

DDOT's parkDC: Penn Quarter/Chinatown Pricing Pilot (2014-2018) was the next step forward in a national trend toward demand-based parking management. The pilot's primary goal was improving the parking experience for customers by rebalancing parking supply and demand. DDOT's plan for meeting this goal combined widely accepted parking practices such as smart meters and alternative payment options with cutting-edge techniques like real-time parking availability information and performance parking. Through this pilot, DDOT aimed to advance the state of practice for parking performance in two ways:

- **Multimodal Focus:** Applying pricing principles to loading zones in addition to passenger vehicles, and
- **Asset-Lite Approach:** Developing the program at a significantly lower price point than current state-of-the-practice.

Hazardous Drop-off in the travel lane, Southwest Waterfront, DC

Multimodal Transportation in the District of Columbia

DDOT sought to match or better the success of other performance parking programs, generating accurate occupancy information with less equipment. This asset-lite approach streamlined what other agencies have undertaken to measure real-time occupancy, share real-time information with the public, and appropriately price parking.

The parkDC pilot sought to use technology, pricing, and information to make parking easier and reduce congestion in part of downtown Washington, DC. The parkDC pilot met the customer- and agency-related goals identified by DDOT at the pilot's outset. Due to the success of the parkDC pilot, DDOT is working to expand demand-based parking pricing to other District neighborhoods going into 2020.

Looking Ahead

In 2020 and beyond, DDOT will continue to seek innovative curbside management solutions for an ever-changing transportation landscape. With a continuing shift in curbside needs and new mobility options coming online, PGTD will look to continue to be at the vanguard of curbside management through flexible regulatory frameworks, progressive pilot projects, and forward-looking curb-use policies.

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Benito O. Pérez is a Curbside Management & Operations Planning Manager with the District Department of Transportation. In his capacity, he works on managing a team involved with creating, accessing, analyzing, visualizing, disseminating, and working with stakeholders to leverage data for policy development, resource allocation, and operations management of the District's curbside. Mr. Pérez earned his Masters of Arts in Urban Planning and Masters of Science in Civil Engineering from the University of Florida in 2009.

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David Lipscomb is the Curbside Management Planner at the District Department of Transportation. Lipscomb's projects include planning and evaluating motorcoach parking, implementing DDOT's pickup/drop-off zone pilot program, parking sign redesign, and neighborhood parking planning. Lipscomb has a Masters in Community Planning from the University of Maryland, College Park. Additionally, David has more than a decade of experience in journalism and communications.

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Cameron Stokes is a Policy Analyst in the Policy and Legislative Affairs Division at the District Department of Transportation. His portfolio includes policy, legislative, and regulatory development and analysis of topics including parking, curbside management, and public space. Cameron has over 8 years of experience working in government at the local and federal levels. He received his J.D. from Georgetown University Law Center and his B.A. in Journalism and Mass Communication from UNC-Chapel Hill.

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Dennis Ayuk is the Construction Control Representative at the District Department of Transportation (DDOT). In this role, Dennis is responsible for the enforcement and protection of the District of Columbia public right of way relating to construction and maintenance conducted in the public space. He recently completed DDOT's internship program working on multiple projects, including planning and evaluating DDOT's pickup/drop-off (PUDO) zone pilot program, development of the PUDO zone sign, parking sign redesign, and ADA compliance evaluations in curbside programs. Dennis earned a Bachelor's of Transportation Engineering in December 2018 from Morgan State University.

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Evian Patterson is Associate Director of the Parking and Ground Transportation Division at the District Department of Transportation. As Associate Director, he leads parking and curbside management, focusing on implementing data-driven parking solutions and providing accessible public information with technological innovation. He also serves as an Operations Administration leader for activities related to large special events, including planning and implementing ground transportation access and use of District curbsides. He holds a master's in public administration from New York University with a focus on public finance and municipal revenue generation and a bachelor's degree from the University of North Carolina at Wilmington.

Go Human Kit of Parts:

Tactical Urbanism & A Lesson in the Transformative Power of Demonstrating Safety

Dorothy Le Suchkova & Julia Lippe-Klein

As the nation's largest Metropolitan Planning Organization, the Southern California Association of Governments (SCAG), represents six counties, 191 cities, and more than 19 million residents. SCAG undertakes a variety of planning and policy initiatives to encourage a more sustainable Southern California now and in the future. In 2015, SCAG launched its active transportation safety and encouragement campaign, Go Human. Go Human aims to reduce traffic collisions in Southern California and encourages people to walk and bike more. The campaign is currently funded by the California Office of Traffic Safety and utilizes a variety of strategies for safer and healthier communities, including education, advocacy, information sharing, and temporary safety demonstration projects that help residents re-envision and shape their neighborhoods and streets.

Go Human is a response to the unacceptable rates of injuries and fatalities across the region involving people walking and biking. On average, 1500 people are killed and 5,200 are severely injured on our roads every year in southern California. There are roughly 270 collisions every day, which is about 99,000 every year. On any given day, six people are killed by a car or a truck, and most of those fatalities occur on local roadways. People

Lighted walking tunnel at Illuminate Riverside, Riverside, CA, December 2018.

walking and bicycling in the region are killed at a disproportionate rate. While walking and bicycling trips account for just under nine percent of all daily trips in the region, people using these modes make up 27 percent of all traffic fatalities (SCAG. 2017. Transportation Safety Regional Existing Conditions) Go Human aims to support efforts to reduce collisions and improve safety, while simultaneously encouraging more people to walk and bike.

One of the most successful strategies that Go Human utilizes includes tactical urbanism or temporary safety demonstration projects. SCAG works in close collaboration with partner cities, counties and other stakeholders to identify, plan and showcase potential safety and connectivity improvements, as well complete streets, which are streets designed and operated to enable safe use and support mobility for all users, regardless of age, ability, or type of transportation[1]. By physically demonstrating infrastructure in live traffic settings, communities have the opportunities to test out, refine and identify support for improvements. This engagement strategy has proven to be enormously successful in collecting community feedback that can be used to strengthen funding applications for infrastructure projects. More than just getting projects in the ground, the pop-ups are serving essential roles in facilitating community participation and leadership within planning efforts, shifting the culture around prioritization of travel modes, impacting political will, developing active transportation champions among elected officials, and seeding opportunities for key programming components, like Safe Routes to Schools efforts.

SCAG previously facilitated a Call for Proposals from jurisdictions and contracted with consultant teams to implement and secure materials for these pop-up projects. Through that model, SCAG hosted more than 30 demonstration projects. Recently, SCAG shifted its approach, and instead developed a lending library of durable, easily installable materials to loan across the region. This approach has reduced reliance on funding and private firms, creating more accessible opportunities for temporary demonstration projects. In alignment with California's Pedestrian Safety Month in September, with funding from the California Office of Traffic Safety, SCAG released its highly anticipated Go Human Kit of Parts lending library.

What is the Kit of Parts, or KOP? It's a collection of modular physical "pop-up" pieces (similar to oversized legos) that agency partners can borrow at no-cost to demonstrate safety treatments in their jurisdictions to support community engagement for planning efforts. The KOP consists of parklets, creative crosswalks, separated bike lanes, median refuge islands, and curb extensions. The treatments were identified and prioritized by Go Human's Steering Committee, comprised of representatives from each of SCAG's six-county transportation commissions, county public health departments, and nonprofit partners. When showcasing the treatments together, the KOP creates a Complete Street. To date, SCAG has developed two identical KOPs. One is kept at a storage facility, where partners can access individual pieces or treatments Another option for partners is to request the entire KOP to be transported in a container to a project site. The materials are durable to withstand extensive use, but easy to carry and install. Setup is swift and requires minimal staff support.

Alongside the demonstration components of the KOP, SCAG has developed a survey tool for residents to use, modifying as appropriate, to collect feedback from people at the demonstration. The short survey, developed in

1 https://www.transportation.gov/mission/health/complete-streets

Parklet at CicLAvia "Meet the Hollywoods," August 2019.

English and Spanish, evaluates demographics, infrastructure support, and travel behavior. Results from the survey tool can be used for funding applications to reflect community outreach. SCAG also makes its advertising materials available to partners that utilize the KOP, to complement the safety infrastructure with safety messaging. Materials include lawn signs, banners, and postcards, which remind drivers to slow down and watch for people walking and biking. Campaign messaging is a result of the Statewide Integrated Traffic Records System (SWITRS) collision analysis that has identified key collision types.

SCAG also makes programming elements available to partners that borrow the KOP. SCAG's Go Human Challenge includes five different interactive, educational modules that complement the infrastructure components. The modules include playful all-ages activities featuring themes including transportation safety trivia, environmental responsibility, climate resiliency and more. These programming resources are also available as part of the lending library, and deepen visitor's engagement with and understanding of the planning efforts.

Since its release, the demand has been high and the KOP has been showcased to tens of thousands of residents at events across Southern California. In just over three months, the KOP has been deployed over 15 times for a variety of projects, in conjunction with open streets events, festivals, Safe Routes to School demonstrations, bicycle-friendly business districts, safety demonstrations, and conferences. The responses from partners who have used the KOP have been overwhelmingly positive. For example, Maria Minaglia, health educator for the Orange County Health Care Agency had this to say: "We are SO appreciative of this community resource…to make active transportation safer and more prominent in Orange County."

What is the power of the KOP? As mentioned above, the KOP brings to life potential street

improvements that can be challenging to understand on paper as a rendering or in model form alone. With the KOP, planners and the public can better understand, evaluate and build support for potential projects, while engaging with the public every step of the way. As a key tool for public outreach, this lending library of resources creates opportunities to test out and provide feedback on planning concepts to secure permanent infrastructure and safer corridors.

Across seven events in 2017 and 2018 that surveyed respondents asking the question "Have you ever attended a community meeting hosted by the City to discuss transportation?" an average of 73% indicated they had not. This number indicates that a majority of residents attending Go Human events previously were not engaged in providing feedback or input to inform planning decisions, but through Go Human, they have an avenue to participate in the planning process. Event mini reports, compiled by consultant teams, can be found on the Go Human website[2].

In designing the KOP lending library, SCAG utilized lessons learned from previous SCAG sponsored tactical urbanism demonstration projects, such as City of Riverside Illuminate Riverside, and City of Culver City's Experience Elenda, which showed that demonstration projects can be powerful in changing public perceptions by showing people safer connections.

Illuminate Riverside, one of the region's signature events attracting millions of visitors, made accessing the Festival of Lights from the Metrolink Station brighter, safer and more enjoyable. The project provided participants a safer walkway from the train station to the Festival of Lights itself and featured temporary improvements including a curb extension, artistic crosswalks, a class III bike lane, a lighted tunnel, and wayfinding signage

Artistic Crosswalk at Brea Junior High School Safe Routes to School Demonstration Event, Brea, CA, November 2019.

2 http://gohumansocal.org/Pages/Events.aspx

Curb Extension at CicLAvia "Meet the Hollywoods," Hollywood, CA, August 2019.

in an effort to encourage accessing the event by train to reduce vehicle traffic, congestion, and pollution. The event featured free e-scooter rides and guided walking tours to experience the pop-up safety improvements.

City of Riverside Mayor Rusty Bailey expressed the positive effect of Illuminate Riverside on infrastructure improvements: "We are going to take the information we learn from this project and put it into effect with striping, bike infrastructure, and sharrows to expand safe and active travel for people all across Riverside," Mayor Bailey said. Out of 209 surveys collected at Illuminate Riverside, 100% wanted to see the lighted tunnel as a permanent feature, 93% wanted to see bike share and e-scooter share as permanent features, and 80% thought it was "very important" to make it easier to walk and bike between where people live, work, and play (SCAG. 2018. City of Riverside Demonstration Project Final Report)

Experience Elenda demonstrated planned active transportation infrastructure treatments on Elenda Street, between Washington and Culver Boulevard in Culver City, and collected resident feedback on bike and pedestrian improvements. The demonstration allowed participants to experience and provide feedback on a two-way cycletrack, high-visibility crosswalks, and curb extensions. Moreover, the demonstration allowed city engineers to refine the designs prior to construction. Culver City's Mayor Thomas Small spoke of the demonstration's influence on permanent improvements: "These improvements are planned to be installed permanently along with many other improvements to the intersections around La Ballona Elementary School to make it easier and safer for everyone to get to and from school," said Mayor Small.

Map and photo of two-way cycletrack on Elenda Street at Experience Elenda, Culver City, CA, September 2018

Out of 147 surveys collected at Experience Elenda, 90% of respondents supported the two-way cycletrack, 99% thought the demonstrations made the street safer and more inviting, 93% supported the high-visibility crosswalks, and 88% supported the pedestrian bulbouts (SCAG. 2018. City of Culver City Demonstration Project Final Report).

More than one-quarter of the projects demonstrated since the inception of Go Human have moved forward in some form – projects have secured additional funding for implementation or have been fully constructed, like the improvements on 8th Street in El Centro in Imperial County, or the improvements that are part of Vision San Pablo, in Palm Desert in Riverside County. With the development and availability, SCAG and Go Human hope to continue to facilitate temporary demonstration projects alongside jurisdictions, in an effort to improve and implement infrastructure across the region.

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Revamping Site Design Specifications to Support Human-Scaled Transport Networks

David A. King & Kevin J. Krizek

Introduction

The last half-century of urban transport planning is defined primarily by accommodating personal cars. This may be changing. New transport technologies and devices that are more human-scaled[1] have developed, particularly over the past few years, and have fueled prospects to dislodge the primacy of cars. The efficacy of these newer and human-scaled vehicles, however, is bounded by the networks that are available—networks which are defined by the rights of way on which they travel (links) and destinations at the terminal location of a trip (nodes). Both are important. The overwhelming majority of planning efforts to better accommodate human scaled vehicles has focused on network links for these new modes. Less attention has been devoted to how site design and planning at nodes impedes or supports human-scaled transport.[2] Efforts to help transport networks evolve, and their corresponding systems, will be compromised if only some parts to the networks adapt while others remain idle. Options to support first and last mile legs of transit are important, but have limited value when the first or last few feet are largely impermeable to anything but driving. We argue that lack of attention to developing human-scale nodes is important and lack of action will eventually bound capacity. We therefore point to opportunities for reforming site development guidelines.

Better sidewalks, more bike lanes, and multi-modal cross-sections of streets present the "much-turned-to" remedy for progressive transport planning efforts. Recent editions of National Association of City Transportation Officials (NACTO) and American Association of State Highway and Transportation Officials (AASHTO) guidelines are evidence of this. These guides largely focus improvements to streets and the emphasis on such links in a transport system come at the expense of focus on nodes. Improvements to terminal locations such as apartment complexes, shopping centers, schools, municipal buildings and more are often not considered. For travelers accessing such sites via foot or bicycle, at issue is that site entrances are generally wired only for automobiles, as is travel within it. Consider auto-only-oriented drop-off zones,

1 By human-scaled we mean vehicles that can safely share operating space with people walking. This includes bicycles, scooters, golf carts, and yet to be invented vehicle types. Required characteristics include being small enough to fit in a bike lane, weighing no more than a few hundred pounds, and limited to slow speeds.

2 While this essay addresses human-scaled transport, an important subfield of human-scaled is for those with disabilities. People with disabilities have additional, and critical, needs for access to nodes that require additional research and consideration.

seas of parking lots, curb cuts long enough to accommodate multiple lanes of traffic and more. These conditions render such nodes as mostly impermeable for these other forms of travel.

The features that make these places impermeable for human-scaled travel are prescribed by the regulations that city officials enact (or have enacted some years ago). Mandated rules in zoning regulations, building codes, and site planning guidelines hold court here. For any substantial change in transport, whether mode choice, congestion or emissions, to have effect, these site characteristics are important. Yet, they have mostly been considered in a peripheral manner against the body of transport and land use scholarship. This essay demonstrates the need for new site design guidelines to steer such developments in ways that allow a human-scaled transport network to develop through design – or more importantly, redesign.

To support our argument that development nodes are important components to an evolving transport system, we present rationales for new site design guidelines that will help steer actions in ways that allow a human-scaled transport network to develop. Site planning elements interface in many ways with the larger transport system and are too often left off the table. Our aim is to help lay the foundation for a new generation of site design guidelines that will help old standards (e.g., Lynch and Hack, 1984) evolve. A new generation of site planning manuals, supported by new research into these issues, are needed and poised to address human-scaled movement that supports both permeability to sites and comforting travel within them (e.g., how should a half-acre parking lot be transformed to allow safe cycling access?).

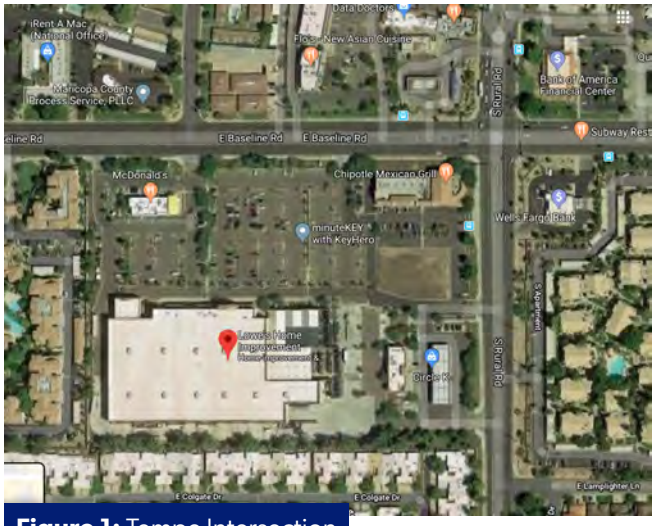

Figure 1: Tempe Intersection

Source: Google Maps, 2019

Planning Permeable Development

The magnitude of the issue can best be exposed by considering the widespread areas of cities that focus on auto-oriented transport networks. Consider the Phoenix region alone; streets comprise 26 percent of land and parking an additional 10 percent (Hoehne et al. 2019). More than one-third of the total land area is prescribed by a regulation that prioritizes the car. This results in many unintended consequences. The more cities are built for driving, the harder it is for people to get around by other means (King, Smart, and Manville 2019).

In terms of development regulations, travel corridors within development sites are prescribed for fast moving traffic. Buildings are spaced further apart than necessary, or desirable to allow easy walking between destinations. Entrances to buildings are too often oriented away from the street toward parking lots for those arriving by cars. Cumulatively, the standards ardently present a commitment to driving automobiles—a commitment which will continue to persist unless alternative site design guidelines or aggressive retrofit efforts are offered. For many corner sites, such as the Tempe intersection shown in Figure 1, there simply aren't any site entrances at the corners, which is where the crosswalks

are.[3] Larger new commercial and residential developments often seal themselves off from the street by using walls and landscaping. Much of this is required by development regulations, and sometimes by developer preference.

Fully mitigating externalities on-site

Communities stipulate that externalities be mitigated on each development site through a variety of development regulations. Accessory parking requirements—a defined number of spaces required based on the size and use of the buildings—are widely accepted as problematic for walking and cycling because of how they place car storage between sidewalks and doors, in addition to promoting free parking for motorists. Yet mode choice effects of parking are just one aspect of required parking. Knock-on effects of such requirements extend to landscaping required to partly mitigate heat and run-off from surface lots. Standards may also require bioswales to collect and clean stormwater before rain can reach the sewer system. Though parking requirements are well intentioned, such stipulations are deleterious because they unnecessarily increase impervious surfaces and the subsequent need for additional infrastructure improvements. These issues start at the site design level and bring increased complexity of having to address other downstream effects of such automobile centered policies. While negative externalities should be accounted for, in terms of site planning for sustainability and human scaled transport, there is need to consider how communal knock-on effects are shared and perhaps mitigated at the street or corridor level rather than individual sites. There is opportunity to remove accessory requirements for everything while acknowledging the trade-offs that must be made to balance traffic, environmental and economic concerns.

Removing accessory requirements may not be an obvious partial solution to access to sites, and storm water management may not appear directly tied to how people get around. The larger point is that site design needs to maximize permeability for people outside of cars in order to make the larger network of transport links work for those same people. When sites are expected to mitigate externalities individually rather than collectively, the result is there is ample land that could be buildings, and places people want to go devoted to minimizing harms caused most often by the very auto infrastructure we argue is problematic. Storm water is a concern, but this concern is amplified by acres of surface parking. Shade is important, but largely because buildings aren't allowed to be built close enough to parcel lot lines and each other to provide shade on their own. Site should maximize the spaces where people want to be, not minimize harm caused by auto-oriented regulations that incrementally expand private vehicle links at the expense of nodes. While site regulations are many, we below highlight two areas of site design that warrant greater attention as to how they affect access by walking, biking and transit.

Curb Cuts

The manner in which curbs are installed and cut defines circulation patterns. Again, most of them are exclusively designed with cars in mind. Any curb that is specified has implications that manifest themselves in both the horizontal and vertical dimensions. Their shape—sharp right angles—aid as bumper rails for cars but largely serve as impediments for other transport modes. They are instrumental in furthering the status quo by making travel by other modes less convenient. Notwithstanding recent advances to modify curb cuts to increase access for disabled travelers

3 Compounding the crosswalk location, people who are hit by drivers when they cross the streets outside of crosswalks are often blamed for crossing the street in the wrong place. The incentives to cross at the crosswalks is diminished if the crosswalks don't lead to where you want to go.

(e.g. Elin 2006; Ferleger 2012)—and some municipalities limiting new ones altogether (e.g., in Manhattan, New York (Delphin 2013)), most cities maintain regimented procedures for their existence.

From a linear (horizontal) perspective, curb cuts define areas of a sidewalk where driving is allowed; meaning the more space dedicated to curb cuts, the less space dedicated to people walking or cycling. They undermine the continuity of the environment, and should be minimized. Yet accessory parking requirements often lead to a new curb cut for each building or business on a street. This reduces safety by inhibiting the overall function of streets and sidewalks so that only by driving are site accessed. The linear problems of curb cuts are compounded by issues in the vertical dimension. In US street design guidelines, most curb cuts are specified to meet 1:12 slope requirements. This complies with disability requirements, but depending on overall sidewalk design, can result in the sidewalk having many undulations.

These types of regulations can be contrasted Dutch curbs. Not only do they prescribe design regulations for sites that prioritize continuous walk and cycle paths, they clearly denote other design principles to designate areas that driving is secondary (A view from the cycle path, 2008). In terms of character of the curbs, rather than an abrupt 90-degree angle, they tend to adopt sloping curbs which can easily tolerate bicycle wheels using a small lip and/or angulated treatment (Figure 2). Retrofitting sites to allow modest and gradual use of differences in height would go a long way in the U.S. Such treatments for easily mountable curbs are called for in a variety of design manuals which have evolved over the years and been fostered by partnerships between public space advocates, traffic departments and site design efforts (e.g., see pages 54-56 of Puccini methods, City of Amsterdam, 2018).

Figure 2: Example curbs

Source: Janssen, 2016

The turning radius of curb cuts is also of note. Typical new construction will have a turning radius of 30 degrees to ensure fast traffic flow into and out of parking lots. Not only is fast vehicular traffic at odds with human-scaled travel, the space requirements force sidewalks to be pushed back to a safer area where drivers are more likely to see people and pedestrians are less likely to interfere with a driver's right of way. Crossing these curb cuts is fraught for those walking or biking.

Building Setbacks

Building setbacks also contribute to prioritizing auto access over other modes. Most obviously, setting back a business increases the distance that must be traveled from the sidewalk to the front door. While adding a couple hundred meters of distance may not mean much when driving, people cover about 1.4 meters per second walking, so 100m means an additional 71 seconds of walking time. New freeways are built for that kind of time savings for drivers. Whatever is required on development sites to mitigate impacts, such as landscaping, storm water retention or other, usually takes space away from areas where buildings can be constructed and incrementally pushed development further apart.

Setting back buildings has additional impacts, however. Buildings set back can't provide shade to the sidewalk, which is a major concern in a heating world. Businesses oriented to parking lots rather than sidewalks mean that people, whether coming by foot, bike or transit, must walk through a parking lot, likely built with auto flow in mind rather than human-scaled transport. Building setbacks also cater to drivers by eliminating any

obstacles to their vision. Arterials with deep setbacks allow drivers to maintain a sight horizon far into the distance rather than focus on the road immediately ahead. This means that where buildings are located, or where trees are planted, affects the speed of travel. The faster cars go, the less likely people will use other modes.

Conclusion

Progressive municipal transport planning efforts largely prioritize efforts to redesign links in the network to better support human-scaled travel. These efforts include bike lanes or better sidewalk space. These are necessary for a system that prioritizes multiple modes. Largely omitted from this suite of actions, however, are efforts to detail site-level characteristics of development nodes (Capasso Da Silva, King and Lemar 2020). The existing design literature is rich with architectural scholars examining how elements of the built environment affect the desirability of an area (e.g., Gehl 2011). These elements might include number of doors that enter onto the street, a tolerable area of blank space on a wall or the size of an awning over a door. Similar ideals are sometimes addressed at a larger such level, such as service metrics for pedestrian areas, with characteristics such as continuity, cohesion and attractiveness as necessary for desirable pedestrian places (Sarkar 1993). More of this thinking should be woven into design regulations.

Given that transport networks are only as good as their weakest link—or in this case, node—this essay argues the importance of retrofitting such sites and points to the type of site planning regulations that could be revamped. Documenting detailed case studies where design solutions have been employed to retrofit such practices—either physical or regulatory—can go a long way here for others to learn from. Unless municipalities change the site design details of development opportunities, a future transport network won't differ from what currently exists.

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Evaluating Minimum Parking Requirements in Zoning Codes

Kees Den Hollander, Alex Baum & Koen Beekhuis

Cities are increasingly focusing on improving livability for citizens and visitors. What is it like to live, work, and play in a given city, and which factors impact these experiences? One way cities believe they can improve livability is by ensuring that there is ample parking. If citizens can get to where they want to go and find a parking space quickly, easily, and cheaply, then their lives will be better, so the thinking goes. In order to ensure this process always goes smoothly, cities require developers of new buildings to provide a minimum number of parking spaces that will serve residents, employees, or customers of the planned building. Minimum parking requirements have been a core element of American zoning codes for nearly a century.

Despite their good intentions, by providing sufficient parking for every user of every building, cities can actually reduce livability by creating an oversupply of parking. After all, a car can only occupy one space at a time. A 2018 study confirmed this oversupply: Des Moines, Iowa, for example, has more than 19 parking spaces per household and Seattle has more than five parking spaces per household[1]. Minimum parking requirements and the resulting oversupply result in a range of unintended negative consequences, including increased housing costs, increased automobile dependence, and a more hostile urban environment.

This paper argues that rather than requiring developers to supply a minimum number of parking spaces, cities should take a site-scaled and neighborhood-scaled approach to mobility as a whole. At site scale, developers could be required to submit for approval a multimodal transportation plan that addresses how all modes will be accommodated as well as the total costs (construction, maintenance, externalities) associated with accommodating each mode on a per-mode-user and per-site-user basis. At neighborhood scale, the municipality could re-evaluate the overall supply and demand of parking every 3-5 years with a focus on how supply can be more efficiently used and demand possibly reduced. As a result of these two parallel approaches, parking and the associated negative impacts on cities could be reduced and livability for citizens and visitors improved.

1 Scharnhorst, Eric. Quantified Parking: Comprehensive Parking Inventories for Five U.S. Cities. Research Institute for Housing America, 2018.

How did cities end up with an oversupply of parking?

When people say "there is never enough parking," what they often mean is "there is never enough parking precisely where I want it, precisely when I want it." When someone arrives at an office building at 9 a.m., or a grocery store at 6 p.m., they may struggle to find parking at these locations at these maximum demand times. On the other hand, they would likely not have a hard time finding parking at the office at 6 p.m. or at the grocery store at 9 a.m. Both the grocery store and the office have an oversupply of parking spaces at certain times of the day when demand is low, and an undersupply of parking spaces when demand is high.

In order to ensure a sufficient supply of parking for each site or building, a municipality specifies in its zoning code a certain minimum parking ratio that a developer must provide, for example, one parking space for every one thousand square feet of floor area or for every one residential unit. These ratios are frequently specified by use, such as office, residential, retail, etc.

The problem with this method is that it frequently does not take into account the context of an individual site or building. There are numerous factors that influence the demand for parking, including proximity to transit, how easy it is to walk or bike in an area, the car-ownership levels of prospective users, the density of the area, other land uses on the site, day of the week, time of day, time of year, etc.

Additionally, minimum parking ratios are often meant to satisfy peak parking demand. Many municipalities use the Institute of Transportation Engineer's (ITE) Parking Generation Manual as a guide for setting the minimum parking ratios. The ITE collects parking demand data on 121 different land uses and calculates an average demand for each use. Much of the data, though, come from studies of sites in areas with ample free parking, minimal access to transit, and at peak demand times. In addition, the average rate is often based on a limited number of studies that can have a wide range of results[2].

When a city bases minimum parking requirements on a series of studies meant to measure peak demand, an oversupply of parking will naturally occur. A 2013 study of parking at apartment buildings in Seattle found that actual occupancy was on average 0.4 parking spaces per dwelling unit less than the minimum parking requirement[3]. That means that for a 20-unit building with a required minimum of 40 spaces (2 spaces per unit), the parking area could be reduced by 8 spaces, or 20%, and still serve the actual demand. This can add up to major space and cost savings, as the following section will show.

What are the impacts of this oversupply of parking?

Creating an oversupply of parking negatively impacts the livability of a city in three main ways:

- Increased housing costs;
- An over-dependence on automobile use; and
- A hostile built environment.

Requiring developers to provide parking increases housing costs, affects new housing supply, and

2 Shoup, Donald C. "The Trouble with Minimum Parking Requirements." Transportation Research Part A: Policy and Practice, vol. 33, no. 7-8, 1999, pp. 549–574., doi:10.1016/s0965-8564(99)00007-5.

3 King County Metro. Right Size Parking, August 2015. (Last accessed 01/04/2020) Retrieved from: https://metro.kingcounty.gov/programs-projects/right-size-parking/pdf/rsp-final-report-8-2015.pdf

often makes living in cities less affordable. To accommodate the required parking on a site, a parking lot or structure must be built. Parking structures are relatively expensive, especially if they are built below-ground or require extra land acquisition – in some cases the parking alone can cost 20-50% of the cost of the building. Parking structures also reduce the buildable area, thus decreasing potential revenue from a property development. With higher costs and lower potential revenue, developers must charge more for a project to be profitable. As a result, luxury housing is often the first, and sometimes only, type of housing that makes economic sense to be built. This has a negative impact on overall diversity of housing supply and results in making a city less affordable.

To illustrate how parking can add 20-50% to the cost of a new building, let's take an example from Phoenix, Arizona. A developer wants to develop a new 31,000 square foot apartment building with 24 one-bedroom and 16 two-bedroom units. The Phoenix zoning code requires 2 spaces per unit in a multi-family building, so this building would require 80 parking spaces[4]. Using an average of 330 square feet per parking space, the building's parking area would be 26,400 square feet, nearly the same size as the building itself. Constructing parking in Phoenix costs an estimated $58 per square foot for aboveground parking and $90 per square foot for underground parking. To build the required number of parking spaces will thus cost $1.531 million for aboveground and $2.376 million for underground[5]. The apartment building itself will cost $4.65 million, using a residential building cost estimate of $150 per square foot[6]. As a result, the required parking spaces add 33% (aboveground) or 51% (underground) to the building's total construction cost. In terms of total construction costs per dwelling unit, parking adds $38,280 (aboveground) or $59,400 (underground) to the base unit construction cost of $116,250.

Phoenix is not unique. Averaging the added parking costs for the 8 U.S. cities examined in Donald Shoup's "The High Cost of Minimum Parking Requirements" with updated 2019 data shows that parking adds 26% or 37% to the cost of a new residential building for aboveground and underground parking, respectively[7]. It is no wonder that developers focus mainly on building luxury housing for which they can charge high rents or build in low-density suburban areas where they can build surface parking lots.

Parking requirements also result in an increase of, and over-dependence on, driving as a mode of transportation. A 2015 study of nine U.S. cities by McCahill et.al showed that an increase in the minimum parking requirement from 0.1 to 0.5 spaces per dwelling unit lead to a roughly 30 percent increase in car mode share[8]. A large supply of parking also causes a resulting decrease in the price of parking to the point where it is free or extremely cheap. When comparing driving with public transit, free parking contributes to making driving seem like the more affordable mode choice, thereby increasing driving and the associated negative externalities.

Effectively, parking requirements also favor driving over other modes such as public transit, walking, and bicycling. Because parking is such a large cost and often has a major impact on the layout of

4 1.5 reserved spaces per 1 or 2 bedroom unit plus 0.5 unreserved spaces per 1 or 2 bedroom unit = 2 spaces per 1 or 2 bedroom unit. Section 702C, https://www.codepublishing.com/AZ/Phoenix/html/PhoenixZ07/PhoenixZ0702.html

5 These figures are averages of the low and high construction cost estimates based on 1st Quarter 2019 rates provided by Rider Levett Bucknall, an international consulting firm that specializes in estimating real estate construction costs. h ttp://rlbintelligence.com/

6 See above note

7 Shoup, Donald. "The High Cost of Minimum Parking Requirements." Transport and Sustainability, Volume 5, Pages 87-113 (2014).

8 Mccahill, Christopher T., et al. "Effects of Parking Provision on Automobile Use in Cities: Inferring Causality."

a site, it often comes first in the planning of a site. As a result, considerations that would improve the experience for pedestrians, cyclists, and public transit users, such as comfortable waiting areas, easily accessible

and secure storage, and an active and street-oriented façade, are frequently viewed as luxuries or afterthoughts. Finally, parking causes a natural sprawling effect in that buildings are farther apart, making walking and bicycling trips longer and less desirable, and also pushes development to the edges of cities in the search for cheaper land to compensate for high parking costs.

Parking also creates a hostile built environment that makes an urban area feel less inviting. Surface parking lots do not contribute to the vibrancy of a street and often feel like dead space. People have no reason to linger in or around a parking lot and this resulting lack of activity cause these spaces to feel unsafe for passersby. Also, because parking lots and structures are so expensive and do not contribute to the profitability of a site, little to no consideration is given to the aesthetics of the parking area,

resulting in an eyesore. Catherine G. Miller, author of C arscape: A Parking Handbook, writes that parking is "devoid of any visual appeal or ameliorating landscaping, thereby creating a dead space."[9] Jakle and Schule, authors of L ots of Parking, write that "the public sees parking lots as ugly. The surface parking lot has become a fact of life and an accepted eyesore."[10]

What is a smarter way to balance the supply and demand of parking and how can other modes be encouraged?

Given the negative impacts of the oversupply of parking, municipalities need a set of policies that better balance different modes and allow actual market demand to set the amount of parking. In addition, parking needs to be addressed at a broader scale in order to take advantage of supply efficiencies and demand strategies.

Site-Scale

At the site scale, developers should be required to submit to the local zoning or planning board a multimodal transportation plan that addresses how all modes will be accommodated as well as the total costs (construction, maintenance, externalities) associated with accommodating each mode on a per-mode-user and per-site-user basis. The goal for having developers complete a multimodal transportation plan with associated cost estimates is for the developer and the municipality to better understand the needs of different modes as well as the relative costs of supporting each mode, and thus to reduce the prioritization of driving by better balancing the needs of other modes.

The problem with using minimum parking requirements is that it only addresses one aspect of mobility: the storage of cars. Instead, developers should consider the needs of users of all forms of mobility. For example, cyclists should have a safe, secure, and easy-to-use place to store their bicycles. For pedestrians, well-lit paths with

clear wayfinding and attractive landscaping will guide people to and from the building with access to multiple sides of the building, thus reducing the distance to nearby destinations. For users of public transit, service updates could be displayed in order to help people plan their trip and save time.

The Parking and Transportation Demand Management Ordinance (PTDM), adopted in Cambridge, Massachusetts in 1998, is an excellent example of this type of thinking[11]. The PTDM requires non- residential building owners who want to increase the number of parking spaces above a certain number to take a series of measures to reduce single occupancy vehicle (SOV) use and encourage the use of other modes. In particular, projects with more than 20 spaces are required to make a commitment to reduce SOV use to a set percent, implement a set of strategies to achieve that goal, and conduct annual user surveys, car and bike parking counts, and monitor the status of the TDM strategies undertaken.

Examples of the TDM strategies include site improvements such as a bus shelter, bicycle repair station, showers, lockers, and real-time transit information that encourage other modes; financial strategies such as transit subsidies, walking or biking incentives, bike-share memberships, and pre-tax transit benefits that also encourage other modes; and alternative ways of charging for parking, such as charging drivers the market rate directly, rather than burying the cost, and encouraging occasional drivers to pay a daily parking rate rather than getting locked into a monthly rate. Rather than instituting these measures after buildings are built, and only with non-residential buildings, this list should be used as the standard to which developers of all new buildings should develop their multimodal transportation plans in order to accommodate and encourage all modes and not just single-occupancy vehicle use.

In addition to describing and designing how each mode's needs will be met, developers should also be required to estimate the actual, long-term costs of their plans. Cost estimates should be determined for each feature, including construction, maintenance over the lifetime of the building, and externalities related to the feature. Using an above-ground parking structure as an example, the developer should estimate the construction costs of the parking structure, associated accessways, and signage; how much it will cost to maintain the structure; and the additional costs to non-users associated with automobile use, such as harmful emissions.

This total number, as well as the costs of any additional features added for the use of drivers, would be divided by the estimated percentage of users that drive as well as by the total estimated users of the building. These two numbers are helpful to understand what the cost to each user and each non-user will be. For example, how much should someone using the parking structure be charged based on the cost, and how much will someone who does not drive have to pay to support these features they do not use? Even with substantial support of other modes, it will become clear through these calculations to what extent parking, and thus driving, is prioritized over other modes.

With this new approach to mobility at the site scale, municipalities will hopefully take a more equitable approach in balancing the needs of users of different modes and thus further encourage sustainable travel. Although this level of planning and financial estimation may seem burdensome to developers and discouraging of development, it could be argued that the

11 Cambridge Community Development Department. Parking and Transportation Demand Ordinance. (Last accessed 01/04/2020) Retrieved from: https://www.cambridgema.gov/CDD/Transportation/fordevelopers/ptdm

quick and easy estimation of minimum parking requirements is what caused many of the problems such as higher building costs and over-dependence on driving in the first place. Requiring developers to invest in more sustainable travel modes and show that prioritizing parking is incredibly costly will have long-lasting impacts and hopefully aid in the shift away from driving as the only option.

Neighborhood- / Municipality-Scale

In addition to improving how parking and mobility are addressed at the site-scale, it is also key for the municipality to look at the challenge of parking at a larger scale. As discussed in the previous section, minimum parking requirements focus on a site's parking needs as if the site existed in a vacuum, without considerations for the aggregate supply of parking in the area or the temporal considerations associated with how the site is used. Instead, every 3-5 years, or more often in faster growing areas, a city should review the supply and demand of parking to determine where the issues exist both spatially and temporally. In this way, the municipality can have a better sense of where and how changes to supply should be made as well as how changes to demand should be addressed. This can be especially helpful for peak demand uses such as major events. In addition to encouraging people to use other modes, parking for the event could be accommodated in under-used areas in order to avoid building peak-level parking facilities directly adjacent to the event space that would be used only for events. In addition, the more that nearby businesses and residences can share parking, the less overall supply is needed.

Transportation Management Associations (TMAs) can play a major role in shaping the supply and demand of parking. On the supply side, TMAs can act as parking brokers. By making it easier for businesses to rent or lease spaces from each other in times of low and high need, and thus flattening out the demand peaks, less overall supply would be needed[12]. In this role, the TMA both monitors the overall parking supply and creates a parking marketplace. TMAs can also support the reduction of demand by providing shuttles from transit hubs or offering commuter financial incentives such as parking cash-out, thus giving people greater freedom to choose alternative modes. Because TMAs work with multiple businesses, they can also be more cost-effective than a program operated by one company. Additionally, they allow smaller companies, which otherwise might not be able to afford to participate, to benefit from the collective association. While TMAs can provide many important functions, because they are funded by local businesses or government grants, they are generally limited to a particular commercial district. As a result, it is important that the municipality work with the local TMAs on a broader strategy that also incorporates changes to minimum parking requirements and implements multimodal mobility strategies.

Creating an effective and goal-oriented parking pricing strategy is another benefit of addressing parking at the neighborhood- or municipality-scale. With a better understanding of when and how demand shifts over time, cities can adjust the cost of parking more efficiently in order to shape demand and ensure a constant supply. So-called performance-based pricing, or performance-priced parking, when combined with simple payment mechanisms and timely updates of pricing and availability, helps drivers plan better and encourages the use of other modes[13]. In areas of high demand, or areas that experience spillover from high-demand areas, municipalities can also use parking benefit districts (PBD) to

12 Litman, Todd. Parking Management, Comprehensive Implementation Guide, 18 March 2019. Victoria Transport Policy Institute, 2019.

13 Donald Shoup. The Politics and Economics of Parking On Campus. University of California Los Angeles, 2008. http://shoup.bol.ucla.edu/PoliticsAndEconomicsOfCampusParking.pdf

reinvest parking revenues into community and street improvements. Austin, Texas, for example, has four parking benefit districts that each dedicate 51% of net parking revenues "to help with local improvements that promote walking, cycling and transit use, such as sidewalks, curb ramps, lights and bicycle lanes, park maintenance, signage, and wayfinding."[14]

Conclusion

In an attempt to improve livability for citizens and visitors, cities want to ensure that new developments provide sufficient parking spaces. They accomplish this through minimum parking requirements in municipal zoning codes that define how many parking spaces should be built based on a building's use and size. This method has led to an oversupply of parking which has three important consequences for livability in cities: increasing housing costs, an over-dependence on private automobiles, and a hostile urban environment. Instead, cities could adopt a parallel site-scale and neighborhood- / municipality-scale strategy to adjust parking supply and demand.

At the site scale, developers could provide a comprehensive mobility plan that accommodates all modes and details the overall costs per mode on a per-mode-user and per-site-user basis. This could help developers and municipalities better understand how different modes can be prioritized and clarify the associated costs of accommodating each mode.

At the neighborhood scale, municipalities could re-evaluate the supply and demand of parking every 3-5 years in order to determine opportunities for more efficient use of existing supply, identify strategies to distribute demand more evenly, and eventually reduce demand. This allows municipalities to think on a broader scale and in a creative way when evaluating the mobility needs of a new development.

In pursuing these strategies, cities have the opportunity to truly improve livability for residents and visitors. The quality of life in a city can be measured by how happy, healthy, and successful people are, and not how easy it is to park.

14 City of Austin, Texas, City Code Title 12, Chapter 12-6, Ordinance Number 20111006-053. http://www.austintexas.gov/department/parking-districts

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Park(let) Here:

Organizational and Demographic Preconditions for the Development of Parklets in Philadelphia

Ariel Ben-Amos , Cara Ferrentino, Andrew Simpson, and Daniel Wolf

Abstract

Parklets are small platforms that transform on-street parking spaces into small parks. Research into parklets to date has largely focused on parklet design, impacts on parking supply, and the behaviors of parklet users as well as pedestrians. What is missing is a stronger understanding of where parklets will be successful and what are some of the preconditions for that success.

To better understand the factors behind a parklet's success—where success is defined as installation for more than one year (or warm-weather season)—the authors surveyed the operators and nonprofits that have installed, operated, and maintained more than 12 parklets in Philadelphia. They also surveyed a control population of Philadelphia businesses and nonprofits. To consider the impacts of the built environment and demographics on parklet success more broadly, the authors analyzed the characteristics of all Census block groups containing parklets across America from 2010 to 2015.

To go beyond a comparison of parklet-hosting neighborhoods to cities as a whole and assess the fundraising and staffing capacity of parklet hosts, the authors supplemented Census data with surveys and tax documents. These data provide insight into the capacity of operators to manage public space, negotiate conflict, and interface with the government. What ultimately emerges is a better picture of the factors associated with a parklet's success, and with alternative uses of parking spaces more generally.

Parklets are more likely to appear in neighborhoods with less parking demand and higher density. Likewise, they are more likely to be developed in front of stores that serve food and beverage, and in neighborhoods with lots of renters. Parklets built in conjunction with nonprofits will be more successful if said nonprofits have both a history of, and capacity for, placemaking activities. These findings suggest that identifying the "market" for placemaking interventions requires understanding not only of land-use tenure and commuting patterns, but also of the capacity of local organizations to support innovative uses of the right-of-way (ROW). For Philadelphia, this research highlights the importance of an organized nonprofit sector in championing such innovation.

Introduction

Parklets are small platforms that transform on-street parking spaces into small parks. They are a popular intervention associated with "tactical urbanism," or the use of low-cost, temporary modifications to enliven public spaces. Since 2010, cities across the United States have established formal procedures for businesses or nonprofits to establish parklets to improve conditions for pedestrians and promote commercial corridor activity. Research into parklets to date has largely focused on parklet design, impacts on parking supply, and the behaviors of parklet users as well as pedestrians. Such research focuses on parklets as a manifestation of transportation and urban design principles. However, at their core parklets reflect a community's willingness to give up one asset (parking) for another (public space), and are better understood as a reflection of a community's willingness to embrace or advocate for change.

While there are some important land use and demographic differences between those communities that host parklets and those that do not, the longevity of any given parklet is often a reflection of different communities' ability to steward these interventions. The history of parklets in Philadelphia broadly reflects this understanding

In 2012, what was then called the Mayor's Office of Transportation and Utilities (MOTU) used $30,000 to seed a parklet program in Philadelphia, as part of a larger series of investments in what the city calls "pedestrian enhancements." Partnering with the city's Department of Commerce (Commerce), MOTU released a Request for Proposals for partners to develop parklets in locations across the city. Commerce's reluctance to play favorites with private businesses meant that only nonprofits were eligible to apply for funding (though they could partner with businesses themselves). Six NGOs representing neighborhoods of varying socioeconomic composition across the city won grants to develop parklets along their commercial corridors. Between 2012 and 2015 parklets debuted in 15 locations, four of which did not sustain parklets for more than a year.

One geographic area, West Philadelphia, has been host to a majority of the city's parklets thanks to the work of the University City District (UCD), which deploys six parklets on an annual basis in conjunction with neighborhood businesses. Today the Office of Transportation and Infrastructure Systems (OTIS), the successor to MOTU, manages the Parklet Program. In 2014, Bill #130950-A authorized the city to create the Pedestrian Enhancement Permit and created regulations and a program application to govern the management of parklets across what is now six different neighborhoods. These regulations systematize the ability to develop parklets. Establishing a parklet in Philadelphia requires letters of support from the owner of the property in front of which the parklet will be situated, the two immediately adjacent property owners, and the district councilperson, as well as a petition indicating the support of 51% of neighbors. Parklets must also pass a design review process before approval and parklet operators must provide insurance for the parklet and sign an operating and maintenance agreement with the city. It is important to note that while the current parklet program in Philadelphia does not require a nonprofit partner to be established, the majority of Philadelphia's parklets are operated by businesses in partnership with NGOs. The authors found that these nonprofits' familiarity with government programming played a significant role in the development of parklets in Philadelphia.

Methodology

The authors developed a series of tools (datasets, surveys, case studies) to understand the capacity of communities to embrace the reallocation of a parking space. To assess the full scope of parklet adoption across the United States, the authors relied on internet (Google) news services and previously published resources. The authors then used American Community Survey (ACS) data to evaluate how parklets' neighborhoods compare to their respective cities, and to each other.

To evaluate organizational capacity, the authors compared publicly available tax data filed by nonprofit community development corporations (CDCs) where available. They also developed case studies to illustrate the local political concerns that impact the longevity of parklets. They complemented this work with a survey sent both to the nonprofits (such as CDCs, Business Improvement Districts, and Neighborhood Improvement Districts)that supported the development of parklets within their service boundary, and to the for-profit businesses that operate or previously operated parklets. This survey was also distributed to a control group of nonprofit partners (Partners) and parklet operators (Operators) whose service boundaries and commercial corridors were similar to those of the parklet operators and partners.

More detailed descriptions of the various datasets, surveys, and tools used by the authors can be found in the following sections.

National Parklet Dataset

To develop a sense of the full scope of parklet proliferation across the U.S., the authors assembled a dataset culled from a variety of sources that identified all the operationally active

parklets within the United States between 2010-2015. These sources include official government websites, Google News searches, and previously published programmatic research such as the City of San Francisco parklet management program, Pavement to Parks. The authors geo-located the identified parklets and associated them with appropriate Census block group level of data of the American Community Survey five-year estimates from 2009-2014 to build a portrait of socioeconomic composition and travel behavior in these neighborhoods.

The authors noted whether the parklet in front of an establishment that served food, and whether the parklet developed with the support of a nonprofit. When such data were not readily available using internet resources, the authors contacted the relevant and responsible agencies. This dataset allowed the authors to assess what neighborhoods and businesses are most likely to support both the removal of parking, and its replacement with a significant investment in the right-of-way.

Local Non-Governmental Organization (NGO) Technical Capacity Dataset

Based on a combination of tax-filing and budgetary data, the authors built datasets that enabled a multifaceted understanding of the technical capacity of parklet partners, their controls, and the larger set of CDCs, BIDs, and NIDs across the city. Control CDCs included in the NGO dataset were both current members of the Philadelphia Association of Community Development Corporations and had geographic boundaries that overlapped with control corridors. The dataset included 23 NGOs, CDCs, and special services districts.

Using the NGO budgets, websites, and tax filings such as IRS Form 990 for these 23 entities, the authors compared the financial capacity, number of staff, and mission orientation of various nonprofits. The authors sought to identify differences between NGO's that do engage in placemaking and those that do not, and those that support parklets (financially, politically, or organizationally) and those that do not.

Survey

The authors developed and administered (with the support of the Temple University Institute of Survey Research) a survey of the NGOs that have sponsored or supported the development of parklets, the businesses that operate parklets, and control NGOs and businesses that serve control corridors (see Table 1 below).

Table 1: Philadelphia Survey Response

COHORT	Universe	Successfully Contacted	Completed Surveys
Operator	15	3	2
Sponsor	7	4	3
Control Operator	560	93	89
Control Sponsor	23	22	6
Former Sponsor	2	2	1

To establish this set of control commercial corridors the authors relied upon a 2009 study conducted by Econsult, titled *Commercial Corridors: A Strategic Investment Framework For Philadelphia*. Econsult used a similar (though more robust) blend of surveys, tax records, and demographics to develop a list of attributes by which one could measure the relationship of a commercial corridor to its immediate neighborhood and the larger region. Philadelphia's parklets all appeared on commercial corridors classified by Econsult as being accessed primarily by pedestrians or transit users, or on more mixed commercial corridors. None were located on industrial, or auto-oriented, commercial corridors. Philadelphia Parklets served commercial corridors that were deemed neighborhood centers, neighborhood subcenters, community centers, or specialty centers. No parklets were on corridors that had a citywide or regional draw.

The authors used the classifications in the Econsult study to identify control businesses and nonprofits. Control entities were either along, or overlapped with, commercial corridors which exhibited regional draw and access attributes similar to corridors with parklets. As will be noted later, the preponderance of parklet operators sell food and/or drink. Thus, the operator survey was from a universe of 560 restaurants (or other purveyors of food and drink) that applied for or renewed food licenses in 2015. Surveyors were only able to contact and survey 93 of these restaurants (Control Operator). Partner controls were members of the Philadelphia Association for Community Development Corporations (the trade association for Philadelphia CDCs) whose corridors overlapped with the control corridors (Control Sponsor).

Results and Analysis

Parklets, Nationwide

Nationally between 2010 and 2015, 31 parklets debuted each year on average, for a total of 189 parklets. These parklets, which were operational for at least one season, appeared in 43 cities across the United States. These cities ranged in population from 7,760 (Montpelier, Vermont) to 8,354,889 (New York, New York). Nationally, 75% of parklets were developed by private businesses and 80% of parklets were placed in front of establishments that served food, beverage, or both. Parklets can be supported in cities of almost any size, but are most likely to be operated by businesses in the food service industry.

Across the U.S., parklets were located in neighborhoods (as defined for the purposes of this study by their Census block group) that were roughly as racially diverse as their host cities and were (with the exception of San Francisco) roughly as wealthy. The residents of parklet host neighborhoods were, on average, roughly the same median age as the rest of the residents of their host cities (35 and 36 years old respectively). Nationally, parklets were located in neighborhoods with median household incomes that were 12% higher than the median household incomes of their host cities, however this is largely due to the large number of parklets in San Francisco. If one were to remove San Francisco's parklets from national averages, parklet host neighborhoods have a slightly lower median household income than their host cities. There were more marked demographic differences between parklet host neighborhoods and their host cities when it came to the education of residents in their respective neighborhoods:

Residents of parklet host neighborhoods were 30% more likely to have bachelor's degrees than their host cities. Furthermore, residents of parklet host neighborhoods were significantly more likely to be part of a non-family household than their host cities and were far more likely to rent than own. Parklets are therefore likely to be adjacent to universities, which have higher concentrations of renters and people with bachelor's degrees than surrounding areas, however these neighborhoods are also antecedent to gentrification as detailed in Florida and Gaetani's "The University's Janus Face: The Innovation-Inequality Nexus", in June 2018's *Managerial and Decision Economics*.

The most consistent and striking demographic differences between parklet host neighborhoods and their host cities are found in residential density and commuting behavior. Parklet host neighborhoods have six times more residents per acre than their cities as a whole (over 35,000 residents per square mile, compared to over 5,500 per square mile). This density is associated with the high percentage of parklet host neighborhood residents who use alternative modes of transportation to get to work. Residents of parklet neighborhoods are far less likely to drive to work than the rest of their fellow city residents and are more than twice as likely to take transit, twice as likely to bike to work, and three times as likely to walk to work (see Table 2 below).

Insofar as demographic preconditions for parklet success are concerned, density is destiny, supporting alternative modes of transportation and a community willing to lose a few parking spaces.

This overview of national parklet demographic data suggests that operators are most likely to find less opposition to the replacement of parking spaces with parklets in dense neighborhoods, with large populations of renters, and a residential population that utilizes alternative modes of transportation to get to work.

"Failed" Parklets

Not all parklets reappear year after year: Parklet "failure" can occur for a number of reasons, such as site-specific construction concerns or the loss of neighborhood support. Only 18 parklets, or about 10% of parklets nationally, failed to reappear in the same location the following year. Neighborhoods that were not able to sustain support tended to have a higher portion of non-family households and a higher share of residents who drive to work than parklet supportive communities. Neighborhoods with failed parklets were also less dense and had lower household incomes compared those neighborhoods whose parklets are still operational. This confirms the importance of density and alternative transportation options as parklet supportive factors. It also suggests that parklets are also more likely to succeed in neighborhoods within a certain income range (i.e., while parklet neighborhoods are likely to have the same median household income as their host cities, the resources and institutional support may not be present in significantly poorer neighborhoods).

Table 2: Modal Split; a comparison between host city and parklet host neighborhoods

MODE	Drive Alone	Transit	Bike	Walk
City	66%	10%	2%	6%
Parklet	38%	28%	4%	17%

Demographic Preconditions for Parklets in Philadelphia

Similar to cities across the U.S., Philadelphia's 15 parklets have been found in neighborhoods that are less car-dependent and more transit-accessible than the city as a whole. Philadelphia's parklet neighborhoods also have similar ratios of renters to owners as parklet neighborhoods in other cities. However, there are some significant differences between parklet host neighborhoods in Philadelphia and those across the U.S.

In Philadelphia, parklets were located in neighborhoods that were not as diverse as the city as a whole. Philadelphia's parklet host neighborhoods had half the proportion of African American residents as the city overall. Philadelphians living in neighborhoods with parklets tended to be younger and have marginally less money per household.

Philadelphia parklets are found in neighborhoods with lower unemployment rates , and while more residents in neighborhoods hosting parklets had bachelor degrees than in the rest of Philadelphia, they also had fewer master's degrees than the rest of the city. Philadelphia's "failed" parklets were more likely to be found in neighborhoods with a higher non-white population and less density than those neighborhoods with longer-tenured parklets.

Some of the differences between parklet neighborhoods in Philadelphia compared to those in other U.S. cities may be attributable to the fact that nearly half of Philadelphia's current parklet portfolio is located in University City, home to a host of universities and thus a neighborhood with lots of students. And while the high proportion of students may explain why parklet neighborhoods in Philadelphia have lower median age and income, other differences are not as easily explainable.

The most significant difference between parklets in Philadelphia and those across the U.S. relates to the presence of nonprofit partners and sponsors. As previously noted, unlike most American parklets, a majority of Philadelphia's parklets are operated in conjunction with nonprofits. This prevalence of nonprofit participation in parklet development in Philadelphia suggests that Philadelphia is particularly well suited to also explore the relationship between third party, nonprofit entities, and their technical and political capacity to impact the right-of-way.

Organizational Preconditions for Parklet Success in Philadelphia

The authors found significant differences between the tax and budgetary information of those NGOs that hosted parklets, and those that did not. NGOs in Philadelphia that helped sponsor parklets have nearly twice as many employees as those that did not. Parklet sponsors tended to bring in nearly five times as much in revenue as Control NGOs, whether this revenue was in the form of grants, donations, or program revenue. Parklet sponsors reported spending close to 15 times more on placemaking activities than control NGOs and nearly six times as much on economic development activities. Parklet sponsors also spent on average nearly twice as much per employee as their control counterparts.

Furthermore, on average both parklet operators and sponsors reported devoting two to three staff positions to developing the parklet and working with the community, and using at least three staff members to support building and maintaining the parklet. Parklet sponsors also reported having more than six times as much staff devoted to public-space management as their control group counterparts reported[1]. Parklet sponsors had a

1 This number is skewed by the number of staff UCD has devoted towards public space maintenance and management (15). However, excluding UCD in calculations, parklet sponsors had 3.75 times more such staff than control NGOs.


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Worldwide Services

proven track record in investing in their internal capacity and public-space programming.

There are additional differences related to experience with city government between sponsors and operators, and control groups. For instance, while virtually all control sponsors had accessed a variety of the economic development resources provided by the city, virtually none of the operators, control or otherwise, had done so. Similarly, both sponsors and control sponsors were far more likely to report positive relations with their district councilperson, while operators and over 50% of control operators noted no engagement with their district councilperson. This suggests that in Philadelphia, capacity is not measured simply by funding, programming, and staffing, but also access to and awareness of city resources.

Conclusion

Philadelphia's parklet program, established in 2012, was one of the nation's earliest. The program structure was originally designed to minimize the city's exposure to risk: The city initially required parklet hosts to be established nonprofits, and still requires hosts to gain evidence of ample community support to avoid substantial political opposition. The program's maintenance and operating agreements, insurance requirements, and design review process, while critical components of the city's risk reduction, also increases the burden on potential parklet hosts.

Program structure has impacted the distribution of parklets across Philadelphia. Parklet program hosts are primarily nonprofits with resources, capacity, and a history of public space management. That Philadelphia has a higher ratio of parklets associated with nonprofit sponsors than the rest of the country, and that Philadelphia sponsors are more likely to have interfaced with the government and politicians than control operators, suggests that in Philadelphia there has been a higher threshold for third parties to participate in the parklet program. Put another way, in Philadelphia, parklets are more likely to be successful where both the built and civic environments are dense and robust.

Philadelphia's story has national implications. Philadelphia's parklets are found in neighborhoods whose nearby residents are willing to lose parking spaces; data show that these neighborhoods are denser and more multi-modal than the city as a whole. However, multimodality and density are not enough. The relationship between municipalities, businesses, and nonprofits significantly impacts the growth and distribution of parklets. Nonprofit and business-owner awareness of the parklet program, estimation of its public benefits, and willingness to meet program requirements, are all critical to a parklet's success. Cities that are interested in encouraging community-driven public space improvements by permitting small changes in the use of the public right-of-way should consider how education and communication, even apart from direct investment, can make their programs more accessible.

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Transit Priority Streets:

A Nuanced Approach to Balancing the Needs of All Users

Dorottya Miketa & John Reinhardt

Addressing congestion has been at the forefront of recent discussions in North American cities given a number of urban trends: economically thriving downtown districts, the success of Transportation Network Companies like Uber and Lyft, and the demand for deliveries spurred by online commerce. While traditional analysis focuses on the movement of vehicles through city streets to determine a Level of Service (a practice that treats single-occupancy vehicles as equal to a bus carrying dozens of people), the conversation has shifted to a focus on moving people. Transit priority streets have been a key part of that discourse.

Some city governments are looking to transit priority streets as a way to improve transit service and grow ridership on their most congested corridors. Recent pilot projects in Toronto and New York City have shown success toward this goal, and a closer look reveals quality of life improvements that extend beyond transportation. Additional cities, including San Francisco, have been exploring the transit priority model as it relates to both transportation as well as safety, economic growth, public health, improved civic space, and other quality of life improvements.

What are Transit Priority Streets?

Historic efforts to prioritize transit include bus-only "transit malls," bus lanes, Bus Rapid Transit, and other bus-priority treatments such as signal prioritization. More recently, the idea of "Transit Priority Streets" has come to represent an effort to balance the needs of all users of busy, mixed-use urban corridors, prioritizing high-occupancy transit while maintaining other essential street functions and uses through an integrated plan of policies, infrastructure improvements, and operational changes. In some cases, private vehicles are completely banned from a priority street. In other instances, only certain uses, such as drop-offs or pickups for private vehicles are permitted, or only at certain times of day. The reprioritization of space often provides opportunity for public space improvements and accommodations for active modes of transportation.

The Reasons for Transit Priority Streets

Transit ridership has declined in major cities across the country in recent years. According to a 2019 study by TransitCenter, transit ridership has declined in 28 out of the 35 regions with the highest transit usage[1]. Unreliable service, delays, and slow buses are likely reasons for transit riders to take transit less frequently or completely abandon it for other modes. This loss in ridership can become a vicious cycle: fewer riders results in less revenue for transit agencies; this may force agencies to cut service or make fewer improvements, further decreasing ridership.

Moreover, while congestion can be a natural result of successful, economically vibrant cities, it also has adverse impacts on commuters and surrounding communities. Studies have shown that long commute times can have negative health impacts including an increase in stress, depression, anxiety, and obesity[2]. Vehicles idling in traffic contribute to air pollution, which has been linked to asthma and other respiratory issues. Donald Appleyard's seminal 1981 book, Livable Streets, contained research showing that residents of more congested streets tend to go outside less and make fewer social connections on their block than those on streets with less traffic.

Pedestrian deaths have also been on the rise in recent years, with a 35 percent increase in pedestrian deaths nationally between 2008 and 2017[3]. The growth of Vision Zero programs in cities across North America has highlighted the particular safety concerns on highly traveled transit corridors.

All of these factors—an increase in congestion on city streets; the continued loss of transit riders; health impacts; and pedestrian safety concerns—have created a movement towards prioritizing the movement of people, rather than vehicles, on city streets.

Three Cities Trying New Things

Toronto's King Street

Toronto applied one of the most nuanced approaches to balancing transit priority with local vehicle access on a major downtown thoroughfare in recent years. Traffic congestion on King Street, an important east-west corridor, was causing a reduction in transit speeds on North America's highest-ridership streetcar line, leading to further ridership decline and congestion from increased car usage[4]. At some times of day, one could walk faster than the streetcars, or would need to let several pass before being able to board due to crowding brought on by traffic congestion (a phenomenon known as "bunching").

In November 2017, the City launched a pilot program to remake the street as a "Transit Priority Corridor." The pilot set out to study the priority corridor's impacts in three areas: mobility, economic prosperity, and placemaking[5]. As the case with many pilot programs, the city worked to

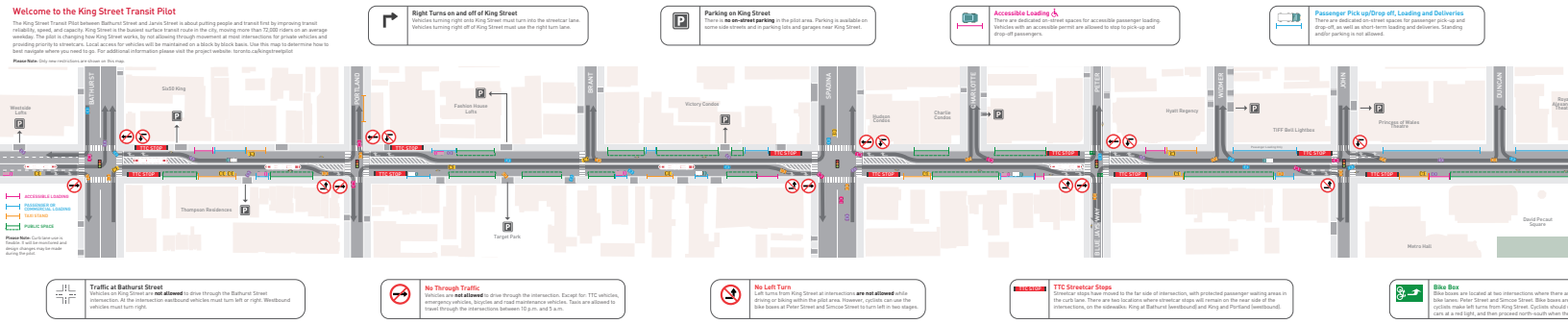
1 Who's On Board 2019: How to Win Back America's Transit Riders, TransitCenter, 2019, https://transitcenter.org/wp-content/uploads/2019/02/TC_WhosOnBoard_Final_digital-1-1.pdf.

2 Annette Schaefer, "Commuting Takes Its Toll," Scientific American, 2005, https://www.scientificamerican.com/article/commuting-takes-its-toll/.

3 Governors Highway Safety Association, "Pedestrian Traffic Fatalities by State: 2018 Preliminary Data", 2019, https://www.ghsa.org/resources/Pedestrians19.

4 David Meyer, "Four Lessons for 14th Street From Toronto's Transit-First King Street," Streetsblog, 2019, https://nyc.streetsblog.org/2019/04/29/four-lessons-for-14th-street-from-torontos-transit-first-king-street/.

5 Placemaking seeks to turn public space into a valued community asset through intentional interventions. See the Project for Public Space website to learn more. https://www.pps.org/article/what-is-placemaking



Toronto's King Street

implement the changes quickly and at a relatively low cost[6].

The pilot changed the way private vehicle drivers interacted with the corridor, effectively changing it from a regional through-street to a street for local access only. Regulations prohibited the through movement and left turns of private vehicles on King Street at most intersections to prioritize the streetcar. On-street parking was removed, replaced with limited loading and pick-up/drop-off zones, with other on-street parking capacity absorbed by side streets and nearby garages. Given these modifications, space that was once used to accommodate automobiles was reallocated for public and commercial uses.

As part of temporary infrastructure improvements, the city installed raised transit stop platforms at several locations to speed passenger ingress and egress and improve accessibility. The platforms include a dedicated waiting space for passengers as well as an integrated bike path and ramp for cyclists. It was the first time this type of platform had been implemented in a Canadian city[7].

Two years into the pilot, the streetcar saw an all-day ridership increase of 17 percent, with even bigger spikes during commute times—33 percent during the eastbound AM commute, and 44 percent during the PM commute. Cycling volumes on King Street increased by 150 percent. Importantly, the pilot showed that the vehicle regulations disallowing through traffic on the corridor did not disrupt the larger roadway network[8]. Impacts to business activity were less clear and harder to measure, given larger economic trends; while growth in customer spending marginally decreased over the course of the pilot[9], business license turnover was lower than surrounding areas at the conclusion of the pilot.

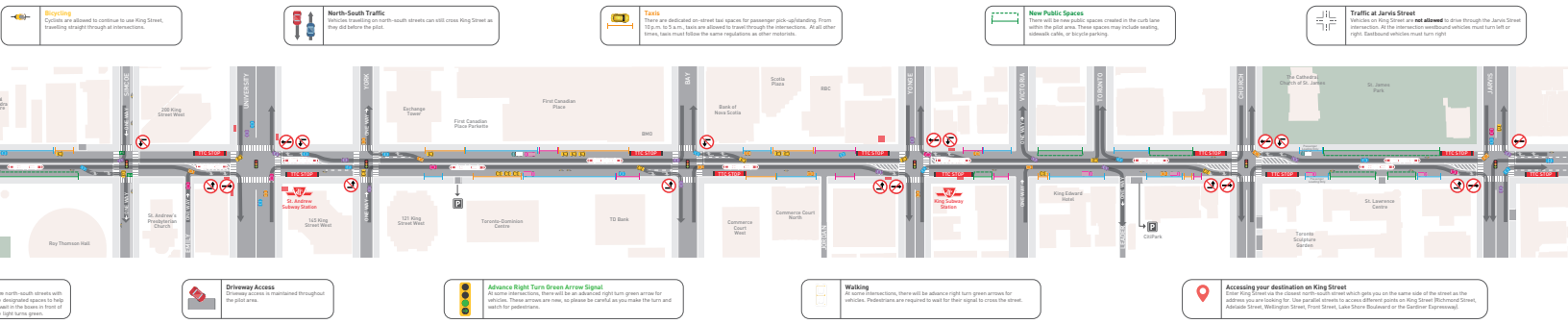
The pilot proved so successful that on April 16, 2019, Toronto's City Council made King Street a permanent Transit Priority Corridor.

6 City of Toronto, "King Street Transit Priority Corridor Overview," https://www.toronto.ca/city-government/planning-development/planning-studies-initiatives/king-street-pilot/king-street-transit-pilot-overview/.

7 City of Toronto, "Public Realm Transformation," https://www.toronto.ca/city-government/planning-development/planning-studies-initiatives/king-street-pilot/public-realm/.

8 City of Toronto, "King Street Transit Pilot – November & December Update," https://www.toronto.ca/wp-content/uploads/2019/04/8fa6-TS_King-Street-Dashboard_Nov_Dec-Update.pdf.

9 City of Toronto, "The Future of King Street: Results of the Transit Pilot" https://www.toronto.ca/legdocs/mmis/2019/ex/bgrd/backgroundfile-131188.pdf



New York City's 14th Street

14th Street is a critical east-west corridor in the heart of Manhattan that runs parallel to one of the only east-west traversing subway lines in the borough, the L train. As New York City was preparing to divert thousands of L train riders to other crosstown modes due to a major tunnel rehabilitation project, city leaders looked to the success of the King Street pilot when considering how to move people along 14th Street.

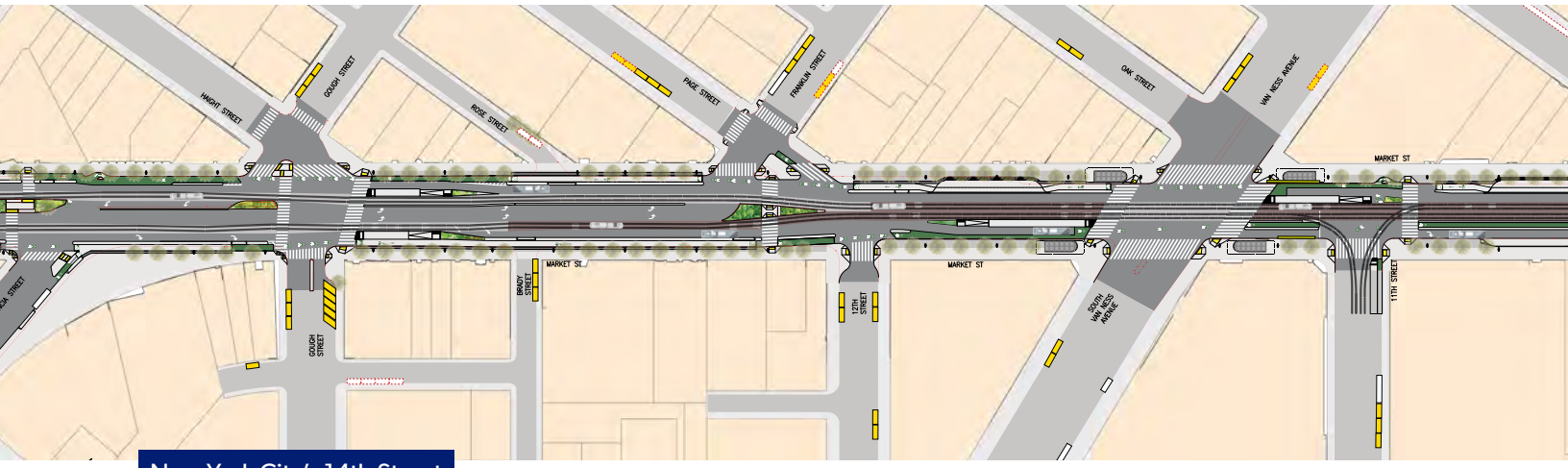
Two Select Bus Service (SBS) lines, the M14A-SBS and M14D-SBS, run along 14th Street[10]. These routes are some of the slowest yet busiest routes in New York City. It is also an important truck route and a Vision Zero Priority Corridor for the city. Maintaining truck traffic while increasing pedestrian safety in the area were important factors as the city considered changes to the street.

In order to improve bus speeds and increase reliability, the New York City Department of Transportation implemented an 18-month Transit and Truck Priority (TTP) pilot project in October 2019. Only buses, trucks, and emergency vehicles are allowed to make through trips on 14th Street from 3rd Avenue to 9th Avenue from 6 AM to 10 PM[11]. Other vehicles may still travel on 14th Street for local pickups, drop-offs, and

New York City's 14th Street

10 Launched in 2008, Select Bus Service seeks to provide complimentary service to the subway system by improving the speed and reliability on high-ridership corridors. Treatments implemented to promote these outcomes include off-board fare payment, painted bus lanes, traffic signal priority, and longer spacing between stops. http://web.mta.info/mta/planning/sbs/

11 New York City Department of Transportation, "14th Street Select Bus Service with Transit & Truck Priority Pilot Project," https://www1.nyc.gov/html/brt/html/routes/14th-street.shtml.



New York City's 14th Street

garage access, but they need to make the next available right turn off of the TTP zone. All left turns are also prohibited along the TTP zone. Other improvements to the TTP zone include the addition of bus boarding platforms at bus stops, curb extensions to reduce pedestrian crossing distances, and additional pedestrian space around Union Square.

While a formal performance report on the 14th Street TTP is forthcoming, initial data that has been publicly reported by the Metropolitan Transportation Authority has shown 30 percent improvement in bus travel times along the corridor[12].

San Francisco's Market Street

In San Francisco, Market Street is being reconceived as part of the *Better Market Street* plan[13]. The $600 million redesign is intended to prioritize public transit, enhance pedestrian safety, and improve the public realm along the 2.2-mile corridor of Market Street between the Embarcadero and Octavia Boulevard.

Although planning for the project goes back nearly a decade, and restrictions prohibiting cars from turning onto Market Street at certain intersections were in place as part of a Vision Zero Safer Market Street plan as early as 2015, the Better Market Street plan goes a step further to ban private vehicles altogether in the goal of prioritizing transit, walking, and cycling[14].

To achieve this overarching mobility goal, the project will include physical interventions such as transit-only lanes, a protected sidewalk-level bikeway, wider sidewalks for pedestrian activity, and painted safety zones. These are coupled with operational improvements, including bus route changes and loading restrictions. Most commercial and passenger loading activities (excluding taxis and paratransit) will take place in new loading zones on side streets near Market Street[15].

12 Metropolitan Transportation Authority, "Select Bus Service Improvements on New 14th Street Busway Increase M14 Bus Ridership Up to 37%," http://www.mta.info/press-release/nyc-transit/select-bus-service-improvements-new-14th-street-busway-increase-m14-bus.

13 The project is a collaboration of six public agencies: San Francisco Public Works, San Francisco Municipal Transportation Authority, San Francisco Planning Department, San Francisco Public Utilities Commission, the Office of Economic and Workforce Development, and the San Francisco County Transportation Authority.

14 Eric Jaffe, "To Improve Street Safety, San Francisco Bans Cars From Turning," CityLab, 2015, https://www.citylab.com/design/2015/06/to-improve-street-safety-san-francisco-bans-cars-from-turning/396473/.

15 Better Market Street, "Commercial and Passenger Loading," http://www.bettermarketstreetsf.org/about-loading.html.

The project will be completed in phases, with a series of quick-build interventions and policies, such as bicycle intersection improvements, peak-hour loading restrictions, and painted safety zones at eight intersections starting in early 2020. The final design is still under consideration.

Transportation Outcomes, and Those That Extend Beyond

Travel Time

Travel times on the streetcar in Toronto and the buses in New York have decreased along the priority corridors. In Toronto, the streetcar is more reliable, and travel times have decreased by 5 minutes on average during the worst time periods[16]. Travel times for the M14A/D-SBS buses in New York have also improved by 5 minutes from 3rd Avenue to 8th Avenue where the TTP zone has been implemented[17].

Opportunities for Cyclists

As part of the transit priority zones in Toronto and in San Francisco, dedicated spaces for cyclists have also been incorporated. The integrated bike paths and ramps along the King Street corridor in Toronto have enabled transit riders to board the streetcar easily while maintaining space for cyclists. In San Francisco, cyclists will now have a safe, separate bike lane where they will no longer need to veer around the streetcar tracks to make their way down the street.

Open Space

The opportunity for placemaking is a stated goal of both transit priority streets in San Francisco and Toronto. In Toronto, reconfiguring the street meant the opportunity for new public spaces. As part of the Everyone is King Design Build Competition, businesses, community members, and design professionals had the opportunity to submit public space design proposals. The city selected 10 public space installations and two durable parklets for installation. In addition, the city developed a café strategy in coordination with the transit priority corridor that allowed for utilization of the curb space for dining.

San Francisco hasn't seen a redesign of Market Street in nearly 50 years, since Lawrence Halprin created the plan that left San Francisco with many of the civic spaces that exist today. In recognition that Market Street functions as the city's civic, cultural, and economic center, Better Market Street includes plans to update the streetscape's plantings, furnishings, and public art.

Noise/Air Quality

Reducing the number of private vehicles in the transit priority zones has also reducedthe amount of noise and air pollution along the corridors. There are fewer vehicles idling in traffic, emitting harmful particulate matter that contributes to air pollution. Residents and visitors along the 14th Street TTP zone in New York have remarked at how quiet the street has become without all of the car traffic[18].

Safety

Improving safety is a stated goal in New York and San Francisco. Both cities identified their transit priority corridors as areas of focus in their Vision Zero planning, prior to the adoption of their

16 City of Toronto, "King Street Transit Pilot – November & December Update," https://www.toronto.ca/wp-content/uploads/2019/04/8fa6-TS_King-Street-Dashboard_Nov_Dec-Update.pdf

17 Metropolitan Transportation Authority, op. cit.

18 Ginia Bellafante,"Cars Were Banned on 14th Street. The Apocalypse Did Not Come," The New York Times, 2019, https://www.nytimes.com/2019/10/13/nyregion/14th-street-cars-banned.html.

priority street plans (14th Street is considered a "Vision Zero Priority Corridor," while Market Street is identified as part of Vision Zero SF's High Injury Corridor). According to Better Market Street's website, "half of the City's top 10 intersections for injury collisions involving people walking or biking are on Market Street." A series of high-profile pedestrian fatalities at Market Street intersections in August 2019 put a spotlight on the need for safety improvements.

Some of the improvements planned for Market Street include painted safety zones at eight intersections, bicycle intersection improvements, and peak hour loading restrictions to reduce conflicts. As mentioned, New York City will reduce pedestrian crossing distances as part of its plan.

The Future of Transit Priority Streets

Although "Transit Priority Street" improvements seek to improve transit operations and reduce vehicle congestion, the impacts extend beyond the transportation realm. As seen in Toronto, a carefully considered approach can balance the needs of all users while successfully facilitating public benefits that encourage a socially and economically vibrant street. The recent move to make the project permanent shows the promise of this approach.

In New York City, a headline from The New York Times in the week following implementation proclaimed "Cars Were Banned on 14th Street. The Apocalypse Did Not Come."[19] According to early data from MTA, bus travel times improved 38 percent year over year, and ridership was up 21 percent in the month following the launch. This early success will be monitored over time, but initial feedback on the project has been overwhelmingly positive[20].

While the idea of banning private vehicles from a given street is controversial, support for the project in San Francisco was built through emphasizing the quality of life improvements that the project would bring. The project passed with a unanimous 7-0 vote by the San Francisco Board of Supervisors in October. Given this support, many in the government and advocacy communities have their sights set on additional priority streets[21].

As other cities throughout North America become more ambitious and creative proposing ways to balance the competing needs of their streets, a look to these three cities highlights the benefits and rewards of the "transit priority street" model. With this model, the toolbox has expanded beyond simple "mixed traffic," "bus lane," and "transit mall" to include more sophisticated strategies that take advantage of time-of-day access and turn restrictions, creative signal timing, and more closely integrate transit improvements with high-quality bicycling and walking infrastructure.

19 Bellafante.

20 Elizabeth Rosmer, "Automated camera enforcement coming to 14th Street busway," New York Post, 2019, https://nypost.com/2019/11/20/automated-camera-enforcement-coming-to-14th-street-busway/.

21 Roger Rudick, "OUT, DAMN CARS! 'Better Market Street' Approved!", Streetsblog, 2019, https://sf.streetsblog.org/2019/10/15/better-market-street-approved/.

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Highways to Parkways

A Vision for Transforming an Urban Expressway as a Model for Urban Planning in the 21st Century

Ryan Kucinski

21st Century Context

In 2020, the state of transportation planning in the United States - its importance to daily life, the technical approaches to its practice, and its guiding ethos - is growing in the minds of urban planners and in the nation's popular consciousness. This is occurring at the same time that many factors are influencing a shift in transportation planning.

Figure 1: Downtown Buffalo Rendering

Rendering of Downtown Buffalo with demolition of the Buffalo Skyway and potential development.

Entrenched approaches to infrastructure planning, development, and public policy contrast with the need for immediate, systematic changes to all modern systems such as energy production, agriculture supply chains, and waste management if we are to meet our responsibilities to address human climate change and unshakable environmental injustice. There is an increased understanding of the impact of transportation systems on community character, individual behaviors, and health. Evolving lifestyle preferences of younger generations and the rapid evolution of new technologies form an iterative process for new innovations, particularly

in mobility systems. How to finance reinvestment in our communities, which grows economic opportunity for all, are faced with short-term and perpetual funding challenges stemming from the decades-long evolution of tax codes that have reduced obligations from the wealthiest corporations and individuals.[1,2,3,4]

While seemingly part of an abstract picture, these evidence-based trends are converging at the height of an era of increasing polarization in social and political philosophies for the purpose and role of government, questioning the equity and success of modern American capitalism, and value of the rights of individuals versus the responsibilities of society - simply put as a difference between public and private life.

Against this backdrop of complex, changing influences exists the planning profession. As it has evolved from its origins in improving public health, through periods of City Beautiful and Urban Renewal, there has been consistent pursuit to improve quality of life as individual disciplines have stood apart at times. Today, issues of equal opportunity in public policy and environmental sustainability are woven throughout modern challenges. At the macro scale, growing socioeconomic inequality perpetuates vicious cycles: income and wealth inequality is the most extreme since the Great Depression[5], the population and economic growth of globally connected "superstar" cities are contrasted with the continued decline of others, described by Richard Florida as the "New Urban Crisis."[6] While human climate change is threatening global mass extinction, greenhouse gas emissions resulting from cumulative transportation and land use development patterns continued to rise in 2019, defying the consensus recommendations of the global scientific community[7]. For the first time in 2017, the transportation sector became the leading source of greenhouse gas emissions[8]. At the individual scale, decades of research document links between health and access to economic opportunity with community design and infrastructure. Asthma rates are significantly higher in communities adjacent to urban highways[9]. Decades of prioritizing city transportation towards personal automobiles creates barriers for low-income communities: jobs are located further away, and often personal automobiles are faster and more reliable than transit but creates harsh financial burdens[10]. Considering the challenges across macro and micro scales, there is a need to think holistically how routine redevelopment of cities can

1 Gardner, M., Roque, L., and Wamhoff, S., "Corporate Tax Avoidance in the First Year of the Trump Tax Plan," Institute on Taxation and Economic Policy, 16 December 2019, https://itep.org/corporate-tax-avoidance-in-the-first-year-of-the-trump-tax-law/

2 U.S. Federal Individual Income Tax Rates History, 1862-2013 (Nominal and Inflation-Adjusted Brackets), Tax Foundation, 17 October 2013, https://taxfoundation.org/us-federal-individual-income-tax-rates-history-1913-2013-nominal-and-inflation-adjusted-brackets/

3 Hungerford, T., "Corporate Tax Rates and Economic Growth Since 1947," Economic Policy Institute, 4 June 2013, https://www.epi.org/publication/ib364-corporate-tax-rates-and-economic-growth/

4 United States Federal Corporate Tax Rate 1909-2020," Trading Economics, https://tradingeconomics.com/united-states/corporate-tax-rate

5 Distribution of Wealth in the United States and Implications for a New Worth Tax, Washington Center for Equitable Growth, 2019, https://equitablegrowth.org/the-distribution-of-wealth-in-the-united-states-and-implications-for-a-net-worth-tax/

6 Florida, Richard, "Confronting the New Urban Crisis," CityLab, 2017. https://www.citylab.com/equity/2017/04/confronting-the-new-urban-crisis/521031/

7 United Nations Emissions Gap Report 2019, https://www.unenvironment.org/interactive/emissions-gap-report/2019/

8 US Emissions, Center for Climate and Energy Solutions, https://www.c2es.org/content/u-s-emissions/

9 Living Near Highways and Air Pollution, American Lung Association, https://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/highways.html

10 Bliss, Laura, "As the Planet Warms, Who Should Get to Drive," CityLab, 2019 https://www.citylab.com/transportation/2019/02/car-ownership-climate-change-driving-poverty-economic/582091/

improve the condition of those who have been disadvantaged and remedy the unintended consequences of past development patterns.

The recent trend of urban planning has been towards connecting disciplines, for example how planning schools and professionals now emphasize the link between land use and transportation. Yet within transportation planning, there has been less movement towards consistent strategy that incorporates comprehensive and granular scales. A long-standing influence on transportation planning, particularly since World War II, is the engineering approach to moving vehicles as efficiently as possible. It has created a condition, described by the University at Buffalo Urban Regional Institute, where, "Our basic problem is that our dependence on the automobile [has] led us to create an urban pattern that can only be served well by the automobile."[11] Over time that approach has become detrimental to safety (resulting in over 6,000 pedestrian fatalities from vehicle collisions in 2018, a 51% increase since 2009[12]), health (in 1985 no state

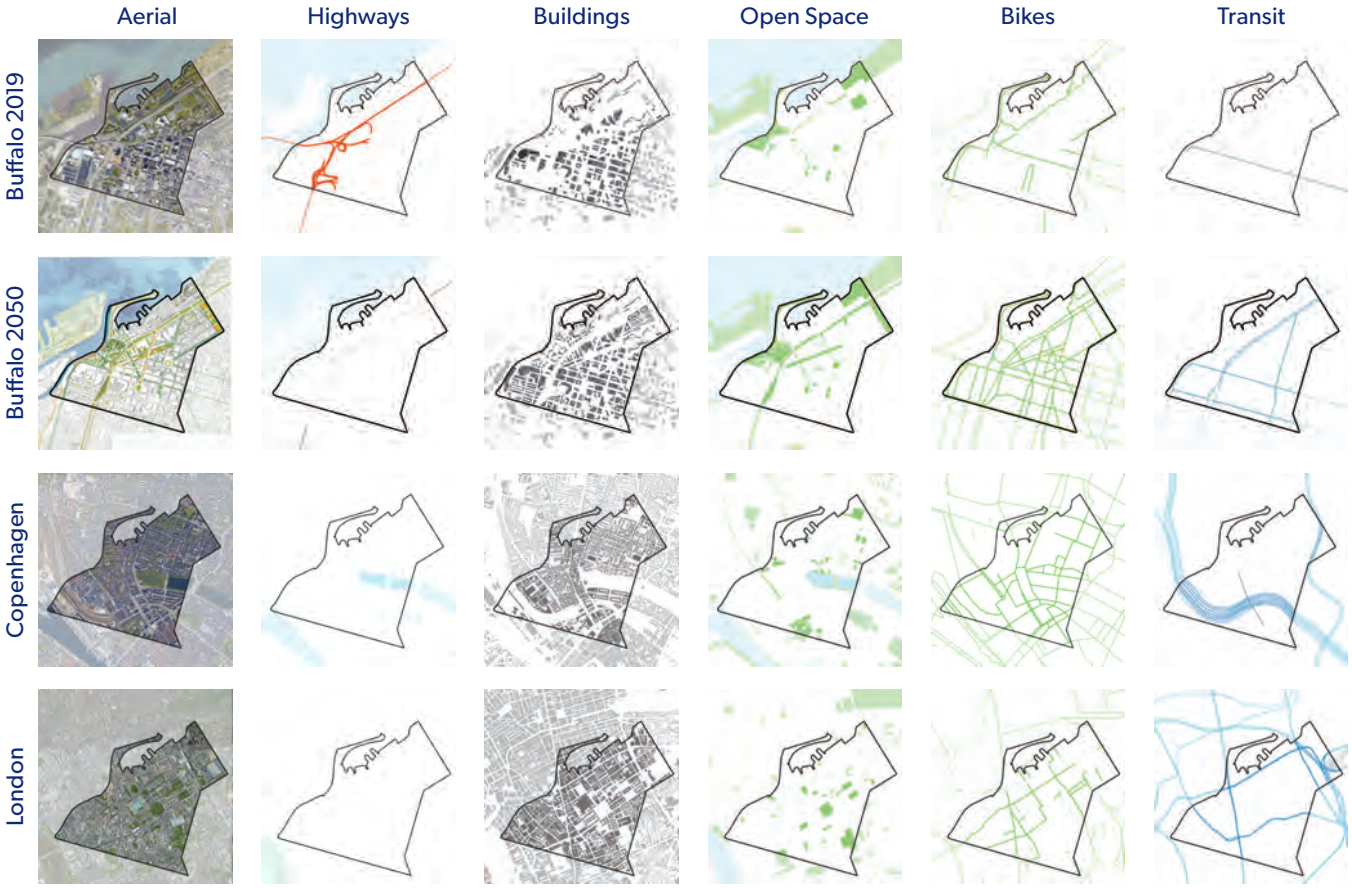


Figure 2: Comparison of City Systems

Maps for aerial imagery and location of highways, building figure-ground, open space, bicycle network, and rail lines compare the cities of Buffalo, London, and Copenhagen in 2019 with Buffalo in 2050 based on the Highways to Parkways proposal.

11 University at Buffalo, Regional Institute, State University of New York at Buffalo, School of Architecture and Planning, 2014. "One Region Forward: A New way to Plan for Buffalo Niagara."

12 Short, Aaron, "Cyclist and Pedestrian Deaths Skyrocket in 2018 as Motorists Stay Safe," Streetsblog USA; June 2019; https://usa.streetsblog.org/2019/06/18/cyclist-and-pedestrian-deaths-skyrocket-in-2018-as-motorists-stay-safe/

had an average obesity rate higher than 15%; in 2018 every state except Colorado had an average of at least 25%[13]), and happiness (nationwide decline in self-reported well-being[14]). In 2008, the Congress for New Urbanism introduced the idea of Freeways without Futures as, "an alternative to costly highway repair and expansion."[15] Today, proposals for freeway removal across the county, "offer a roadmap to better health, equity, opportunity, and connectivity in every neighborhood, while reversing decades of decline and disinvestment"[16] They are holistic solutions filling a gap in transportation planning, and embody the approach of the "Green New Deal," whereby solutions to fix our climate fix everything else.

Not limited to highways, the emergence of internet and telecommunication technologies coupled with issues of sustainability and inequality have made existing city infrastructure systems obsolete for the needs of the 21st Century. Economies are, and have been, built upon foundations of transportation and utility infrastructure. The US economy is increasingly trending towards service- and knowledge-based economy; there will be unknown impacts from technological developments; and renewable energy systems will be essential to future economies. With these uncertainties, it is more important than ever to remember foundational industries and draw upon the common characteristics of successful cities through the ages - namely, how economic innovation has typically occurred in dense, vibrant urban settings[17]. To avoid the mistakes of highway building, technological advances should not be assumed to solve all problems themselves and should be implemented within an enduring community fabric. These factors are starting to guide modern transportation planning, exemplified by the new principles for investment by Transportation for America[18], which no longer advocates for increased public funding for infrastructure and transportation until there is a foundational shift in what type of projects are funded and how they are implemented - towards improving a multi-modal transportation network. As mobility is the essential element connecting the varying spheres of our daily lives from work to respite, the setting of our mobility requires a transportation infrastructure revolution that encourages the soul's ability to breathe freely. All this supports the need to design for people, not cars.

This is a sample of the context considered for the challenges and opportunities present in the transformation of city transportation infrastructure. The remainder of this essay provides a brief summary of a proposal to reimagine an obsolete urban expressway in Buffalo, New York. Specifically, it will describe the background of the Buffalo Skyway Competition, the Highways to Parkways vision, the proposed design, and the preliminary feasibility approach to financing and traffic.

13 Blumenthal, D. and Seervai, S. "Rising Obesity in the United States is a Public Health Crisis," The Commonwealth Fund, 2018, https://www.commonwealthfund.org/blog/2018/rising-obesity-united-states-public-health-crisis

14 Florida, Richard, "Unhappy States of America"; CityLab; https://www.citylab.com/life/2018/03/the-unhappy-states-of-america/555800/

15 Freeways without Futures 2008, Congress for New Urbanism, https://www.cnu.org/highways-boulevards/freeways-without-futures/2008

16 Freeways without Futures 2019, Congress for New Urbanism, https://www.cnu.org/highways-boulevards/freeways-without-futures/2019

17 Jacobs, Jane, Economy of Cities, 1969.

18 "Why we are no longer advocating for Congress to increase transportation funding" Transportation for America, http://t4america.org/2019/10/03/why-we-are-no-longer-advocating-for-congress-to-increase-transportation-funding/

Skyway Competition

In the spring of 2019, Empire State Development, the umbrella economic development agency of New York State, began a design competition to reimagine the Buffalo Skyway, a four-mile long elevated expressway along the Lake Erie waterfront built at the beginning of the Urban Renewal era. At the time it was completed in 1953, the Skyway was going to be the next great transportation project for the City of Buffalo. It was built to provide truck freight connections between a future interstate highway network through Buffalo's central business district and the expansive steel and manufacturing facilities

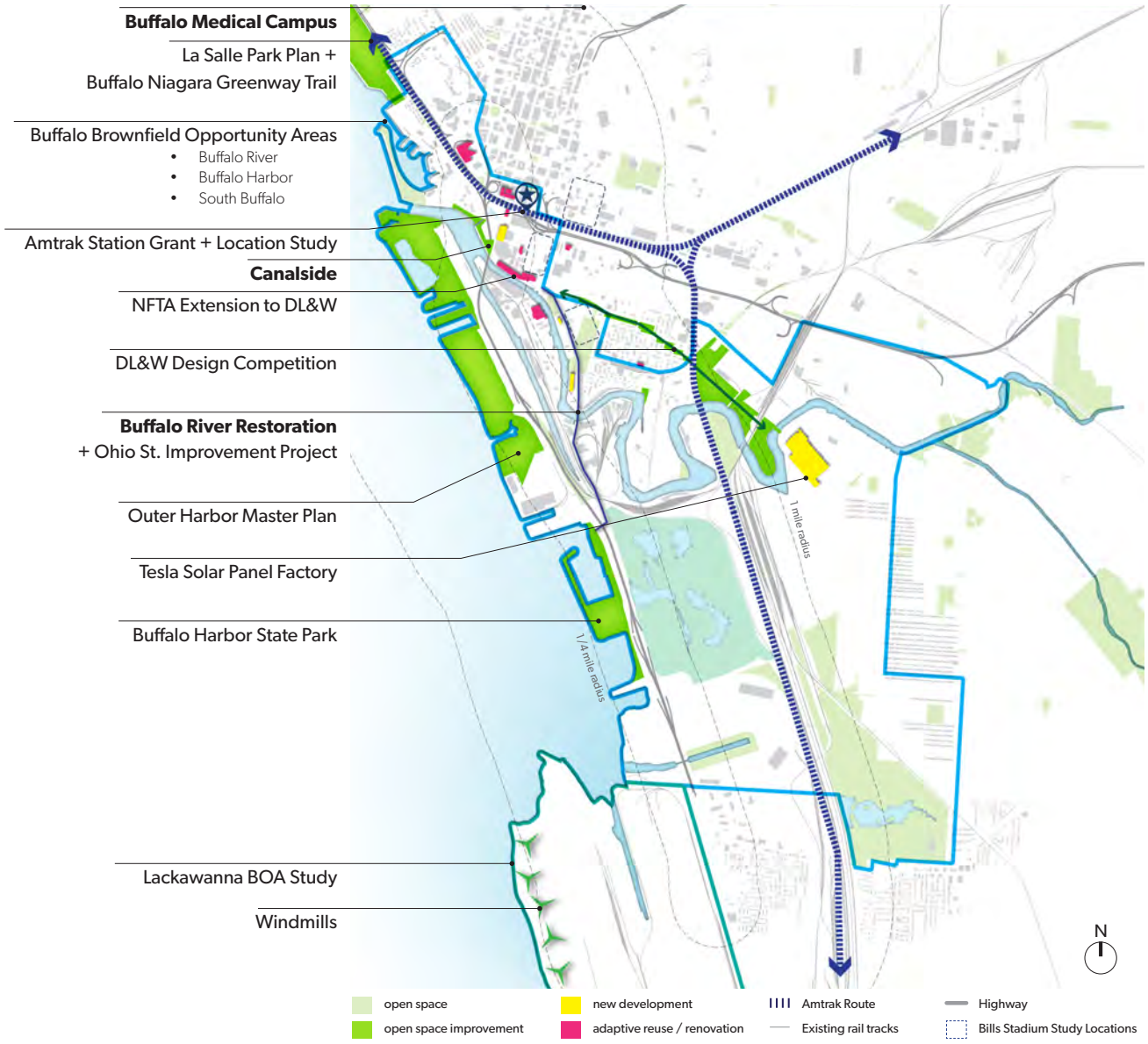


Figure 3: Existing Conditions Analysis

Diagram of existing conditions along the 4-mile Buffalo Skyway corridor from downtown Buffalo to the City of Lackawana.

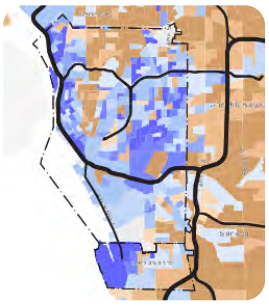
to the south, which grew organically from the City's original grain transshipment economy. This industry was established after the development of the Erie Canal in 1825 and drove a robust local economy into the 1960s. As the City of Buffalo has exemplified the depopulation and deindustrialization trend of "Rust-Belt" cities since the 1960s, the Buffalo Skyway has ultimately become a Freeway Without a Future, so-named by the Congress for New Urbanism in 2014[19]. Simply, the Skyway competition asked for a new transformative vision for the highway corridor.

Existing Conditions

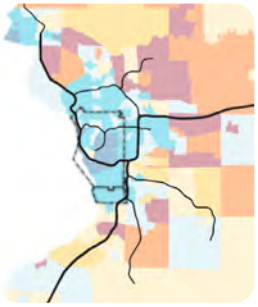
This proposal examined a range of geographic scales increasing from local, city, regional, to global - this is appropriate as the Skyway exists at many scales - it is as much a part of the city and region as it is a singular barrier between the city and its waterfront. Additionally, funding for any transformation would likely require drawing from sources each scale. The Buffalo Skyway itself is composed of a four-lane, limited-access expressway elevated on an earthen berm, connecting to a 110-foot-high bridge crossing over the Buffalo River, ultimately connecting with both the elevated I-190 expressway and Delaware Avenue (a main arterial) in downtown Buffalo. After generations of de-industrialization and suburban growth, the Skyway has evolved to largely service daily commuter traffic from the "Southtowns" (Buffalo's southern suburbs), carrying almost 40,000 trips a day[20] as part of a regional system with other highways (I-90, I-190, US 219, and US 179). Concurrently, since the closing of the region's major steel plant complexes in the 1980s, land uses along the Skyway Corridor's length have drastically transitioned from heavy manufacturing

Humboldt Parkway; Buffalo, NY circa 1951: historic fabric surrounding the parkway shows a traditional urban neighborhood

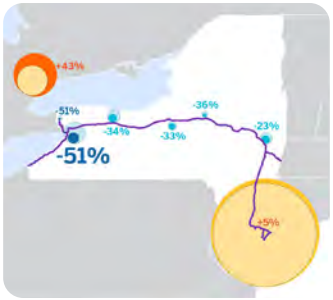
Humboldt Parkway replaced by Kensington Expressway, resulting in reduction of urban fabric exemplified by vacant lots



Decline of urban neighborhoods reduces community capital and creates downward spiral characterized by lack of opportunities



Regional Population Migration 1970-2010 growth of suburban areas following development of freeway network



Decline of city populations and economic activities has been a defining narrative of the 20th Century for mid-size cities, in contrast to growing cities connected to global economies

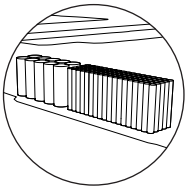
Figure 4: Highway Impacts

Tracing the impact of highways over-time moving from local to statewide scales.

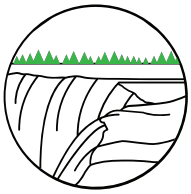
19 2014 Freeways without Futures; Congress for New Urbanism; https://www.cnu.org/highways-boulevards/freeways-without-futures/2014

20 Request for Submissions; Empire State Development; https://esd.ny.gov/doing-business-ny/requests-proposals/usa-niagara-buffalo-skyway-corridor-competition-rfs

Olmsted Park & Parkway Network



Agriculture Industry



Applied Innovation

Figure 5: Three Guiding Principles for Program and Design

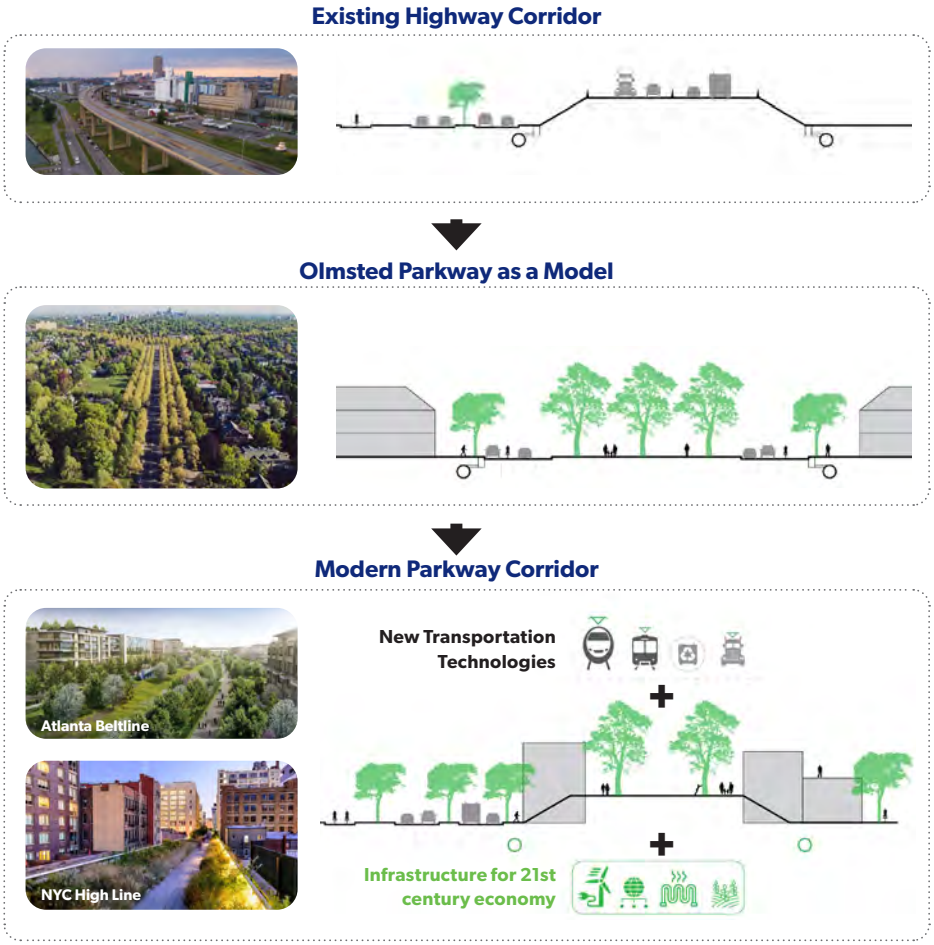


Figure 6: Highways to Parkways Design Approach

to largely vacant and underutilized, recently redeveloped for open space and recreational uses, premised on its waterfront location. While the Skyway provides the most direct connection between downtown and the Buffalo Outer Harbor, traffic analyses over the last decade demonstrate that its primary use is by vehicles passing through the waterfront to some other destination rather than those going to the waterfront[21].

First known for snow, the City of Buffalo is also the home of the country's first citywide park and parkway system designed by Fredrick Law Olmsted in the late 19th century – a revolutionary and egalitarian approach to city planning from America's father of landscape architecture. However, during the era of urban renewal, parts of that system were disconnected and destroyed for intercity highway construction. Hollowing out of the City's traditional, walkable urban fabric occurred along with depopulation through suburban migration as a result of the new highway network and historic redlining policies. From 1970 to 2010, the Western New York region decreased in population by 16%, while the amount of urbanized land increased by 78% - 160 square

21 Ibid.

miles of natural land[22]. To put in perspective, the greenfield development surrounding Buffalo since 1970 is more than the combined size of Buffalo, San Francisco, and Minneapolis (52, 47, and 54 square miles respectively). As this development redistributed a declining population, increasing the environmental, economic, and behavioral consequences of urban sprawl, this land area could otherwise support a combined population of at least 1.9 million people (Buffalo's peak population of 580,000 in 1950, as well as the populations of San Francisco 883,000 and Minneapolis 425,000 in 2018). Today the population of Buffalo is less than 260,000 people. A pattern across New York, depopulation (and sprawl) have characterized every secondary city in the state: Buffalo (a population decline of 51%), Niagara Falls (51%), Rochester (34), Syracuse (33%), Utica (36%), Albany and Troy (23%). While New York City has increased population and prospered in many respects, it has also become extraordinarily unaffordable, and exemplifies the mismatch between economic opportunity and housing within regions across the country.

Highways to Parkways Proposal

The overall vision for transforming the Skyway corridor is based on a simple idea: rebuild communities by creating neighborhoods for people, where 100% sustainable infrastructure, multi-modal transportation connections, mix of land uses, and inclusive spaces allow people to live, work, and play year-round. When cities are designed for people, they remain attractive to live in and are resilient to the uncertainties of changing economic and demographic conditions. As urban highways impact multiple scales from local communities to regions, this vision could provide

Figure 7: Development Areas

Four development areas highlighted along the corridor, and connected by an Olmsted Parkway.

Figure 8: Downtown Buffalo Winter Rendering

View towards the Buffalo River in winter showing demolition of the Buffalo Skyway, new pedestrian and bicycle bridge, and Food Hall with a green roof that becomes a sled hill in winter.

22 University at Buffalo, Regional Institute, State University of New York at Buffalo, School of Architecture and Planning, 2014. "One Region Forward: A New way to Plan for Buffalo Niagara."

Figure 9: Southtowns Parkway Corridor Section

A public parkway lined with mixed-use buildings that bridge divide between elevated and at-grade sections of the corridor.

a positive impact across those same scales. Olmsted's Park and Parkway system provided the natural model governing a new urban form locally: open space for adjacent neighborhoods and providing public access to all parts of the city. With the development of transportation, connect neighborhoods through parks and public transit.

"Live local, think global" guided specific design approaches for the Highway to Parkways proposal. New neighborhoods were designed for multi-modal connections to other parts of the city, as well as to anticipate the need for how other parts of the city would need to be updated as additional segments of the urban highway network reached the end of their useable life. Locally, the Skyway Corridor is envisioned to be redeveloped through multiple mixed-use neighborhoods, each with an intimate relationship with public open space by designing with nature (topography, nature preserves, Buffalo River and water network), and driven by new modern infrastructure networks needed to support diverse economic activities in transportation (high speed rail, local public transit, electric freight, autonomous vehicles) and sustainable energy (green energy grid, telecommunications, data centers, and urban agriculture). Citywide, it would be the first step in comprehensively repairing and expanding the Olmsted Park and Parkway network. Finally, the proposal was linked to the New York State Climate Action Plan (passed in 2019), which provides the foundation for the policies and phasing timeline proposed.

Specifically, there are four unique development areas:

1. Urban Mixed-Use Neighborhood: Within the existing downtown infill development would support new modern tech jobs (leveraging an existing high-capacity fiber optics line along Main Street), downtown residents, and an entertainment district. An anchor of this district would be restoration of the lost Olmsted Terrace Parks and a new food hall, with a sloping green roof that becomes a sled hill in winter, which showcases regional agriculture (and new agriculture proposed along the Southtowns Connector).

2. Southtowns Parkway Corridor: The roadway on the earthen berm would receive phased road diets, ultimately transforming into a fully naturalized parkway. Along the edges of the berm, new development would consist of two-seven story attached buildings supporting mixed land uses. At the distance of small urban blocks, openings varying in size and program would allow movement between existing Fuhrmann Boulevard and the new parkway. Restoring the agriculture heritage of the city, and advancing modern practices of urban, organic farming, commercial greenhouses would be integrated among buildings, and the parkway landscaping would include harvestable species.

3. Lakeside Commerce Park: An existing industrial park would be complemented by infill of emerging light, flex, and green manufacturing. New solar panel sculptures would be incorporated throughout the district to create multiple benefits: environmental restoration, energy production, indicating pathways, and placemaking. A new transit station at Ridge Road in Lackawanna would allow this area to transition to a more diverse mix of uses over time.

4. Bethlehem Steel Site: An existing vacant brownfield, it is proposed to complement the Lakeside Commerce Park with similar manufacturing for sustainable/emerging industries near Fuhrmann Boulevard. Most of the site would be devoted to natural habitat restoration, outdoor recreation, and renewable energy production with solar panel sculptures. Combined with Lakeside Commerce Park, the proposals solar panels estimate producing 373 million kWh/year, annually offsetting 198,000 tons of CO2 with a value of $43.8 million.

In total the proposal created 103 acres for new open space and 140 acres for development, defined in three categories: Skyway Corridor (60 acres open space / 71 acres development), I-190 Corridor (34 / 48 acres, respectively) Adjacent Infill in Downtown (9 / 21 acres, respectively)

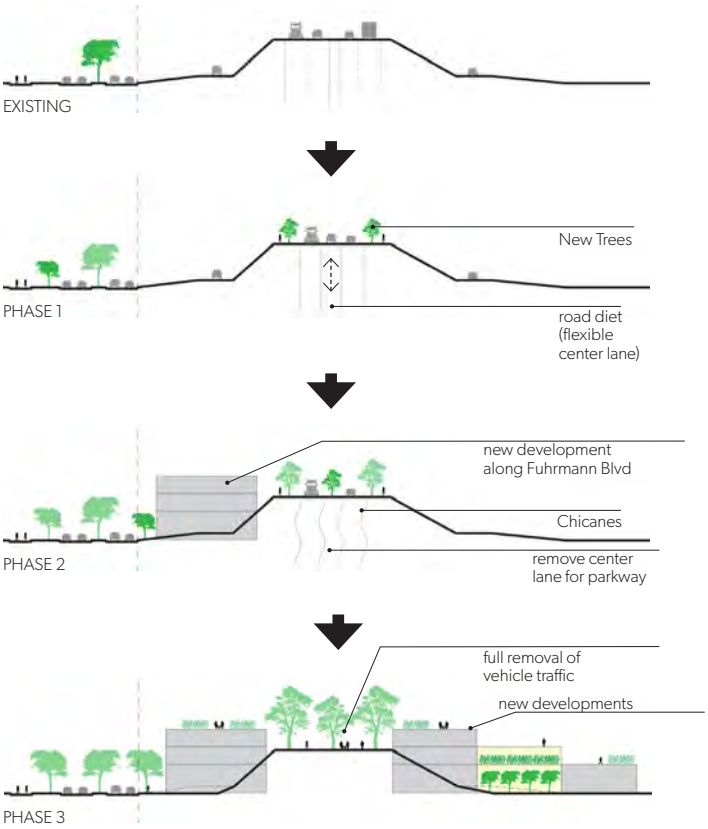


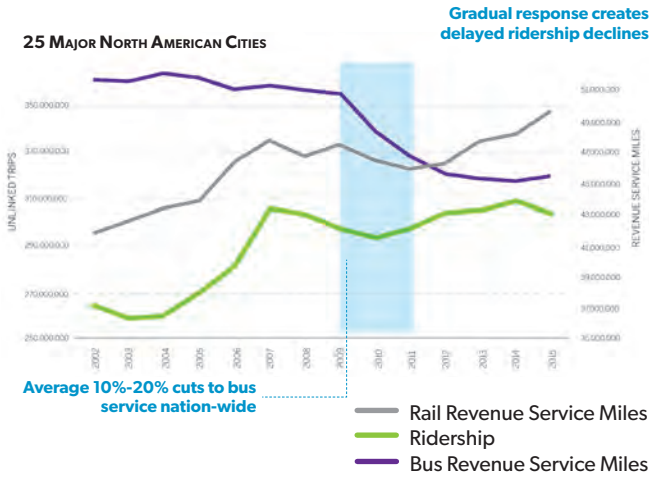
Figure 10: Southtowns Connector to Parkway Phasing

Transition from an exclusive highway to the proposed final condition of a parkway and new development can occur through multiple road diets.

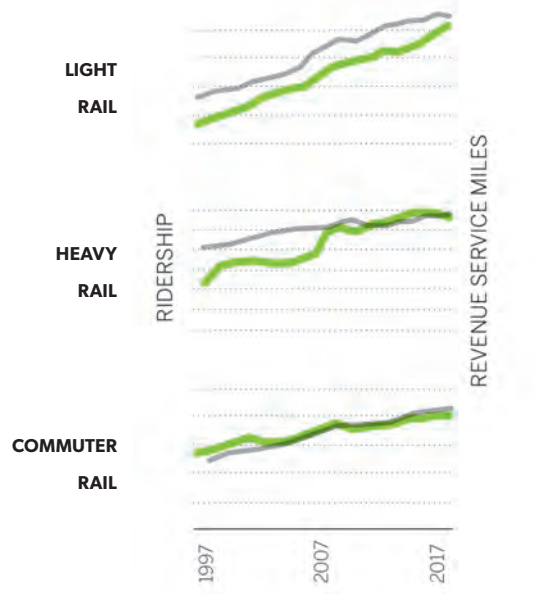
Technical Feasibility: Traffic

Two main approaches guide the strategy for addressing traffic: a long-term phased approach to reducing vehicle capacity rather than immediate removal, and incorporating modern best practices that measure and address traffic holistically with other urban systems. With the goal of growing local economic development in neighborhoods that have been under-invested for decades, while simultaneously addressing macro environmental challenges of our carbon-based transportation system, it is necessary to change the physical conditions that convenience driving above all else. As documented induced demand demonstrates how traffic is never solved with additional capacity, this proposal would be a catalyst for reducing vehicle demand by increasing the public transit and active transportation network within the city and concentrating infill and transit-oriented development around those investment areas – building a real first-/last-mile active transportation network to shift short trips to modes other than vehicles.

Critics contend that people will not want to stop driving, but the data show that they do when provided with quality public transit and bicycle networks. From 1997 to 2017, national ridership



United States



Source: Federal Transit Administration National Transit Database

Figure 11: National Transit Ridership Trends

Graphs show an increase in rail transit ridership during the past two decades and responding the increased service levels.

for light, heavy, and commuter rail has increased with increasing rail service (measured by revenue service miles)[23]. While the narrative has centered on overall declining transit ridership over the past decade, with limited critical narrative citing the link between nation-wide bus service cuts between 2009-2011 (by an average 10-25% , with no return to former levels), which reduced overall transit ridership and overshadowed rail ridership trends[24]. Additionally, the classic report from the Portland Bureau of Transportation identified that 60% of the surveyed population is interested but concerned about riding bicycles[25]. That ridership potential is since supported by the increase of daily bicycle trips after implementation of protected facilities in many cities and regions[26].

Technical Feasibility: Financial

Over 30 years, high-level cost estimates for this proposal were $1.3 billion. Any redevelopment transforming the Skyway Corridor will occur at the neighborhood scale, which will require a variety of incremental infrastructure and redevelopment projects ranging in scope, value, and cost. Thus, financing would come from a diverse mix of both short- and long-term sources typical of complex redevelopment processes. Finding correct partners among public, private, and non-profit sources with common interests will be key in creating a successful partnership to complete the proposed infrastructure projects. One primary strategy would be to establish a value-

23 Boisjoly, G. et al (2018). Invest in the Ride: A 14-year longitudinal analysis of the determinants of public transport ridership in 25 North American cities. Transportation Research, Volume 116 (October 2018), 434-445. https://www.sciencedirect.com/science/article/pii/S0965856418300296

24 IBID

25 Four Types of Transportation Cyclists in Portland; https://www.portlandoregon.gov/transportation/article/158497

26 "If you build it, people will ride," People for Bikes, http://peopleforbikes.org/our-work/statistics/statistics-category/?cat=protected-bike-lane-statistics

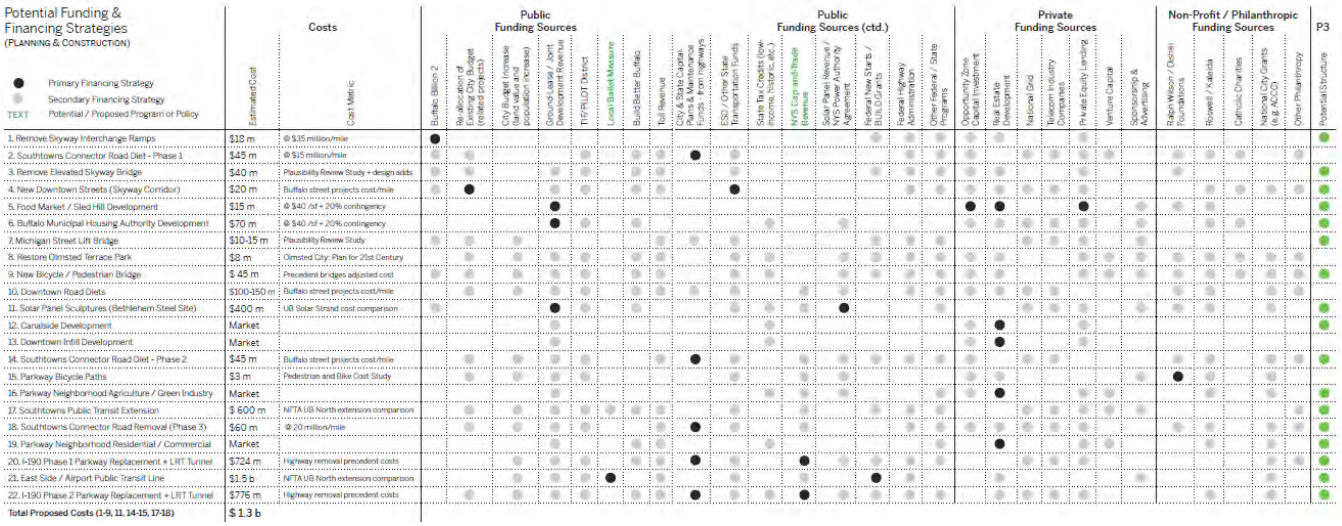


Figure 12: Funding Sources

The matrix provides cost estimates for major elements of the Highways to Parkways proposal, as well as matches primary and secondary funding sources from public, private, and non-profit sectors with their most appropriate infrastructure investments.

capture policy that prioritizes ownership of new economic growth to existing communities. As contributions in amount and from types of sources would change over time, financing of individual infrastructure elements (e.g. bike paths or fiber-optic lines) would be strategically matched with appropriate sources. Finally, public-private partnerships (P3s) would be encouraged to engage multiple partners, speed up delivery time, and build consensus.

To provide quantifiable representation of the value created by the proposed vision for the local population, the proposal referenced applicable methodologies, assumptions and estimates of two previous studies of similar highway removal projects in New York State: removal of I-81 in Syracuse and removal of the Rochester Inner Loop[27]. The similarities between the nature and scope of the three highway projects as well as the cities of Buffalo, Rochester, and Syracuse in terms of regional construction costs, economic development, and land values allow this proposal to build off of the previous two studies while incorporating additional information specific to the Skyway project and the Buffalo region. The Highways to Parkways proposal estimates yields the following thirty-year value creation summary (Table 1).

27 Syracuse I-81: Urban Design Study of the I-81 Project Area; AIA CNY I-81 Task Force; July, 2014; https://www.aiacny.org/assets/I-81-Booklet-2014-09-03-2page-spread.pdf
Rochester Inner Loop East Reconstruction Project Benefit Cost Analysis & Real Estate Market Analysis; HR&A Advisors; June, 2013: https://www.cityofrochester.gov/innerloopdocs/

Table 1: Project Value Creation (2020-2050)

	Developable Acres Created or Enhanced	Proposed Development Sq/ft	Construction Potential	Estimated Development Land Value	Discounted Land Value in 2020
Skyway Corridor	71.3	6,296,520	$878,057,077	$1,003,987,482	$590,678,492
190 Corridor	48.5	9,311,552	$1,482,545,942	$1,668,776,972	$1,241,726,790
Complementary/ Infill	21.5	9,862,230	$1,504,333,887	$1,701,578,478	$1,266,134,191
Totals	141.3	25,470,301	$3,864,936,906	$4,374,342,932	$3,098,539,474

Additionally, using Buffalo and Erie County Tax rates, as well as five-year average of Buffalo's equalization assessment rate, annual tax revenue projections for the City and County were estimated at (cumulative by decade): $22 million by 2030, $58 million by 2040, and $111 million by 2050.

These projections are just estimates, but nonetheless demonstrate the significant potential value of the broader Skyway vision. The proposed strategic phasing in terms of individual construction projects and impact leads to an escalating form of land value creation and tax revenues which can, in turn, be used to sustain and enhance the broader cohesive vision. Furthermore, I-190 Corridor and Adjacent/Infill new and redevelopment value does not account for their full potential; the original proposal only indicates development on a fraction of parcels to support the proposed urban form near the Skyway corridor. For example, infill development on only half of downtown Buffalo's parking lots could yield another 25 million square feet of potential development.

	SF	Land Value	Construction Potential	Estimated Developed Land Value	Discounted Land Value (3%)	5 year average Equalization Rate for City of Buffalo	Fair Assessment Equalization Value	Annual property tax revenue (City and County)	Discounted property tax
Totals									
Skyway Corridor									
2030	2,507,716	$ 50,154,328	$ 282,863,559	$ 333,017,887	$ 247,796,584	75%	$ 248,431,344	$ 8,337,944	$ 6,204,213
2040	2,799,386	$ 55,987,725	$ 413,006,498	$ 468,994,223	$ 259,670,730	75%	$ 349,869,691	$ 11,947,184	$ 6,614,866
2050	989,418	$ 19,788,352	$ 182,187,019	$ 201,975,371	$ 83,211,179	75%	$ 150,673,627	$ 5,091,860	$ 2,097,779
Total	**6,296,520**	**$ 125,930,405**	**$ 878,057,077**	**$ 1,003,987,482**	**$ 590,678,492**		**$ 748,974,661**	**$ 25,376,987**	**$ 14,916,858**
190 Corridor									
2030	1,796,605	$ 35,932,095	$ 224,550,376	$ 260,482,471	$ 193,823,422	75%	$ 194,319,924	$ 6,601,580	$ 4,912,196
2040	3,195,064	$ 63,901,275	$ 472,677,906	$ 536,579,181	$ 399,265,304	75%	$ 400,288,069	$ 13,379,126	$ 7,407,698
2050	4,319,883	$ 86,397,660	$ 785,317,659	$ 871,715,319	$ 648,638,065	75%	$ 650,299,628	$ 21,857,629	$ 9,005,054
Total	**9,311,552**	**$ 186,231,030**	**$ 1,482,545,942**	**$ 1,668,776,972**	**$ 1,241,726,790**		**$ 1,244,907,621**	**$ 41,838,335**	**$ 21,324,947**
Infill/Complementary									
2030	2,374,130	$ 47,482,608	$ 234,313,665	$ 281,796,273	$ 209,682,892	75%	$ 210,220,020	$ 7,599,354	$ 5,654,633
2040	2,647,566	$ 52,951,323	$ 368,286,481	$ 421,237,804	$ 313,440,487	75%	$ 314,243,402	$ 10,976,624	$ 6,077,490
2050	4,840,533	$ 96,810,660	$ 901,733,741	$ 998,544,401	$ 743,010,813	75%	$ 744,914,123	$ 26,184,788	$ 10,787,786
Total	**9,862,230**	**$ 197,244,591**	**$ 1,504,333,887**	**$ 1,701,578,478**	**$ 1,266,134,191**		**$ 1,269,377,545**	**$ 44,760,766**	**$ 22,519,909**
Overall									
2030	6,694,212	$ 133,569,031	$ 741,727,601	$ 875,296,632	$ 651,302,897	75%	$ 652,971,287	$ 22,538,878	$ 16,771,042
2040	8,824,116	$ 172,840,323	$ 1,253,970,886	$ 1,426,811,209	$ 972,376,521	75%	$ 1,064,401,162	$ 36,302,933	$ 20,100,054
2050	9,846,084	$ 202,996,672	$ 1,869,238,420	$ 2,072,235,092	$ 1,474,860,056	75%	$ 1,545,887,379	$ 53,134,277	$ 21,890,619
Total	**25,364,412**	**$ 509,406,026**	**$ 3,864,936,906**	**$ 4,374,342,932**	**$ 3,098,539,474**		**$ 3,263,259,827**	**$ 111,976,088**	**$ 58,761,714**

Figure 13: Total Valuation by Decade

Competition Outcome

Evaluation of the proposals was based on five umbrella categories: affordability, feasibility, technical competence, design, and experience and qualifications of respondent teams[28]. The competition received over 100 submissions and was concluded in September 2019. The Highways to Parkways proposal advanced as a top nine finalist, making a pitch before the competition jury comprising industry professionals and local and state politicians. Typical of any competition is the unpredictability in the variety of ultimate deciding factors, such as accounting for local public opinion, competition timeline, proposed costs and scale of intervention, stage of the process and fitting within subsequent actionable steps. While the Highways to Parkways vision wasn't selected as one of the top three prizes, it provided a comprehensive proposal of interventions including new public transportation lines, 25 million square feet of mixed-use neighborhood development, renewable energy production, telecommunication infrastructure, and at its heart, a connected public open space network. To date, the competition has been the culmination of decades of conversation among residents, planning professionals, and City and State politicians as to the future of the corridor that will continue in a transformation drawing from all the competition finalists. Perhaps more important, the competition represents an encouraging trend for the future: recognition by local governments of how completely redesigning single pieces of infrastructure for its contemporary context and challenges can be a transformative catalyst for communities.

Looking Forward

The 1950's started the first era of highway building, when the application of new technology drove all infrastructure investment. While it yielded decades of progress, in retrospect, the lasting legacy of urban renewal and highway building is the destruction of historic urban fabric of local, walkable communities, creating the conditions to enable the most significant population migrations of the 20th century: out of cities and into single-use residential subdivisions, creating the globally-devastating rise in greenhouse gas emissions from an exponential increase in driving. Urban highways are now a common characteristic of American cities, along with the range of social, environmental, and economic consequences. This shared quality among all cities demands a new model to transform that infrastructure into a catalyst for sustainable community and economic development, appropriate to its local context.

For Buffalo, this transportation and urban planning opportunity demands the courage from Buffalo's history. By 2050, as Buffalo commemorates 150 years since the Pan American Exposition and inauguration of Theodore Roosevelt - events that separately introduced to the world the City of Light and a legacy of progressive action – we will have the duty to realize the spirit from an era which knew no limit in the pursuit of "knowledge to improve the well-being of our fellow human beings throughout the world," as once described by Bobby Kennedy in Cape Town. Updating the skyway corridor for the challenges and opportunities defining the 21st Century is the next chapter in the renaissance of the City of Buffalo and Western New York. Following a vision transforming Highways to Parkways can also be the physical birth of a new movement of urban design, city and regional planning, and public policy reform; inherited from the legacy of Buffalo;

28 Request for Submissions; Empire State Development; https://esd.ny.gov/doing-business-ny/requests-proposals/usa-niagara-buffalo-skyway-corridor-competition-rfs

rooted in repairing the relationship between humanity and nature - and one another; and committed to creating a better world. In doing so, Buffalo can once again be known as the City of Light in the world.

That light is needed globally, including in places like Los Angeles, which is suffering from induced congestion and housing shortage creating unaffordable housing markets and where 1.2 million people live within 500 feet of freeways[29]. Transforming these highways to parkways integrating nature, energy production, public transit, bikes, people, freight, infrastructure and vehicles could provide the setting for infill development to satisfy the regional housing demand and become the reason how that city and state will meet its climate goals, fulfilling the Paris Agreement. As an estimated 30-45% of all urban residents in the US live in areas that put them at risk[30], redesigning highways can transform the lives of millions for all time to come.

With a transformation that would impact all parts of the status quo, we will not realize the potential of this vision in the first year, nor the first decade, or maybe even during our lifetimes, but let us begin with steadfast resolve today. Only 70 years ago, there were no highways; within the lifetimes of the youngest generation of planners today, all cities can be transformed. The viability of future generations and the ability for all people to live in dignity today depend upon this endeavor.

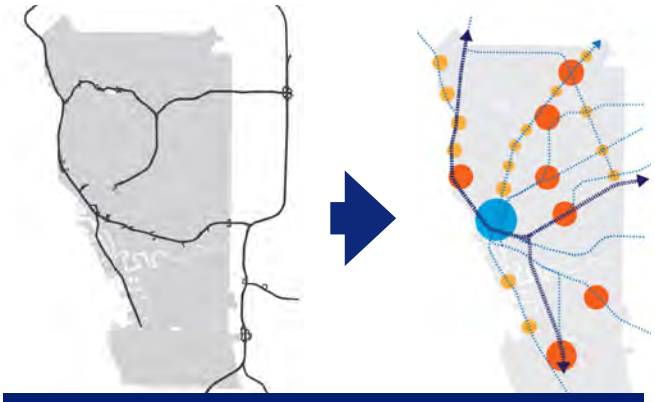


Figure 14: Evolution from Highways to Transit-Oriented Development neighborhood

Figure 15: Highways to Parkways Site Plan

29 Walker, Alissa, "LA Should Dismantle its Freeways," Curbed Los Angeles, 2018, https://la.curbed.com/2018/1/5/16854828/los-angeles-freeways-pollution-solution

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To Santa Monica
LOOK BOTH WAYS

5

HEALTHY COMMUNITIES, HEALTHY CLIMATE

Using Street Tree Data to Plan a Healthier Transportation Network

→ Digital supplement for this article at: http://tiny.cc/hillegass

John Hillegass

Executive Summary

Planting trees is a low-cost intervention that can improve long-term health outcomes, especially for vulnerable populations that have asthma or other respiratory problems. Street trees help absorb and filter pollutants, reducing harmful exposure to nearby populations. This paper looks at the street tree canopy compared to the freight route network in the District of Columbia, both of which are managed and overseen by the District Department of Transportation (DDOT). The goal is to help planners use data to prioritize which segments of a freight route network present the most risk from pollutants to nearby populations.

This paper does not provide a definitive list of which freight routes Washington, D.C., must prioritize. Instead, the paper demonstrates several methods for how to prioritize segments using currently available data. Analysis methods include: (i) Aggregation: Freight Routes to Street Trees, (ii) Hot/Cold Spot Analysis: Tree Quantity and Quality, (iii) Traffic Volume and Street Trees, and (iv) Proximity to Key Demographic Sites. These data analysis methods could be replicated by any city or agency with similar datasets to compare existing tree locations and high-traffic roads.

To conclude, the paper offers recommendations for how the District can maximize benefits from the street tree program and minimize harm associated with freight routes and vehicular traffic. Recommendations include:

1. Supplement street tree data to include non-street trees
2. Determine priorities and intended outcomes for street trees
3. Prioritize street tree placement according to need
4. Create additional space for trees where streets are at capacity

For additional visual analysis, see the accompanying GIS Story Map[1].

Introduction

The District of Columbia is a city of trees. From Rock Creek Park to Fort Circle Park, Suitland Parkway to the National Arboretum, Washington D.C. is filled with parkland that resembles a forest. Trees, however, are not confined to parks. The District has more than 150,000 street trees that are planted in the public right of way, typically

1 https://storymaps.arcgis.com/stories/7dfa37d31b814c10a9cc679d45bc3a93

between the road and the sidewalk. In D.C., the District Department of Transportation (DDOT) is responsible for planting and maintaining street trees.

Trees do much more than look pretty and produce allergens. Beyond their many social and psychological benefits, trees provide shade, lower surrounding air temperature, reduce stormwater runoff, and absorb and filter pollutants from the ground and air[2]. Trees help filter common air pollutants such as carbon monoxide (CO), particulate matter (PM), volatile organic compounds (VOC), and nitrogen oxides (NOx), all of which are found in exhaust from vehicles that burn gas[3]. In a dense urban environment with a transportation system heavily reliant on fossil fuels, the ability to filter pollutants may be one of the most important qualities trees have to offer.

Planting trees is a low cost intervention that may improve long-term health outcomes, especially for vulnerable populations that have asthma or other respiratory problems[4]. The District has a goal to plant 10,500 trees per year in priority areas and reach a tree canopy cover of 40% by 2032[5]. In recent years, DDOT has planted approximately 8,200 trees per year[6]. Most streets in the District already have trees planted along sidewalks while many others are near capacity in terms of available space. This begs the question: How should D.C. prioritize where to plant new trees?

Research into the quality and quantity of trees planted along D.C.'s freight routes is lacking. Previous research has examined the return on investment of planting trees throughout D.C. and compared the distribution of trees to existing racial and economic disparities[7]. This paper examines D.C.'s tree canopy compared to the freight route network. According to the Environmental Protection Agency (EPA), medium and heavy duty trucks emit almost one quarter of global warming emissions from the transportation sector, despite accounting for only five percent of vehicles[8]. This indicates that residents that live or work along freight routes are more likely to be exposed to higher levels of air pollutants. The goal of this paper is to provide methods of analysis that planners can use to prioritize which segments of a freight route network present the most risk of exposure to pollutants for nearby populations. The prioritization of street tree planting could be a tool to help correct some of the generational racial and economic spatial-inequities. However, a full discussion of this topic is outside the scope of this paper. Future research should examine the relationship between freight routes, under-treed

2 Kardan, Omid. "Neighborhood greenspace and health in a large urban center." Scientific Reports. July 2015. 5, Article 11610. Accessed August 16, 2019. https://www.nature.com/articles/srep11610; Astell-Burt, Thomas and Feng Xiaoqi. "Association of Urban Green Space with Mental Health and General Health among adults in Australia." JAMA. July 2019. Accessed August 16, 2019. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2739050

3 Janhall, Sara. "Review on urban vegetation and particle air pollution - Deposition and dispersion." Atmospheric Environment. March 2015. Volume 105, 130-137. Accessed August 16, 2019. https://www.sciencedirect.com/science/article/pii/S1352231015000758

4 Meng, Wang et. al. "Association between long-term exposure to ambient air pollution and change in quantitatively assessed emphysema and lung function." JAMA. 2019. 322(6), 546-556. Accessed August 16, 2019. https://jamanetwork.com/journals/jama/fullarticle/2747669

5 District of Columbia. "Sustainable D.C. 2.0 Plan." page 112. Accessed August 16, 2019. http://www.sustainableD.C..org/wp-content/uploads/2019/04/sD.C.-2.0-Edits-V5_web.pdf

6 D.C. DDOT Urban Forestry Division. "Urban Forestry in Washington, D.C.,." GIS Story Map. Accessed August 16, 2019. https://urban-forestry-D.C.gis.opendata.arcgis.com/

7 McDonald, Rob, et. al. "Planting Health Air: a global analysis of the role of urban trees in addressing particulate matter pollution and extreme heat." The Nature Conservancy. 2016. Accessed August 16, 2019. https://www.nature.org/content/dam/tnc/nature/en/documents/20160825_PHA_Report_Final.pdf; Chuang, Wen-Ching, et al. "Tree canopy change and neighborhood stability: A comparative analysis of Washington, D.C. and Baltimore, MD." Urban Forestry & Urban Greening. October 2017. Volume 27, pages 363-372. Accessed August 16, 2019. https://www.sciencedirect.com/science/article/pii/S1618866715301382

8 Environmental Protection Agency. "Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions 1990-2015." Office of Transportation and Air Quality. July 2017. Accessed August 16, 2019. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100S7NK.pdf

freight route segments, and existing racial and economic disparities.

It should be noted that this paper does not provide a definitive list of which freight routes D.C. must prioritize. Instead, this study seeks to demonstrate several prioritization methods that, using currently available data, could help D.C., or any jurisdiction with similar data, determine which freight routes should be prioritized for street tree interventions. The paper also offers recommendations for how the District can maximize the benefits of a street tree program and minimize the harm associated with freight routes and vehicular traffic.

Analysis

Datasets: The analysis in this paper builds off of two primary datasets. Figure 1 shows the street tree point data maintained by DDOT's Urban Forestry Division (UFD). Figure 2 shows the freight route network also provided by DDOT and made available through D.C.'s open data portal.

Data Limitations

Street Trees

The District's street tree dataset only includes street trees and does not take into account trees on private property or in parkland. For example, some of the freight segments identified as having zero street trees, such as Canal Road along the Potomac heading northwest from Georgetown, are surrounded by parkland and do have significant tree cover nearby. Because the dataset does not include non-street trees, visual verification is needed to confirm the results shown by the data. A fuller dataset that included non-street trees would provide a richer analysis.

Freight Routes

The freight route network contains segments of varying length. Therefore, longer segments are likely to have a higher total Diameter at Breast Height (DBH). DBH is a standard measurement of tree size, a proxy for the age and capacity to filter pollutants, by measuring the diameter of the

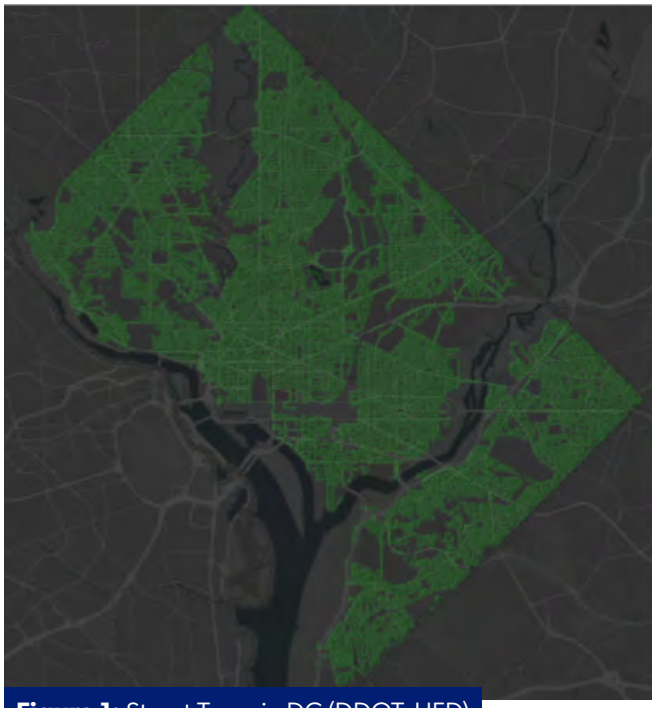

Figure 1: Street Trees in DC (DDOT, UFD)

Figure 2: Freight Routes in DC (DDOT, Freight)

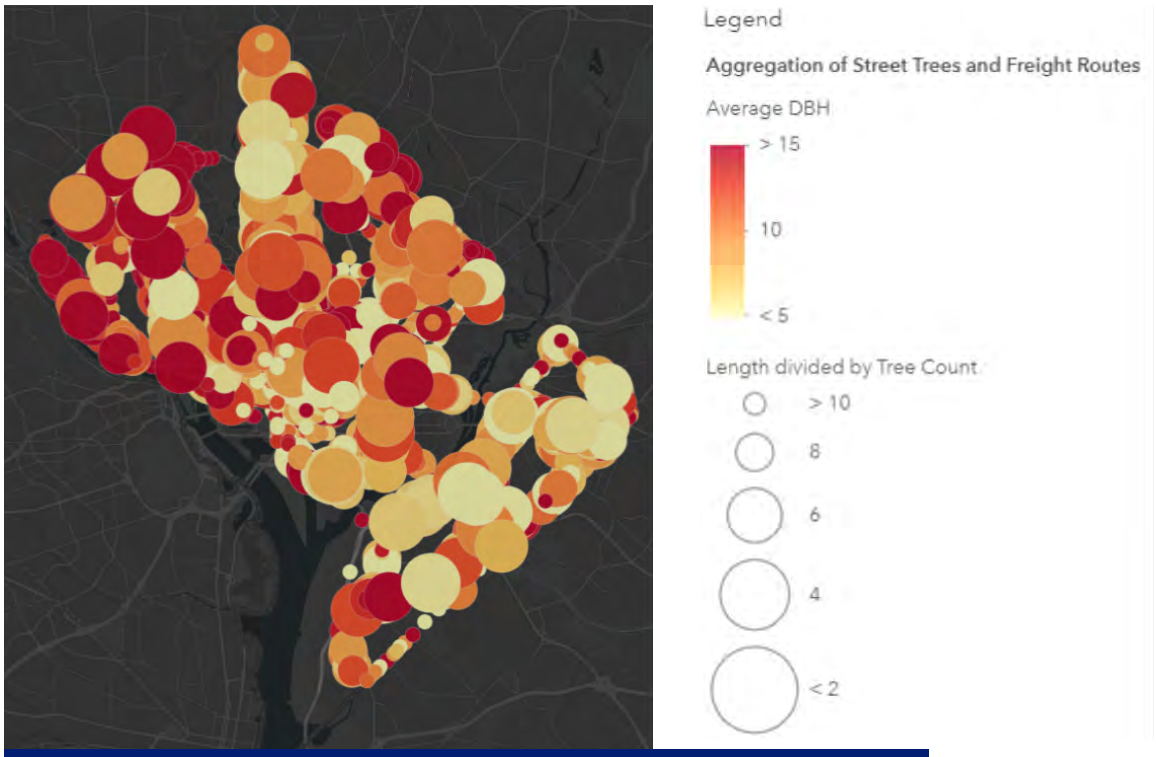

Figure 3: Aggregated Street Trees to Freight Routes by Size and Quantity of Trees

tree approximately four and a half feet above the ground. Any comparison between freight route segments must factor in the length of the segment.

Methods of Analysis

The following section explores four prioritization methods that can help planners determine the prioritization of freight routes most in need of tree canopy improvements for reducing public exposure to vehicle exhaust.

1. Aggregation - Freight Routes to Street Trees

The first analysis looks at freight routes and street trees to assess the quantity of trees along a freight route segment and the quality, determined by their trunk width using the industry standard measurement of the Diameter at Breast Height (DBH). To perform the analysis, a 75-foot buffer was created around all freight route segments in the District to aggregate nearby street tree point data to the individual freight route segment buffer zones. Figure 3 shows the quantity (size of circle) and quality (color of circle) of street trees near each segment of D.C.'s primary freight routes.

Circle Color: Darker circles indicate a larger average DBH, an industry standard to measure tree sizes by measuring the width of the tree 4.5 ft off the ground. Larger trees have more capacity to absorb carbon and other pollutants[9]. White circles indicate smaller, typically younger, street trees with less capacity to absorb pollutants.

Circle Size: Large circles indicate more street trees along the route calculated by the length divided by number of trees along the segment. Small circles indicate fewer trees along the route, or more space between each street tree.

9 Stephenson, N. L. "Rate of tree carbon accumulation increases continuously with tree size." Nature. 2014. Accessed August 16. 2019. https://andrewsforest.oregonstate.edu/sites/default/files/lter/pubs/pdf/pub4835.pdf

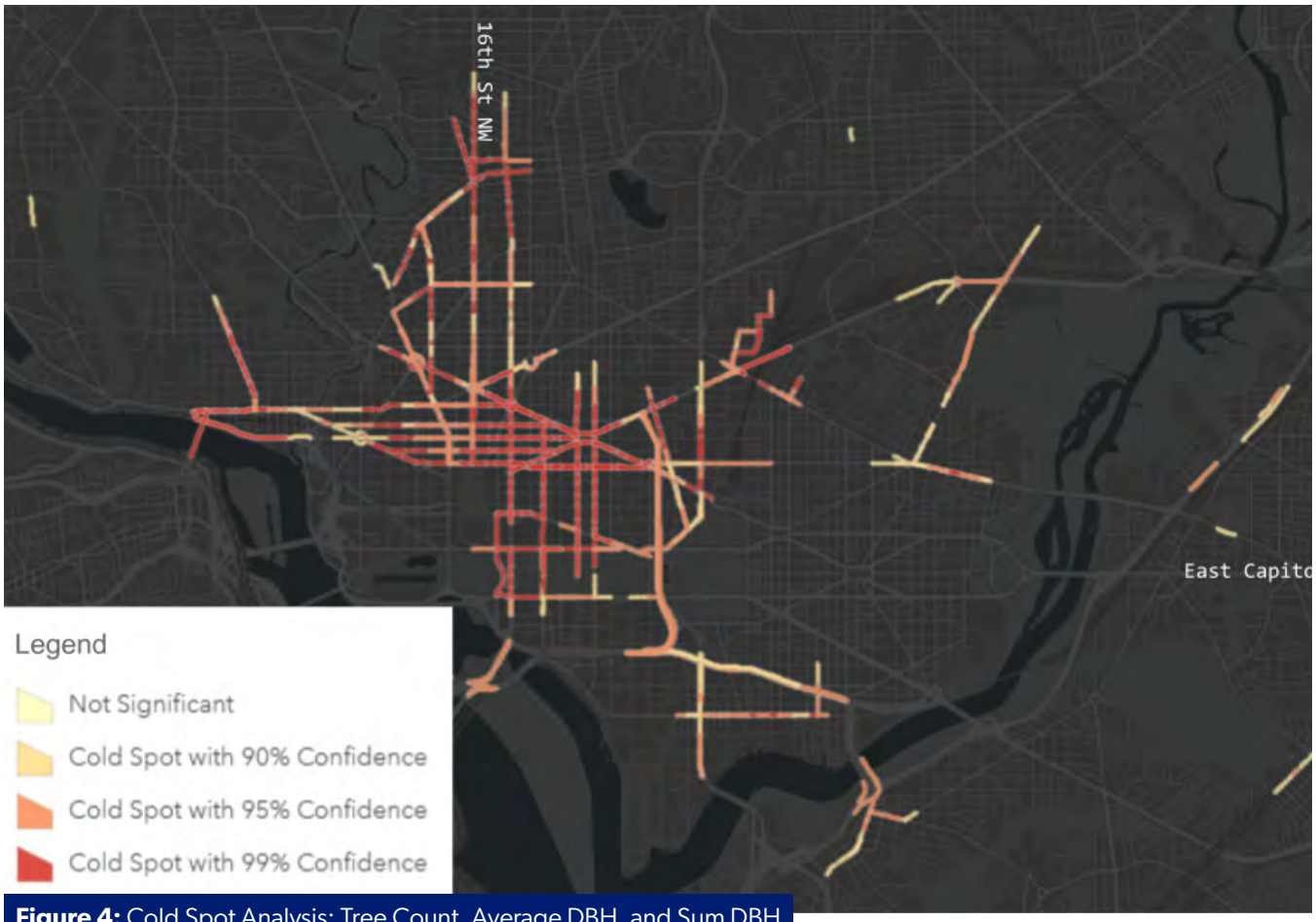

Figure 4: Cold Spot Analysis: Tree Count, Average DBH, and Sum DBH

By filtering the resulting map you can identify segments with large street trees (average DBH more than 15), small street trees (average DBH less than 5), many street trees (sum of DBH more than 500), few street trees (sum of DBH less than 20), and segments with zero street trees nearby. Segments with large street trees are more heavily concentrated in the Northwest quadrant. This pattern mirrors research showing more tree coverage in richer neighborhoods (which are concentrated in the Northwest quadrant of the District)[10]. Segments with small trees are more concentrated close to downtown (perhaps due to density, concentrated development, and construction which can require the removal of established trees).

2. Hot/Cold Spot Analysis - Tree Count, Average DBH, and Total DBH

A hot/cold spot analysis creates a map showing statistically significant spatial clustering based off of the aggregated freight route and street tree data outlined in method one. A hot/cold spot analysis can help planners narrow the focus of the general aggregation in order to identify areas ripe for intervention. A hot/cold spot analysis could be performed using a number of indicators from the dataset. For this paper, three hot/cold spot analyses were performed to find high and low clusters of (a) tree count, (b) average DBH, and (c) sum DBH.

10 Chuang. "Tree canopy change and neighborhood stability," 368.

Figure 4 shows the results of the three analyses (hot/cold spot by tree count, average DBH, and sum DBH) together on one map. The three analyses did not have matching results, however, and several cold spots recurred in two or more of the various analyses. These recurring locations may be prime areas to consider for interventions to increase the tree canopy or mitigate the impacts of freight traffic. Figure 4 shows that much of downtown D.C. is deficient in street tree cover.

3. Traffic Volume and Small Trees

A traffic volume analysis creates a map showing streets with high daily traffic volumes that overlap with freight routes with an average DBH (tree width) smaller than 5. This can help identify segments of the freight network that are most at risk from pollutants. Figure 5 shows streets in the District with an average annual daily traffic (AADT) of between 25,000 and 50,000 vehicles per day. The wider the line, the more traffic per day. Many of these roads are freight routes. Figure 6 shows streets with 25,000 to 50,000 AADT that intersect with freight route segments with an average DBH (tree width) less than 5, meaning these streets have significant traffic but small trees on average.

This method also builds off of the results of the aggregation method and can be modified to focus on different traffic counts (a proxy for pollution levels) and varying tree quality or quantity. Accuracy depends on the quality of the traffic count data and the tree dataset.

4. Proximity to Key Demographic Sites

The fourth method of analysis uses proximity to a public school as a proxy to demonstrate the health risk to the public from exposure to freight-related pollutants. D.C. Public School (D.C.PS) sites were chosen because they serve children and tend to be located in or near residential areas. A similar analysis could be performed for any vulnerable population where you have discrete

Figure 5: Traffic Volume, AADT between 25,000 & 50,000

Figure 6: Segments from Figure 5 with average street tree DBH less than 5

point data of locations frequently visited by the target population. Within the District of Columbia, there are only five D.C. Public Schools within a quarter mile of a freight route segment that is longer than 200 meters and has zero street trees. Figure 7 shows freight routes (a) that are longer than 200 meters, (b) have zero street trees, and (c) are located within a quarter mile of a D.C. Public School. These freight route segments may be ripe for intervention to reduce exposure to vehicular pollution.

This method requires the researcher to map priority populations that should be protected from vehicular exhaust pollution and their proximity to under-treed freight route segments. A modified analysis could target a variety of priority populations according to their locations, such as senior homes, daycares, hospitals, or low-income housing complexes. Further analysis could vary the length of the freight route segments in question or filter based on levels of traffic.

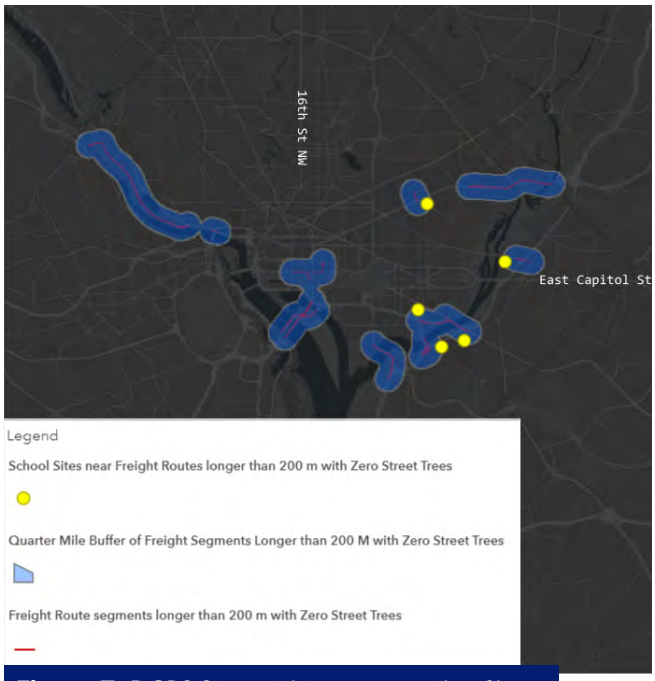

Figure 7: DCPS Sites within quarter mile of long freight route segments

Recommendations

This report has used general aggregation techniques, hot/cold spot analysis, traffic counts, and proximity to key sites as four methods by which to examine segments of a freight route network in need of interventions to limit public exposure to harmful pollutants. However, D.C.'s street tree dataset does not show the full picture of the quality and quantity of trees along freight routes. Until the dataset is expanded to include all trees, visual verification of the recommended priority areas is required. This can be accomplished by using Google Street View images to compare the expected tree coverage, based on the street tree analysis, to the actual tree coverage of a segment. This paper concludes with four recommendations for how the District of Columbia, and planners in general, can use this research to prioritize street tree planting and maximize the benefits trees provide.

1. Supplement Street Tree Data

The District's street tree dataset has a wealth of information that can be put to use to improve the quality of life in the District. However, the benefits from trees do not start or stop at the curb. To get a better understanding of the distribution of trees, D.C. needs better data on all trees within the District, not just the trees in DDOT's portfolio. The District should upgrade the street tree dataset by collecting information on (a) street trees on federal land and (b) non-street trees in parks, on federal land, and on private property.

2. Determine Street Tree Priorities

Jurisdictions and planners need to outline the priorities for street tree plantings. Today, plantings are typically requested by community members through a 311 phone number or mobile application used to request city services. This model can exacerbate inequalities in tree canopy coverage. While Sustainable D.C. 2.0 recommends that D.C. should prioritize trees in "priority areas," it does not provide specific guidance on what or where "priority areas" are[11]. Once priorities are defined, planners can use one of the methods above to help define priority locations. If a jurisdiction wants to maximize tree canopy coverage, it can use a simple heat map to identify cold spots. If a jurisdiction wants to protect vulnerable populations, it should look at tree coverage near key demographic areas. If a jurisdiction wants to ensure there are enough large, old, and healthy trees in every neighborhood, it should analyze average DBH. If a jurisdiction wants to protect nearby populations along heavily trafficked streets, it should look at tree coverage near high-traffic streets.

11 District of Columbia. "Sustainable D.C. 2.0 Plan," 112.

3. Plant Street Trees According to Priorities

Once a jurisdiction has determined the priorities for street tree planting, it can use the methods in this paper to create prioritization plans according to the nexus between street trees, freight routes, and the identified priorities. If a goal were to minimize exposure to pollutants, planners should review the body of research that examines the best type of vegetation to filter pollutants or what types of vegetation best allows for pollutant dispersion[12]. Not every tree is the same and different vegetation may provide different filtering and dispersion benefits[13]. The size, height, and whether the tree is deciduous versus evergreen may affect the tree's capacity to absorb pollutants or whether the pollutants are dispersed away from the street.

4. Create Additional Space for Street Trees

Downtown D.C. consistently ranked as an area of concern when analyzing the number and quality of street trees along freight routes. However, most of the designated spaces for street trees downtown are full. Given the typical density and intensity of use along downtown streets, the risk of exposure to harmful pollutants is heightened. While Downtown D.C. is a prime example, it is not the only area in the city that is nearing capacity for the current space allocated for street trees. In order to continue to improve tree quality and quantity, D.C. will need to find ways to add or re-purpose more public space for street tree planting.

Final Conclusions

Data Is Powerful, But Not Perfect

Data is powerful, but it cannot tell the whole story. Verifying results is necessary to ensure we do not blindly follow the recommendations of a dataset. Faulty or incomplete datasets skew the results of any analysis, so it is important for planners to identify gaps in data and advocate for improvements to data over time.

Defined Priorities and Goals Will Maximize Benefits

Trees take a long time to grow, and they are not all the same. Clearly outlining the priorities and goals of a street tree program will help planners maximize the benefits derived from street trees and help jurisdictions ensure their tree planting program improves equity and neighborhood outcomes over time. The goals and priorities of a community, ideally determined through a public planning process, will help identify the best method of analysis as well as the best types of trees to plant to maximize the benefits from a street tree program.

→ **For more visual analysis, see the accompanying GIS Story Map:** https://storymaps.arcgis.com/stories/7dfa37d31b814c10a9cc679d45bc3a93

12 Abhijith, KV; Kumar, Prashant. "Field investigations for evaluating green infrastructure effects on air quality in open-road conditions." Atmospheric Environment. March 15, 2019. Volume 201, 132-147. Accessed August 16, 2019.

13 Janhall. "Review on urban vegetation and particle air pollution," 135.

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How Mobility Hubs Create Synergy Between Mobility, Energy and Social Challenges

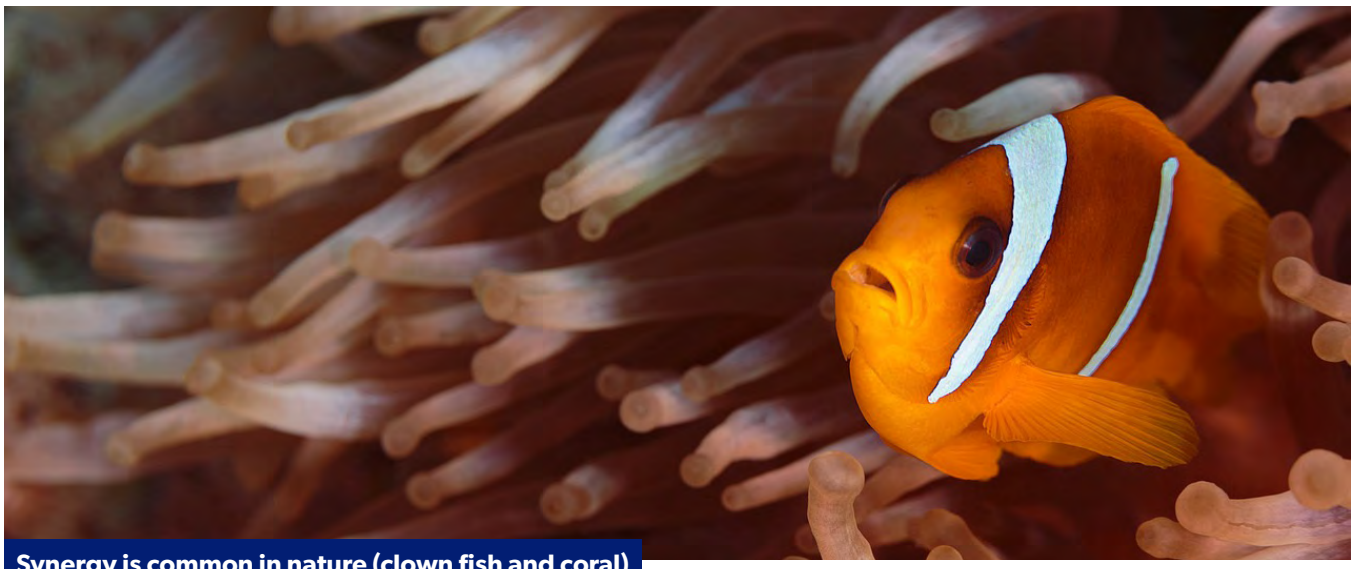
Willem Snel

Introduction

The earth is a beautiful place, with all of its refined ecosystems and natural intertwined networks. But it's vulnerable too. It's becoming increasingly clear that we have to make dramatic changes in order to survive. So, in order to make the right choices and set a course for the future of our world, we have to zoom out. Literally. When we view our earth from space, like an astronaut, it becomes very clear how vulnerable and small the planet is and how we are dependent on each other to define the right way forward.

The world's population growth has been concentrated in cities for several decades and will mostly be within current city limits during the forthcoming decades, which means we have to house a lot more people per km^2. But we are facing a multitude of other challenges in the 21st century too. The circular economy, a higher demand for green spaces and a flexible stock of available homes are all issues on the agenda and all demand square metres within our already densifying cities.

The world seen from the International Space Station



Synergy is common in nature (clown fish and coral)

At the same time, the energy transition resulting from climate change issues, such as air pollution, heat stress, flooding, etc. is now also appearing in our cities. The new energy networks and measures needed to effectively counter climate change effects both require physical m^2 within our cities.

Thirdly, social inclusion is a growing concern, as people are being left behind by an increasingly faster evolving society, be it as a result of a lack of income, a lack of digital skills, language or otherwise.

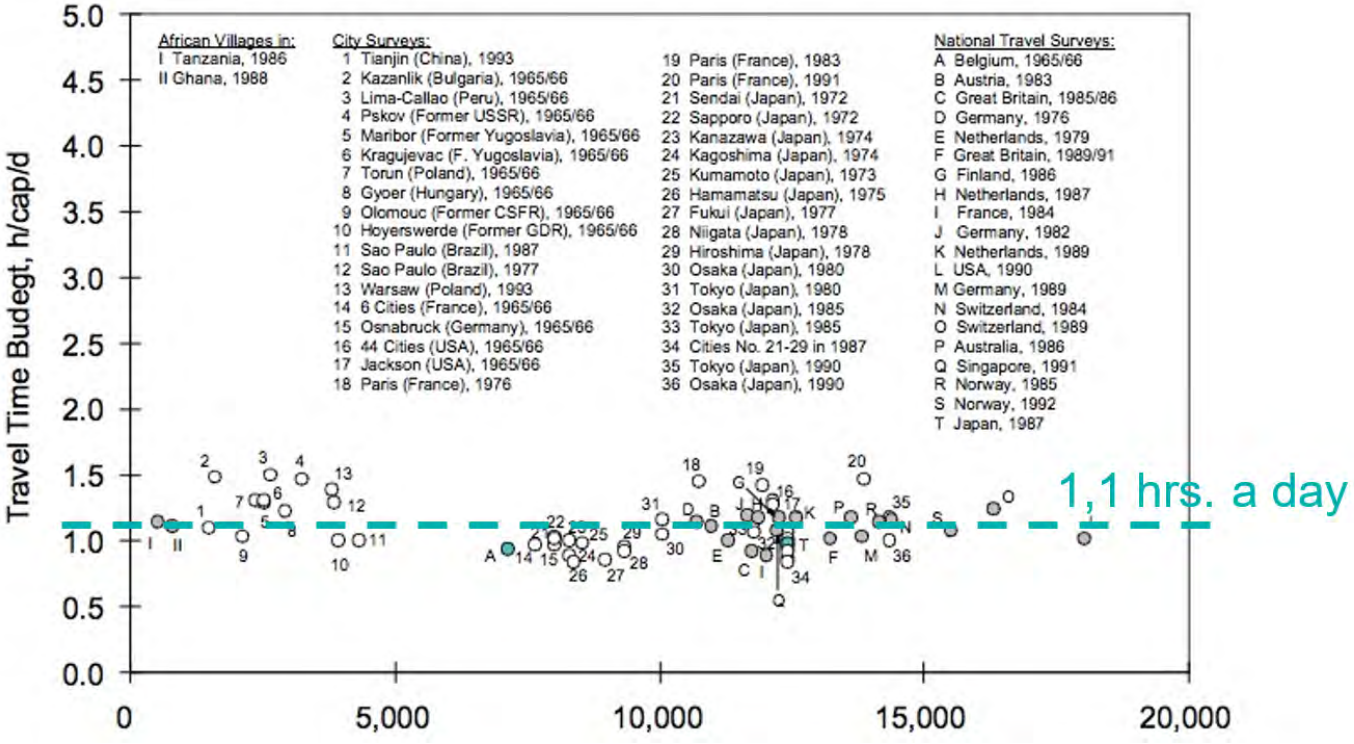
This article therefore focusses on urban areas, where challenges are the greatest and most complex and where a multitude of demands in the field of energy, climate, economy, greenery, safety, inclusion, habitability and recreation all require space. Approaching mobility as a discipline which creates rather than demands space, will literally generate more room for these other important goals.

Mobility hubs, which will be addressed in this article, have the potential to be a big part of the solution to reduce space used for mobility in cities. Space we can use for the other challenges our cities need to face. Mobility hubs can also become a 'battery for the neighbourhood' when combined with the energy transition. And they even have the potential to be an area's new 'social heart' as a result of their implicit use and functionality. We are thereby integrating mobility, energy and social amenities into a new kind of human ecosystem with synergy for all, ultimately resulting in a better quality of life.

Intertwined networks in nature as inspiration for human networks (protein interactions in Treponema pallidum)

Source: Titz B, Rajagopala SV, Goll J, Hauser R, McKevitt MT, et al. (2008)

An example: it is a known fact that cars are idle for on average 23 hours per day. Imagine, as a thought experiment, that all cars in the USA would be shared completely, without any private ownership, based on which we could do with a lot fewer cars as they would be on the road more and not be idle as much. This would save up to 6x the area of New York City or 50x Manhattan in parking spaces! The ever-increasing land prices in cities mean that parked vehicles and parking spaces are a waste of capital and space.



Mobility is not only a means to a goal, but also a goal in itself.

'Marchetti's constant: travel time per day around the world is always and has always been around 1,1 hours (66 minutes) a day. This is a travel need, so moving around is in our DNA. Less than 1,1 hours makes one restless, more makes one uncomfortable.

Source: Schafer, A; Travel Time Budgets (1998)

Future mobility is all about space!

'people throughput': space use of different modalities: equal numbers of people on foot, on bike, in bus and in car.

Source: Australian Cycling Promotion Fund

Looking back on nature's complex ecosystems and networks, let's try and use these as an inspiration to intertwine our own human networks (mobility, energy and social), in order to create a better future, with clean air, freedom to move and a good quality of life for everyone. This article is about making an initial step towards real synergy, as it's found in nature, where combining 1+1 is usually 3 and 1+1+1 could even be 6.

Mobility and spatial planning

Mobility is a basic need. Research around the globe has shown that all persons, wherever they are in the world, want to be mobile – move from A to B to C etc. – for a little over one hour per day. Mobility is not merely a means for reaching a destination, but a goal in itself. It is part of our DNA.

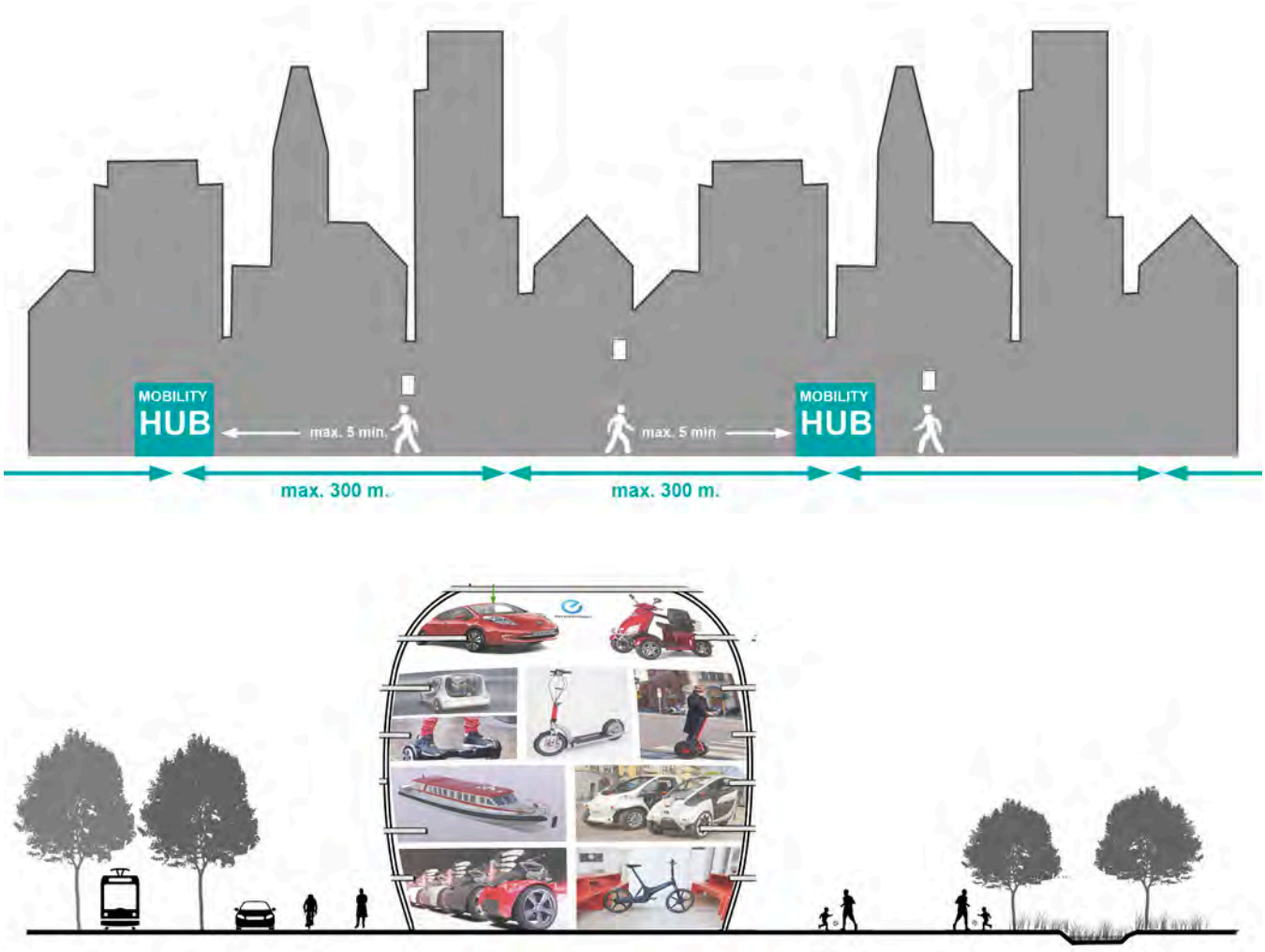
Moreover, urban development and mobility have been closely interrelated for centuries. Villages at junctions of routes and rivers grew into large cities, the invention of railways suddenly made our daily urban system a lot larger than our own village, and the car in its role as a means of transport available to many enabled our cities to keep expanding outwards and merge together-- the start of 'urban sprawl'.

But we are now facing the negative consequences of this urge to expand. Travel is starting to take too long; air and noise pollution are taking a toll; the system appears to be collapsing. Mobility has increasingly demanded more space, particularly because of the car as a private possession. Space which we are now in dire need of in order to reshape our cities in a sustainable manner and make them ready for the future.

The challenges in the 21st century are most pressing within existing urban areas, and the demands are even greater this time—a multitude of demands for buildings (densification), water storage (climate change), greenery (living quality and reduction of heat stress), and energy (energy transition) literally demand space within the already high urban construction challenge. We believe that a more space-efficient approach to mobility can create this space, but this would mean moving away from the trusted set of formalities and design rules; business-as-usual is no longer an option. We will need to adopt a

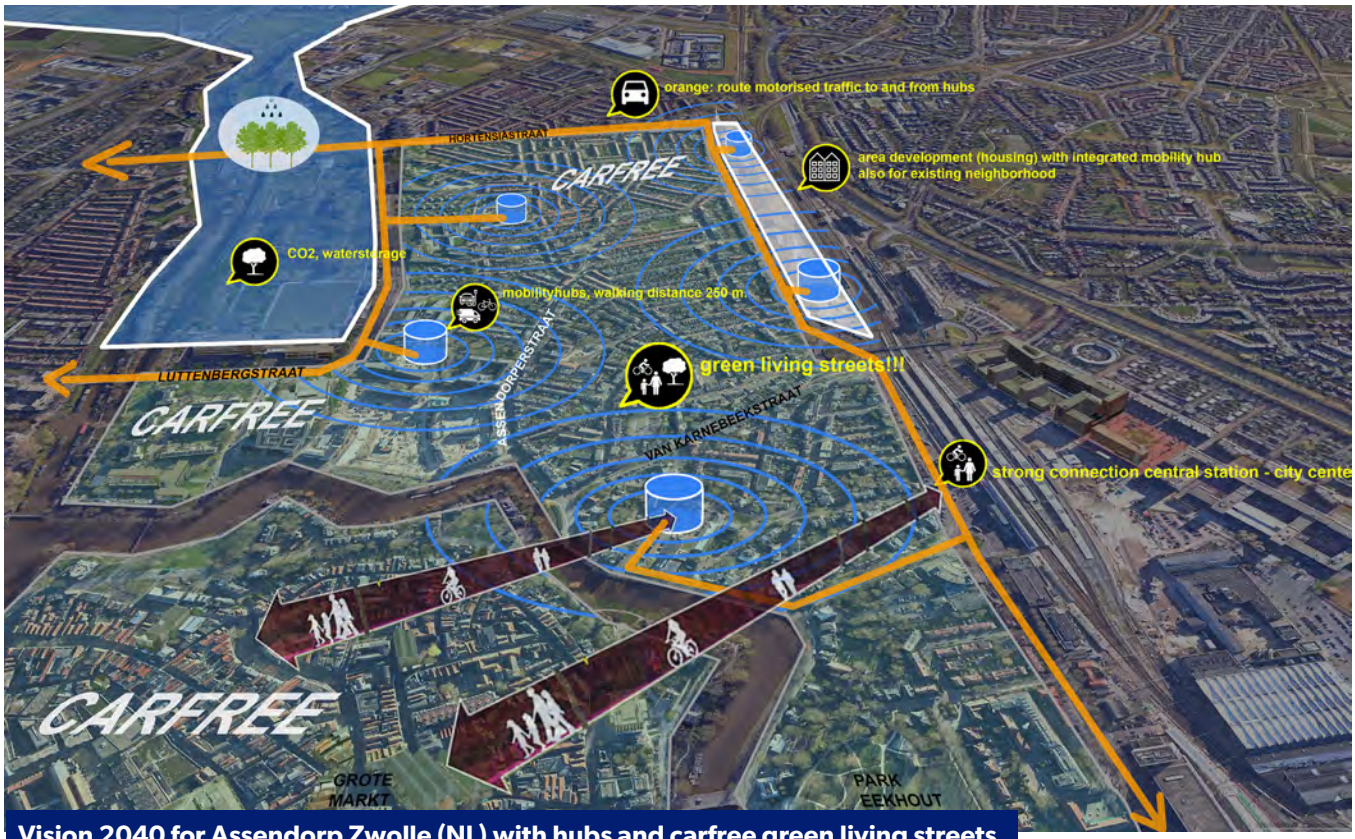
fundamentally different approach to mobility: "re-thinking mobility".

To "re-think mobility" we have to step into the future and imagine our cities in 2040. Mobility hubs as described here will not be here tomorrow, but if we co-operate and follow the dream, they present a tremendous opportunity to integrate mobility, social amenities and energy. In this article, the mobility hub concept is deliberately described from this future perspective, because a complex innovation such as this can only be realised when we start by imagining the future and then start to make (small) steps to reach that desired future.



Concept of a mobilityhub

A concentrated place with public transport and shared electric mobility, max. 300m. walking distance from your home. Shared mobility uses less parking and infrastructure, creating space for landscaping, playgrounds, stormwater storage and heat-stress reduction.



Vision 2040 for Assendorp Zwolle (NL) with hubs and carfree green living streets.

Mobility hubs

Shared electric mobility and excellent public transport

One of the concepts which can make a major contribution to 're-thinking mobility' consists of mobility hubs: a network of locations with a gathering of amenities where (shared) mobility and public transport are offered. Mobility hubs are not interchanges in this definition, but lively, pleasant places where you can find all facilities you would want to use. Not in an unpleasant parking garage, but in a beautiful place you actually want to be in. The hubs must, as a rule, be within easy walking distance (max. 300 metres or a 5 minute walk) from your home, because the idea is that everyone starts his or her journey in the hub to pick the shared vehicle of his or her choice for the day: public transport, bike, scooter, LEV, car, cargo bike, shuttle, boat, etc. Since there would be no ownership, the mode of travel can vary each day. Everything shared, everything as a service, and everything cheaper.

Depending on the density of the urban environment a hub will be bigger or smaller, because the denser the environment, the more people live within the 300 m. radius of the hub. Also, depending on the type of people or type of households, the type and quantity of modalities can be differentialized in order to offer just the right mix of mobility.

In this vision, the hubs would be the 'knots' in our future neighbourhoods, with a hub available for every urban inhabitant within 5 minutes, making ownership of modalities redundant.

Mobility hubs as social destinations

The current, and especially the future, urban citizen will most likely no longer be attached to possessions in this era of the sharing economy, but wants to be facilitated from A to B with personal freedom of choice in the fastest, cheapest, healthiest, or rather cleanest way. This is precisely what the concept of the mobility hub offers. Moreover, residents will change into selective travellers, because the automatic reflex to use the car for everything will be removed. For example, the high-quality availability of public transport and bicycles will make people more likely to choose these (cheaper, healthier, faster) options. This results in fundamental behavioural change!

This, in turn, leads to a reduction in the private ownership of cars (in particular), and a modal shift towards more public transport (the locations of the hubs will have to be aligned with the public transport system) and active and shared mobility. The space taken up by parked and driving vehicles is significantly reduced in this manner. One shared car for instance can already replace 4 private cars (source: CROW- KpVV, Going Dutch, 2014). This freed-up space can be used for the other challenges we face in cities: trees and water to reduce heat stress, bioswales for water storage, green areas to play in, separate cycling paths, etc., but also space that can be used for the major

Adding urban and social functions from a user perspective creates a 'heart of the neighborhood'. A beautiful place you start and end your journey each day, and meet people.

Visual of the hub, a high quality building with urban functions on the 1st floor, and high quality public space around, freed from parked modalities and transformed into green and pleasant streets.

densification challenge. Innovating in mobility concepts can literally allow mobility to offer space to these other challenges: Mobility as space-maker!

Because the hub would be the central location of your travel behaviour and the place where you start and end your journey every day, the hub is also a social meeting spot. After all, all residents in a radius of approximately 300 metres visit this space virtually daily. This makes the hub perfectly suitable for gathering other social and commercial functions such as a package pick-up point, a pharmacy, a supermarket, a childcare, a cafeteria, etc. But it can also house a municipal desk or information point where residents can be informed or ask questions about the use of shared mobility, a meeting spot for elderly residents, a community centre for young people, etc. This links the new, shared, and clean mobility to other functions in one's daily living and mobility pattern, and the hubs host social functions that lead to a greater social inclusion in this manner.

This turns the hub into the 'heart of the neighbourhood'. It must be a building with a great architectural quality and a human factor. The functionalities and the added value to the daily living pattern make it pleasant and desirable to make use of public transport or the electrical shared mobility in the hub rather than a private car.

Energy transition

Fossil fuel emissions and the associated air pollution and greenhouse effect is becoming an increasingly greater public health issue. A new absolute emissions record is registered almost every year. Mobility is responsible for 25% of these emissions. The US, Northwest Europe and China suffer from especially high levels of NOx pollution, resulting in health issues, and even in a life expectancy loss of 1 to 3 years. The need for

a rapid transition towards clean forms of mobility (electrification) is clear and urgent.

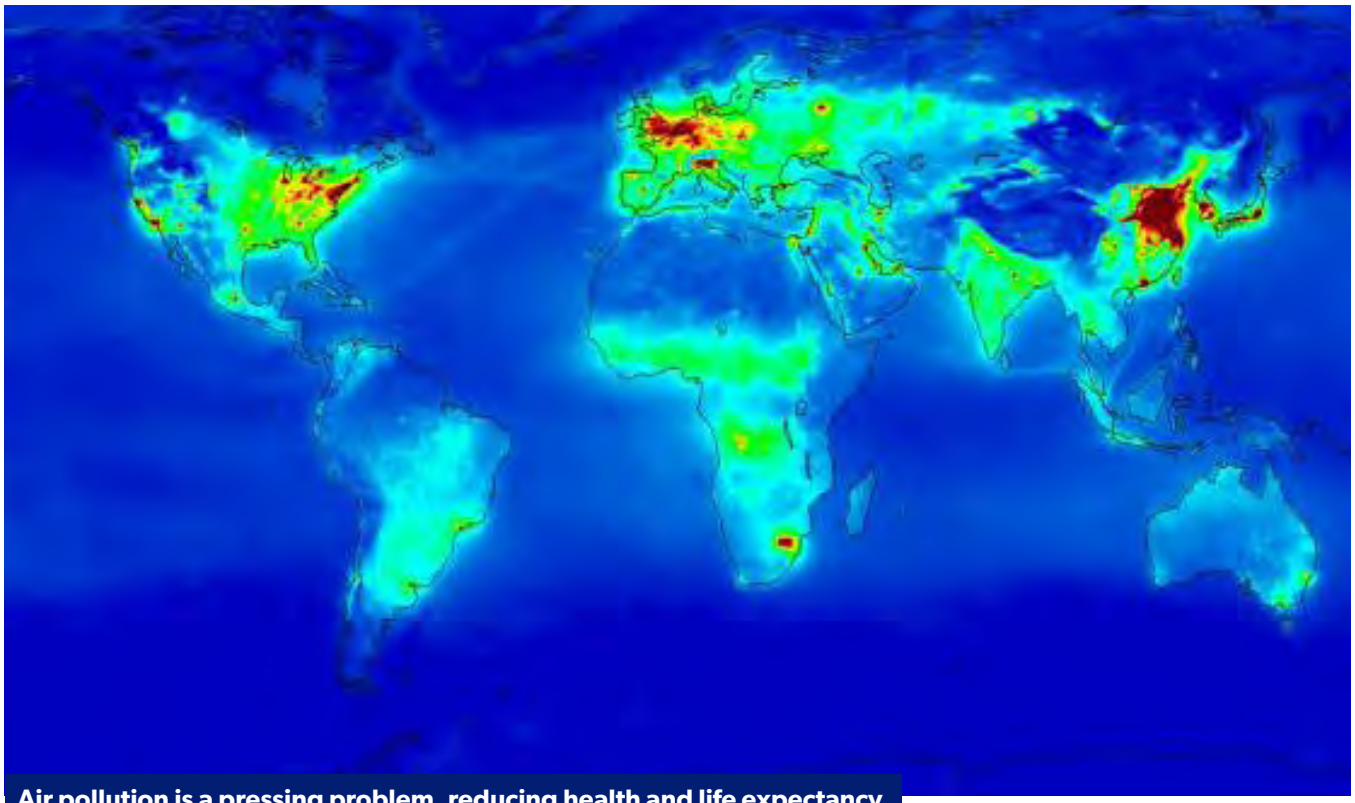
Clean mobility and the energy grid

Mobility hubs offer a major opportunity to accelerate the electrification of transport by only offering electric vehicles in the hub. Since all electric vehicles will have an excellent battery, this offers the opportunity to level the burden on the energy grid ('peakshaving') by charging and returning electricity from the car batteries to the energy grid (smart grid). After all, the capacity of the energy grids is facing increasing pressure because of the electrification and is at risk of exceeding its capacity at certain times. Mobility hubs can reduce or even prevent major investments in expanding the energy grid through this 'peakshaving'.

Mobilityhubs as energy source

But there are more opportunities. The hubs can also become the 'power houses' of the neighbourhood. After all, they are approximately 600 metres / 0,37 miles apart (2x the maximum walking distance from the perspective of the user). This creates the chance to provide homes in a radius of 300 metres around the hub with sustainably-generated heat using Aquifer Thermal Energy Storage (ATES), a system which stores water in the ground, used for cooling in summer and heating in winter.

A second potential source of energy is the hub itself: solar panels on top of the hub generate clean electricity for the vehicle batteries but can potentially also be used to offer homes around the hub with clean electricity (just like the ATES). The surrounding flat roofs will potentially also need to be equipped with panels to generate



Air pollution is a pressing problem, reducing health and life expectancy.

Source: KNMI; OMI satellite image of NOx pollution worldwide

Adding urban and social functions from a user perspective creates a 'heart of the neighborhood'. A beautiful place you start and end your journey each day, and meet people.

sufficient energy for this purpose. As a result, the hub does not only offer shared and clean mobility within a radius of 300 metres but also clean and sustainably generated energy: 'a battery for the neighbourhood'.

The ultimate dream is to offer all required mobility to each home in the city within a radius of 300 metres, and to provide them with all heat and energy from this hub. A 'smart grid' which puts less or no strain on the overarching energy grid, which otherwise would have to be highly invested in to expand its capacity.

Business case through synergy

In the mobility hub concept, the merger of mobility, energy, and urban functions results in a comprehensive 'heart of the neighbourhood', a place where true synergy arises. This synergy, in particular, is the business case underlying this concept. The separate aspect of shared mobility can often not be turned into a comprehensive business case at this time. But the combination with energy and social functions is such an added value to the business case that it becomes feasible. The ultimate result is:

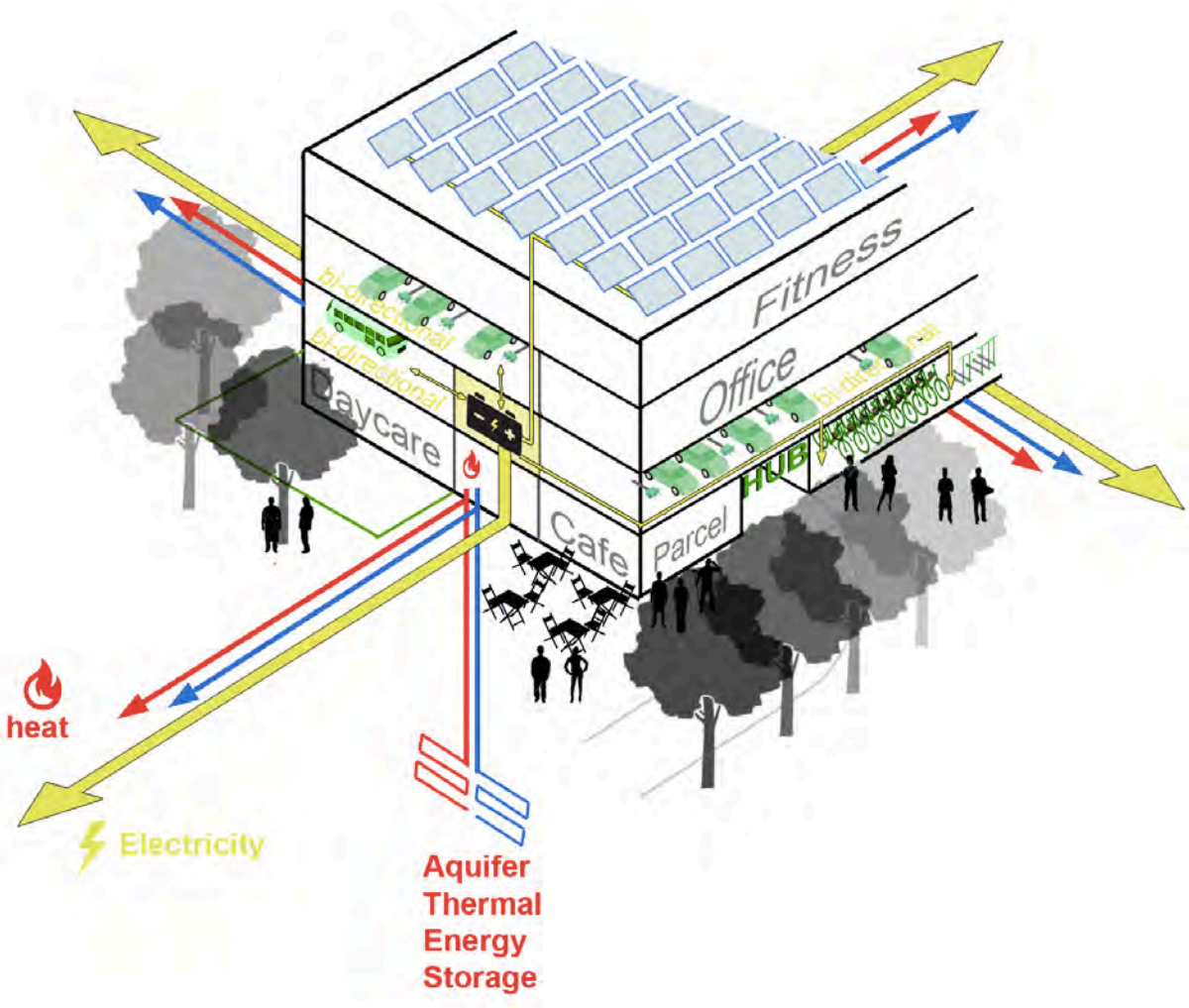
- Less space taken up by parked cars. Space that can be used for climate adaptation: water storage/ reducing heat stress, greenery, playgrounds, active mobility (walking/cycling), or better public transport.
- Accelerated transition towards electric mobility, which is very urgent from the perspective of NOx emissions and climate change.
- Improved social structure in the neighbourhoods. A radius of 300 metres within

which everyone can find mobility, energy, and facilities leads to a sense of community, like in a village. A shared interest and something to be proud of.

- A '5-minute neighbourhood' with all mobility and daily amenities a 5-minute walk away.

Area developments as incubators

Large-scale area developments are being planned at the moment in virtually all cities around the world in order to meet the demand for housing. These area development projects are perfectly suitable for testing and implementing innovations such as mobility hubs. After all, the way in which we want to live, move, and work can be fully re-invented in these area developments, because we know that a relocation (of a residence or place of work) is the perfect time to achieve behavioural changes in people. Mobility behaviour is notorious learned behaviour, which means that a compelling event like moving your home or place of work to a new area development is the most opportune moment to truly make people travel in a different manner. By thinking in terms of personae and giving fictitious users a real face, we can find out which other needs the future residents and users have. In this way we can



The hub as a high-quality addition to the urban fabric. Mobility, Energy, urban functions come together in one beautiful place.

The hub as a high-quality addition to the urban fabric. Mobility, Energy, urban functions come together in one beautiful place.

customize for each area development the type and quantity of mobility hubs and modalities and make them perfectly suited for the (future) inhabitants.

These customizations and additions are not limited to mobility, but specifically concern other facilities such as package pick-up points, daycare, fitness, supermakets etc. The development of an area with predominantly single-person households will result in different requirements in terms of facilities and mobility than a family-oriented area development. Thinking in terms of demographics with living and travel styles ensures that the mobility facilities can address the needs, rather than the other way around. Facilities based on demand, not based on supply. One size does not fit all!

The business case becomes clear here for parking alone. Focussing on public transport, active mobility, and shared transport significantly reduces parking needs. Parking in an urban redevelopment project will generally need to take place underground or at least in a built structure. An average cost price of a built parking space of approximately € 25,000 ($27,580) quickly leads to € 150 million ($165 million) in savings in construction costs in an average urban area development of 5,000 homes. This financial benefit should specifically be used to create mobility hubs, Mobility as a Service services, but also to investment in high-quality public transport.

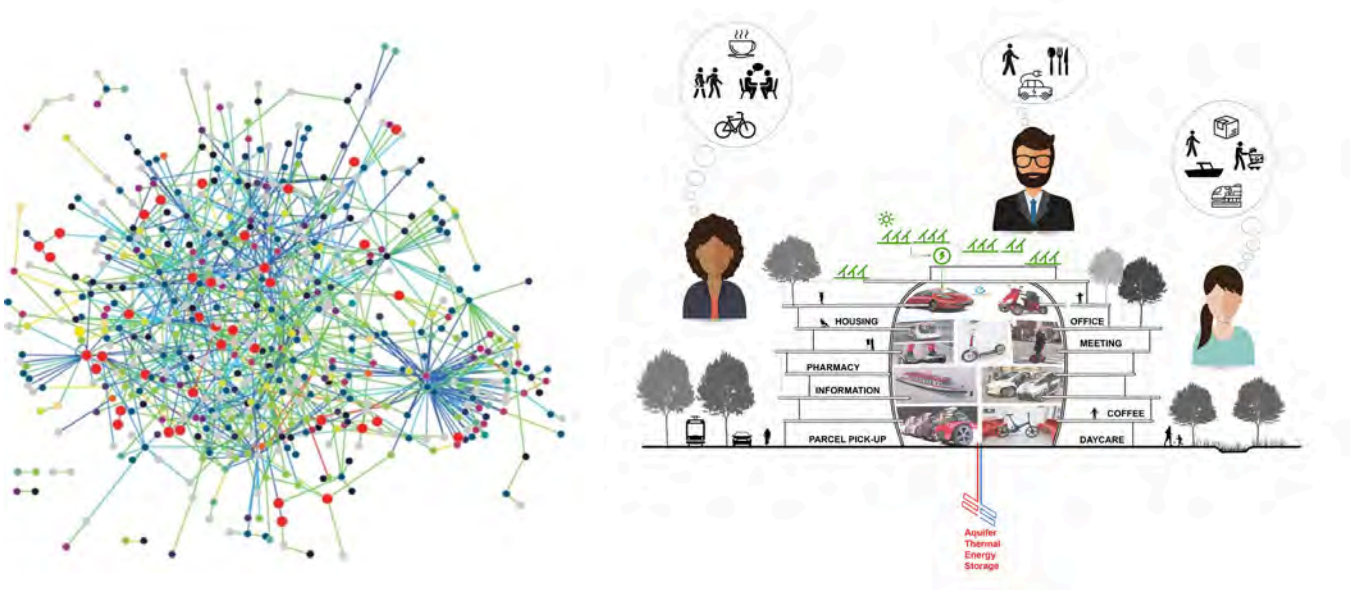
The lessons learned in area developments and the associated new behaviour can also be used in existing urban areas in the future. Shared mobility will replace parking spaces on the streets, which

results in an enormous quality improvement of the public space. This results in more space for landscaping, playing, water storage, space to meet people, and in turn leading to a higher 'qualify of life'!

Symbiosis and synergy

True innovation and progress can only be achieved when we really start to collaborate, not only private and public partnerships, but also inter-disciplinary partnerships among mobility, energy, economy and social departments within governments. Mobility hubs require a comprehensive approach to mobility, behaviour, energy, urban planning and architecture of policymakers, designers, residents and developers, in order to truly capitalize on the potential. Considering the major challenges and the pressure on available space, all parties – particularly city governments – will need to take this step towards more comprehensive and less sectoral considerations to be able to remain healthy and attractive cities: now and in the future.

When we look back at this in 2050 – from space – we will hopefully be able to conclude that we have learned from symbiosis in nature, and that we have accordingly linked our own human networks together in an intelligent manner, creating true synergy and quality of life.



The dream for the future: mobility, energy and social neworks coming together in an intertwined system, inspired by nature.

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Noise: the Silent Killer

Alex Baum, Kees Den Hollander & Rens Jonker

Cities provide many opportunities and advantages for people and society in general. The concentration of residents and visitors enables innovation, collaboration, and cultural exchange. The vibrant streets of these melting pots of humanity used to be characterized by the sounds of people conversing, children laughing, and merchants selling goods. Today's city streets, by contrast, are a cacophony of roaring engines, screeching wheels, and blaring horns – not the sounds of a healthy place to live, work, or play.

In fact, road traffic noise is a major health concern that affects many people and needs to be addressed. Many proposed solutions focus on engineering and technology, either by blocking the noise from reaching people using barriers or by eliminating it from the source, for example by applying quiet electric engines. It is important however to consider other solutions, such as reducing car usage and lowering vehicle speeds. These approaches have additional benefits such as reducing tailpipe emissions, improving road safety and increasing livability.

In order to understand the problem and possible solutions, this paper first demonstrates the seriousness of road traffic noise by refuting three false claims which are often used as excuses for not taking concrete steps against noise. These claims are:

1. road traffic noise has no real effects on human health
2. road traffic noise only affects a small portion of the population
3. road traffic noise affects fewer people than air and rail traffic noise.

Once the seriousness of road traffic noise is affirmed, this paper then reviews what has been done to address road traffic noise. One of the challenges of governments addressing road traffic noise is that it often falls under the responsibility of multiple departments, such as transportation and environmental protection. Enforcement is then delegated to a separate department such as the police.

Major efforts to address road traffic noise began in the 1970s with federal legislation. In a few years, however, these initiatives lost funding and effectively ended, signaling that road traffic noise was not considered a priority. Since then, some local governments have taken up the cause, generally in the form of noise codes or ordinances. Work that continues on the national level, for example through the Federal Highway Administration or the Transportation Research Board, is generally limited to blocking the noise, such as by building sound barriers around highways.

Finally, this paper evaluates a series of "alternate" or "new" solutions that seek to reduce, eliminate, or mitigate harmful road traffic noise in urban areas.

1. Focus on the vehicle engine itself and reduce or eliminate the noise at the source. This technology-oriented solution is often suggested but could take the longest to realize.
2. Focus on the type of vehicles and emphasize shifting to smaller, quieter, and when possible, human-powered. This logistics-oriented approach requires planning, coordination, and funding, but provides added benefits such as improved street safety.
3. Eliminate all non-human-powered vehicles from certain streets or at certain times. This spatial / temporal approach acknowledges that noise is a reality in cities, but that it should be confined to certain corridors or certain periods of the day. As mentioned above, this strategy does not actually reduce the overall city noise, but simply shifts the problem into selected areas.
4. Reduce vehicle speed. This indirect approach could be the simplest to accomplish in terms of major infrastructure, logistics, or technological changes, but also may have the least actual impact on the noise level.

Is road traffic noise really that bad?

The problem of road traffic noise is often dismissed for several reasons. Noise in general is often thought of as more of a nuisance or an annoyance and not a real health concern with serious health effects. Additionally, road traffic noise is thought of as a concern limited to the unlucky few who live on high volume streets, and not a problem affecting a large segment of the population. Finally, because a single car is far quieter than, for example, a plane or a train, many also believe that road traffic noise is less of a concern when compared with other modes. All of these perceptions have been proven false, demonstrating that road traffic noise is a serious health concern that needs to be addressed.

Road traffic noise is more than a nuisance and has been demonstrated to have serious, long-term negative health impacts. The World Health Organization (WHO) has determined that "at least one million healthy life years are lost every year from traffic related noise in the western part of Europe."[1] In terms of specific health impacts, the European Environmental Agency (EEA) has linked exposure to road traffic noise with increased stress and reduced sleep which can result in premature death, cardiovascular disease, cognitive impairment, sleep disturbance, and hypertension.[2] In fact, the WHO has categorized noise from road traffic alone as the second most harmful environmental stressor in Europe, behind only air pollution from fine particulate matter.

Road traffic noise also affects a major segment of the population and cannot be dismissed as a niche concern. Within the U.S., the American Housing Survey (AHS), administered by the Census Bureau, collected household level data on perceptions of road traffic noise from 1997-2009. Respondents were asked to evaluate whether their neighborhood "has heavy street noise/traffic," and, if so, whether the noise/traffic is "bothersome," and, "so bad you want to move."

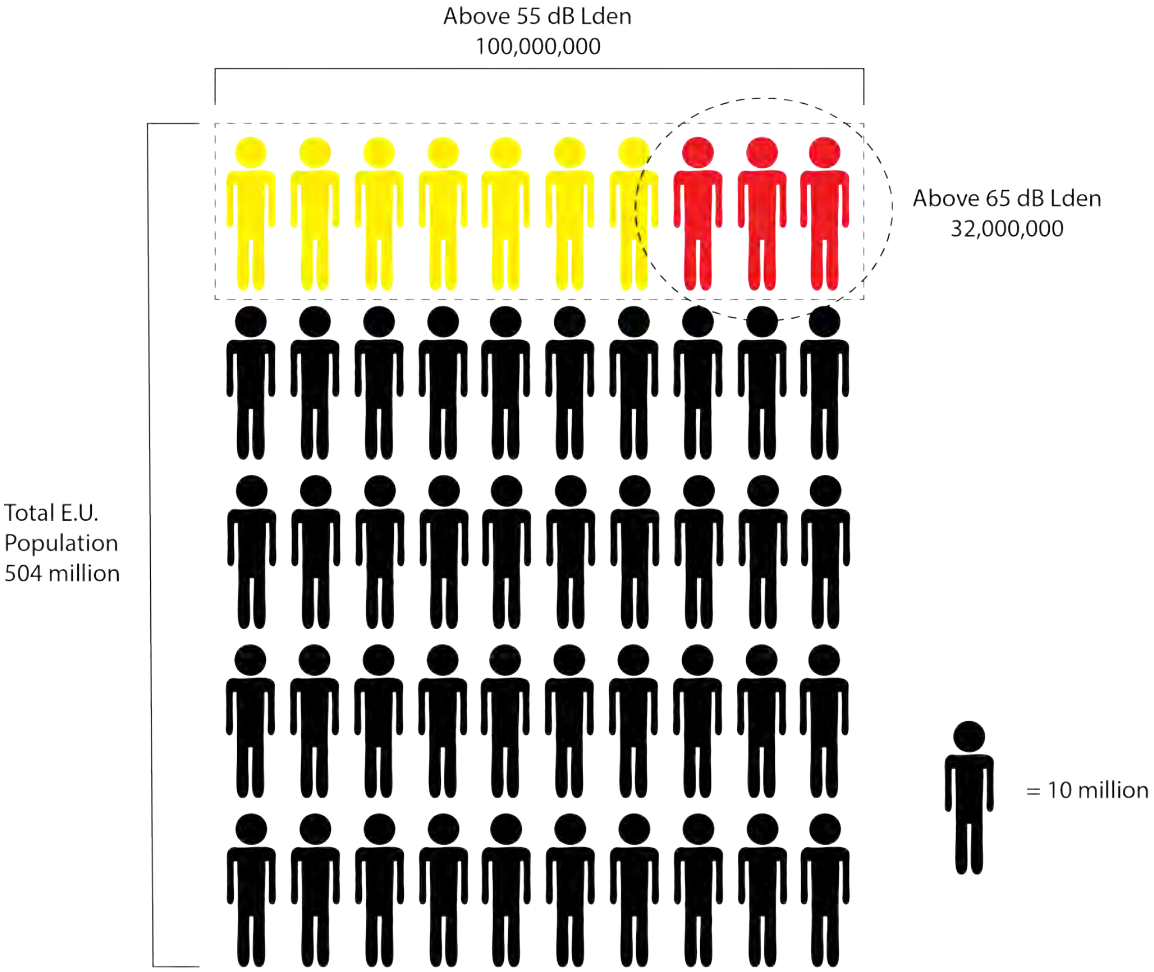
In 2005, 1 in 4 households reported street noise present, over 1 in 10 households reported that this noise was bothersome, and over 1 in 25 households stated that the noise was "so bothersome they want to move."[3] Assuming an average household size of 2.6 people, based

1 World Health Organization. Burden of disease from environmental noise, 2011. Retrieved from: https://www.who.int/quantifying_ehimpacts/publications/e94888/en/

2 European Environment Agency. Managing exposure to noise in Europe, 2017. Retrieved from: https://www.eea.europa.eu/themes/human/noise/sub-sections/noise-in-europe-updated-population-exposure.

3 United States Census Bureau. ***American Housing Survey, 2005***. Retrieved from: https://www.census.gov/programs-surveys/ahs/data/2005/ahs-2005-summary-tables/h150-05.html

Graph 1: Different Levels of Reported Noise Exposure Compared with Total U.S. Population (2005)



Graphic produced by the author with data from the American Housing Survey (2005) and American Community Survey (2005).
Note: Numbers, except U.S. Population, based on number of households multiplied by average household size of 2.6 people.

on the population and number of households in 2005, that means that nearly 30 million Americans suffer from bothersome street noise and that for over 11 million it is so bad that they want to move.[4] (See Graph 1) In 2009, nearly 1 in 4 households, representing nearly 68 million people, responded that there was "bothersome street noise or heavy traffic present."[5] Although questions relating to noise were eliminated from the AHS after 2009, it can be assumed that this trend has continued to grow.[6]

Outside the United States, according to the EEA, an estimated 100 million people within the 33 member states are exposed to road traffic noise above 55 decibels, which is the threshold above which noise is harmful.[7] Of this group,

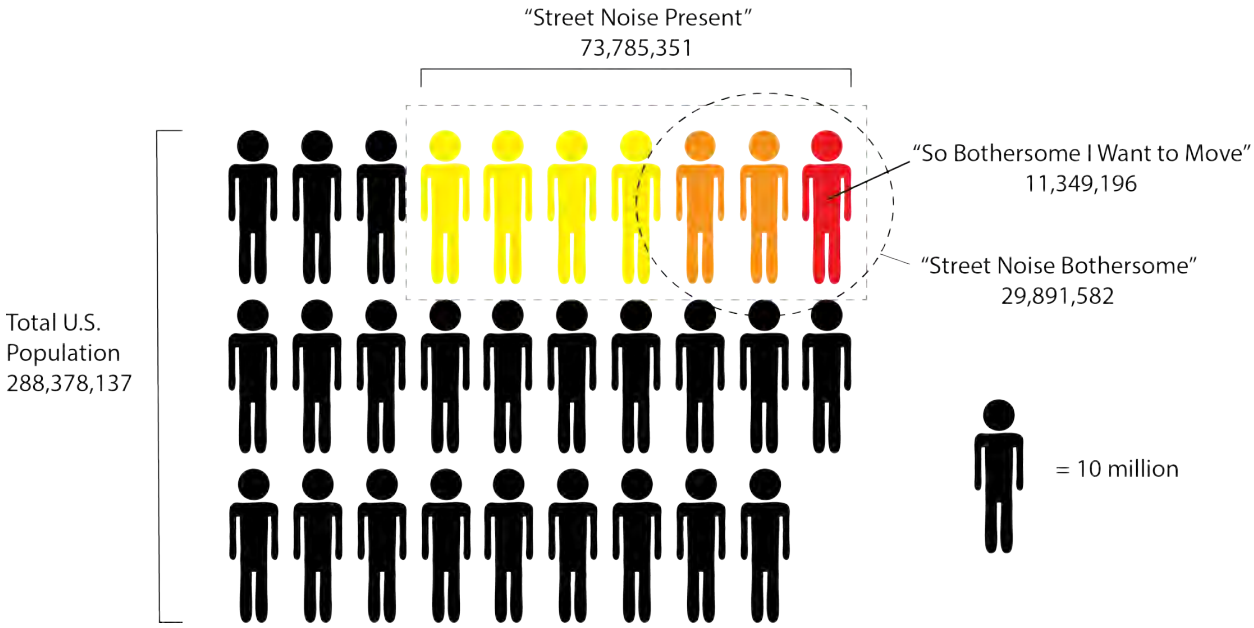
4 United States Census Bureau. American Community Survey, 2005. Retrieved from: https://www.factfinder.census.gov

5 United States Census Bureau. American Housing Survey, 2009. Retrieved from: https://www.census.gov/programs-surveys/ahs/data/2009/ahs-2009-summary-tables0/h150-09.html

6 Eggers, Frederick. "Streamlining the American Housing Survey." Prepared for the U.S. Department of Housing and Urban Development Office of Policy Development and Research. Econometrica, Bethesda, Maryland. June 2009.

7 European Environment Agency. Road traffic remains biggest source of noise pollution in Europe, 2012. Retrieved from: https://www.eea.europa.eu/highlights/road-traffic-remains-biggest-source

Graph 2: Number of People in the E.U. Exposed to Different Noise Levels Compared with Total E.U. Population (2012)

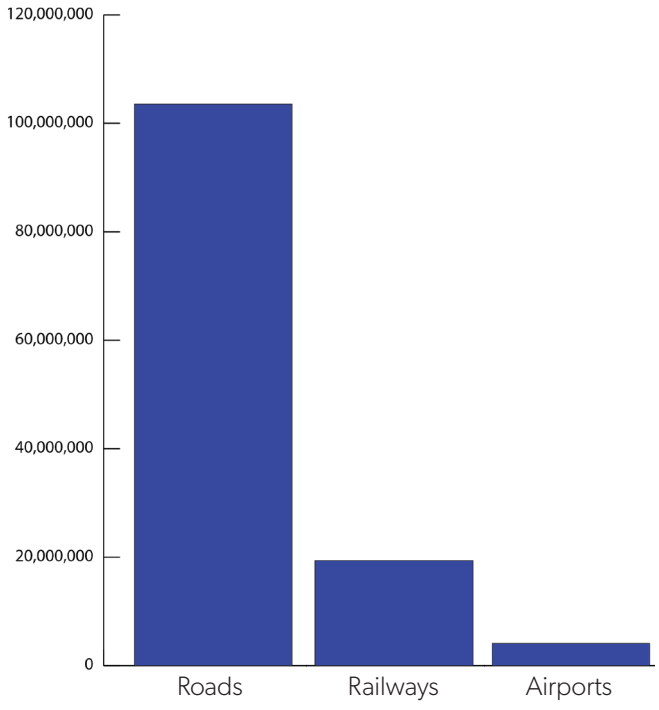


Graphic produced by the author with data from the European Environment Agency and Eurostat.

approximately 32 million people are exposed to road traffic noise above 65 decibels, which is deemed to be very harmful. (See Graph 2)

As compared with other seemingly louder transport modes, road traffic noise is of far greater concern due to the number of people impacted. In fact, the EEA has shown that, within the transport sector, road traffic noise far outweighs rail and air traffic noise in terms of the population affected.[8] Compared with the 100 million people affected by road traffic noise, approximately 19 million people are affected by rail traffic noise and just over 4 million people are affected by air traffic noise. (See Graph 3)

Graph 3: Number of People in the EU Exposed to Noise Levels above Lden 55 dB (2012)



Graphic produced by the author with data from the European Environment Agency.

8 European Environment Agency. Road traffic remains biggest source of noise pollution in Europe, 2012. Retrieved from: https://www.eea.europa.eu/highlights/road-traffic-remains-biggest-source

What steps have been taken to address road traffic noise in the United States?

As a result of these misperceptions, little has been done within the United States to address the problem. Road traffic noise was first addressed at the federal level in 1972 with the passage of the Noise Pollution and Abatement Act. The Act established the Office of Noise Abatement and Control within the Environmental Protection Agency and sought to address noise in three primary ways: first, coordinate federal research and activities around noise control; second, establish federal noise emission standards; and, finally, to inform the public of the noise emissions from products.[9] Despite the best intentions, the Act lost its funding in 1981 and the work on the federal level effectively ended, though the laws associated with the Act have never been rescinded. Since then, the responsibility for addressing noise has shifted to lower levels of government. The resulting state and local laws currently in force are largely based on the regulations established by the EPA in the 1970s.

The Federal Highway Administration (FHWA), as a result of the Federal-Aid Highway Act of 1970, is responsible for road traffic noise abatement, but its responsibility is limited to federally-funded highway projects involving new highway construction or the addition of new lanes.[10] Other than through the use of noise barriers, the FHWA also advocates for Noise Compatible Planning, such as using open space as a noise buffer, though the agency has limited control in local land-use decisions.[11]

The Transportation Research Board, a research arm for the National Academy of Sciences, Engineering, and Medicine, focuses on road traffic noise through its "Transportation-Related Noise and Vibration Committee." Unfortunately, the committee's work in this area, similar to the FHWA, focuses almost entirely on mitigating highway noise, particularly through noise barriers. In fact, the committee's focus is so limited to the use of noise barriers, despite their limited applicability, that it acknowledges that "Most roadway noise analysis and abatement therefore focuses on these types of roads [limited-access highways or arterials with few curb-cuts] and does not address many of the other types of highly traveled urban or suburban arterials or feeder roads."[12]

As a result of this focus by federal agencies and research groups on highway noise, many cities have taken it upon themselves to regulate road traffic noise on non-highway streets under their control. New York City's Noise Code, for example, prohibits plainly audible (without a detection device) muffler or exhaust noise from vehicles under 10,000 pounds that can be heard at a distance of 150 feet.[13] For motorcycles and vehicles over 10,000 pounds, the distance is 200 feet. In general, these laws tend to target individual vehicle owners rather than general traffic noise.

One of the main challenges associated with reducing, eliminating, or mitigating road traffic

9 42 U.S. Code § 4901(b).

10 United States Department of Transportation, Federal Highway Administration, Office of Planning, Environment, & Realty, Highway Traffic Noise, https://www.fhwa.dot.gov/environment/noise/. (Last accessed: 01/02/2020)

11 United States Department of Transportation, Federal Highway Administration, Office of Planning, Environment, & Realty, Highway Traffic Noise, https://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/. (Last accessed: 01/02/2020)

12 Transportation Research Board, TR News, Number 240, September-October 2005 (Page 11). Retrieved from: http://onlinepubs.trb.org/onlinepubs/trnews/trnews240.pdf

13 City of New York. Local Laws of the City of New York for the Year 2005, No. 113. Retrieved from: https://www1.nyc.gov/site/dep/environment/noise-code.page

noise is that the responsibility often falls on multiple levels of governmental authority and departments. Who is responsible for road traffic noise within a city? Which level of government – federal, state, city, or other – should be the primary authority? This can be tricky if roads are owned, operated, or maintained by different levels of government within the same city. The department in charge of handling road traffic noise can also be difficult to define. Road traffic noise is often grouped with all other types of noise and, in the case of New York City, falls under the responsibility of the city's Department of Environmental Protection. Enforcement can also be difficult to assign – in New York City it is shared by the DEP and the police department, depending on the issue. In Los Angeles, the Noise Enforcement Team of the Los Angeles Police Department handles noise issues. In addition, because traffic noise reduction is often thought of as an engineering problem, such as using different pavement types or building sound barriers, rather than a planning problem, the issue is usually assigned to engineers rather than planners who might approach the problem differently. In the next section, four different planning-focused solutions will be discussed and evaluated to determine which solution or combination of solutions would help cities tackle the challenge of road traffic noise and improve their livability.

How should road traffic noise be reduced, mitigated, or eliminated?

This section reviews four possible solutions that address road traffic noise. A description of each solution follows, along with an evaluation of its advantages and disadvantages. Additionally, the section considers whether a solution provides additional benefits in terms of safety and livability. Finally, the section discusses general steps necessary for implementation.

Technology Solution

New technology can play a major role in reducing noise from individual vehicles. Improvements in electric engines, tire materials, and road surfaces can make vehicles virtually silent, as evidenced by the recent introduction of regulations that would require artificial noise be added to new electric vehicles.[14]

As compared with other seemingly louder transport modes, road traffic noise is of far greater concern due to the number of people impacted

Logistics Solution

A second possible solution is better optimizing the vehicles used in cities. Many vehicles are designed and used for both short and long trips, at high and low speeds, and with small and large amounts of passengers and cargo. As a result, most vehicles are over-engineered for the needs and limitations of cities; they create more noise, emit more particles, and take up more space than is necessary. For example, according to the 2017 National Household Travel Survey, over 35 percent of vehicle trips are two miles or less.[15] In addition, the average occupancy of a vehicle per vehicle-mile is 1.67.[16] Given that most vehicles are designed for at least 4 people, that is an oversupply of noise, particle emissions, and space. For many people, nearly all of these short, single-person trips could be completed by

14 Stenquist, Paul. Why Quiet Cars are Getting Louder. New York Times, 10/24/2019. Retrieved from: https://www.nytimes.com/2019/10/24/business/electric-vehicle-noises-nhtsa.html

15 U.S. Department of Transportation, Federal Highway Administration. ***National Household Travel Survey, 2017***. Retrieved from: https://nhts.ornl.gov/

16 Ibid.

	Overall Impact on noise	Behavior Change	Infrastructure Changes	Additional Benefits (Improved Safety / Livability)
Technology	High	Low	High	Neither
Logistics	High	High	High	Safety and Livability
Spatial/Temporal	Low	High	Low	Safety and Livability (select areas / times)
Speed	Low (depends on actual change in speed)	Low	High (depends on the level of traffic-calming)	Safety

walking, bicycling, or some other form of electric micro-mobility. Similarly, in terms of freight and delivery services, rather than using a tractor-trailer or large truck, many shipments could be completed using small electric vans or electric-assisted cargo bicycles.

Spatial / Temporal Solution

A third solution eliminates most non-human-powered vehicles from certain streets and/or at certain times. This spatial/temporal approach acknowledges that noise is a reality in cities but that it should be confined to certain corridors or periods of the day. Barcelona, for example, has limited or barred motorized traffic from some residential neighborhoods altogether. There, smaller residential blocks are compiled into so-called "superblocks", with the inner streets only accessible to pedestrians, bicycles, emergency vehicles, and residents' vehicles.

Speed Solution

The final approach seeks to reduce noise through speed reduction. Vehicles are generally quieter at slower speeds, so reducing speed limits could reduce road traffic noise. According to the Noise Pollution Clearinghouse, "reducing vehicle speeds from 40 to 30 mph is as effective as removing one half the vehicles from the roadway."[17]

Evaluation

Each solution has advantages and disadvantages. The table above highlights a few key advantages and disadvantages and rates them for each solution as being "Low" or "High". Additional benefits resulting from the solution are also noted.

Overall Noise Reduction

Of all possible solutions, the technology and logistics solutions have the highest overall impact on noise. The impact of the speed solution on overall noise would depend on the actual reduction in speed, but would likely be less of an impact than the technology and logistics solutions.

The spatial / temporal solution could have an impact on the overall noise level if, as a result of low-noise areas and times, people and companies switched to quieter modes. It is more likely, though, that this solution would simply shift the

17 Noise Pollution Clearinghouse. ***Noise Increases with Vehicle Speed.*** (Last Accessed: 01/02/2020) Retrieved from: https://www.nonoise.org/resource/trans/highway/spnoise.htm

noise to other areas and times. For those living in predominately residential areas, the noise level would likely be reduced, but for those living in more mixed-use areas and on major streets, the noise would likely worsen as loud vehicles are concentrated in certain corridors. If cities are to achieve a sustainable level of density, and want to encourage active mobility, cities can no longer be segregated into separate commercial and residential areas and must have mixed-use buildings, streets, and neighborhoods.

As a result, if all areas have some level of commercial and residential development, it would be hard for a city to justify the decision as to on which streets noisy vehicles are allowed and which not. From a temporal perspective, if an area is mixed-use, with housing, retail, and office space, then there would not necessarily be a logical time of day that would be least disruptive for noisy vehicles.

Behavior Change

Certain habits, behaviors, and processes are very difficult for people and companies to change. As a result, the less a person or company has to change, the more likely a solution is to be successful and implementable. The logistics solution would require a significant shift in behavior and process as people switch to other modes and companies modify their shipping and delivery processes and invest in smaller and electronic or human-powered vehicles. The spatial / temporal solution would also require a shift in shipping and travel patterns in order to avoid low-noise areas and times. The technology and speed solutions would not require major behavioral changes.

Infrastructure Improvements

Major changes to infrastructure are expensive, can take a long time to implement, and require significant public sector coordination and planning. As a result, the less major infrastructure must be changed in order to implement a solution, the more likely it will be implemented.

The technology solution relies heavily on cities providing the required charging infrastructure, both in the space required for charging stations and the strength of the electric grid to handle a massively increased load. The logistics solution would require new transfer centers where goods could be moved from large trucks and trains to smaller electric or human-powered vehicles. In addition, in order to encourage people to shift to non-car modes, significant investments in public transit as well as pedestrian and bike infrastructure would need to be made in most cities.

The speed solution would also require major infrastructure in order to truly lower traffic speed. While speed sensors could be deployed and traditional policing increased, to truly limit speed, roads would need to be re-designed with narrower lanes, roundabouts, traffic calming devices such as speeds humps and chicanes, and speed-timed traffic lights.

The spatial / temporal solution requires the least, if any, major infrastructure changes as it relies on restricting access to certain areas and at certain times.

Added Benefits (Safety / Livability)

When reducing noise also improves other conditions in cities such as road safety and overall livability, everyone wins. As a result, the more a solution also improves road safety and overall livability, the more likely it is to be implemented.

The logistics and speed solutions could both improve the road safety and overall livability in cities, through slower speeds and a move towards smaller, human-powered vehicles.

The technology solution presents the fewest additional benefits to cities. As mentioned above, reducing vehicle noise can actually make vehicles more dangerous to the safety of pedestrians and

cyclists, especially at night, in inclement weather, and for those with visual impairments. In addition, simply reducing the noise from vehicles, rather than reducing the number of vehicles, does not necessarily make an area a pleasant place for children to play or for people to interact.

With the spatial / temporal solution, the road safety and livability benefits would only be felt in some areas or at some times and in other areas or times it would likely get worse. In addition, any policy around noise would likely conflict with other strategies such as reducing traffic or loading congestion. New York City's Off Hour Deliveries program, while speeding up deliveries and reducing congestion, faces the obvious challenge of reducing the noise of deliveries during nighttime hours. The program's website has a lengthy page dedicated to "Noise Management" that provides recommendations as well as references to the NYC Noise Code regarding quiet technology, as well as transporter and receiver behavior.[18]

Special Note on Technology

The technology solution suffers from an uncertain implementation timeline. Electric vehicles have been around since the first half of the nineteenth century and yet a number of factors have contributed to the glacial pace of adoption. It currently takes approximately 15 years for the entire U.S. fleet of internal combustion engine vehicles to turnover, meaning that many vehicles built in 2020 will still be on the road in 2035. With new electric vehicles, though, despite a decline in sale prices and improvements to battery technology, many purchasers are concerned about the availability of charging infrastructure, the range of the vehicles, and the high sale price, thus potentially lengthening the fleet turnover rate.[19]

Implementation

In addition to evaluating the likeliness that a solution will be implemented, it is also important to discuss what steps will be required to implement the various solutions. As discussed above, efforts to reduce road traffic noise have been limited at all levels of government for a number of reasons. This section will address some of those major stumbling blocks and limitations.

Similar to the way cities have organized their Vision Zero efforts, road traffic noise reduction will require a multi-department task force made up of representatives from the departments in charge of transportation, health, and business, as well as enforcement. An important early step of this task force will be to set increasingly ambitious benchmarks for the number of people exposed to road traffic noise and the level of exposure. Based on these benchmarks, priority areas with the highest number of people exposed to the highest noise levels should be addressed first.

As discussed in the logistics solution, cities also need to encourage people and companies to use vehicles that are quieter and are a better fit for the needs and limitations of a city. Making it easier and safer to use different modes through improved infrastructure will encourage this switch. In addition, making it more difficult and expensive to drive through road and parking pricing, the elimination of minimum parking requirements in zoning codes, and higher taxation on vehicles and fuel will force people to think twice about which mode they use for trips. In terms of freight vehicles, shippers and delivery services will need to better optimize their shipping routes and improve the transition of goods between long-distance trucking or rail to more local vehicles.

18 City of New York, Department of Transportation. Noise Management. (Last accessed: 01/02/2020) Retrieved from: https://ohdnyc.com/noise-management

19 Toth, Jacqueline. For Widespread Adoption of Electric Vehicles, Many Roadblocks Ahead. Morning Consult, 05/22/2019. (Last accessed: 01/02/2020) Retrieved from: https://morningconsult.com/2019/05/22/for-widespread-adoption-of-electric-vehicles-many-roadblocks-ahead/

At the federal and state levels, specific regulations for road traffic noise need to be set. These regulations should provide deadlines for when vehicle manufacturers must meet certain noise levels for new vehicles as well as similar deadlines for when older vehicles above a certain noise threshold will no longer be allowed on the road. With each deadline, the acceptable level of noise produced from the vehicle will be reduced.

Enforcement is another key aspect for these solutions to be successful. Given the limitations and costs of traditional policing, technology needs to play a key role. France, for example, has experimented with devices that identify and fine noise regulation offenders.[20] These sensors could also be used to enforce the spatial / temporal strategy by detecting and fining violating vehicles that enter designated quiet streets or operate at designated quiet times.

Conclusion

Road traffic noise in cities is a major health concern that affects a significant percentage of the overall population. Up until now, little has been done to address the problem.

This paper reviews four possible solutions and evaluates them based on a set of criteria. The paper then discusses a general implementation strategy for cities. While this paper reviews each of these potential solutions separately, the most effective solution is likely a combination of all of them.

When city streets return to human-scale, human-speed, and human-volume-level, and people can live, work, and play in a healthy setting, the true potential of the close concentration of residents and visitors can be realized. Streets make up 80% of the public space in cities and can be places where people debate new ideas, work together to create change, and celebrate diverse cultural customs.

20 Van der Ven, Michel. ***Frankrijk test 'geluidspaal' die luidruchtige voertuigen op de bon slingert.*** Tweakers, 09/02/2019. (Last accessed: 01/03/2020) Retrieved from: https://tweakers.net/nieuws/156740/frankrijk-test-geluidspaal-die-luidruchtige-voertuigen-op-de-bon-slingert.html

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Transportation Energy Beyond Fossil Fuels: Reducing Vehicle Miles Traveled

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Current State of Transportation Energy

The world's energy use is primarily driven by fossil fuels, especially in the transportation sector. This reliance on fossil fuels is unsustainable into the future, damaging to the environment, and causes security concerns, so it is important to focus on reducing transportation's dependence on fossil fuels through technological and behavioral changes. Transportation energy is an important topic for planners because planners can affect people's use of personal vehicles through changes in planning-related programs, policies, plans, and code updates.

U.S. Transportation Energy Consumption & Trends

A total of 101.19 quadrillion Btu of total primary energy was consumed in the U.S. in 2018, averaging just under a two percent increase per year since 1949. Specifically, for the transportation sector, a total of 28.48 quadrillion Btu of total energy was consumed in the U.S. in 2018 (28 percent of total energy consumption)[1], averaging a two percent increase per year since 1949 (see Figure 1).

1 U.S. Energy Information Administration, Monthly Energy Review November 2019

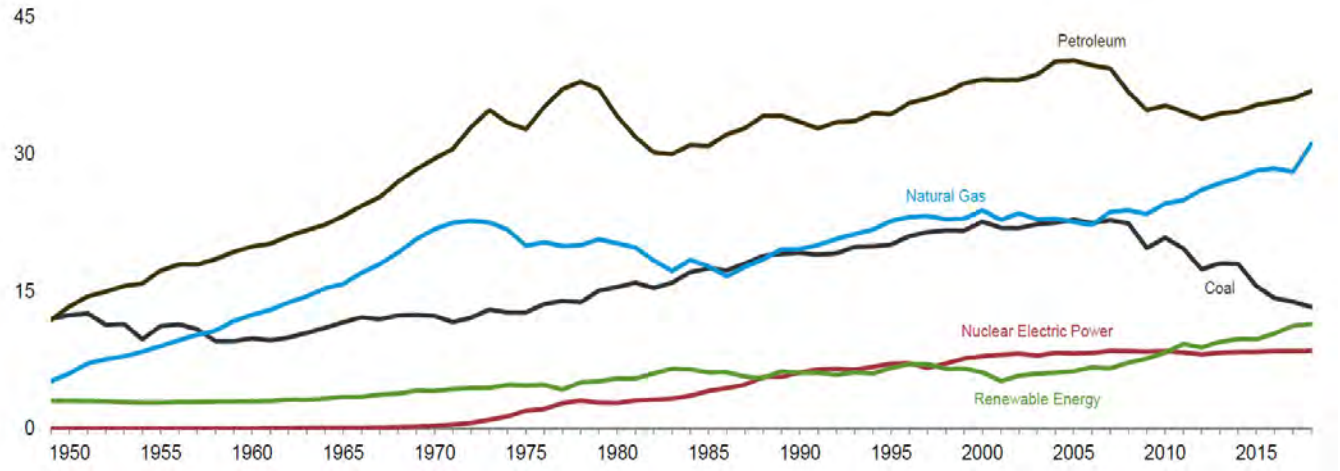

Figure 1: Energy Consumption by Sector, 1949-2018

Source: U.S. Energy Information Administration, Monthly Energy Review November 2019

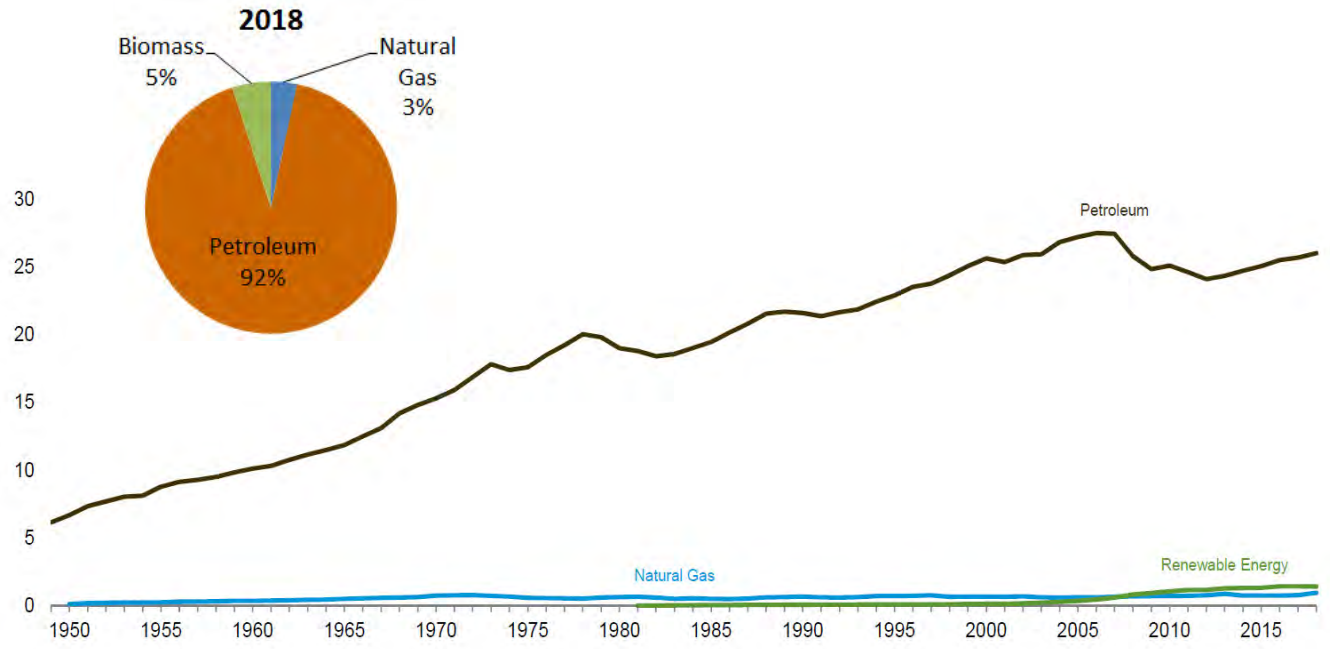

Figure 2: Transportation Sector Energy Consumption, 1949-2018

Source: U.S. Energy Information Administration, Monthly Energy Review November 2019

In addition, 91 percent of transportation energy consumption in 2018 was from petroleum[2] (see Figure 2).

Vehicle Miles Traveled Definition & U.S. Trends

Vehicle miles traveled (VMT) is defined as the total miles traveled by all road vehicles in a specific geographic area in one year, divided by the total population of that area[3]. As of September 2019, the current (12-month adjusted) VMT in the U.S. was estimated at 3.25 trillion vehicle miles[4], which is a historic high (see Figure 3). Comparing with previous years, VMT has increased by 39 percent over the last 25 years (2.34 trillion vehicle miles in 1994). Also of note, VMT was steadily increasing at two percent per year from 1994 to 2007, at which point the recession started and VMT reduced slightly (for the first and only time) until 2014 when it started increasing again at approximately 1.5 percent per year.

Transportation-Related Energy Issues

This heavy reliance on road vehicles and usage of fossil fuels directly contribute to several world-wide issues:

- Environmental damage
- Energy supply limitations
- Energy dependability and security concerns

Environmental damage that is connected to transportation energy includes climate change from greenhouse gas emissions, air pollution from vehicle emissions, water pollution (from roadway stormwater runoff and acid rain), and energy extraction impacts (habitat damage, water pollution, acid mine drainage). The transportation

2 U.S. Energy Information Administration, Monthly Energy Review November 2019

3 U.S. Department of Transportation, "VMT Per Capita," February 2016.

4 Federal Highway Administration, Traffic Volume Trends September 2019, and U.S. Department of Transportation's Bureau of Transportation Statistics, "National Transportation Statistics 2018."

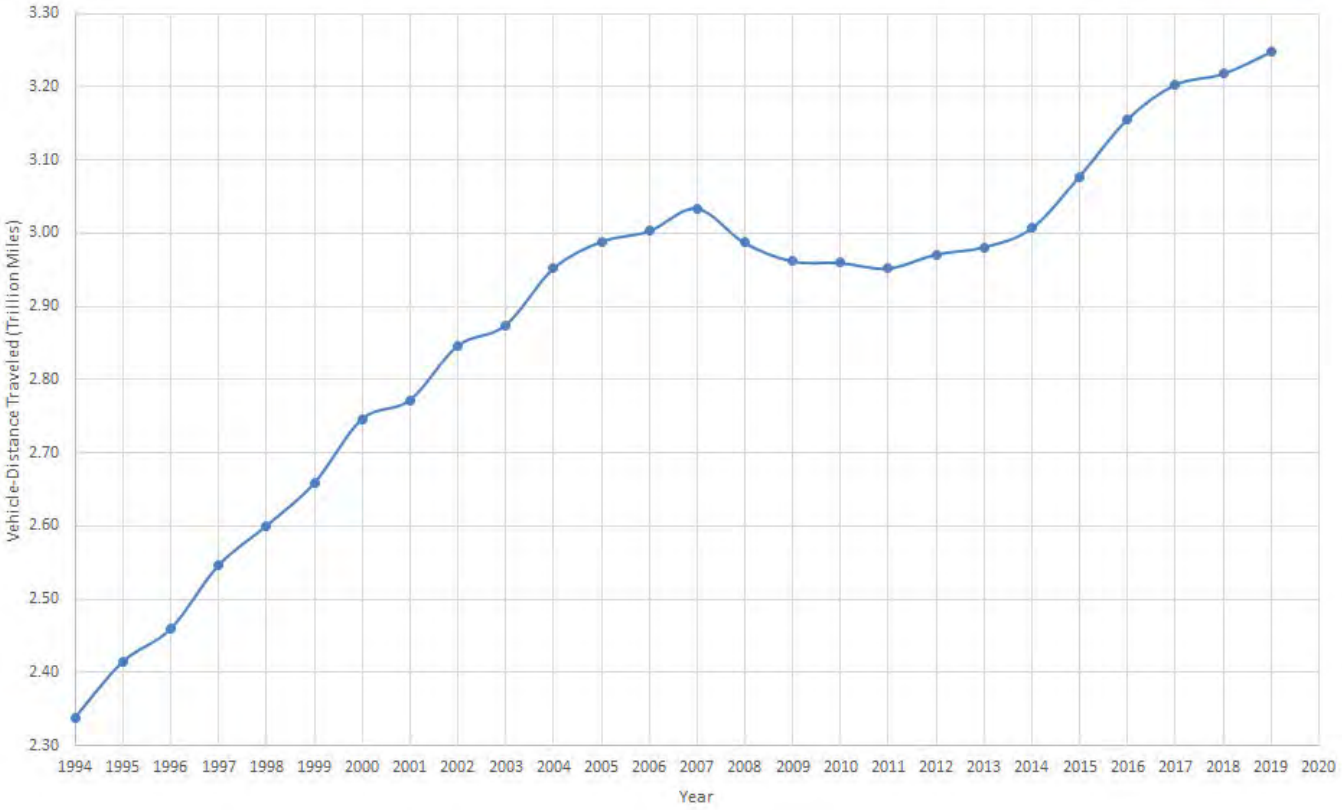

Figure 3: Travel in Millions of Vehicle Miles, All Roads & Streets, September 2019

Source: FHWA Traffic Volume Trends, September 2019

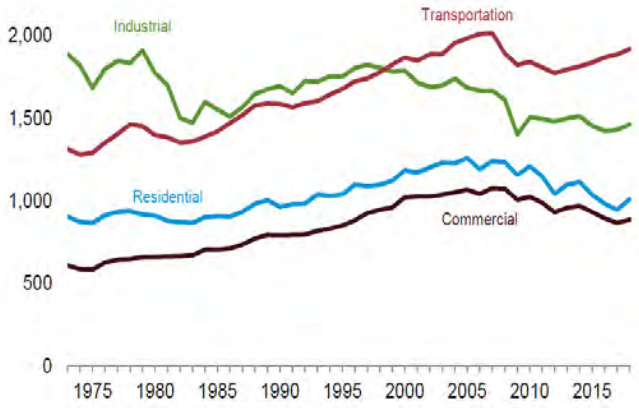

Figure 4: Carbon Dioxide Emissions from Energy Consumption by Sector, 1973-2018

Source: USEIA Monthly Energy Review November 2019

sector is currently the largest producer of carbon dioxide emissions (see Figure 4).

Energy supply limitations are related to the usage of nonrenewable energy sources, including the steady decrease of reserves that are increasingly difficult to extract and the related price fluctuations that occur with shortages. In addition, although U.S. production (and export) of petroleum has increased in recent years, the U.S. still consumes far more than its produces and is therefore dependent on non-domestic sources (outside the U.S.). Energy security concerns are connected to the reliance on non-domestic energy sources. Many of these non-domestic energy sources are located in politically unstable or volatile areas. World events can affect international crude oil markets, and instabilities in supply areas can cause production disruptions and transport restricts.

Addressing Transportation-Related Energy Issues Overview

To address the transportation-related energy issues, solutions can be grouped into three main categories:

1. Improve vehicle energy intensity
2. Use low-carbon fuels
3. Reduce vehicle miles travelled

A high-level overview of these three categories was introduced in the 2013 State of Transportation Planning. Then, the first category (improving vehicle energy intensity) was explored more in depth in the 2016 edition. Then, the second category (using low-carbon fuels) was discussed in the 2018 edition. These first two categories are focused on technological changes, both of which have been shown to contribute to addressing transportation-related energy issues. A great deal of research and invention has been directed toward these two categories in order to improve the related technologies even further.

However, research indicates that these two categories, alone, will not be able to fully address the transportation-related energy issues[5]. The third category, reducing vehicle miles traveled, is therefore essential to achieving a sustainable future for our civilization. This third category is challenging in that it requires human behavioral change, and, also as critical, requires elected and appointed leaders at all levels of government to approve and enforce programs, policies, codes, regulations, and laws that reinforce this behavioral change. As a result, reducing vehicle miles traveled may be the most challenging category of solutions to attain, but it also may be the most important since it not only will address transportation energy issues, but it can also help to address other economic, environmental, health, and safety issues (discussed further below).

The next sections focus on different methods that can be used to address reducing vehicle miles traveled. In general, studies have shown that people drive less as travel alternatives become available, as driving becomes more expensive and less convenient, and as trip destinations move closer together[6]. Therefore, the following solutions are grouped by ways to influence people (1) to **make fewer trips** and (2) to **use alternative modes of travel**. – i.e. travel less; travel differently.

Travelling Less

The first group of VMT reduction methods focus on how to influence people to travel less and make fewer trips. Options include:

- ***Build denser, mixed-use land uses*** – A variety of land uses can be grouped together in areas at higher densities so people can make one trip by car and then walk around to their various destinations versus driving multiple places in various locations to accomplish the same tasks. It is also important to focus this development in and adjacent to already-developed areas instead of greenfields and undeveloped areas. This option can be accomplished by local governments updating their comprehensive plans, land use maps, and zoning codes and by local inter-governmental coordination.

5 Mangan, Emily, "Do climate plans do enough on transportation?" Smart Growth America, Transportation for America program, November 2019.

6 Deborah Salon, "The Effect of Land Use Policies and Infrastructure Investments on How Much We Drive: A Practitioner's Guide to the Literature." UC Davis National Center for Sustainable Transportation, California Digital Library, November 2015.

- ***Prioritize infrastructure maintenance*** – People do not want to travel (drive) on congested roadways. Since we cannot 'build our way out of congestion,' we should instead focus more of our time, resources, and funds on maintaining the infrastructure we have over making improvements to roadways and building new roadways. This option can be accomplished through changing policies and programs at federal, state, and local levels of government related to infrastructure improvements and maintenance.

- ***Enact congestion pricing*** – Directly charging motorists for the use of a roadway via tolls can serve as a deterrent and reduce the number of people choosing to drive on certain roads at certain times, with the added benefits of reducing congestion and raising additional revenues for roadway maintenance. This option can be accomplished by the governmental entity that owns the roadway converting it to a tolled roadway with toll booths and technology that can change rates depending on the time of day and/or congestion level of the roadway and/or congestion level of the roadway. Typically, limited-access roadways, such as freeways and highways, work best for conversion to congestion pricing since roadways with a high density of access points make controlling users a challenge. To assist roadways users, vehicle management systems and phone or dashboard apps can be introduced which provide real-time route information and mode choice alternatives, such as transit.

- ***Increase parking rates*** – Similar to congestion pricing, increasing the cost of parking, especially in dense areas with limited parking, can also serve as a deterrent and reduce the number of people choosing to try to park in those areas at certain times. There are also added benefits of reducing congestion and raising additional revenues for parking lot maintenance. This option can be accomplished by local governments working with parking lot owners to increase their rates and vary the rates depending on the time of day and/or congestion level of the roadway. Also, local governments can convert existing free public parking to metered parking, with the option to vary the rates also.

- ***Raise the cost of gasoline/decrease subsidies*** – Increasing the cost of gasoline does not have a specific time or location deterrent like for congestion pricing and parking costs, but it instead serves as an overall deterrent to driving and influencing people to travel less. This option can be accomplished at the federal, state, and local levels of government through the federal excise tax (currently 18.30 cents per gallon as of January 2019), state gasoline taxes (varies by state, currently averaging 28.31 cents per gallon as of January 2019), and local taxes (sales taxes and other local taxes, varies by locality).

- ***Increase the cost of vehicles and maintenance*** – Similar to increasing the cost of gasoline, increasing the cost of vehicles and maintenance does not have a specific time or location deterrent, but it instead serves as an overall deterrent to driving and influencing people to travel less. This option can be accomplished at the federal and state levels of government through the federal and state taxes and vehicle registration fees.

- ***Provide telecommuting options*** – Telecommuting provides an opportunity for employees to work from home or other remote locations, which eliminates their regular trips to their place of employment. This option can be accomplished at the local government level by the local government working with employers to update their policies on offering telecommuting options to some of their employees.

- ***Offer flexible work hours*** – Similar to telecommuting, employers offering flexible work hours provides an opportunity for employees to flex their time so that they either only need to travel to work a few days per week by working longer days or they can stagger their start/end times to a different time of day to avoid the rush hour, thus reducing VMT and congestion. This option can be accomplished at the local government level by the local government working with employers to update their policies on offering flexible work hour options to some of their employees.
- ***Encourage internet shopping/delivery*** – Some regular household trips include grocery and retail store destinations. So, if those stores offer online shopping and delivery options, then those types of household trips are reduced. Although delivery-vehicle trips are increased as a result, delivery vehicles utilize trip chaining (multiple stops for one trip), which is a more efficient use of the transportation network with a fewer number of vehicles utilizing it. Internet shopping and delivery is a private sector action, but local governments can encourage and educate employers in their communities on the benefits of updating their policies to offer online shopping and delivery to their customers.
- ***Authorize insurance companies to offer Pay-As-You-Drive insurance*** – Insurance companies can assess participants based on their number of vehicle miles traveled each year, in combination with traditional risk-based rates, which allows motorists to reduce costs and encourages people to drive less. This option can be accomplished by state governments passing legislation that authorize insurance companies to create this option.

For some trips, especially necessary ones, some of the options that have been described above may not influence people to travel less, but may instead influence them to still make their trip but choose to change their mode choice from driving to carpooling, riding transit, walking or biking. This choice to change modes will still reduce vehicle miles traveled and is addressed further the next section – traveling differently.

Travelling Differently

This second group of methods focuses on how to influence people to travel differently and choose to make trips via alternative modes of travel to personal vehicles. Options include:

- ***Build denser, mixed-use land uses*** – This option is repeated here from the previous section because people are more likely to travel differently via an optional mode if land uses are denser (closer together so more convenient to get to) and mixed (more land use options to visit). Traveling less is a good start, but some trips are necessary (going to work, school, pharmacy, grocery, etc.), so placing a variety of uses (mixed) in close proximity to each other (dense), makes it easier for people to choose to take those trips via a bus, walking, or biking
- ***Offer mobility options*** – If people do not have options, they cannot use them. Offer a variety of mobility options, including:
  - Public transit (bus, streetcar, trolley, rail)
  - Ferries (with traversable waterways)
  - Biking and bikeshare programs
  - Walking
  - E-scooters & other micromobility options
  - Park 'n' rides, car-sharing, and car-hailing
  - Intermodal connections and fare-bundling for services

- ***Accommodate various users and experience levels*** – There are a variety of potential users of transportation systems, so providing mobility options that are accessible and useable by everyone will encourage people to use alternative modes of travel. Typical groups of users with specific transportation needs include:
  - Children
  - Adults
  - Elderly
  - Cyclists
  - People who are differently-abled / ADA accessibility
  - People who choose not to drive
  - People who cannot afford to drive
- ***Provide interconnected, safe, accessible, comfortable, and context-sensitive mobility options*** – Mobility options need to consider all of these factors to encourage people to use them. Employ techniques such as:
  - Complete streets
  - Context-sensitive solutions
  - Streetscapes
  - Traffic calming
  - Place-making
- ***Incentivize commuters to travel to work differently*** – State governments can create commuter incentive programs, which offer a tax credit to employers who provide employees with incentives to commute by carpooling, transit, biking, and walking. In addition, the federal government could increase the federal pre-tax transit deduction for workers.

Additional Benefits

In addition to addressing transportation-related energy issues, reducing vehicle miles traveled can have further benefits. These benefits are not directly related to transportation energy improvements, but they do result from reducing vehicle miles traveled so are important to briefly mention here.

- ***Health and physical activity*** – People who have easily-accessible mobility options tend to be more physically active in their day-to-day lives.
- ***Mobility independence*** – People who cannot and choose not to drive but can rely on many mobility options can comfortably travel on their own without assistance.
- ***Transportation safety*** – Slowing down cars and making communities more walkable and bikeable makes everyone safer when they are traveling.
- ***Infrastructure maintenance costs*** – Infrastructure maintenance costs can be reduced when mobility options are offered if roadway use decreases. As a result, roads experience less congestion so do not need to be widened to accommodate more vehicle traffic, and pavement experiences less wear from vehicle use.
- ***Economic benefits*** – For households, their transportation costs from having to maintain personal vehicles is potentially reduced (fewer cars needed and/or less maintenance required from less use) so they have more available income. For communities and businesses, denser mixed-uses revitalize areas and increase tax revenues.

Key Challenges

With changes come challenges, so it is important to consider potential challenges and how to address them to help ensure that the changes are sustainable. This section discusses challenges to implementation, which are grouped by: (1) Challenges that may prevent implementation of methods to travel less and travel differently; and (2) Challenges that may occur if those methods are implemented.

Challenges to implementation:

The following three challenges must be overcome by a majority of the public and elected and appointed officials at all levels of government for reducing vehicle miles traveled to become a priority:

- ***Behavioral change*** – For those of us who can and do drive, we like the convenience of quickly driving somewhere and being able to park at the location with little to no hindrances, so it will be challenging to change that mindset.
- ***Climate change acceptance*** – A majority of the public and our elected/appointed leaders need to accept climate change as fact and move from acceptance into agreeing to addressing it.
- ***Unified vision and political will*** – In addition to accepting and addressing climate change, our communities need to have a unified vision of what they want their communities to look like and how they should function.

Challenges from implementation:

If the first group of challenges to implementation are addressed and changes become a widespread reality, then the following challenges may also need to be considered:

- ***Equity*** – Any time there is change, it is important to evaluate, identify, and mitigate potential disproportionate impacts to specific groups of people, especially underserved populations. For example, if costs are increased, whether via congestion-pricing on freeways or the gasoline tax is increased or parking is no longer free, then low-income households may be disproportionately impacted by not being able to afford the new/higher costs, so options needs to be provided, such as new/more efficient transit options that are convenient and low/no-cost.
- ***Cost*** – Options to travel less will most likely reduce infrastructure costs, but options to travel differently will require public investment in infrastructures and services. Therefore, it is important to analyze and quantify the costs and benefits of implementing options to select which ones are best and to incorporate any externalities into the analysis so it is accurate.
- ***Property ownership rights*** – Promoting density and mixed land uses in addition to multiple modes of travel will require new or updated land use plans, zoning codes, and public right-of-way, all of which may place additional restrictions on how property owners may use and develop their land and possibly result in some partial or total property takes. As a result, an inclusive, community-based approach to updating Comprehensive plans, land use plans, and zoning should be utilized to ensure community engagement and participation in the updates prior to the changes going into effect to help increase understanding and support.

- ***Alternative mode availability*** – To encourage people to travel differently, we cannot just make driving a personal vehicle less convenient, but we also need to prioritize investments in services and infrastructure for public transit, biking, and walking to provide people with acceptable, convenient, and safe options to driving.

Conclusions & Next Steps

Current transportation-related energy usage patterns and trends are associated with many issues. To address these issues, technological improvements will help, but behavioral changes related to reducing vehicle miles traveled are also necessary. However, behavioral changes can be difficult to implement. Although change can be difficult, it is critical in addressing transportation-related energy issues. Below is a summary of the major changes that need to be implemented to reduce vehicle miles traveled and affect behavior:

- ***Policy changes*** – Require/promote denser, mixed land uses and multi-modal transportation systems and discourage sprawling, low-density development patterns, in addition to working with employers to incentivize mobility options for employees and customers.
- ***Code changes*** – Require/promote denser, mixed land uses via zoning codes and development regulations; require multi-modal transportation infrastructure as part of development applications.
- ***Funding changes*** – Update federal and state funding programs to require/prioritize methods that reduce vehicle miles traveled.

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Carrots vs. Sticks in Transport Policy

Russell Pildes and Jesse Boudart

Public policy tends to operate on a continuum ranging from carrots to sticks. Where carrot policies establish incentives designed to entice changed behavior toward a desired end state, sticks intervene stridently to push society towards the intended future. In transportation, today's conventional wisdom relies on carrots for social gains, but this policy relies on proactive users. A growing cohort of Americans has realized that carrot-based environmental policy is moving too slowly to address impending global climate change and demands sweeping change sooner.

In the US, transportation consumes significantly more energy than any other sector of the economy, and therefore contributes significantly more to greenhouse gas (GHG) emissions and climate change than any other sector.[1] To combat climate change, US transportation policy has primarily relied on carrot policies to shift travel behavior, but the incentives seem counter-productive as the Federal government still will provide 80-90% of funding[2] for local roadway projects at considerably greater amounts of money than for other modes, and therefore continues to fund highway expansions.[3] Though good mass transportation is more efficient than single-occupant vehicle transportation,[4] transit incentives have stagnated, and now the number of dangerously underfunded transit systems[5] and the dearth of safe bicycle facilities in the US has become an international caricature.

The international experience with stick policies has proven results. Congestion pricing in London and Stockholm have not only cut driving and shifted travel to other modes but actually fund improvements for those non-auto options. At least nine countries[6] have begun enacting bans on fossil fuel-powered vehicles to realize known air

1 US Energy Information Administration, "US Total Energy Consumption by Sector (2018)," accessed November 11, 2019, https://www.eia.gov/totalenergy/data/browser/index.php?tbl=T02.01#/?f=A&start=1949&end=2018&charted=3-6-9-12.

2 US Department of Transportation, "FAST Act Fact Sheet: Federal Share," February 2016, https://www.fhwa.dot.gov/fastact/factsheets/federalsharefs.cfm.

3 Joseph Stromberg, "The 'Fundamental Rule' of Traffic: Building New Roads Just Makes People Drive More," Vox, May 18, 2015, https://www.vox.com/2014/10/23/6994159/traffic-roads-induced-demand.

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6 Michael Coren, "Nine Countries Say They'll Ban Internal Combustion Engines." (Quartz Magazine, August 7, 2018), https://qz.com/1341155/nine-countries-say-they-will-ban-internal-combustion-engines-none-have-a-law-to-do-so/.

quality benefits from even a single day car-free.[7] In light of carrot policies' speculative nature and poor results, we should seriously consider stick policies to more effectively manage the impact of transportation on the environmental. The purpose of this document is to examine transportation carrot policies, compare their effectiveness to stick policies, and then discuss how stick-oriented policies should be tailored to the issues of America's transportation system.

Carrots

A carrot is a gift. If a policy makes it easier to do some desired activity, it is a carrot policy. For example, consider a transit fare subsidy. Each travel mode has an associated time and money cost for use: minimizing the relative difference between them may convince some travelers to switch modes. Another, more complex example would be the Federal-aid Highway funding formula match. This does not actively discourage other infrastructure, but relative to other Federal funding streams, the 80-20 Federal-to-local split makes road construction seem much less expensive to the project sponsor.[8]

In both of these examples, financial incentives are the carrots offered to entice an actor to choose one thing instead of another. Carrot policies in transportation operate at multiple scales - in the US, the three main scales are Federal, State, and local - but in effect, they can be subdivided into Funders and Spenders. Funders supply money for projects, while Spenders consume money in order to build or implement projects. For example, consider: the US Department of Transportation (USDOT) administers funding programs utilized by metropolitan planning organizations (MPOs) and transit authorities. Here, USDOT is the Funder, and the MPOs are the Spenders. The structure of Funders plays a substantial role in what Spenders downstream can do, and this makes sense from a fiscal point of view.[9] However, Spenders respond predictably to the carrots established by Funder policies and are ultimately constrained to what is fundable rather than other considerations.

The Federal-Aid Highway Program and the Federal Match

The Federal Highway Administration's whole program of administering Federal-aid funding is an excellent example of how carrot policies operate: it employs a structured approach to make roadbuilding easier. It establishes eligibility criteria[10] and creates hierarchical relationships between Funders and Spenders that flow from the Federal Highway Administration (FHWA) in Washington DC to the states and from there to the metropolitan planning organizations and other local governments. Transportation is a national issue and the Federal government has the national tax base, so this logic is sound in concept. The fiscal scale implications also allow practitioners to use Federal funding allocations as a reasonable proxy for overall funding availability. FHWA and its companion agencies of Federal Transit (FTA), Federal Rail (FRA), and the Maritime Administration (MARAD) are similarly structured around formula funds and grant programs, illustrating the basic forms of financial carrot policies in US transportation policy.

For example, consider FHWA's aforementioned Federal-Aid Highway Program (FAHP). Like

7 Linda Farthing, "Pollution Levels in Bolivia Plummet on Nationwide Car-Free Day" (The Guardian, September 3, 2017), https://www.theguardian.com/cities/2017/sep/03/bolivia-car-free-day-pollution.

8 US Department of Transportation, "FAST Act Fact Sheet: Federal Share."

9 For brevity, we will not discuss fiscal federalism at length. However, we accept the fundamental thesis that programs of national significance should be funded at the corresponding scale, of statewide importance at that scale, and so on, in order to ensure that essential programs and projects receive appropriate support from the appropriate tax base. For further reading, please see, e.g., Bird 1999 "Fiscal Federalism".

10 "Federal-Aid Highway Program (FAHP): In Brief" (Washington DC: Congressional Research Service, June 5, 2019).

many other funding programs across the US Department of Transportation's (DOT) modal administrations, FAHP will kick in Federal dollars for eligible local projects by matching a share of the overall cost of the project. This "Federal match" effectively cheapens the project for state and local agencies, since they only need to raise a portion of the total cost to pursue needed capital projects that they ordinarily could not afford. FAHP's 80-90% match is particularly generous, making any eligible project dramatically cheaper to the Spender.

The match creates unbeatable incentives, in turn influencing how state and local governments approach capital improvement planning. Heavy subsidies for certain projects can have far-reaching local impacts for regional transportation and land use, but also for municipal finances. In the 1990s and 2000s, the Massachusetts Highway Department (now MassDOT) set about replacing aging components of Interstate 93 and had the well-intentioned goal of putting the interstate underground, thereby freeing up space above for other purposes. Had Congress not revised its funding offer to Massachusetts following the uncovering of the now-infamous cost overruns, Boston's $22 billion Central Artery and Tunnel Project, known as "the Big Dig", would have cost the United States $18.7 billion while Massachusetts would only have needed to provide $3.3 billion.[11] Clearly, the project was going to be very expensive even before the cost overruns. However, reclaiming former highway space provides public benefits which justify such large FHWA funding.[12]

FTA also provides a Federal match between 80-90% for its urban and rural formula funding programs.[13] However, DOT seems to primarily offer carrot policies that tilt the field towards automobiles.[14] Of the $70.2 billion appropriated for DOT programs in FY2019, FHWA and its road-focused mission received $48.9 billion, or 70% of the total - more than the other modal administrations combined.[15] By contrast, FTA received $13.4 billion (19%), FRA received $2.5 billion (3.6%), and MARAD received a mere $20 million (0.03%). The latter two numbers are particularly troubling: FRA regulates a number of commuter rail transit services, and rail and maritime freight transportation emit far less pollution and use less energy than trucks.[16]

Moreover, even though FTA provides equal proportions of matching funds, the amount of money it can spend is relatively minute in comparison to that of FHWA. It is therefore understandable that, in the case of the Big Dig, Massachusetts buried I-93 without any meaningful accommodation for non-auto transportation options. Doing so has made automobiles the most practical mode for intra-city travel in the Boston metropolitan area. Coupled with continued land-use reform failure, Boston can now claim the worst roadway congestion in

11 Andrew Ba Tran, "Federal Spending on Massachusetts Transportation over Time" (Boston Globe, December 5, 2014).

12 Garrick, Norman et al., "Freeways Without Futures" (Congress for the New Urbanism, 2019), https://www.cnu.org/sites/default/files/FreewaysWithoutFutures_2019.pdf.

13 US Federal Transit Administration, "FTA Circular 9030.1E: Urbanized Area Formula Program Guidance And Application Instructions," January 16, 2014, https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FINAL_FTA_circular9030.1E.pdf; US Federal Transit Administration, "FTA Circular 9040.1G: Formula Grants for Rural Areas Program Guidance And Application Instructions," November 24, 2014, https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Circular_9040_1Gwith_index_-_Final_Revised_-_vm_10-15-14%281%29.pdf.

14 "Department of Transportation (DOT) Appropriations: FY2019" (Washington DC: Congressional Research Service, September 25, 2018), https://crsreports.congress.gov/product/details?prodcode=R45321.

15 Ibid. Table 3.

16 C. James Kruse, Jeffrey Warner, and Leslie Olson, "A Modal Comparison of Domestic Freight Transportation Effects on the General Public: 2001-2014" (National Waterways Foundation, January 2017), http://nationalwaterwaysfoundation.org/documents/Final%20TTI%20Report%202001-2014%20Approved.pdf.

the United States.[17] This metropolitan area's experience is not unique.

Highway-Funded Transit: A False Flag

Some will say this characterization of incentive funding programs is misleading, and point out that FHWA also funds some transit projects under the auspices of environmental quality improvement. While technically true, this point misses the forest for the trees. For an ideal example, one way that FHWA implements the Clean Air Act is through the Congestion Mitigation and Air Quality Improvement (CMAQ) Program. With an annual appropriation of around $2.5 billion apportioned to the states under the FAST Act, the CMAQ program funds transportation projects that will improve local air quality. In addition, while primarily a highway-oriented program, CMAQ can fund a small number of transit project types as well as active transportation. One might come to the conclusion that FHWA's carrots are capable of improving environmental outcomes despite being a highway program.

However, the details do not support the claim that the CMAQ carrot is of any real use in shifting Americans towards a more environmentally-friendly transportation future. Recall that successful carrot policies get people to shift from one set of behaviors to another by making it easier to do the right thing. Weaning Americans off of their car-and-detached-house habit is no small task.[18]

The CMAQ program does provide additional funding for qualifying transit projects, which effectively makes them cheaper, but the incentives are limited in ways that render them unhelpful in both the short and long terms. Chiefly: 1) the total available funding per project relative to costs is a pittance, and 2) agencies cannot fund maintenance, rehabilitation, or operations with CMAQ funding[19] despite transit service quality being key to increased transit use.[20] Increasing the frequency and reach of transit is important, but throughout the US ridership is falling where transit already exists.[21] As we have learned over and over again, making transit work today is a precondition for having it work in the future, which in turn is a precondition for all the other benefits we seek.[22] Limiting funding exclusively to new expansions takes aim at problems we do not currently have while ignoring the ones we do, and incentivizes projects that are similarly misguided. Moreover, funding schemes like this also require MPOs to not only ask their state DOTs for the CMAQ money but also to successfully persuade the public to provide additional money for maintenance; local communities are forced to cobble together rehabilitation funding from somewhere else entirely.

This lack of non-automobile transportation carrot funding is ultimately the point. Funders can only spend money available to them. The principles of fiscal federalism would suggest that the Federal government is promoting the highest national

17 Adam Vaccaro, "The Worst Gridlock in the US Is Right Here in Boston," Boston Globe, February 12, 2019, https://www.bostonglobe.com/metro/2019/02/12/bragging-rights-boston-now-has-worst-rush-hour-traffic-country-report-says/wMNdRAIrEV7svwShY80NaJ/story.html.

18 Andre Sorensen, "Taking Path Dependence Seriously: A Historical Institutionalist Research Agenda in Planning History," Planning Perspectives, no. 30 (2014): 1–22.

19 See Section B: Ineligible Projects in the 2013 CMAQ Interim Guidance. https://www.fhwa.dot.gov/environment/air_quality/cmaq/policy_and_guidance/2013_guidance/cmaq2013.pdf

20 Steven Higashide and Mary Buchanan, "Who's On Board 2019: How to Win Back America's Transit Riders" (New York: TransitCenter, February 2019).

21 For example: Laura Bliss, "Why People Vote For Expanded Public Transport But Don't Actually Use It" (Pacific Standard, February 1, 2019), https://psmag.com/economics/why-people-are-not-using-public-transit; Andrew Small, "Denver Radically Expanded Its Transit. So Why Are More People Driving Cars?" (CityLab, November 2, 2017), https://www.citylab.com/transportation/2017/11/denver-public-transit-growing-pains/544472/.

22 For an international success story, consider Auckland, New Zealand. Transit ridership was so low at the end of the 1980s that service was nearly eliminated. However, investment in existing service since 2000 has resulted in a massive increase in transit utilization and positive downstream effects. https://ourauckland.aucklandcouncil.govt.nz/articles/news/2019/03/services-and-passenger-trips-surge-on-auckland-s-new-transport-network/, https://www.nzherald.co.nz/transport/news/article.cfm?c_id=97&objectid=10575671

interest as the master funding source, but instead they give out carrots for automobile-related projects at a much greater intensity than for any other mode. Moreover, its policies are flexible for transit and other healthier uses in name only. Therefore it should not surprise us that some states continue to fund highway expansions and simultaneously allow their transit systems to wither, even though the concepts of induced demand and discrete mode choice, not to mention the environmental benefits of dense settlement, have been demonstrated anecdotally and empirically for decades.[23]

Prioritizing one mode over another is not inherently wrong - in fact, we will later argue that slanted prioritization is ultimately required to achieve necessary environmental policy outcomes. However, in light of the many important environmental policy imperatives encoded in Federal and state legislation to prevent the poisoning of air and water and to reduce overall environmental impact,[24] the fact that transportation funding is allocated to the least environmentally-friendly and least efficient projects illustrates the brokenness of our incentive structure.

Sticks

Whereas carrots promote favored behaviors by removing barriers for certain activities, stick policies add burdens to make unwanted behaviors less desirable. Sticks typically require payments to mitigate societal harms from an action, pressuring actors to do it less. So-called "sin taxes" are classical examples: a higher tax on cigarettes makes it more costly to smoke and has been used successfully to decrease the rate of smoking among teenagers.[25] Environmental regulations are another example of stick policies - you either pay for certain behaviors, such as pollute or utilize carbon for energy or, alternatively, pay a penalty it. The trillion-dollar questions for transportation planners and engineers are: if we want to reach our environmental goals, should we minimize driving? Should it be penalized?

There are some well-researched reasons why people should drive less for their personal transportation: 1) Personal car transportation produces an enormous amount of GHG emissions,[26] 2) habitual automobile commuting contributes to obesity,[27] and 3) automobile commuting decreases happiness.[28] These reasons have nothing to do with why other modes might be better choices, only with why driving itself is harmful. Nonetheless, the public and its elected officials have not passed legislation to curb driving. It may be that the negative consequences of driving do not inspire people to change. As discussed in the last section, people tend to choose the easier options available to them, rather than what may be rationally more advantageous; path dependence is real, and gifts are certainly more politically palatable than penalties.

Though not as popular in the American context, stick policies have been quite effective in shifting travel behavior, particularly when directed at

23 Stromberg, "The 'Fundamental Rule' of Traffic: Building New Roads Just Makes People Drive More."

24 Examples include Federal laws such as the Clean Air Act, Clean Water Act, the Energy Policy Acts, and the National Environmental Policy Act.

25 Ann Boonn, "Raising Cigarette Taxes Reduces Smoking, Especially Among Kids" (Campaign for Tobacco-Free Kids, June 28, 2019), https://www.tobaccofreekids.org/assets/factsheets/0146.pdf.

26 US Environmental Protection Agency, "Sources of Greenhouse Gas Emissions," 2017, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

27 Christine Hoehner et al., "Commuting Distance, Cardiorespiratory Fitness, and Metabolic Risk," American Journal of Preventative Medicine 6, no. 42 (June 2012): 571–78.

28 Erik Hansson et al., "Relationship between Commuting and Health Outcomes in a Cross-Sectional Population Survey in Southern Sweden," BMC Public Health, October 31, 2011.

environmental outcomes. This is their primary advantage over carrots: rather than offering incentives for a desired infrastructure format (e.g., funding roads, buses, or bike lanes) and relying on people to choose, sticks target the activity itself and require actors to re-organize themselves around a binding constraint.

Perhaps sticks are just misunderstood or poorly explained by their advocates. This section discusses a paradigmatic example of a transportation stick that could meaningfully improve environmental outcomes in transportation beyond the capabilities of similar carrots.

Congestion Pricing

A Congestion Pricing (CP) system charges people a fee for driving into a designated part of a metropolitan area. For example, London's CP system charges users who drive in the central city between 7am to 6pm on weekdays. In Sweden, Stockholm and Gothenburg CP systems are similar to London's, and include an additional premium if you travel during the morning and afternoon peak hour rush hours. Singapore and Milan have also implemented CP systems.

CP schemes have proven results. Immediate benefits of the programs include a reduction in commuting times for people driving, increased driving reliability, and decreased air pollution.[29] In the short to medium time frames, the money from fees can be used to enhance other transportation options, like increasing transit facilities and frequency, improving pedestrian facilities, and expanding separated bicycle facilities.[30]

One clear way of explaining the societal benefits of paying to drive is to compare road pricing to matinees at the movie theater.[31] Most people want to see movies in the evening. However, with limited seating, only so many people could see movies if the theater was only open in the evening. Those seats on Saturday night are much more valuable than on Tuesday afternoon, but not everyone is willing to pay full Saturday-night-out prices to go at a less desirable time. No one is made better off by this: many would-be moviegoers cannot get into the theater, and theaters miss out on that revenue. So, theaters make Saturday night showings more expensive than Thursday matinees, pushing the time-flexible moviegoer to a less congested time at the cinema. That way, more people see the same movie in less crowded showings, and theaters get additional revenue for better seats and better popcorn.

As it goes with the price of a seat at the cinema, so it goes with road pricing: more people can enjoy quicker, more reliable travel times on the same road if travel costs differ at peak and off-peak times of day. If everyone has the same prices for the whole day, then, perversely, every trip takes longer, more fuel is burned, and the government loses out on revenue to make transportation better. And if it's Saturday night, the film you want to see is going to be sold out by the time you arrive.

American metropolitan areas need CP systems more than ever, for several reasons. Primarily, transit projects make up about 20% of those funded by the gas tax-supported Highway Trust Fund, whereas the remainder fund highway projects.[32] As we mentioned, FHWA programs

29 Nicole Badstuber, "London's Congestion Charge Is Showing Its Age" (CityLab, April 11, 2018), https://www.citylab.com/transportation/2018/04/londons-congestion-charge-needs-updating/557699/.

30 Jonas Eliasson, "Cost-Benefit Analysis of the Stockholm Congestion Charging System" (The World Bank, n.d.), http://siteresources.worldbank.org/INTTRANSPORT/Resources/StockholmcongestionCBAEliassonn.pdf.

31 Jesse Boudart, "What Our Highways Can Learn from Movie Theaters" (Commonwealth Magazine, August 19, 2019), https://commonwealthmagazine.org/opinion/what-our-highways-can-learn-from-movie-theaters/.

32 Marla Westervelt, "The Highway Trust Fund: What Is It Good For? A Response to Surface Transportation Devolutionists" (Eno Center for Transportation, January 19, 2015), https://www.enotrans.org/article/highway-trust-fund-good-response-surface-transportation-devolutionists/.

do fund some transit- and active transportation-related projects, but we stand by the assertion that these do not resolve the disparity, for reasons discussed ad nauseam elsewhere.

Since additional old-fashioned highway projects will not decrease traffic congestion, this 80-20 split in the Highway Trust Fund's allocations represents a huge funding imbalance. While levying additional taxes to fund transit is technically feasible, this approach has struggled outside already transit-rich metros for decades.[33] Even though the Highway Trust Fund (including the Mass Transit Account) relies on emergency infusions from general revenue and is expected to become insolvent in 2021, there has been no political appetite to raise the gas tax that fund either account, let alone meaningfully shift DOT appropriations priorities as discussed above.

CP offers a way for state departments of transportation and metropolitan agencies to modify how to provide transportation for their citizens. Road pricing is a stick mechanism to shift travel behavior to different times of day, different routes, and different modes as people adjust to the additional cost of driving. When messaged properly, these initiatives can help convince people of the benefits of reliable travel times, and of the improved noise and air quality that everyone will experience if people pay to drive during the peak hours of the day. Moreover, these organizations should be transparent on where the congestion charge fees will be spent. However, these large organizations need leaders from within to 1) help create internal consensus, 2) help see through technical paths forward, and then 3) convince legislators (and/or the public) of the benefits for CP systems.

Based on recent movement in New York City, there may be enough popular clarity and political will to begin enacting CP on a wider scale in the United States.

Carrot and Stick Policy Comparison

Comparing a carrot to a stick policy is complicated because each policy is a different kind of lever to influence someone's decision to do something. However, there is evidence of the effectiveness of these different types of policies.

Motorists primarily respond to "out of vehicle" costs, such as the cost of on/off-street parking or tolls, when making travel choices.[34] They generally do not account for vehicle maintenance, depreciation, and insurance, which drivers must pay to be able to drive in the first place and are therefore relatively invisible. The kind of car you drive and your driving record influence these invisible costs, as some vehicles are more reliable and good driving results in low insurance costs, but compared to out of vehicle costs, drivers tend to focus on minimizing more visible per-trip "fees". The best way to avoid per-trip fees? Taking a different transportation mode. That modal choice is what is needed to minimize automobile use.

Carrot policies, such as employer-provided transit subsidies and parking cash-out programs, have been in place for decades. However, they have known limitations, partly to do with the structure of available funding for change discussed above, and partly because of overlapping or even contradictory subsidy schemes.[35] The California Bay Area has employed a more aggressive

33 Stateside Staff, "RTA Takes a Crack at Southeast Michigan Transit Plan… Again." (Michigan Public Radio, July 19, 2019), https://www.michiganradio.org/post/rta-takes-crack-southeast-michigan-transit-plan-again.

34 Greg Marsden, "The Evidence Base for Parking Policies—a Review," Transport Policy 13, no. 6 (November 2006): 447–57.

35 Tony Dutzik, "Subsidizing Congestion: The Multibillion-Dollar Tax Subsidy That's Making Your Commute Worse" (TransitCenter, 2014).

transportation demand management (TDM)[36] program since 2016, but observes no more than three percent of eligible employees shifting from driving alone to transit or carpooling (~50,000 people out of about ~1.5 million people).[37]

While these incentives provide some benefit to commuters, non-automobile mode share is in single digits, and these incentives do not create revenue to improve non-automobile transportation services. Importantly, this policy does not seem to reflect the value that commuting by car is bad for us and bad for the planet.

For CP and other stick policies, illustrating the policy's benefit needs to overshadow any perceived negativity from the penalty. Messaging may be difficult, but a faster trip for all people is a direct effect of congestion pricing - an outcome that cannot be argued over. In the long run, eliminating parking would increase the amount of public space available for housing and parks, instead of for car storage. People still need to get around - banning cars is not an appropriate step by itself. But when tied to concerted transit expansions, land use reform, and unimpeachable implementation accountability, Americans can realize these benefits relying only on a sense of their own clocks and pocketbooks.

Reflection

Stick policies will directly change how we structure our lives and consume precious natural resources. If we take the lives of our people and the health of our planet seriously, leaders in legislation need to champion these policies. But even more importantly, we need professionals who are willing to tirelessly propose these policies over and over until we see them enacted. The type of policies proposed need to reflect the amount of change we need if we care about environmental goals.

Critically, policy-makers can, have, and should continue to use carrots and sticks together. However, emphasis on one or the other belies a sense or absence of urgency. We take the position that uncertainty about the extent or pace of the impending environmental catastrophe should drive us toward faster, sweeping change: with the stakes so high, we believe it is more cautious to act on the worst-case scenario and be happily surprised rather than discover we did too little too late. Measures of effectiveness for any policy in this context ultimately refer to environmental impacts, such as energy consumption; emissions; air, water, and soil quality; and of course health outcomes for humans, plants, and other animals. Under this premise, the argument presented here focuses on the relative strengths of each policy type for the purpose of achieving environmental policy outcomes in transportation.

36 Todd Litman, "Transportation Demand Management," in Online TDM Encyclopedia (Victoria Transport Policy Institute, April 2, 2014), https://www.vtpi.org/tdm/tdm12.htm.

37 "Bay Area Commuter Benefits Program: Report to the California Legislature" (Bay Area Air Quality Management District, February 2, 2016), http://www.baaqmd.gov/~/media/files/planning-and-research/commuter-benefits-program/reports/commuter-benefits-report.pdf.

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Pricing for Health:

Assessing the Asthma-Related Health Co-Benefits of Reduced PM2.5 from the LA Mobility Go Zone

Juan Reynoso

Introduction

In California, as of 2016, the transportation sector represents the greatest source of greenhouse gas emissions at 40.5% and, despite improvements in fuel efficiency, transportation emissions are rising as vehicle miles traveled (VMT) continues to increase (CARB, 2018; Next10, 2018). Motor vehicle exhaust emits a concoction of chemicals including carbon monoxide, carbon dioxide, nitrogen oxides, ozone precursors, elemental/black carbon, particulate matter, and volatile organic compounds (e.g. benzene and formaldehyde). Many of these chemicals are regulated by the U.S. Environmental Protection Agency as ambient air pollutants and have been identified as hazardous and/or carcinogenic compounds (EPA, 2019).

From a public health perspective, fine particulate matter (PM2.5) is responsible for the largest share of the air pollution related burden of disease (HEI, 2018). It is particularly worrisome for health because it can reach the deepest alveoli of the lungs, cross the barrier between the lungs and the blood, and lead to a variety of chronic cardiovascular and respiratory diseases, including asthma. Every year in California, PM2.5 exposure contributes to about 7,200 premature deaths due to cardiopulmonary causes, 1,900 hospitalizations for exacerbated cardiopulmonary disease, and 5,200 emergency room visits for asthma (CARB, 2017). Mobile sources, and the fossil fuels that power them, are the largest contributors to the formation of PM2.5 in California (CARB, 2016). A large body of peer-reviewed literature has found that traffic density explains variation in local and regional PM2.5 concentrations (Moore et al, 2007; Weijers et al, 2004) and that proximity to major roads and highways is associated with an increased risk of asthma (McConnell et al, 2006). Therefore, reducing vehicle emissions is critical to improving air quality and public health in California's cities.

To combat urban air pollution, cities across the world are increasingly implementing vehicle-reducing policies, such as low emissions zones, license-plate driving restrictions, and congestion pricing (also known as road pricing or cordon/area pricing) (Peters, 2019). Of these three policies, only congestion pricing has been considered in the United States. Congestion pricing is a road user fee that charges vehicles a variable or fixed fee to drive into or within a highly congested area (Walker, 2018). The goal is to reduce the number of cars during peak periods, enabling all users to move more efficiently and reliably within the congestion pricing zone throughout the day. Moreover, this policy forces drivers to internalize the negative health and environmental externalities of excessive

vehicle use. Only a handful of cities currently operate congestion pricing programs: London, Gothenburg, Milan, Oslo, Singapore, Stockholm, and Trondheim (Walker, 2018). For the purposes of this assessment, three of those cities were researched in-depth because of their pertinence to the principal research questions (see Table 1). Overall, multiple studies have found that congestion pricing programs significantly reduce VMT and local concentrations of carbon dioxide (CO_2), nitrous oxide (NO_x), and coarse particulate matter (PM_{10}), however results vary slightly as the degree of impact partly depends on the relative size of the area and fee.

Although it is internationally known for its car culture and congestion, the Los Angeles metropolitan region is also now considering implementing congestion pricing for its largest employment cluster on the Westside (Chiland, 2019). The Mobility Go Zone, proposed by staff at the Southern California Association of Governments (SCAG), would charge road users $4 per vehicle entering the area during peak congestion periods, but trips originating in the zone would not be charged (SCAG, 2019). To address equity concerns, discounts would be offered for all low-income motorists and residents of the zone. The estimated annual $86.5-135.2 million in revenue would be used to improve the zone's pedestrian, bicycling, and public transportation infrastructure and operations (SCAG, 2019).

Most research on congestion pricing examines impacts to traffic and commuting times, but less has been written about the impacts to public health. Hence, based on the proposed LA Mobility Go Zone, this study seeks to: 1) assess the demographic profile of residents who live in the zone, 2) estimate PM2.5 reductions, and 3) assess potential asthma-related health co-benefits from these PM2.5 reductions.

Table 1: A summary of a few existing congestion pricing programs in comparison to the proposed Mobility Go Zone in Los Angeles (CARB, 2019; Croci, 2016; Kelly et al, 2011; Simeonova et al, 2018).

	London	Stockholm	Milan	Los Angeles
Starting Year	2003	2007	2012	TBD
Area	21 km^2 (1.3% of metro surface area)	30 km^2 (16% of metro surface area)	8 km^2 (4.5% of metro surface area)	11.6 km^2 (0.1% of metro surface area)
Metropolitan Population	14 million	2.3 million	3.2 million	13.2 million
User Fee	~$15 USD daily fee	~$1.15-4.25 USD single passage fee	~$5.60 USD daily fee	$3.29-4.00 daily fee
Time of Application	Weekdays 7am-6pm	Weekdays 6:30am-6:30pm	Weekdays 7:30am-7:30pm	Peak congestion periods
VMT Reduction	-14.21	-18.21	-11.21	-8% (estimate)
Emmissions Reduction	-16% CO_2 -13% NO_x -12-15% PM_{10}	-13% CO_2 -5-7.5% NO_x -15-20% PM_{10}	-6% CO_2 -17-18% PM_{10}	TBD

Methods

This study used Esri's ArcGIS 10.5.1 software (Esri, 2017) to perform spatial analyses. Based on SCAG's feasibility study (SCAG, 2019), an analysis was conducted to calculate the total area of the pricing zone in comparison to the rest of the Los Angeles metropolitan statistical area as defined by the United States Census Bureau (U.S. Census, 2019) (see Table 1). For the demographic analysis, data was obtained from the Census Bureau's 2017 American Community Survey 5-year estimates at the census tract level (U.S. Census, 2019). Data on age, population, median household income, and commute-to-work mode share were collected for all census tracts in the Los Angeles metropolitan area and total counts were calculated specifically for the Mobility Go Zone.

For the air quality analysis, Los Angeles PM2.5 and asthma data at the census tract level were obtained from publicly available datasets from the University of Southern California's Price Center for Social Innovation (USC, 2018) and SCAG's GIS Open Data Portal (SCAG, 2018). Both datasets are based on information collected from the State of California's Environmental Protection Agency as part of their California Communities Environmental Health Screening Tool (CalEnviroScreen) 3.0, which helps identify "disadvantaged" communities that are disproportionately burdened by environmental pollution and socioeconomic vulnerability (CalEPA, 2017). In order to assess potential PM2.5 reductions in the LA Mobility Go Zone, the below equation was used. Two estimates for the percent contribution of road transport to total PM2.5 emissions were used: 1) 20%, based on a positive matrix factorization source apportionment study of Los Angeles in 2014 (Hasheminassab et al, 2014), and 2) 50%, based on a World Health Organization estimate for OECD cities (WHO, 2019). As shown in Table 1, SCAG estimates that the Mobility Go Zone will result in an 8% reduction in daily VMT.

*(road transport % contribution to PM2.5 emissions) * (VMT % reduction) = (PM2.5 % reduction)*

Low PM2.5 reduction estimate (20%) * (8%) = 1.6%

High PM2.5 reduction estimate (50%) * (8%) = 4%

The two PM2.5 reduction estimates were then applied to the current PM2.5 concentrations in each census tract in the Mobility Go Zone; thus, obtaining estimated future PM2.5 concentrations for each census tract. Maps were generated for current and estimated future PM2.5 concentrations.

*(1 - PM2.5 % reduction) * (current PM2.5 concentration) = (estimated future PM2.5 concentration)*

After calculating these demographic estimates and PM2.5 reduced concentrations, the potential asthma-related health co-benefits from the Mobility Go Zone were calculated. For this estimation, the USC data for asthma-related emergency room visits in 2017 was combined with a conversion factor from a study of U.S. children enrolled in Medicaid that found an average increase of 1ug/m^3 in predicted PM2.5 was associated with a 4.2% increase in asthma emergency room (ER) visits (Keet et al, 2016). It is important to note that since this conversion factor was from a nation-wide study, the strength of these findings specifically for Los Angeles is not high.

Results and Discussion

Although the Mobility Go Zone only covers 0.09% of the region's surface area, this study found that it is a relatively dense part of Los Angeles. As of 2017, there are approximately 70,788 people who live in the zone, which is 0.53% of the region's population or about six times the density than would otherwise be expected. Within this community, there are about 10,183 children and youth under the age of 19, or 0.3% of all children in Los Angeles; again, a higher than expected density of children. Since lung development continues into adolescence and children are particularly susceptible to environmental exposures (Simeonova et al, 2018), the large population of children living in the zone suggests that there may be particularly long-term health co-benefits from PM2.5 reduction as a result of congestion pricing. Moreover, a lower percentage of residents of the zone (72.7%) rely on motor vehicles to commute to work than the average Los Angeles resident (84.5%). This study found that the zone's median household income of $82,062 is higher than the overall region's median household income of $65,331, but within the zone, there is a wide income distribution as about 18% of households have a household income below $25,000 and 8.2% of households do not have access to a private vehicle. In order to address equity concerns of congestion pricing, it is also important to note that 70% of all low-income person trips originate either within the zone or in the surrounding Westside region of Los Angeles and, of all people driving alone to the zone for work, only 2.2% are low-income (SCAG, 2019). These figures suggest that low-income residents are traveling shorter distances that can more easily be covered by public or active transportation and, of those who are traveling to the zone from far away, the vast majority are already commuting by carpool or public transportation.

As of 2017, the vast majority of census tracts in the Mobility Go Zone were found to have annual PM2.5 concentrations that exceeded the primary National Ambient Air Quality Standard (NAAQS) of 12 ug/m^3 (EPA, 2019). After applying the low and high VMT reductions described earlier, the annual average PM2.5 concentration for the zone is expected to decrease to 11.54-11.83 ug/m^3. Disaggregation of these research findings by census tract are presented in Figure 1 and Table 2. This study found that the proposed congestion pricing zone would reduce VMT enough to lower local PM2.5 concentrations below the NAAQS for annual PM2.5. In other words, if the Mobility Go Zone program is implemented, then it is expected to shift the zone from a nonattainment to an attainment area for PM2.5. Since the majority of the Los Angeles South Coast air basin is currently a nonattainment area for PM2.5, this air quality improvement from the congestion pricing program is sure to be a welcome relief for residents of the zone.

As a result of these estimated PM2.5 reductions, the Mobility Go Zone is also expected to provide health co-benefits. Currently, there are approximately 414.73 asthma-related ER visits every year from residents of the zone. However, the annual asthma ER visits for residents of the zone is estimated to decrease to between 406.34 and 411.38 ER visits per year. Hence, if implemented, the congestion pricing program would prevent 3.35-8.39 asthma-related ER visits every year. Disaggregation of these asthma findings by census tract are presented in Table 2. Although the number of annual preventable ER visits appears small, it is important to note

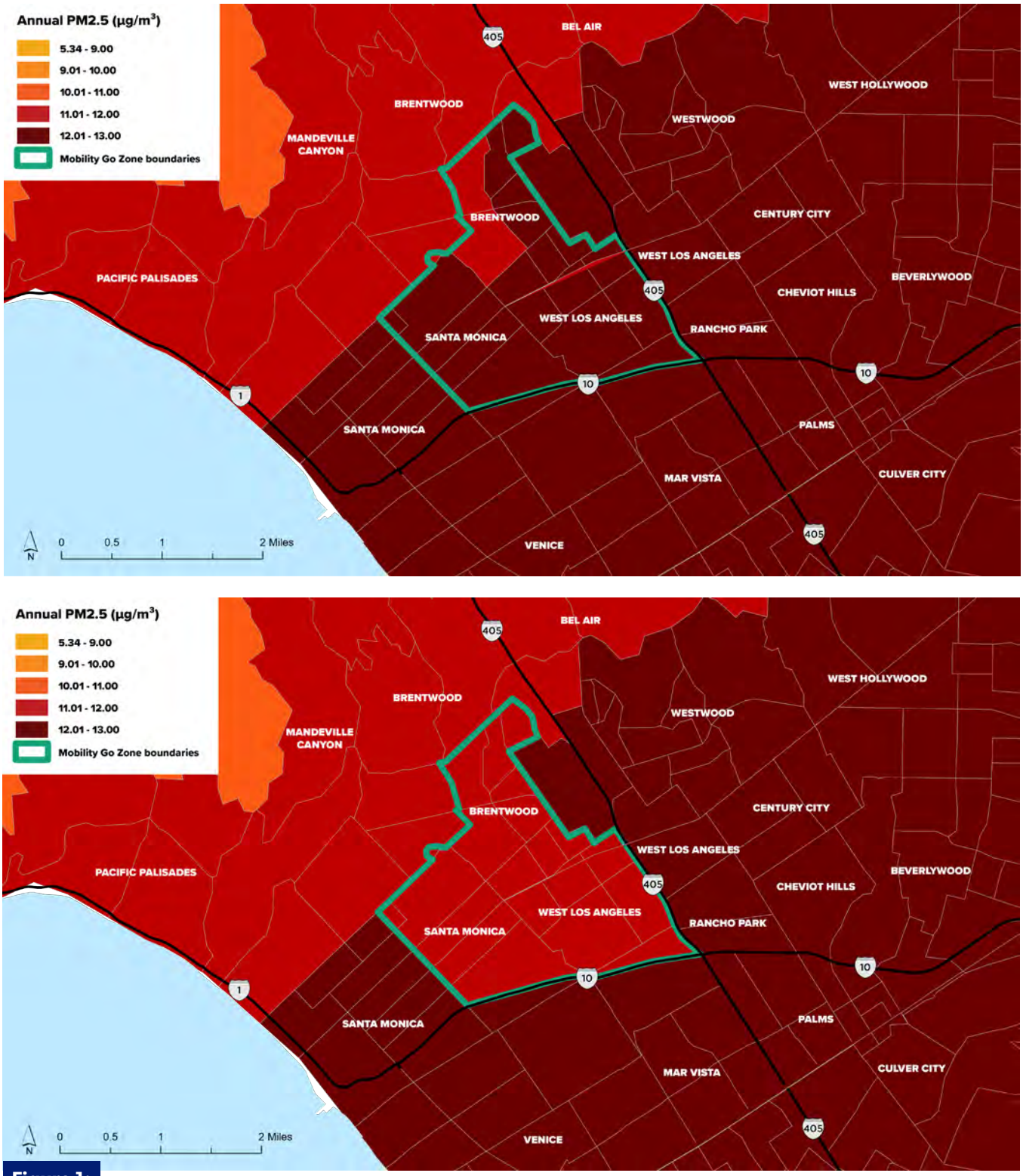

Figure 1:

The map on the top displays the 2017 average PM2.5 concentrations before implementation of the Mobility Go Zone, while the map on the bottom displays the estimated average PM2.5 concentrations after implementation of the Mobility Go Zone. The proposed congestion pricing program is estimated to shift the zone from a nonattainment to an attainment area for PM2.5.

Table 2: Estimated current (USC, 2018) and future PM2.5 concentrations and asthma-related emergency room visits for all census tracts that lie fully or partly within the Mobility Go Zone boundaries. The last row provides both the average PM2.5 concentrations and the total asthma-related emergency room visits.

	Current and Future PM2.5 Concentrations (ug/m³)			Current and Future Asthma-Related Emergency Room Visits		
Census Tract	2017 Annual Concentration	Future Low Reduction Estimate	Future High Reduction Estimate	2017 ER Visits	Future Low Reduction Estimate	Future High Reduction Estimate
Tract 2641.02	12.05	11.86	11.57	14.77	14.65	14.47
Tract 2641.03	12.05	11.86	11.57	14.77	14.65	14.47
Tract 2643.01	12.05	11.86	11.57	13.57	13.46	13.30
Tract 2643.02	11.63	11.44	11.16	12.73	12.63	12.48
Tract 2673	12.05	11.86	11.57	19.33	19.17	18.94
Tract 2674.02	12.05	11.86	11.57	19.62	19.46	19.22
Tract 2674.03	12.05	11.86	11.57	19.33	19.17	18.94
Tract 2674.04	12.05	11.86	11.57	11.22	11.13	10.99
Tract 2675.01	12.05	11.86	11.57	19.33	19.17	18.94
Tract 2675.02	12.05	11.86	11.57	19.39	19.23	19.00
Tract 2676	12.05	11.86	11.57	19.57	19.41	19.17
Tract 2677	12.05	11.86	11.57	17.49	17.35	17.14
Tract 2712	12.05	11.86	11.57	24.17	23.97	23.68
Tract 7016.01	12.05	11.86	11.57	22.31	22.13	21.86
Tract 7016.02	12.05	11.86	11.57	60.62	60.13	59.39
Tract 7017.01	12.05	11.86	11.57	57.47	57.00	56.31
Tract 7018.01	12.05	11.86	11.57	49.04	48.64	48.05
Total or Average	**12.03**	**11.83**	**11.54**	**414.73**	**411.38**	**406.34**

that this figure is an under-estimation of total asthma-related co-benefits because this study only examined PM2.5; all other pollutants from road transportation (e.g. nitrogen oxides, ozone, and volatile organic compounds) were not considered. Moreover, in comparison to other congestion pricing programs, this calculated asthma co-benefit appears to be an under-estimation. For example, a study of the total air pollution health co-benefits from the Stockholm congestion pricing program found a reduction of 5.83 asthma visits per 10,000 children and that reductions in air pollution from traffic by one unit (1 mg/m^3) decreased visits for acute asthma by 4-15% depending on the length of exposure to reduced pollution (Simeonova et al, 2018).

In addition to this potential under-estimation, this study has two other limitations. First, a separate source apportionment study was not conducted. Rather than rely on a study that used air pollution data from 2012, if a source apportionment study with more recent data had been conducted as part of this research, then a higher confidence in the findings could have been achieved. Second, there are numerous confounding factors between PM2.5 and road transportation that must be taken into account: vehicle mix, emission rates, wind direction, wind speed, and other meteorological parameters. As a previous Health Effects Institute report has argued, it is difficult to detect "significant air quality improvements related to an intervention against the backdrop of broader regional and meteorological changes…" (Kelley et al, 2011). However, this study's strength is in its spatial analysis of health and environmental data at the fine-grained level of the census tract. Moreover, to the author's knowledge, this research is the first to attempt to estimate the potential health co-benefits from the proposed congestion pricing program in Los Angeles.

Conclusion

Congestion pricing programs are increasingly being considered and adopted by cities across the globe as a key strategy to reduce congestion and improve air quality. Similar to the experience of other cities that have implemented congestion pricing, this study estimates that the Mobility Go Zone in Los Angeles will result in reduced PM2.5 annual concentrations at a local level and thus reduced asthma-related ER visits. Since much of the Los Angeles metropolitan area is a nonattainment zone for PM2.5, any effort to reduce the region's reliance on motor vehicles, such as congestion pricing, should thoroughly be considered as a public health policy. Moving forward, further health impact analyses of other air pollutants should be conducted to gather a holistic picture of the total potential health co-benefits from the LA Mobility Go Zone. Given the current public hesitation to adopting congestion pricing in Los Angeles (Chiland, 2019; ITS, 2019), SCAG should propose a six-month pilot program similar to the pilot program first implemented in Stockholm. Once residents experience the benefits of reduced congestion and improved air quality, public opinion has consistently increased in support of congestion pricing (Domonsoke, 2019). In the end, if Los Angeles political leaders are seriously committed to mitigating climate change and improving public health, then innovative policies like congestion pricing must be adopted in order to create more healthy and sustainable communities.

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Juan Reynoso is a joint degree candidate at Harvard University, where he is currently pursuing a Masters of Urban Planning and a Masters of Public Health. Prior to graduate school, he worked as a grantmaker at The California Endowment where he helped manage multiple, multi-million dollar funding portfolios to support organizing and advocacy campaigns to promote healthy, just, and sustainable communities in Southern California. Juan received a B.A. in Human Biology with honors from Stanford University.

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6

HARNESSING DATA & EMERGING TECHNOLOGY

Using Health Data in Transportation Planning

Sarah Powers

As placemaking, Complete Streets, Vision Zero, Safe Routes to School, and other "active transportation" initiatives are taking hold in the US, awareness about the connections between health and transportation has grown. Citing health data in program descriptions can make the connection even clearer and help strengthen the case for these programs. Because these initiatives seek to improve the built environment for safe and healthy transportation, including health data also provides opportunities to connect with non-traditional transportation planning funders and organizations. Health indicators may also help guide programs to the areas with the greatest needs—areas that have suffered disinvestment and are home to marginalized and poor populations tend to have poor health indicators. Data often correlates with the input that community members provide, so can strengthen community members' voices. Lastly, framing built environment initiatives with health data provides a more holistic picture of the initiative, which helps counter arguments that these initiatives are provided to benefit only privileged populations, such as white, male bikers.

The built environment influences health in major ways. One of the easiest connections to make is between the built environment and our physical health, because active modes of transportation involve various forms of physical activity, which helps prevent chronic diseases. But the built environment affects many other aspects of human health, too—mental health, asthma, traffic crash deaths/injuries, and access to healthcare, healthy food, and economic opportunities. The public health field has made great strides in identifying built environment conditions that influence health, known as the "social determinants of health" (SDOH). The Centers for Disease Control and Prevention (CDC) has a helpful website[1] explaining SDOH and data tools for exploring them.

SDOH statistics can be included in several sections of plans, reports, and other program descriptions and justifications. Rates of overweight/obesity, diabetes, and heart disease can be used as indicators for the need for programs that provide better opportunities for physical activity. Select statistics relevant to the populations being served by the program. For example, obesity is a worldwide problem with much data available. Note: report authors

1 https://www.cdc.gov/socialdeterminants/data/index.htm

should heed the CDC recommendations for using respectful language and images when discussing obesity[2].An introduction to a Safe Routes to School walkabout report that appropriately centers health data might read:

> *In late 2019, the World Health Organization released a new study finding that worldwide, the majority of adolescents are not getting enough physical activity each day to prevent related health problems[3]. In the US, 80 percent of adults do not get enough physical activity and 71 percent are overweight or obese. Obesity is a direct threat to individual health and leads to a higher risk of heart problems, diabetes, high blood pressure, cancer, and other chronic diseases[4]. Safe Routes to School programs can facilitate physical activity for both adolescents and adults and contribute to a reduction in obesity by encouraging walking and biking to school.*

See this SRTS walkabout report here[5] that includes health data.[6]

To narrow down the long list of SDOHs, focus on key chronic diseases and quality of life measures that compile several indicators into one score or index. Many public health departments are now developing such scores or indices. In Virginia, the Department of Public Health developed the Health Opportunity Index[7] (HOI) that provides a measure of the opportunity to live a long and healthy life. The index is measured at the census tract level on a five-point scale from very low to very high and is determined by over 30 variables[8]. In 2018, the Office of Health Equity and the Richmond City Health District collaborated to study the relationship between the HOI and rates of traffic crashes. The analysis results showed that areas with a very low HOI, which is at least half of the city, experience rates of traffic crash fatalities and injuries over two and a half times that of areas with a very high HOI.

The Chicago Department of Public Health (CDPH) provided data analysis for the Chicago Vision Zero Action Plan[9] published in 2017. As part of this analysis, CDPH used its Economic Hardship Index[10], a score that includes rates of unemployment, poverty, number of dependents, crowded housing, per-capita income, and educational attainment. The resulting analysis showed that areas with a high economic hardship score have a traffic crash fatality rate three times that of areas with a low score. As well, CDPH showed that black Chicagoans die in traffic crashes at a rate two times that of

2 US Centers for Disease Control, "Adult Obesity Prevalence Maps: Notes on Language and Images," Available: https://www.cdc.gov/obesity/data/prevalence-maps.html, Accessed 10 December 2019.

3 World Health Organization, 22 November 2019, Available: https://www.who.int/news-room/detail/22-11-2019-new-who-led-study-says-majority-of-adolescents-worldwide-are-not-sufficiently-physically-active-putting-their-current-and-future-health-at-risk, Accessed 9 December 2019.

4 US Centers for Disease Control, "Adult Obesity Facts: Overweight and Obesity," Available: https://www.cdc.gov/obesity/data/adult.html, Accessed 9 December 2019.

5 http://www.virginiadot.org/programs/resources/walkToSchool/2016/miniGrants/Chimborazo_Elementary_School_Walkabout_Report.pdf

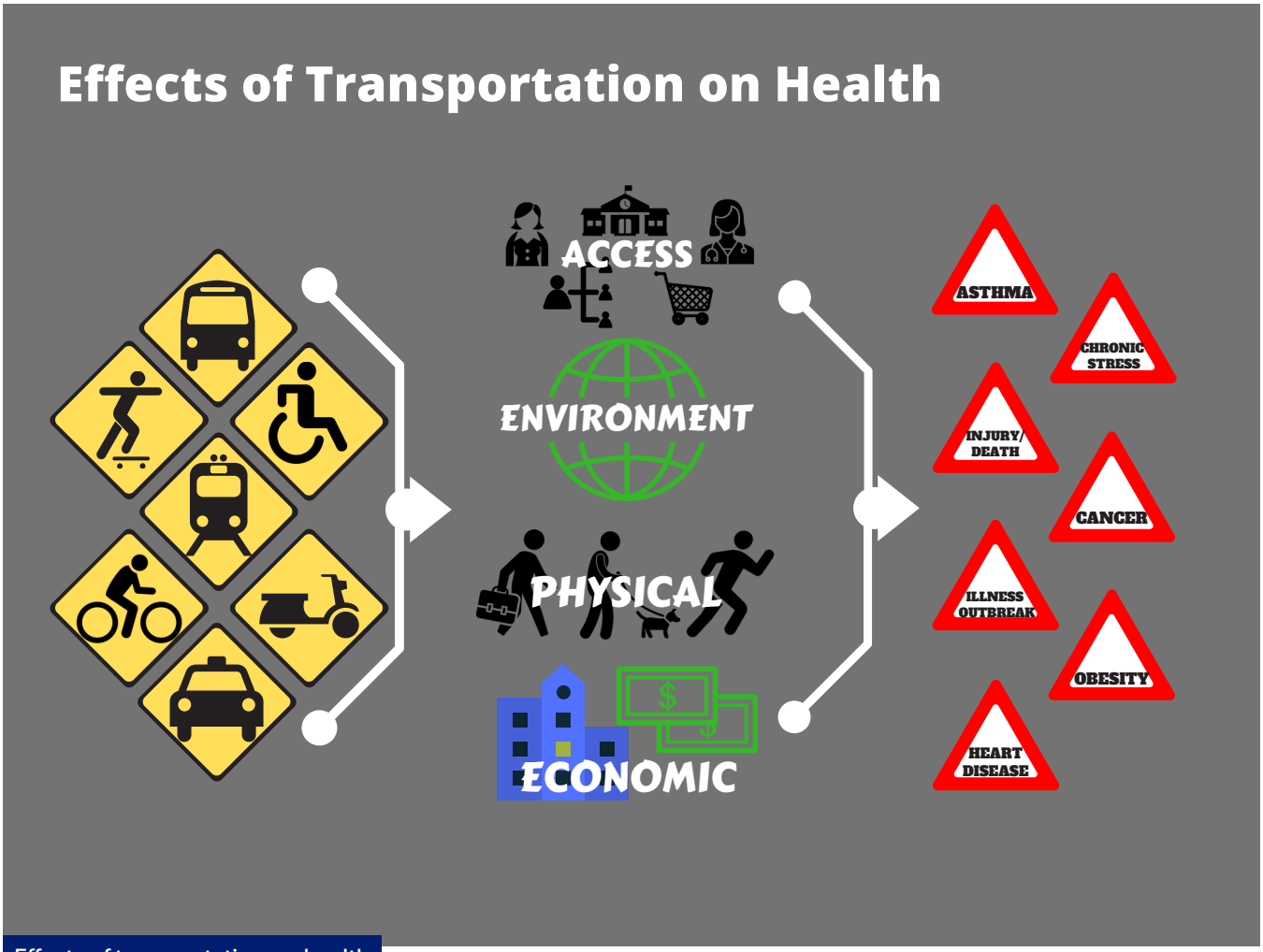
6 A walkabout study is commonly a part of Safe Routes to School programs whereby school and city officials, parents/caretakers and students come together to make observations of the environment around a school and the conditions for walking and/or biking to school. After the walkabout, a report is generated with an analysis of the existing conditions and recommendations for infrastructure, educational, and other types of improvements to be made. While working for the Richmond City Health District, I coordinated a walkabout study at Chimborazo Elementary School. As part of the resulting report, I added health indicators to the existing conditions section, which had never been done before in Virginia. Feedback from the Virginia Department of Transportation was positive and we also used the report to connect with other health organizations.

7 https://www.vdh.virginia.gov/omhhe/hoi/

8 Virginia Department of Health, "Virginia Health Opportunity Index: Definitions," Available: https://www.vdh.virginia.gov/omhhe/hoi/what-is-the-hoi/definitions, Accessed 10 December 2019.

9 https://secureservercdn.net/198.71.233.109/8gq.ef1.myftpupload.com/wp-content/uploads/2016/05/17_0612-VZ-Action-Plan_FOR-WEB.pdf

10 https://data.cityofchicago.org/Health-Human-Services/hardship-index/792q-4jtu/data



Effects of transportation on health

white Chicagoans[11], and Latinx Chicagoans at a rate almost one and a half times that of white Chicagoans. Utilizing quality of life measures along with chronic disease data paints a fuller picture of the environment and can explain why an individual or population may not feel safe or secure using active transportation in that environment.

Other demographic indicators that can be utilized are those related to vulnerable or marginalized populations. The percent of elderly or families with children or age demographics can help make a case stronger for a change to the built environment or need for educational programming. Consider including chronic disease rates and the percent of the elderly population for Vision Zero High Crash Areas or Networks to better describe who is impacted, how they are impacted, and why change is needed.

For program evaluation, the selected health indicators could also be tracked by population over time to measure the effect of program implementation on health.

11 City of Chicago, "Vision Zero Action Plan," Available: https://secureservercdn.net/198.71.233.109/8gq.ef1.myftpupload.com/wp-content/uploads/2016/05/17_0612-VZ-Action-Plan_FOR-WEB.pdf, Accessed: 10 December 2019.

Data collectors may find that data are unavailable at a city or local level. Use these obstacles as opportunities to advocate for the need to start collecting this data and to improve surveying, if necessary. Data from a neighboring city, region, or even at the national level can be used to approximate local conditions. Potential data resources include the CDC 500 Cities project[12] and national level US Census data.

Making the connection between health and transportation can help attract funding for transportation programs from non-traditional resources. Because people age 50 and over are more likely to be victims in fatal and serious injury crashes, the Association for the Advancement of Retired Persons (AARP) is a strong partner of Vision Zero in Chicago. The Richmond City Health District (RCHD) attracted the American Heart Association to its Vision Zero, Safe Routes to School, and Complete Streets initiatives because of the impact of these programs on SDoH and chronic disease. The CDC is funding built environment initiatives through nonprofit organizations and public health departments. The Virginia Department of Health and RCHD received funding for a Complete Streets workshop by the National Complete Streets Coalition from the CDC. The CDC also funds other programs, such as the Walkability Action Institute[13], organized by the National Association of Chronic Disease Directors. Each health condition has an organizational body dedicated to funding initiatives to prevent or treat the condition; the American Diabetes Association and the American Cancer Society are two other examples. Reaching out to such partners can bring not only new ideas but also resources to the table.

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12 https://www.cdc.gov/500cities/index.htm

13 https://www.chronicdisease.org/page/WAI

Centralizing Active Transportation Data Collection Tools

Hannah Keyes & Rye Baerg

Introduction

With cities across the United States looking to expand the use of active transportation to achieve health and sustainability goals, access to accurate data for planning is critical. This is especially true as new technologies enable the collection of granular automobile and micro-mobility data, enabling the analysis of their cost-benefits as never before. Likewise, elected officials are now, more than ever, expecting to allocate resources and make investments using data-driven decision-making and a comprehensive understanding of cost-effectiveness. Similarly, state and regional funding agencies are under pressure to show that projects they are paying for with public tax dollars will deliver the stated benefits.

While many modes of transportation have extensive data collected and analyzed (e.g.: transit and highways), active transportation (e.g.: walking, bicycling, and riding scooters) has, to-date, suffered from a lack of usage data that could help planners better understand trends and needed investments. Specifically, a lack of volume data and counting devices have continually plagued the bicycle and pedestrian planning community. For example, planners in California can currently see where bicycle and pedestrian collisions occur, but without corresponding volume data, there is no way to know if the rate of collisions is unusually high for the number of roadway users.

Background

The Southern California Association of Governments (SCAG) is the nation's largest regional planning agency, covering a region that spans six counties, 191 cities, and 19 million residents. SCAG is responsible for conducting land use and transportation planning as part of the Regional Transportation Plan and Sustainable Communities Strategy. This requires SCAG to collect and analyze data on a wide variety of transportation topics to meet federal and state mandates related to air quality, safety, and greenhouse gas reductions. SCAG also provides data and planning resources to its local jurisdictions to support their sustainability efforts.

While Southern California is known as a haven for the automobile, increasing the number of trips taken through improvements in active transportation infrastructure will play a significant role in meeting the region's sustainability, safety and public health goals. Currently the region faces significant challenges in each of these

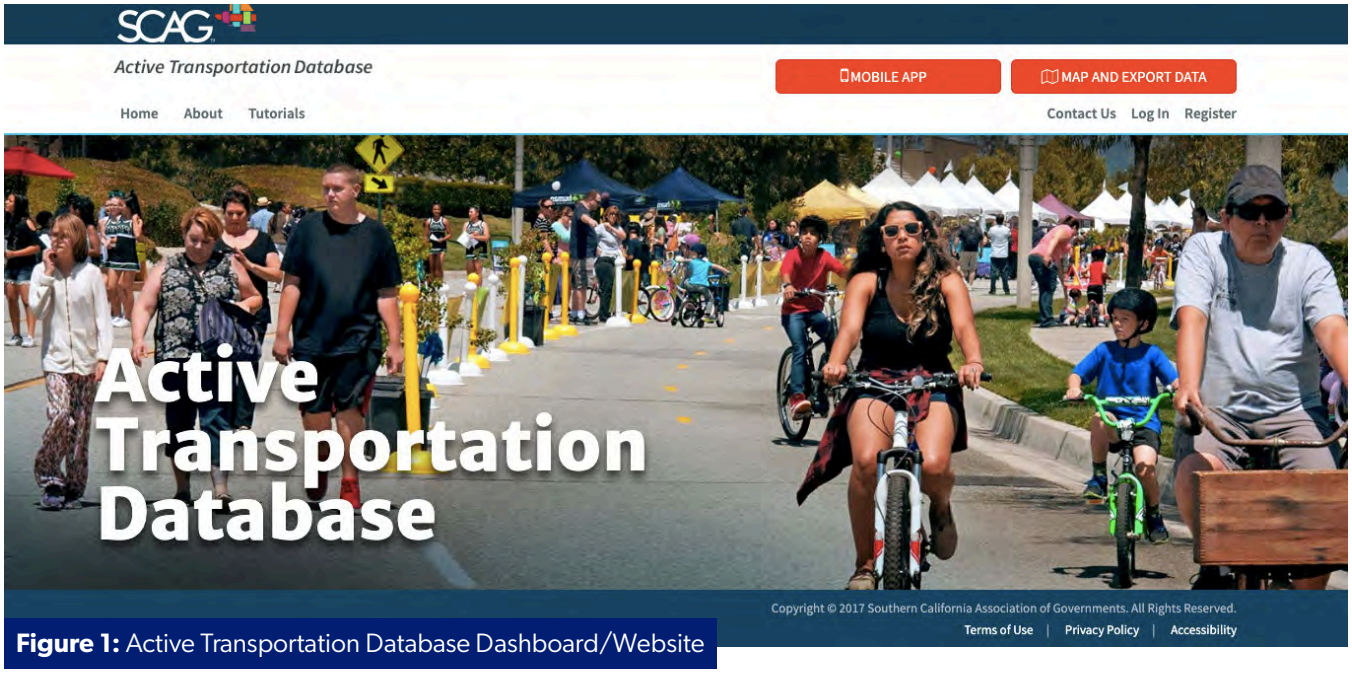

Figure 1: Active Transportation Database Dashboard/Website

areas[1]. Poor air quality due to auto emissions continues to be a major public health concern as air pollutants exacerbate chronic conditions and disproportionately affect vulnerable populations (children, pregnant women, older adults, outdoor workers and populations with disabilities). The region continues to suffer from high rates of pedestrian and bicycle collisions with pedestrians representing 29% and bicyclists representing 4% of all fatalities, while they make up only 7.1% and 1.2% of trips, respectively. Likewise, many in the region suffer from chronic diseases related to physical inactivity (for adults ages 18-64, the rate of diabetes is 8.9%, heart disease is 3.4%, and hypertension is 22%) which cost the region approximately $21 billion per year in medical expenses and lost productivity[2].

Both the State of California and SCAG have, in recent years, expanded funding for active transportation projects. In the most recent rounds of funding, the statewide Active Transportation Program[3] (ATP) requires walking and bicycling volume counts to be taken by successful applicants before and after the projects are implemented. However, determining the extent of the project benefits has not been conducted in a uniform manner that will allow for broader, program-wide analysis. To solve this issue, the California Department of Transportation (Caltrans) recently released interim count guidance[4] for ATP projects to support applicants in collecting data in a consistent manner. Likewise, SCAG has developed the Active Transportation Database (ATDB) to collect and store volume counts consistent with the Caltrans guidance, as shown in Figure 1.

1 Connect SoCal: https://www.connectsocal.org/Pages/default.aspx

2 Southern California Association of Governments. (2016). Active Transportation Health and Economic Impact Study.

3 2019 Active Transportation Program Cycle 4 Guidelines: https://catc.ca.gov/-/media/ctc-media/documents/051618-2019-atp-guidelines-final-adopted-a11y.pdf

4 Interim Count Methodology Guidance for Active Transportation Program: https://catc.ca.gov/-/media/ctc-media/documents/051618-2019-atp-guidelines-final-adopted-a11y.pdf

What is the ATDB?

The Active Transportation Database (ATDB) was created by SCAG, in partnership with the Los Angeles Metropolitan Transportation Authority, to standardize the way counts are collected across the SCAG region and fill the gap in volume data[5]. The ATDB serves as a central location where agencies can provide and analyze volume count data which will help planners effectively prioritize projects and better articulate infrastructure needs and anticipated project benefits. In addition, the ATDB provides an interactive online mapping tool that consolidates all datasets required for Caltrans' Active Transportation Program and SCAG funding programs, along with a rich library of land use, transportation (physical infrastructure as well as traffic, commute share, and High Quality Transit Area layers), and demographic data. The tool also include region-wide active transportation counts from nearby projects and from automatic counters all around the region, as shown in Figure 2.

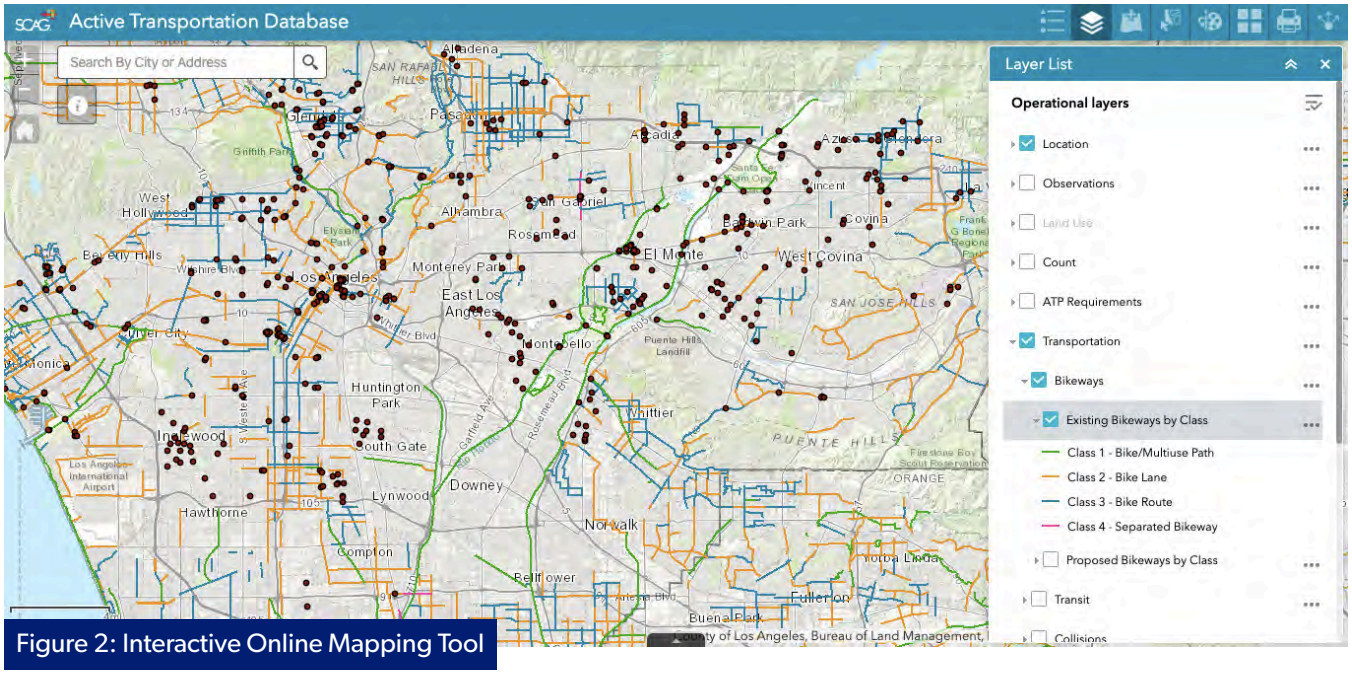

Figure 2: Interactive Online Mapping Tool

The ATDB provides an accessible method of collecting and storing bicycle, pedestrian, wheelchair, and scooter/skateboard volume counts. Each dot on the map (Figure 2) represents a location where a count has occurred. Significant detail is available for every count location including the physical characteristics of the location where the count occurred, time and date, as well as whether it rained. These details help to ensure consistency when the data is analyzed for trends.

The ATDB was expanded from lessons learned from a previous project called the Bicycle Data Clearinghouse (Clearinghouse). SCAG worked with a consultant to expand and further develop the existing Clearinghouse into the ATDB by researching different utilization scenarios. The research included consulting with previous users of the Clearinghouse through direct communications and a survey, a review of similar

5 SCAG's Active Transportation Database: https://atdb.scag.ca.gov/Pages/Home.aspx

Figure 3: Active Transportation Database Mobile Application

national programs[6], regional modelers, similar mobile counting applications, and the Federal Highway Administration (FHWA) Transportation Monitoring Guide (TMG). Building off the federal guidance in the TMG, SCAG hired a web developer to create the user portal and developed a schema for collecting the data, counter locations, and user information.

Where the Clearinghouse was developed to store volume data only from manual counting forms and only for bicycles, the ATDB includes more methods for counting multiple modes. For example, data can be collected from volunteer-led manual counts using either paper forms or mobile devices, uploaded as a spreadsheet, or collected from automated counters which produce larger datasets. The mobile application (Figure 3) is designed for use in both high- and low-volume count locations with options to simply count the total number of users of each mode on the main screen (left), or add details about the person counted on the additional details screen (right).

Users may elect one data collection and upload process over another due to available resources, existing processes at their jurisdiction, level of detail desired, or the physical limitations of the count location. Provision of these multiple data upload and collection options allows the user flexibility to tailor their use of the ATDB to the specific scenario while adhering to federal volume count collection guidelines.

Successes, Challenges, and Next Steps

During the development of the ATDB, the project team struggled to create a system that is both simple for users to access and meets the data standards of the FHWA TMG guidelines. The complexity of the TMG guidelines demands an increased level of effort from users to set up count locations and to upload data. Additionally, staff time required to onboard volunteers and to facilitate the count process can pose a significant challenge in smaller jurisdictions and those with fewer resources.

The ATDB has been through multiple iterations since its inception as the Bicycle Data Clearinghouse. With each iteration, functionality has been added, the user experience has been streamlined, and the data capacity and coverage has been expanded. Looking forward, there is significant opportunity to expand the data analysis functionality and collect additional datasets through expanded data sources. The potential data can be derived from emerging counter technologies and other data collection efforts such as the Mobility Data Specification, a specification developed by the Los Angeles Department of Transportation to manage shared

6 Delaware Valley Regional Planning Commission; Portland State University's Bike Ped Portal; Washington State DOT; Boston Region Metropolitan Planning Organization (MPO); Arlington, VA; Lane County Council of Governments (COG) (Oregon)

mobility providers (such as scooter and bikes share providers)[7].

As new counting technologies emerge and develop, it is imperative that the data be accessible and that data collected using different collection tools be consistent so that planners and policy-makers can accurately understand how the public right-of-way is used and make data-driven decisions about what changes should be made to the public realm. The ATDB creates a standardization of data for the Southern California region that accommodates a wide variety of counting tools while meeting FHWA TMG guidelines and centering the work on a streamlined user experience designed for both technologically-savvy seasoned professionals and count volunteers who may have never before performed a count. SCAG is committed to continuing this work to expand access to robust active transportation data.

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7 LADOT Mobility Data Specification: https://github.com/openmobilityfoundation/mobility-data-specification


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Multimodal Index:

A Collaborative Data Driven Project Facilitated by a Local Public Health Agency

Elizabeth Young Winne, MURP**, MPH, Nick Heimann**, MPH**, & Ryan Dusil**, MURP

Introduction

The Multimodal Index (MMI) describes Census Block Group-level access to non-motorized and transit networks in Fort Collins and Loveland, small cities in Larimer County, Colorado. The final product is a static map, and the Subcommittee members who created it hope to eventually make an interactive map that can be accessed online. The MMI was created during 2018-2019 as a collaborative project that harnessed multi-sector expertise and was led by the Built Environment Program (BEP), a grant-funded program within the Larimer County Department of Health and Environment (LCDHE). This article focuses on the collaboration required to create a scalable and transferable tool that explores health equity and transportation factors to support transportation planning and decision-making processes.

Built Environment at a Local Public Health Agency

In 2016, the Larimer County Department of Health and Environment (LCDHE) launched a Built Environment Program (BEP) to promote physical activity and address health inequities by promoting healthy community goals in urban plans and policies; however, LCDHE does not have the authority to implement land use and transportation policies.

BEP follows a Health in All Policies (HiAP) approach and implements a two-pronged strategy to achieve goals: 1) work directly with professionals who implement land use and transportation policies to support the integration of health into plans and policies; and 2) work with community members, non-profit agencies, and advocacy organizations to develop community-driven projects and support effective community engagement efforts. This requires BEP to rely on a diverse range of partners, representing multiple sectors, institutions, and disciplines, including non-profit organizations, community-based groups, data analysts, land use and transportation planners, and public works and engineering staff.

In practice, BEP seeks projects from partners and offers technical assistance to create and increase organizational capacity to incorporate health into plans and policies (Figure 1). In 2018, BEP's three full-time staff supported 48 departments, committed 84 hours to seven Technical Advisory Committees, and spent 46% of technical assistance time providing support on projects with a policy implication or direct connection to policy. While the approach is simple, the work requires significant capacity and funding.

In addition, part of BEP's approach includes facilitating working groups. These groups are intended to foster multi-sector networking,

Figure 1: BEP Goals and Technical Assistance Areas

collaboration, and resource sharing. BEP facilitates three working groups, each with complementary focus areas: a Built Environment Leadership Team, Community Engagement Working Group, and Data Working Group (Figure 2). In 2018, BEP hosted 36 coalition meetings with 265 participants, and planned four workshops attended by 72 decision makers, staff, and community members. The Multimodal Index (MMI) described herein was a product of the Data Working Group. The Data Working Group played an integral role and was key to creating this useful tool.

Purpose and Function of Data Working Group

Data Working Group (DWG) is a multi-sector group of professionals representing local government (staff of local government, not including design practitioners, who may be in communication, program development, GIS, and/or those who do not fall into a different category), design practitioners (those working on planning, land use, zoning, transportation, and streetscapes), data analysts and Information Technology staff (IT, IS, data analysts, and/or evaluation professionals), local public health agency or health care organizations (organizations

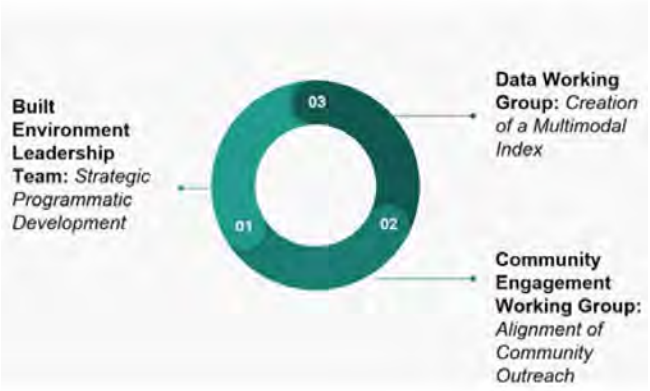

Figure 2: Recent Working Group Focus Areas

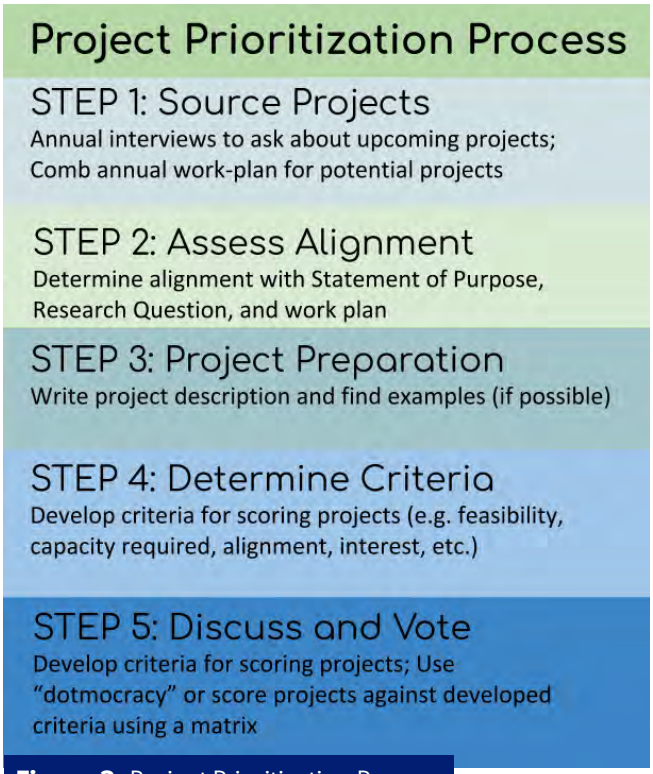

Figure 3: Project Prioritization Process

delivering public health and/or health care services), as well as occasional participation of university and school district representatives. Central to the group's operation has been the creation of a Statement of Purpose which states DWG will collaboratively work to create healthier communities by collecting and analyzing data, creating materials or tools to educate, and sharing best practices.

Project Prioritization

One of the ways that the Statement of Purpose is put into action is through the creation of joint projects that leverage data to shine light on how health is influenced by planning. Selected projects must be in alignment with the Statement of Purpose and must also answer the Research Question. The research question was created by DWG through a facilitated brainstorming process where members bring their own expertise to look at existing data and policy gaps and formulate a question that might help solve some policy gaps. The research question, developed originally in 2017, that guided the creation of the MMI asks: How do policies influence the variability of infrastructure quality between neighborhoods? DWG members then leveraged the Statement of Purpose and the research question to prioritize one of the several proposed projects, as shown in Figure 3.

Creation of the Multimodal Index

Once the Data Working Group (DWG) selected the Multimodal Index (MMI) using the project prioritization process, the first step was to establish a subcommittee that would work on technical development. The Subcommittee originally created a nine-month process plan to help structure the project creation (Figure 4). During the first two months of the project, the Subcommittee established a strong foundation by creating a shared vision, establishing group norms, determining a communication channel, and choosing a project manager. During this time, the Subcommittee also determined a definition for the Multimodal Index as "a [tool that] describes a neighborhood's access to non-motorized transportation and transit options" and outlined long- and short-term goals.

Following those foundational steps, the Subcommittee discussed and debated the technical aspects of the project. The group intended to use existing index products from other regions to guide development of an index that was relevant and achievable for the northern Colorado region. As DWG began to review similar concepts for replication, it became clear that the Subcommittee would not be able to replicate a model exactly. Rather, the group would need to identify a model, or set of models, that could be modified and adapted to the context of the region.

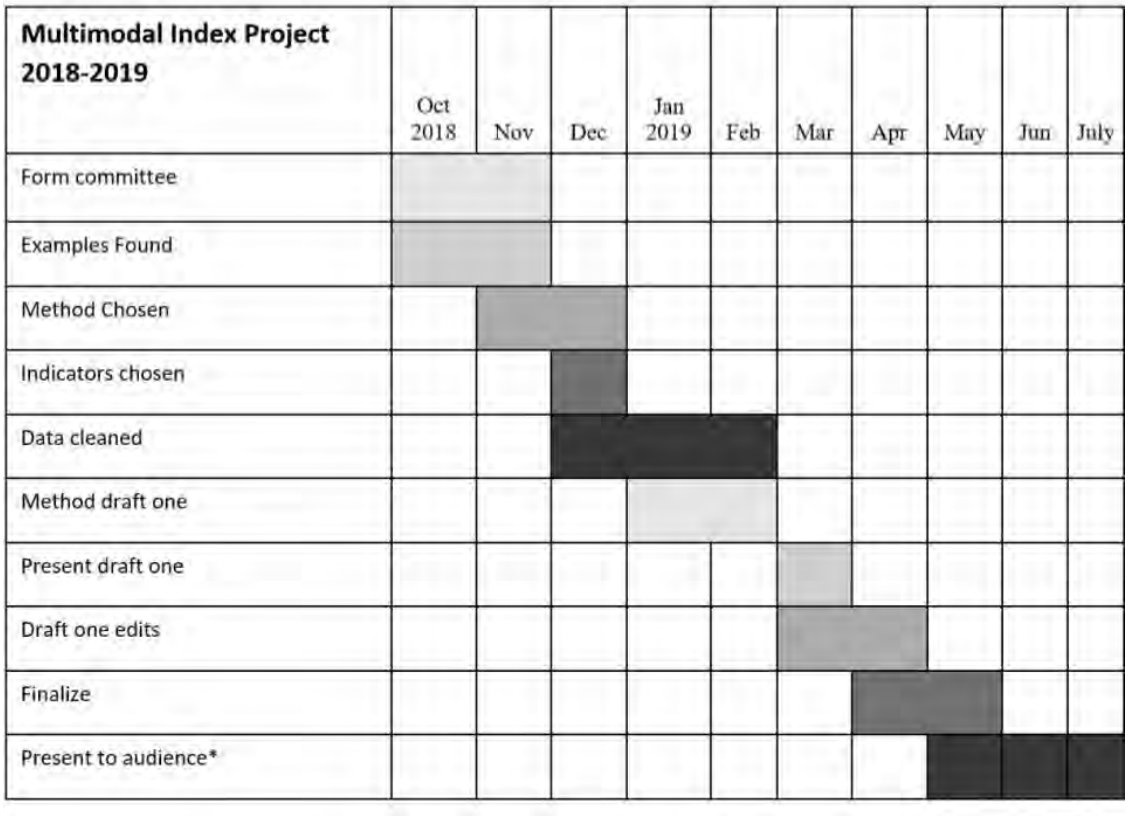

Figure 4: Original Project Schedule

The group created criteria, shown as Figure 5, for scoring the existing index products they reviewed. Scoring included criteria such as the methodology's ability to integrate infrastructure quality into the score, whether it required indicators that can be problematic in less densely populated areas due to survey data quality or ambiguous interpretation, and whether it allowed for an objective process to create a quantifiable and standardized score. DWG and Subcommittee scored three methodologies ("Equity of Access to Bicycle Infrastructure" by Rachel Prelog for the League of American Bicyclists, 2015; "2018 Neighborhood Slow Streets: Scoring Methodology and Zone Evaluation" for Boston Department of Transportation, 2018; and "Measuring Access to Opportunity" for the City and County of Denver Blueprint, 2018), and settled on modelling the MMI indicator scoring methodology based on the neighborhood project evaluation done by Boston's Transportation Department. This existing product was chosen for its practicality, adaptability, and descriptive nature. The methodology generated a final neighborhood-based score using three categories: Vulnerable Users, Crash History, and Proximity to the Active Transportation Network.

Once the Subcommittee had a methodology to adapt, the debate began around what indicators to use in the index. The Subcommittee started with the same categories (Vulnerable Users, Crash History, and Proximity to the Active Transportation Network) provided in the "Neighborhood Slow Streets" methodology but considered 15 indicators that were readily available and relevant to the region. The Subcommittee considered

	Directions: Using the Criteria in the rows, score each methodology shown in the columns. Score 1 through 5 = 1 means "impossible", 2 means "it's unlikely", 3 means "maybe," 4 means "likely" and a 5 means "definitely." Add scores up in Total Row for each column.	League of American Bicyclists "Bike Equity Index"	City/County of Denver "Access to opportunity"	Boston "Slow Street Neighborhood Application"
1	Can the methodology integrate quality into the score?			
2	Can the methodology integrate level of service into the score?			
3	Can the methodology be easily adaptable to transit, bike, and pedestrian modes?			
4	Does the methodology use an objective process for producing a quantifiable and standardized score that can be easily mapped (i.e, an objective criteria, Z-Score, other statistical process)?			
5	Does the methodology require indicators that notoriously have high margin of error? (for example, "no vehicle household" at the block group level)			
6	Can the methodology easily include other indicators that are prioritized by the Data Working Group (i.e, health and/or demographic data)?			
7	Is the methodology easy enough for multiple stakeholders to understand and replicate?			
8	Would the final product be easily replicable and scalable in a growing region?			
9	How easily can the final product be updated or modified as data changes (is the data easily accessible? Is the final product automated? How much data manipulation is needed?)?			
	Total			

Figure 5: Scoring Criteria for Choosing a Methodology

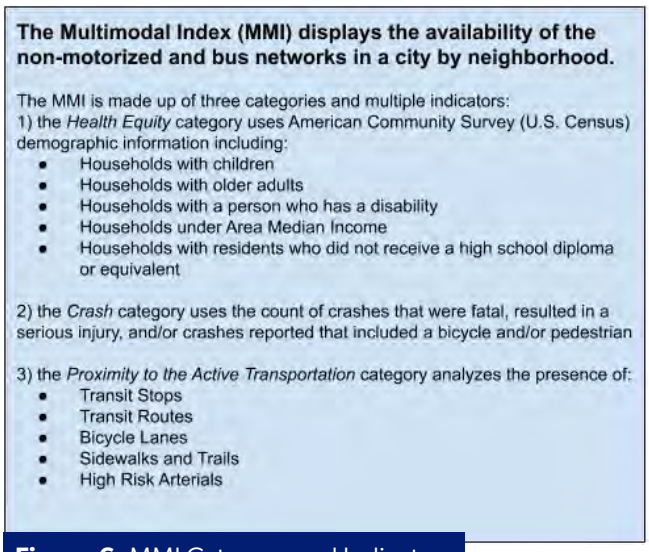

Figure 6: MMI Category and Indicators

the pros and cons of using each indicator and all participants had the ability to fully share opinions. After three meetings of deliberation, the Subcommittee determined that the best option to finalize indicators was to use exploratory statistical analyses to understand which local indicators would be the most appropriate for the context. The resulting indicators were divided into three categories: Health Equity, Crashes, and Proximity to the Active Transportation Network (Figure 6).

The six months spent developing a methodology and indicators were essential in allowing Subcommittee members from different institutions and disciplines to build relationships, trust, and rapport. This time was foundational to the group's success.

During the Spring, Summer, and Fall of 2019, the Subcommittee experienced high performance and it became clear that time spent developing trust and rapport would be a benefit to the group overcoming obstacles. As Subcommittee members tackled data analysis tasks, the group ran into data quality issues and had to create consensus on which limitations would be inherent to the MMI. After twelve months of collaboration, the MMI was finalized in October 2019. The final product is a static map, and Subcommittee members hope to eventually make an interactive map that will be accessed online. The Multimodal Index, as presented to partners in November 2019, is shown as Figure 7 and Figure 8.

A lower MMI score indicates greater availability to the non-motorized and transit network; whereas a higher score indicates less availability and therefore more opportunity for connectivity improvements.

Next Steps for the Multimodal Index

At the time of publication in the 2020 State of Transportation Report, the Multimodal Index (MMI) is being disseminated. The Subcommittee prioritized this essential step to ensure the MMI provides value to the community and to the stakeholder organizations represented and served by the Subcommittee members. While a true success, the completion of a large, collaborative project like the MMI should not be considered the final step. Rather, dissemination of the final product signals movement into a new phase where continued engagement of the group members is essential.

The Dissemination Plan is educational and focused on providing facts and information about the MMI. The Dissemination Plan calls for the creation of a versatile toolkit including an infographic, one-page fact sheet, presentation, brief methodology, and a detailed methodology. Creation of the toolkit started in Winter 2019, presentations are planned for early 2020, and the Dissemination Plan is expected to be finalized by Fall 2020. In addition to Dissemination, potential short- and long-term projects have been identified, although none of these ideas have been formalized at the time of publication.

Potential Short-Term Projects

In addition to the implementation of the Dissemination Plan, partners of DWG and BEP realized the potential for the MMI to serve as a tool for advancing transportation equity within

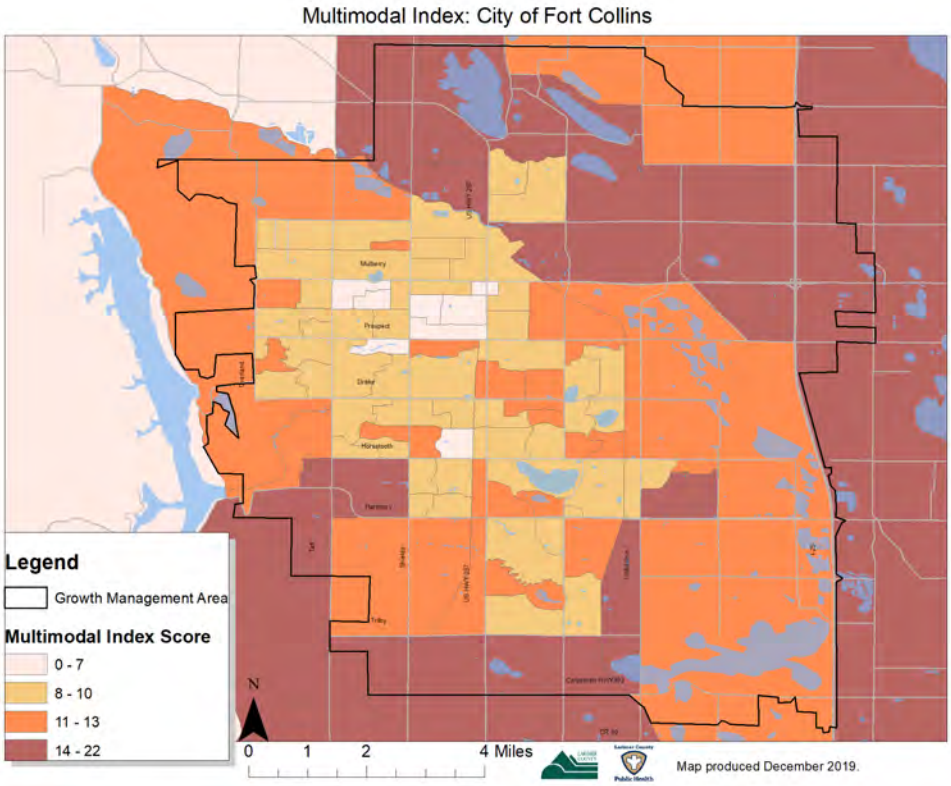

Figure 7: Multimodal Index, City of Fort Collins

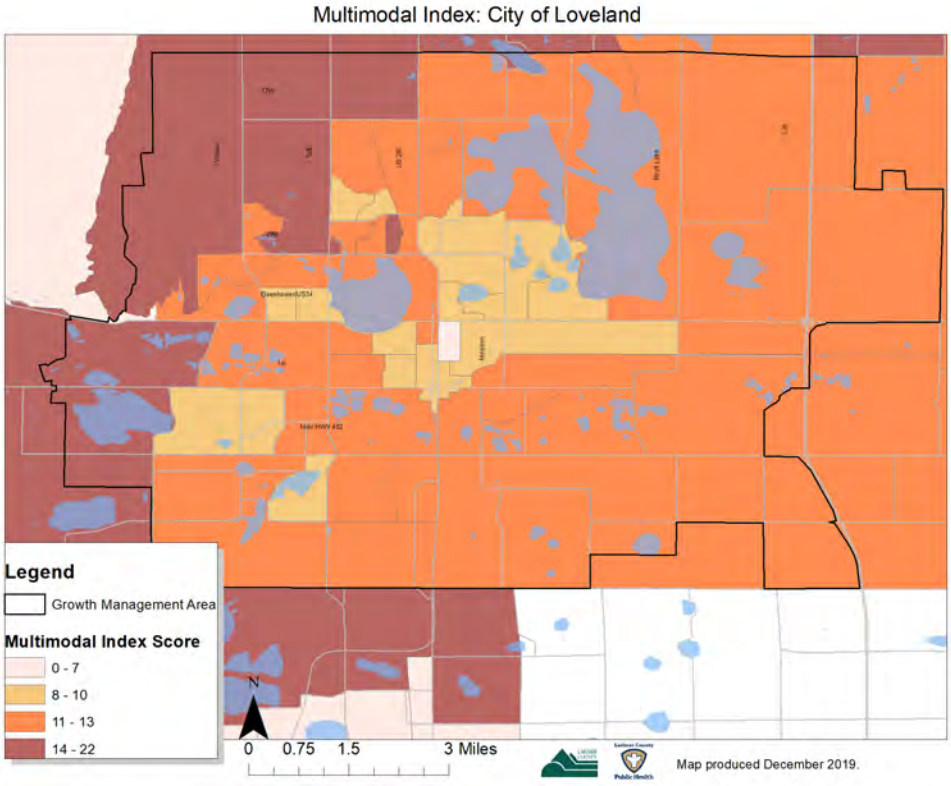

Figure 8: Multimodal Index, City of Loveland

the region. There have been conversations between local non-profit organizations and the Subcommittee about organizing experiential events that can provide decision makers with hands-on experience to demonstrate how policies can inequitably distribute multimodal infrastructure throughout a city. Likely, the Subcommittee will support the efforts by providing context about the MMI, but the events would be facilitated by a non-profit entity. Ideally, these events could work with community members and non-profits to identify short-term projects and quick wins that can be implemented to better support neighborhoods, highlighted by the MMI, that lack access to the multimodal network.

Potential Long-Term Projects

At this point, there are no plans in place for the MMI to be incorporated into any plan updates; however, partners have begun discussing a variety of ideas. The MMI provides a framework and methodology that can be adapted or adjusted based on unique community contexts, which could lead to the MMI becoming an objective scoring tool for project prioritization. Notably, the Dissemination Plan associated with the MMI is intended to supplement local professional knowledge about the interaction between land use, transportation, and health equity which can have an influence on local long-range plans.

Lessons Learned about Multi-Sector Collaboration

For similar projects, professionals may want to leverage a multi-sector coalition, but that task may be seen as burdensome or difficult. The remainder of this article provides insights and lessons learned for leveraging multi-sector collaboration to implement a project.

Lesson Learned: Project Manager was Essential

The Health in All Policies (HiAP) approach used by Built Environment Program (BEP) relies on multi-sector collaborative efforts in order to successfully accomplish program goals of promoting health and equity in plans and policies. The Multimodal Index (MMI) process exemplifies the synergistic benefits of a multi-sector collaboration and was successfully managed by the BEP. Ultimately, BEP had responsibility to accomplish the MMI as a function of the Data Working Group; no other members of the Subcommittee had the project as part of their regularly outlined job duties. The project manager was able to research, plan meetings, set up worksheets and activities for the group to deliberate successfully, and work on the project tasks with individual Subcommittee members. The time and capacity required to implement the project cannot be understated, as the project manager spent a conservative estimate of 10% of total work time, or 200+ hours over the course of the year on the project.

Lesson Learned: Multi-Sector Partnership was Invaluable

At the first Subcommittee meeting in October 2018, Subcommittee members spent time identifying missing skill sets and perspectives. Prioritizing diverse representation within the group at the beginning allowed the Subcommittee's composition to quickly expand, thus increasing the depth of skills, capacity, and perspectives of the Subcommittee at the start of the process (Figure 9).

Lesson Learned: Create a Shared Vision

The initial decision to invite more partners and stakeholders at the beginning of the process paused all other planning efforts. When willing and interested stakeholders were present, the Subcommittee collaboratively created and agreed upon the MMI definition, a purpose,

Partner	Sector	Institution	Discipline	Involvement
City of Fort Collins, FC Moves	Public	City government	Multimodal planning	Continuous
City of Fort Collins, Planning & Development Services	Public	City government	Land use planning	Continuous
City of Fort Collins, Transfort	Public	City government	Transit operator	Intermittent
City of Loveland, Public Works	Public	City government	GIS	Continuous
Larimer County, Data Analytics	Public	County government	IT	Intermittent
Larimer County, Economic and Workforce Development	Public	County government	Data analytics	Continuous
Larimer County, GIS	Public	County government	GIS	Intermittent
Larimer County, Health and Environment	Public	County government	Health	Continuous
Health District of Northern Larimer County	Public/Non-profit	Special tax district/non-profit	Public Health, Population Health Data Analytics	Continuous
North Front Range Metropolitan Planning Organization	Public	Regional government	Transportation planning	Continuous
Local Advocacy partners	Non-profit	Non-profit	Bicycle, pedestrian, and transit advocates; Older adult advocates; Persons with disabilities advocates	Future Dissemination

Figure 9: Multi-Sector Subcommittee Members

and associated Subcommittee goals. While the motivations for participating varied greatly amongst Subcommittee members, developing a shared vision helped create a foundation and provided grounding statements for the group to reference when making difficult decisions.

Lesson Learned: Process and Schedule Must Be Iterative and Flexible

There was a need to be flexible as the project went through many iterative phases, which led to a significant delay in the original timeline, which was projected to take only nine months. The actual schedule is shown as Figure 10. However, participants noted that increased flexibility led to a higher quality product and greater ability to engage participants. The delays were necessary for the Subcommittee to recalibrate, reflect, and consider alternatives. The resulting efforts led to the thoughtfully created tool designed by professionals with differing perspectives and knowledge on transportation, land use, data, and spatial analytics.

Lessons Learned: Assess Data Quality at the Start of Process

Because the MMI required hyperlocal data (existing and planned trails, sidewalks, bike lanes, transit stops, transit routes, and arterial roadways) the Subcommittee relied on various geospatial datasets. However, the Subcommittee

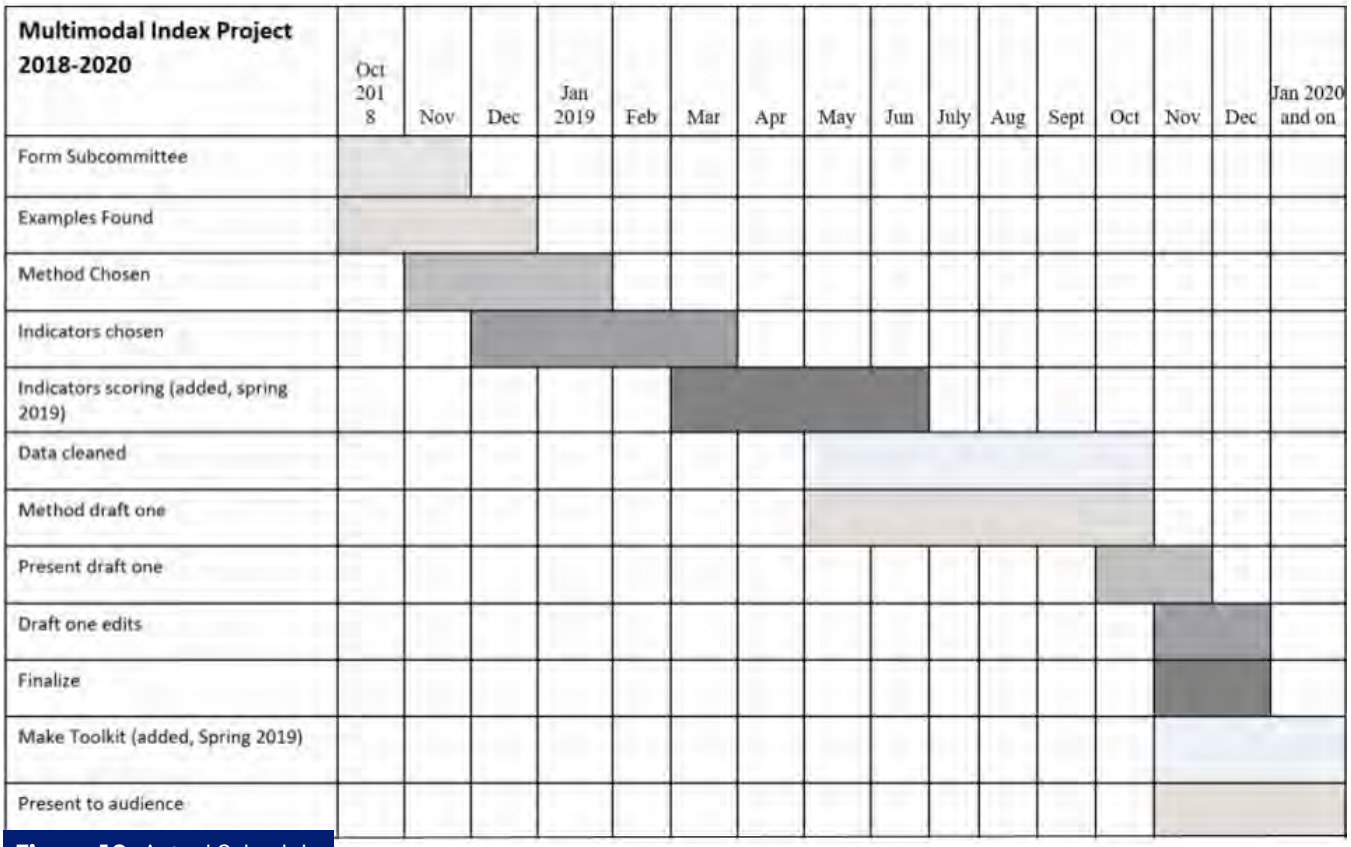

Figure 10: Actual Schedule

quickly realized the only similarity in the datasets was the mere existence of shapefiles managed by each respective municipality. There was no consistency in quality, attributes, projections, scale of accuracy, or network completeness. Furthermore, updates to data occurring within the City of Fort Collins or the City of Loveland are not automatically updated within the North Front Range Metropolitan Planning Organization's systems, resulting in even more effort required to clean and aggregate data across jurisdictional boundaries. However, the Subcommittee was too far in the process to abandon the entire project, so they made compromises to the original intent. In hindsight, a critical first step in determining project feasibility should have been assessing the data's accuracy, consistency, and completeness across all data owners.

Conclusion

The Subcommittee aspired to create a spatial analysis tool that would describe access to the multimodal network at a neighborhood scale. Debatably more important, the Subcommittee created a framework for a multi-sector group to successfully collaborate on a geographically diverse project despite sectoral or municipal differences in knowledge, skills, and data quality. The MMI is a powerful tool as a result of the group's diverse composition. While there are lessons to be learned from this project, these facts remain clear: high-functioning, collaborative working groups require care in cultivation; schedule changes should be anticipated and managed with transparency and flexibility; and early assessment of the group's capacity to standardize data managed by multiple organizations is important for determining project size and scope.

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City Tech Solution:

Delivery Congestion Reduction

David Leopold, George Letavish, Laura Vecchetti, Finn Swingley, Jordan Cooper, Megan Blouin, Danielle Fournier & Adam Hecktman

Summary

The explosion of e-commerce has led to faster, more frequent, and more abundant delivery services, resulting in increased congestion in cities, disruptions to supply chains, and increased costs for delivery providers.

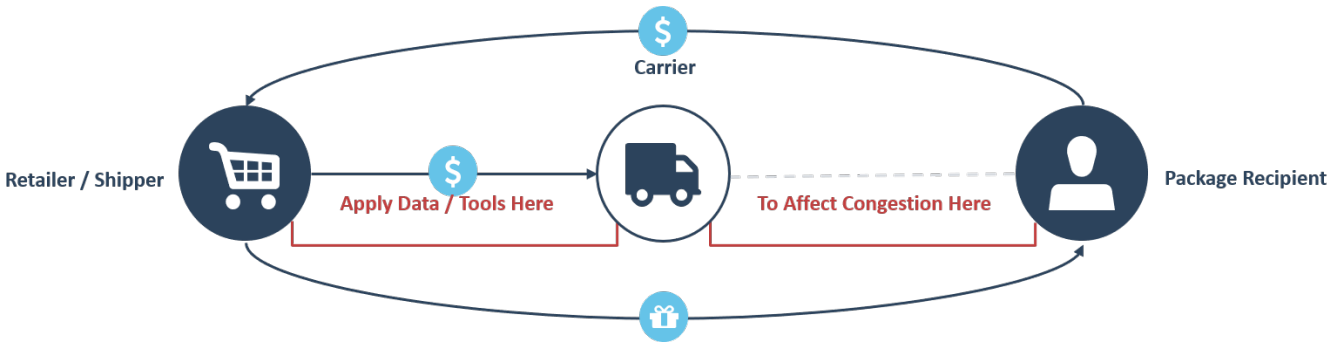
To address this need, City Tech Collaborative partnered with HERE Technologies, Accenture, UPS, and Microsoft to develop new data tools to create flexibility for last-mile package deliveries, with the potential to reduce traffic congestion.

Using a known congested area in Chicago as a testbed, the team analyzed UPS vehicle data to understand routes, delivery performance, and the impact on congestion. By merging traffic data and delivery activities, the pilot demonstrated opportunities for efficient, cost-effective, and congestion-reducing road-sharing for both delivery carriers and consumers.

The effort showed how multiple stakeholders can benefit from integrating delivery data and traffic mapping to understand exactly where delivery services are causing friction in cities. With this information, cities, retailers, and shippers can target specific populations and offer incentives at scale to increase delivery flexibility and reduce congestion and associated costs. In addition, cities could make data on traffic congestion and mitigation efforts easily accessible to third parties.

Deliveries: Disrupting Traffic and Supply Chain in Cities

Same-day deliveries and expanded online shopping options are becoming part of consumers' everyday lives. Although convenient, the increased demand for fast deliveries contributes to road congestion in cities globally.



Increased traffic congestion is not only a nuisance, but it is also dangerous to all who share the road – from drivers to bikers to pedestrians – as well as takes an additional toll on the environment.

Consumer demand has encouraged last-mile urban logistics to increase delivery services and frequency, even in constrained geographies. These demands increase costs for delivery providers as well as disrupt supply chains across industries.

Understanding the impact of deliveries in cities can help shippers, retailers, and cities become more efficient with their logistics and decrease traffic congestion.

A Collaborative Approach to Solution Development

Delivery services and the resulting traffic congestion affect cities, public and private businesses, and residents. Unique collaboration among delivery service providers and data analytics organizations can determine the extent to which delivery services are causing road congestion and the areas where their impact is the highest. Using these tools, retailers and deliverers can determine flexible delivery options for consumers, thus reducing traffic congestion and lowering delivery costs.

The Delivery Congestion Reduction pilot resulted from a workshop hosted by City Tech in September 2017 to explore opportunities to develop innovative demand management methods for last-mile deliveries and to reduce congestion in cities. By collaborating with and understanding end-users and their real-world challenges, the workshop identified solutions that can be designed, developed, and deployed to more effectively manage urban logistics.

City Tech's solutions focus on the intersections of physical infrastructure, data and digital infrastructure, and public and private services. Delivery congestion impacts all three of these areas, thus calling for collaboration across sectors.

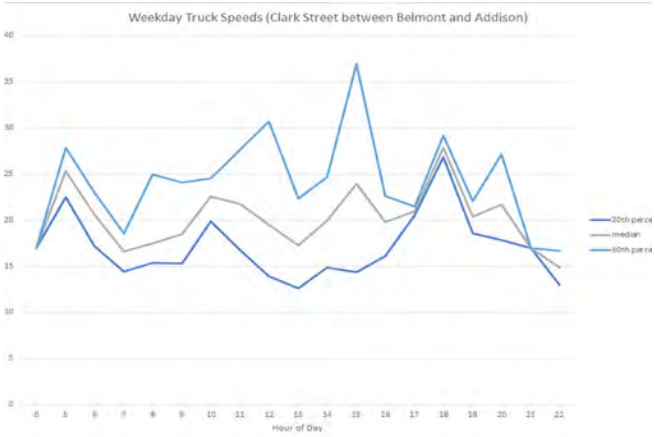
City Tech Collaborative

City Tech Collaborative (CityTech.org) is an urban solutions accelerator that tackles problems too big for any single sector or organization to solve alone. City Tech's work uses IoT sensing networks, advanced analytics, and urban design to create scalable, market-ready solutions. Current initiatives address mobility, healthy cities, connected construction, and emerging innovation opportunities. City Tech was born and raised in Chicago, and every city is a potential partner.

As a member-driven consortium, City Tech combines the best tools and thinking from leading corporations, local governments, startups, civic and academic institutions, residents, and community organizations. From identifying and developing the initial problem statement to implementing a solution, City Tech's solution development methodology accelerates impact-driven innovation and collaboration, as well as enables multiple parties to come together to work on a single solution.

Here Technologies

Lead sponsor of the solution, HERE Technologies (Here.com) builds open solutions for the future and redefines the digital map and the future of location technology. As creators of three-dimensional maps packed with layers of information and insights, HERE's data science team led the traffic congestion analysis at a highly granular, road segment level and developed the solution to determine the relationship between delivery stops and their effect on traffic delays.



HERE analyzed traffic speed at specific stretches of Chicago's streets.

An example of HERE's mapping to determine weekday truck congestion at specific times in Chicago.

Accenture

Accenture (Accenture.com) drives innovation by partnering with clients to transform and grow organizations. The Accenture team provided key project management to focus the solution and meet the pilot's goals.

UPS

UPS (UPS.com) is the world's largest package delivery company and a leading global provider of specialized transportation and logistics services. UPS supplied vehicle trajectory and delivery stops data and insights on Chicago routes for analysis.

Microsoft

Microsoft (Microsoft.com) enables digital transformation for the era of an intelligent cloud and an intelligent edge. Microsoft was essential in orchestrating the design of the approach, model, and analysis of the solution.

Pilot

The team analyzed congested areas in Chicago as a testbed as well as examined UPS delivery route data. With the goals of reducing traffic congestion from UPS delivery vehicles, the pilot set out to:

- Demonstrate capabilities to validate routing and scheduling models
- Identify specific locations to target with interventions
- Identify characteristics of high congestion/cost areas for last-mile delivery

Pilot Design

HERE provided and analyzed traffic congestion data at the road segment level in highly granular and aggregated time frames to determine the testbed area.

UPS supplied vehicle trajectory and stops data on seven Chicago routes from October 9, 2018 to November 7, 2018 to understand delivery

and congestion patterns. The data included information on:

- 7 routes
- 23 vehicles
- 288,000 GPS points
- 152 trajectories
- 12,612 stops

Using this known congested area in Chicago, HERE conducted analysis using UPS data to determine the correlation and identify potential areas where flexibility in time or location of deliveries could reduce costs and ease congestion. The pilot demonstrated opportunities to merge data and delivery activities into efficient, cost-effective, and congestion-reducing road-sharing techniques for both delivery carriers and consumers.

Analysis: Identify Stops & Speeds Related To Deliveries

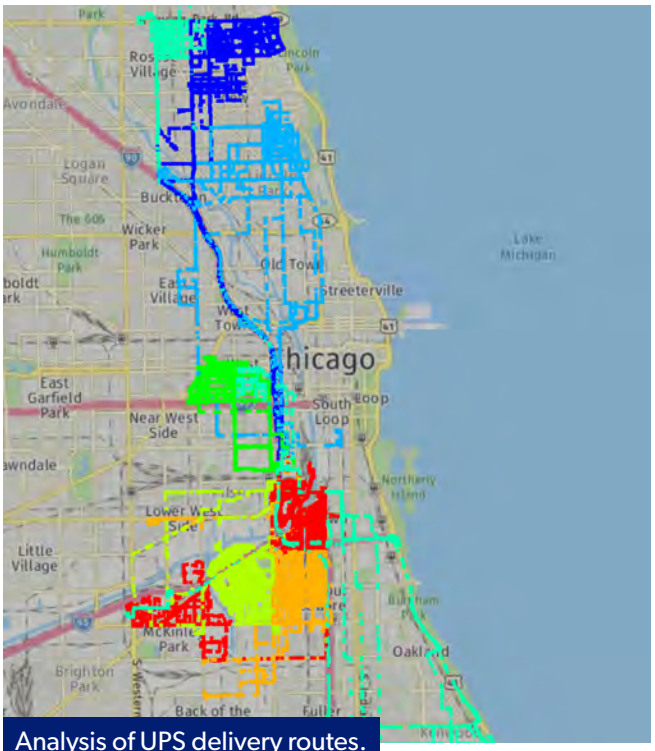
Analysis:

Delivery stops were identified in UPS's trip log records based on when "ignition off" was listed in the data. These stops were mapped to match HERE's map segments with traffic speed data.

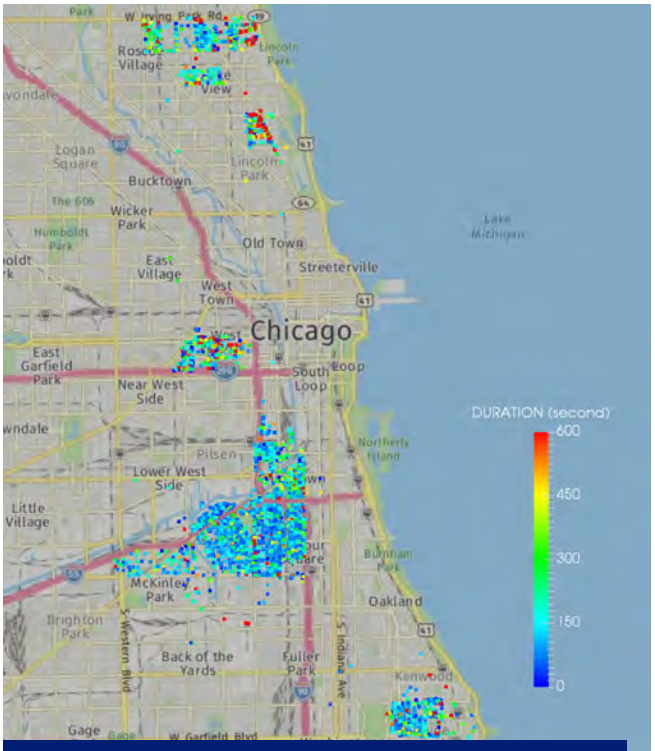
HERE matched each UPS stop to the appropriate road segment, then used the weighted average

Date Time	Latitude	Longitude	Speed	Ignition	Aux1_Backing	Aux2_Braking	Aux3_Bulk Head	Aux4_Seat Belt
12:52:39.063	41.95435	-87.66321	0.00					
12:53:03.063	41.95433	-87.66323	1.24					
12:53:07.127	41.95425	-87.66328	9.32					
12:53:08.127	41.9542	-87.66328	9.32					
12:53:15.127	41.9539	-87.66328	9.32					
12:53:30.063	41.95407	-87.66349	0.00					
12:53:34.063	41.95407	-87.66349	0.00					Off
12:53:37.063	41.95407	-87.66349	0.00	Off				Off
12:53:39.063	41.95407	-87.66349	0.00	Off			Open	Off
12:58:32.063	41.95407	-87.66349	0.00	Off				Off
13:34:11.063	41.95407	-87.66349	0.00	Off				Off
13:36:41.063	41.95407	-87.66349	0.00	Off			Open	Off
13:37:07.127	41.95407	-87.66349	0.00	Off			Open	Off
13:37:35.063	41.95407	-87.66349	0.00	Off				Off
13:37:44.063	41.95407	-87.66349	0.00					Off
13:37:45.063	41.9541	-87.66349	0.00					Off
13:37:47.127	41.9541	-87.66349	0.00					
13:37:52.063	41.95412	-87.66349	1.24					
13:37:56.127	41.9542	-87.66354	9.32					
13:38:01.063	41.9543	-87.66351	0.00					
13:38:06.063	41.9543	-87.66351	2.49					
13:38:08.127	41.95435	-87.66349	9.32					
13:38:09.127	41.95435	-87.66344	12.43					

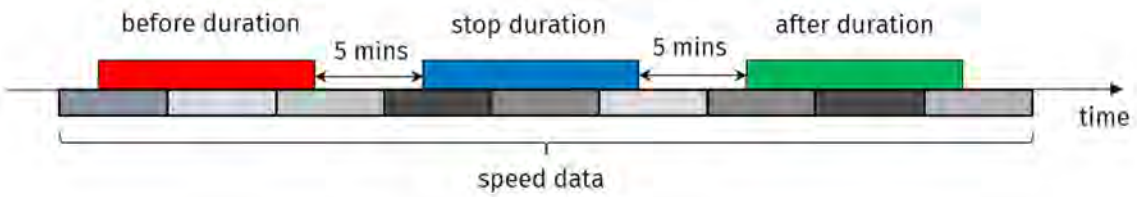
Analysis of UPS schedule data.



Analysis of UPS delivery routes.



Map shows the duration of each UPS delivery stop for the analysis.



traffic speed at that location to assess the time leading up to, during, and after the delivery. The traffic analysis was accomplished using processed, archived GPS probe data matched to the HERE map segments, averaged in five-minute intervals. HERE then tested whether there were statistically significant differences between traffic speeds during the stop and before/after the stop.

Results:

Using UPS data, HERE Technologies' data science team compared the data to understand where traffic patterns and congestion differed to determine the impact on congestion. The team found no significant difference between speeds before, during, or after UPS stops, and a larger sample size is needed to fully draw correlation between deliveries and road congestion. However, qualitative data suggests that there must be some impact on road congestion from deliveries.

Analysis: Stops And Packages Per Road Segment

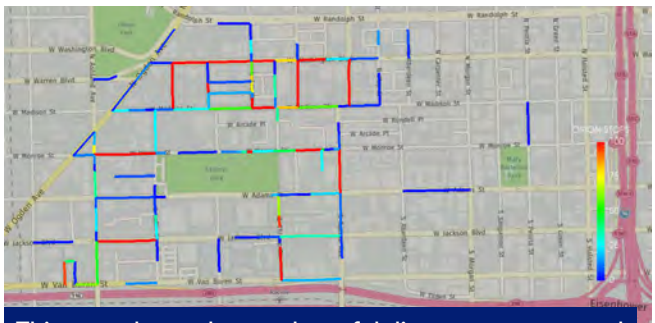
Analysis:

The team analyzed the number of stops per road segment as well as the number of packages delivered per road segment to determine delivery demand in specific geographies.

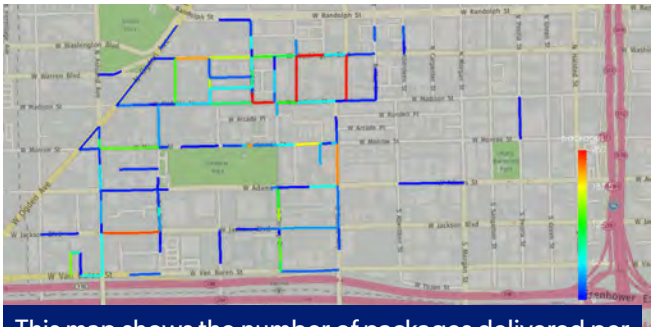
The team aligned the stop time as defined in GPS data (engine off) with package delivery data contained in UPS's data file (Orion), then determined the number of packages delivered per stop and total time spent delivering each package.

From this, the team found the following general statistics:

- Total number of stops = 10,197 (There are 12,611 stops identified from GPS files, out of which the team was able to match 10,197 with the Orion stop files)
- Median stop duration = 162 seconds



This map shows the number of delivery stops per road segment.



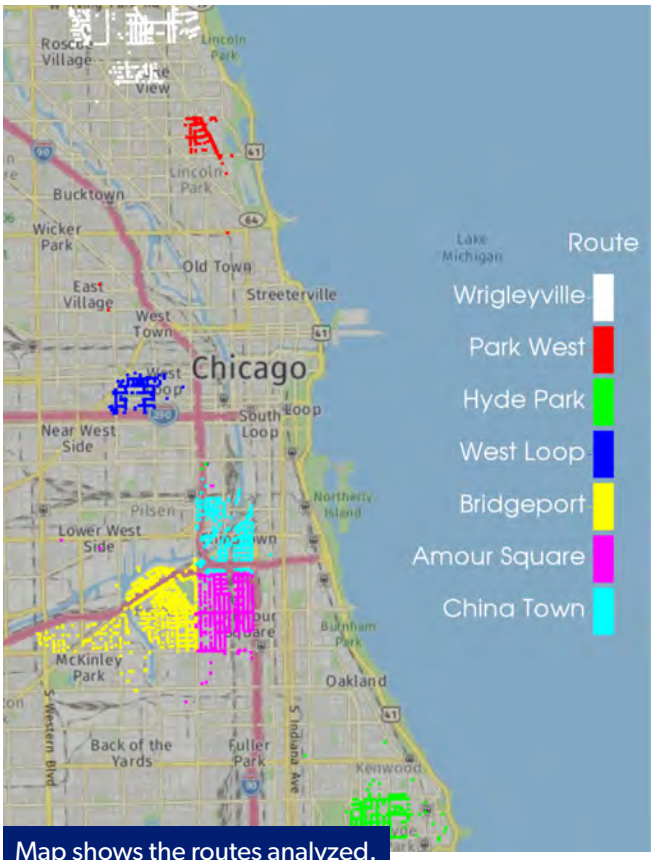
This map shows the number of packages delivered per road segment.

- Median number of packages delivered per stop = 2
- Median package delivery rate (i.e., number of packages delivered per minute of stop duration) = 0.8

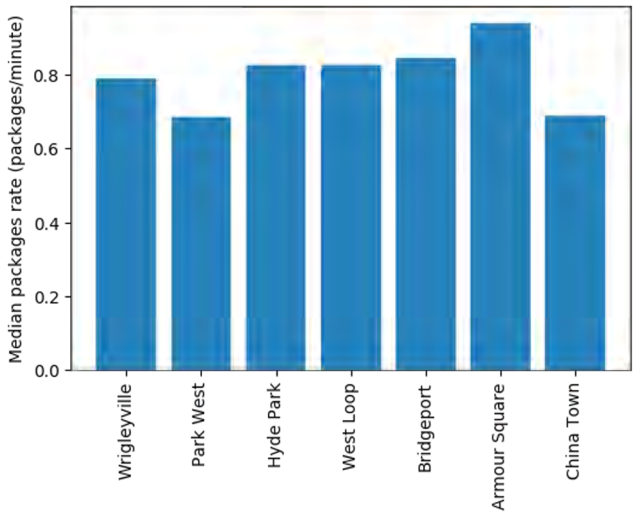
Results:

Analysis found that UPS balanced the number of packages delivered on a route with the level of difficulty (amount of time required) quite well, with a similar median rate for per-package delivery across all seven analyzed routes.

Although the overall per package rate was relatively consistent across routes, variances in time per stop and time per package existed. Routes with a high number of packages and a high number of stops tended to occur on commercial or mixed-use roads. Park West tended to have longer stops and more packages delivered per stop than other routes (see charts above for median duration and median number of packages per stop for each route). The analysis found an inverse correlation between the number of stops and the stop duration.

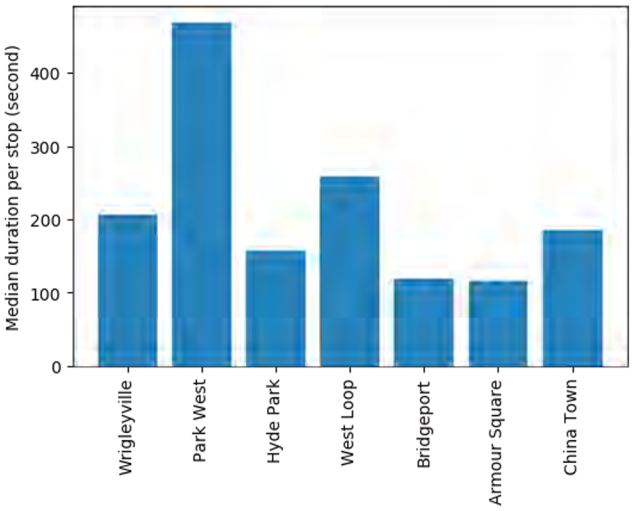


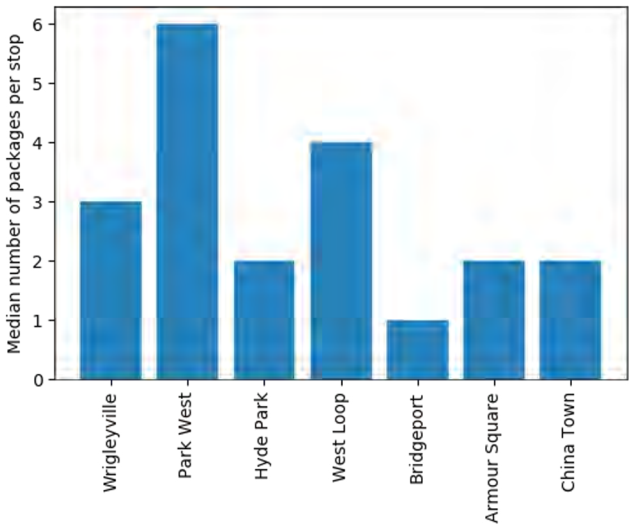
Map shows the routes analyzed.

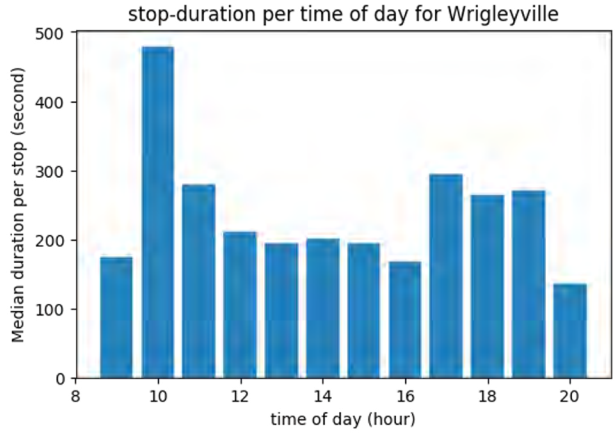


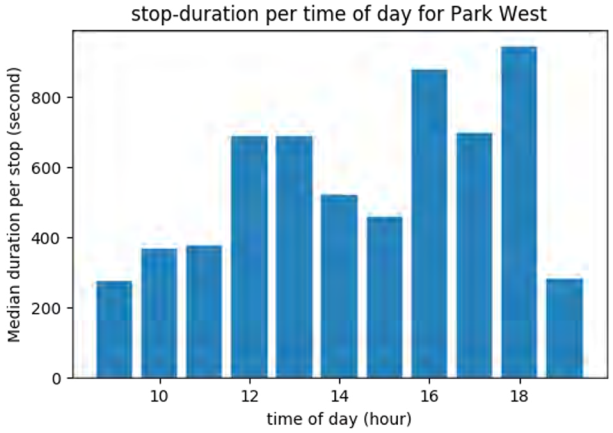
Graph shows the median packages rate (packages delivered per minute) for each route.

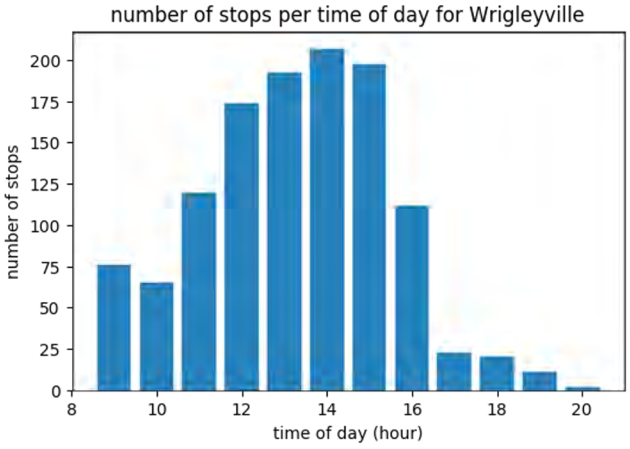
For most routes, the longest stops occurred at 10 a.m. and 11 a.m., with Park West being the outlier and experiencing the longest stops at 4 p.m. (see charts below for stop duration over time of day for example routes).

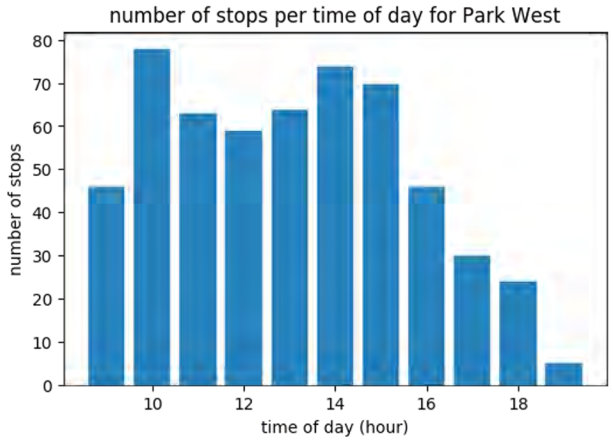


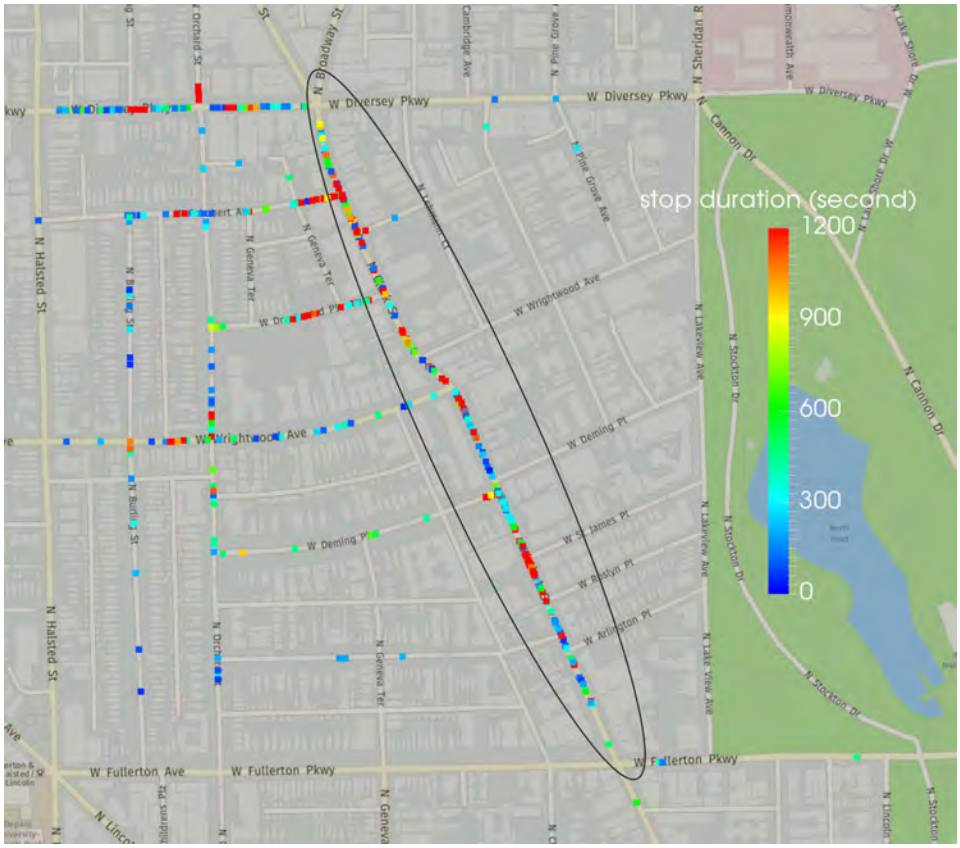


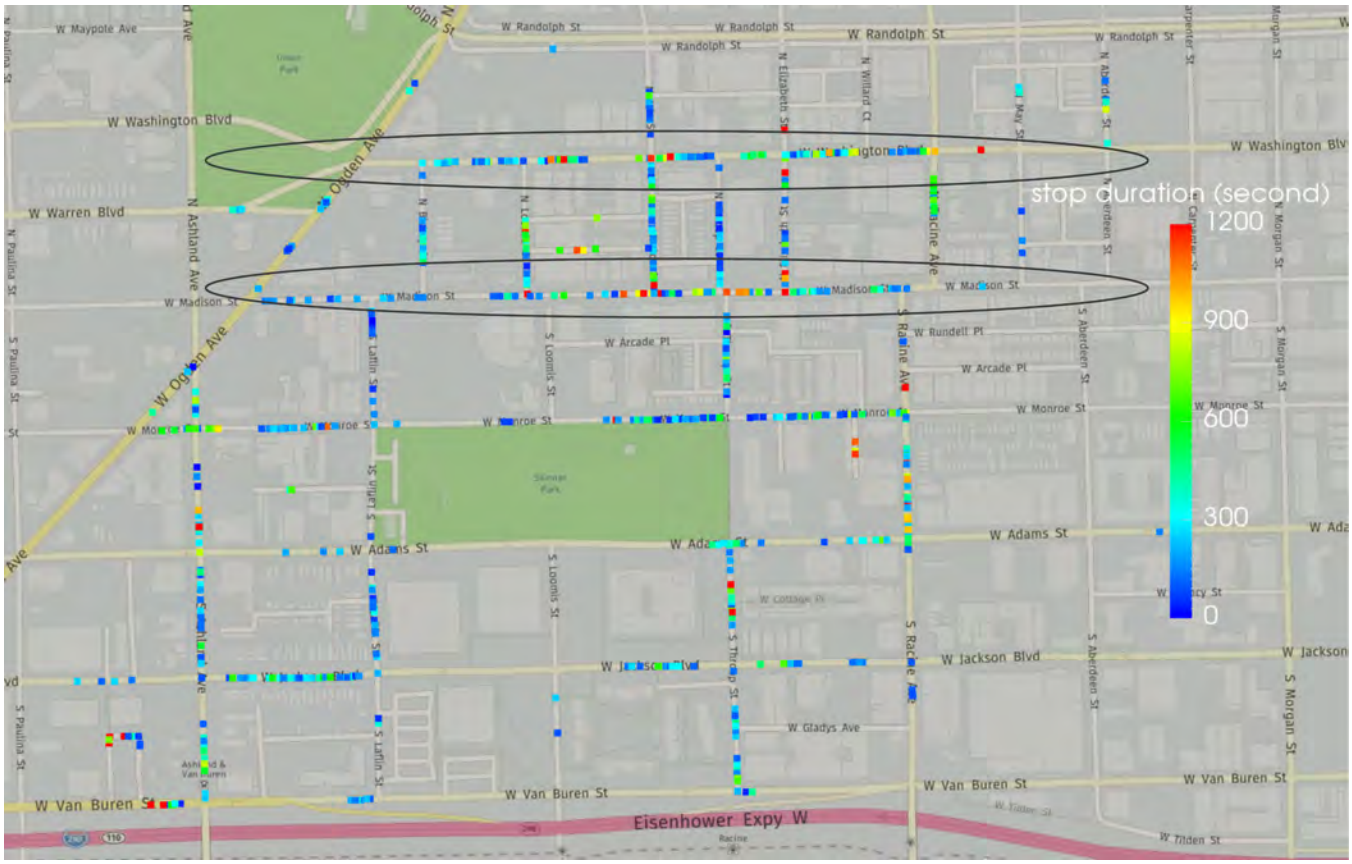












Circled areas on the maps of Park West (left) and West Loop (below) show routes with many delivery stops that take a long time to deliver. Mixed-use/ commercial streets such as these would benefit from testing incentives to maximize delivery efficiency and minimize traffic congestion.

Analysis: Pain Points and Opportunities

Following the analysis of packages per route, the team identified pain points for delivery drivers, focusing on where deliveries were taking comparatively longer and where costs were higher. Conversely, the team also analyzed where deliveries were particularly efficient, allowing drivers to deliver a large quantity in a short amount of time.

Low Rate Deliveries Results:

Peak time for low rate deliveries (few packages delivered over a long duration) was 2 p.m.

The team assumes that larger, more difficult deliveries are deliberately scheduled for mid-day.

These low rate deliveries were most concentrated in Wrigleyville and West Loop.

Bridgeport and Armour Square had higher overall number of packages than other routes (potentially due to more residential deliveries).

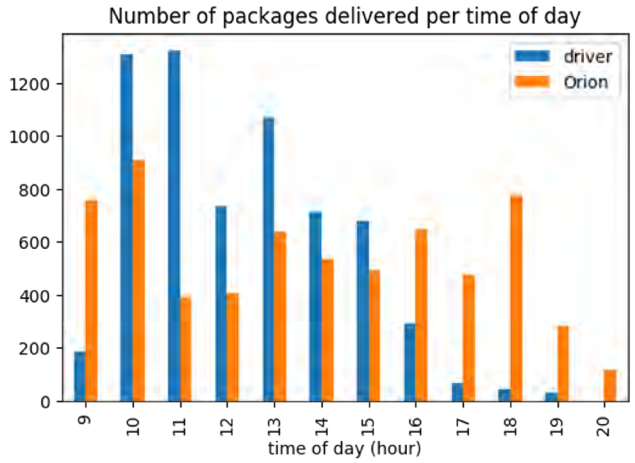
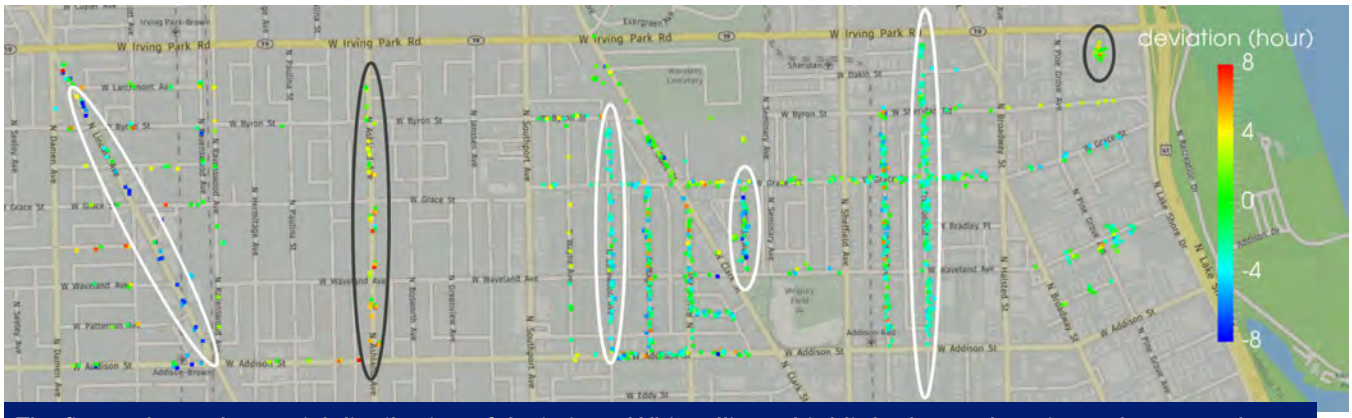


Chart shows how driver delivered during the day vs. what was scheduled in the Orion system.

High Rate Deliveries Results:

Peak time for high rate deliveries (many packages delivered over a short duration) was right after and right before rush hours (10 a.m., 3 p.m. to 4 p.m.).

West Loop was unique for having both the highest rate and the lowest rate deliveries, potentially due to the diverse route. Bridgeport and Armour Square both had higher overall numbers of packages and higher rates of delivery, potentially due to the areas being more residential.



The figure shows the spatial distribution of deviations. White ellipses highlight the road sections where actual deliveries tend to be earlier than Orion ETAs. Black ellipses highlight the road sections where actual deliveries tend to be later than Orion ETAs.

Analysis: Scheduled vs. Actual Delivery

Using the Wrigleyville route, the team compared behavior of drivers to what was actually scheduled on the Orion delivery scheduler. Drivers delivered heavily between 10 a.m. and 3 p.m., perhaps to avoid rush hour traffic. The Orion schedule, on the other hand, assigned many deliveries at 9 a.m., 4 p.m., and 6 p.m. On average, the actual delivery was 1.3 hours earlier than the Orion scheduler ETA, and some deliveries were as many as eight hours earlier or later than scheduled. When looking at overall delivery time (first delivery to last delivery of the day), drivers typically beat what was scheduled.

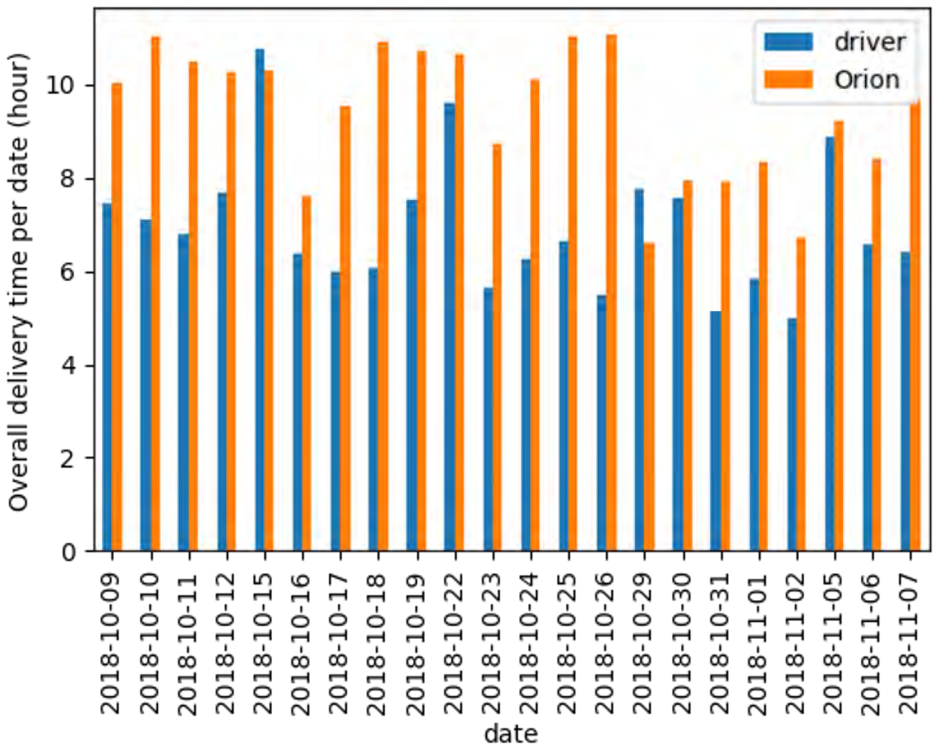
Results

The Delivery Congestion Reduction pilot:

- Demonstrated capabilities to validate routing and scheduling models
- Identified specific locations to target with interventions
- Identified characteristics of high congestion/cost areas for last-mile delivery

The team determined:

- **New Opportunity:** It is possible to merge traffic data and delivery activities into more efficient road-sharing techniques to optimize traffic conditions and decrease delivery costs.



Comparison of actual route time spent for delivery per day vs. what was scheduled. The overall delivery time is defined to be the length of the time period starting from the first delivery of a day until the last delivery of the day.

- **Cost Optimization:** Identification of peak delivery cost times and locations can help inform the creation of delivery routes and optimization of delivery windows to minimize delays.
- **Scheduling Efficiency:** Differences between driver preferences and behavior and routing software recommendations show the potential for using more optimal routing to improve efficiencies and reduce costs for carriers and consumers.
- **Congestion Reduction:** Although it is most likely that deliveries are contributing to traffic congestion, a larger data sample, covering both a longer time frame and a larger geographical area, would lead to more statistically significant results. With this information, delivery service providers can make decisions around timing and frequency of deliveries to reduce congestion and cost.

Impact and Recommendations

Certain streets are inherently more difficult for deliveries – commercial and mixed-use streets proved to take the most time to make deliveries. Other factors, including bike lanes, pedestrian paths, availability of loading zones, street width, and street parking, may influence efficiency of deliveries and impact traffic congestion.

With the success of the pilot, City Tech, HERE Technologies, Accenture, UPS, and Microsoft demonstrated that it is possible for shippers to merge their data with third-party traffic data to understand impacts on congestion. Not only is this information beneficial for shippers, but retailers and even cities can use quantifiable data to focus on locations where interventions will have the most impact on reducing traffic congestion and the associated costs.

Through this analysis, the team identified locations in Chicago, and the underlying characteristics of those street locations, that would benefit from testing incentives. Retailers and shippers can offer incentives at scale at target locations to increase delivery flexibility. Through collaboration, incentives could include retailers and shippers suggesting alternate delivery windows for specific locations at a lower cost to the consumer. Retailers could offer consumers a points-based reward system to only deliver on certain days, or shippers could target customers by zip code or street to suggest alternate pick-up locations that may be more efficient for deliverers. By shifting behaviors and grouping/limiting deliveries, traffic congestion could be reduced, and shippers/retailers could save time and money that may be needlessly spent. Using this methodology, the pilot can be scaled to other cities.

To fully test the pilot's impact, the Delivery Congestion Reduction team recommends the testing of data-driven alternative delivery models in areas that may benefit most from the effort. To successfully deploy such traffic- and cost-reducing measures, the team also recommends that cities make data on traffic congestion and mitigation efforts easily accessible.

About the Authors

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CITY TECH COLLABORATIVE

As the Director of City Solutions at City Tech, David facilitates cross-sector collaboration among universities, government, and industry partners to drive innovative solutions to complex urban challenges. Prior to joining City Tech in 2015, David was Program Manager for the Chicago Department of Transportation Streetscape and Sustainable Design Program, where he directed nearly $100 million of policy, planning, and construction projects ranging from pocket parks and public markets to streetscapes and master plans. He is a former lecturer at the University of Illinois, Chicago and currently serves on the board of Foresight Design, a nonprofit that provides education and community building for sustainable transformation in the Midwest.

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Managing solution development at City Tech, George works with teams made up of experts from the public, private, and nonprofit sectors, along with startups and universities, to execute pilots and implement technologies to benefit city residents across the world. Prior to joining City Tech, George was the Senior Policy Analyst at Get IN Chicago, where he managed the lifecycle of grantmaking for programs serving at-risk youth and analyzed grant performance, outcomes, and compliance. George previously worked as a policy analyst in the Illinois Governor's Office where he performed analysis and project management, including managing the implementation of initiatives such as the GetCoveredIllinois healthcare marketplace website and the Illinois Pathways public-private education partnership; George also served in the United States Army as an intelligence analyst.

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Laura Vecchetti is the Communications and Grants Associate at City Tech Collaborative. As a member of the Partnerships and Communications Team, Laura works to connect City Tech with the community. Prior to joining the team, Laura was the Development and Communications Coordinator at Nexus Onarga Academy, a national nonprofit providing specialized mental health services for children, youth, and families, where she helped secure funding for therapeutic programs. Laura holds a bachelor's degree in Public Relations from Bradley University.

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Jordan Cooper serves as Public Affairs Manager for transportation policy and urban logistics at UPS Global Public Affairs in Washington DC. In this role, Jordan discusses with Federal lawmakers the need to create sustainable and collaborative urban transportation networks. Additionally, Jordan represents UPS on Capitol Hill in advocacy efforts with labor, international trade, and trucking policy.

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Adam J. Hecktman is Director of Corporate Affairs in Microsoft Philanthropies. In this capacity, he works to advance the company's mission by making the opportunities of our rapidly evolving digital economy accessible to all people, particularly those most at risk of being left behind; Microsoft believes technology is a force for social and economic inclusion, and Adam works to create a future where everyone has access to the benefits it provides and the opportunities it creates. With Microsoft in Chicago since 1991, Adam previously worked in Microsoft's Technology and Corporate Responsibility Team, and prior to that was the Director of the Microsoft Technology Center – Chicago. Adam received a Bachelor of Science in Commerce and Business Administration from the University of Illinois at Urbana-Champaign and is currently pursuing his Master of Data Science at DePaul University. Adam has served his community in various capacities and appointments at non-profit, civic, and professional organizations.

Unlocking Mobility Equity through Integrated Payment Systems

Amy O'Hara, AICP

Background

Over the past decade, transportation options have increased greatly in the United States with the deployment of publicly-owned bikeshare systems, private carsharing systems, ridesourcing services, and privately-owned bikesharing and e-scooter sharing systems[1]. These systems, without government intervention, largely operate in a completely digital way – using smartphone applications and websites to book rides and vehicles and requiring credit/debit card numbers or other digital payment to complete the transaction. These digitized resources offer convenience and ease to those who have the means to use them; however, they can also present as barriers to access for users who have lower incomes, are technology-averse, have disabilities, or are un-banked/under-banked[2]. These populations may be left behind due to lack of payment media to book and use the wide variety of services now available, especially as private companies continue to move towards becoming aggregators of mobility services.

The implementation of an "integrated payment system" at a regional, state or national level could tackle the payment barrier that prevents some users from having access to additional mobility options. An integrated payment system (IPS) serves as a platform where individuals can have a multimodal mobility payment account that can be tied to traditional banking systems, digital payment systems, and cash-loading infrastructure such as kiosks, fare machines, and point-of-sale locations. Although an IPS has not yet been implemented in the United States, the likeliest implementation of an IPS will be as an extension of public transportation fare systems that have upgraded to "smart cards" and account-based systems[3] that can be used beyond the payment of transit fares.

The goal of an IPS should be to give more people access to a larger number of mobility options.

1 The Society of Automotive Engineers (SAE) have recently released two taxonomies, one for shared mobility (J3163) and another for micromobility (J3194), to standardize terminology used to describe modes and business models. Both standards are free and open to the public.

2 According to the Federal Reserve, in 2018, 6% of US adults were unbanked (meaning without any checking, savings, or money market accounts) and another 16% of adults were underbanked, meaning they have formal bank accounts but also use alternative services such as payday loans and money orders. Depending on the data source, anywhere from 12 to 26% of Americans have a disability and a Pew Research Center survey captured that people with disabilities and older adults have lower rates of technology adoption.

3 A payment architecture that uses fare media (e.g. smart cards, mobile wallet card emulators, contactless payment cards) to identify a rider account. All fare processing is performed by a back-office system and all value is stored in the patron's unique account, not solely on the card itself, as with paper tickets.

Two key components of ensuring greater transportation equity are fare capping for public transportation (and potentially mobility bundles in the future) and increasing the number of services that can be purchased through public transportation fare systems or regional/statewide IPS.

Fare Capping: Equitable Public Transit Pass Products

Current State of Public Transportation Fare Payment

Public transit agencies in the United States have been largely moving away from cash and/or token-only fare payment systems over the past several years. The American Public Transportation Association (APTA) annual fare survey responses show that bus systems have nearly tripled their adoption of smart cards over the past ten years, increasing from 16.6% to 43.9% accepting smart card fare media. Over the same period, token acceptance has decreased from 33.2% to 18.9%.[4] The 2019 APTA fare survey also noted that 27 of 148 participating bus systems and 3 of 9 participating heavy rail agencies have implemented open payment systems. See "Can Next-Generation Payment Systems Transform the Way We Ride While Driving Down the Cost of Service?" by Derek Toups, AICP in the 2016 APA State of Transportation Planning report for additional information on the types of transit fare payment systems and key terminology.

This move toward more sophisticated fare systems has allowed agencies to implement more complex fare structures, such as distance-based or zoned-fares. It has also allowed for certain populations to receive fare cards that provide reduced fares automatically (such as older adult, low-income, and disability cards), without needing to show documentation to a bus operator or station manager. Additionally, advanced electronic fare systems allow for agencies to offer a wide variety of pass products to customers, which generally

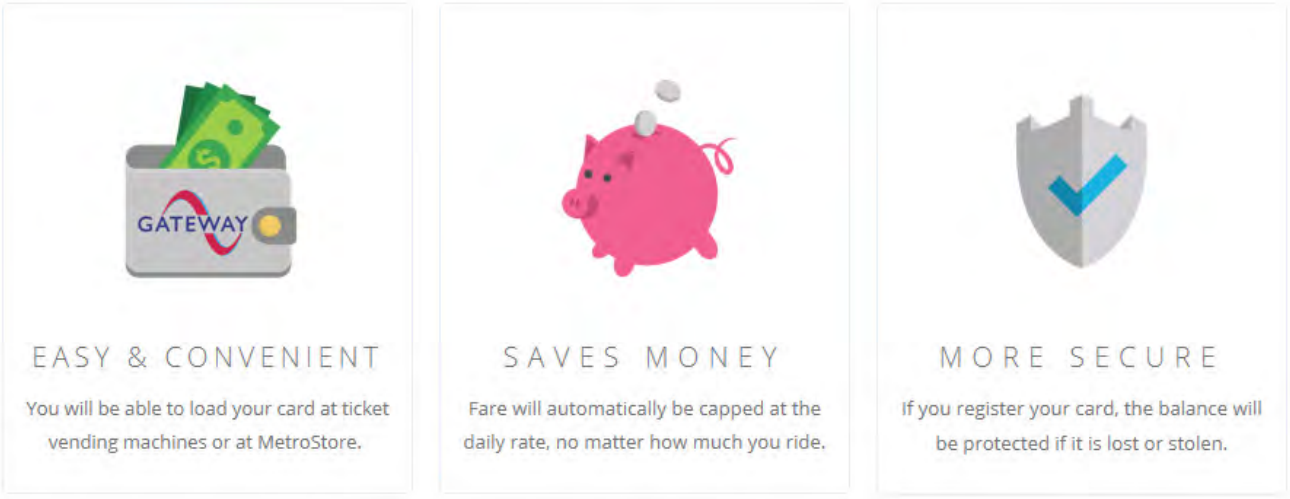
SmarTrip: The Washington, DC regional fare card

Source: WMATA

Clipper: The San Francisco Bay Area (CA) regional fare card

Source: Clipper

4 APTA's Public Transportation Fare Database is an annual report of major elements of fare structures by mode for U.S. and Canadian transit agencies. This essay references data from the 2019 report.



METRO's messaging to customers to encourage Gateway adoption

Source: METRO (St. Louis)

can be purchased at fare machines or online and are active immediately. Lastly, electronic fare systems simplify transfers between vehicles, modes, and even systems. Several regions, such as Washington, DC (SmarTrip) and San Francisco, CA (Clipper) have adopted unified smart card systems where several agencies operate using the same card to improve the customer experience.

Emergence of Fare Capping in the US

Fare capping is the policy of automatically charging passengers no more than the price of a pass product (daily, weekly, and/or monthly) based on their pay-as-you-go rides during the same time period. This type of fare policy is intended to more equitably allow riders of all incomes to receive the benefits of pass products without purchasing the pass up front at the beginning of the week or month. As an example, when a rider on a system where a weekly (7-day) bus pass costs $14 and an individual bus trip costs $1.50 takes their tenth trip within 7 days of the first trip, the fare cap is triggered. They are only charged the remaining $1 to reach the pass cost on the tenth trip and all additional bus trips taken during that 7-day period are free for the rider. Depending on the system, similar products are offered for daily and/or monthly passes.

There are several US transit agencies currently implementing fare capping.[5,6] The following agencies currently implemented fare capping on one or more modes:

- Alameda-Contra Costa Transit District (AC Transit) in Oakland, CA[7]

5 Steven Vance compiled a crowdsourced blog post of currently known US and international transit fare capping initiatives in August 2019 and updated in September 2019.

6 APTA 2019 Public Transportation Fare Database self-reporting of fare capping was verified by information available on agency websites.

7 AC Transit automatically applies a day pass on the third trip of the day taken with a Clipper card. See more at http://www.actransit.org/actrealtime/fares-tickets-passes/.

- Bi-State Development Agency (Metro) in St. Louis, MO[8]
- Central Contra Costa Transit Authority (County Connection) in Concord, CA[9]
- Dallas Area Rapid Transit (DART) in the Dallas, TX metro area, including Trinity Metro in Fort Worth, TX[10]
- Indianapolis Public Transportation Corporation (IndyGo) in Indianapolis, IN[11]
- Interurban Transit Partnership (The Rapid) in greater Grand Rapids, MI area[12]
- Metropolitan Transit Authority of Harris County (METRO) in Houston, TX[13]
- Miami-Dade County Transit in Miami, FL[14]
- Tri-County Metropolitan Transportation District of Oregon (TriMet) in Portland, OR; Portland Streetcar; and Clark County Transit Benefit[15] Area (C-TRAN) in Vancouver, WA (multi-agency partnership)
- Valley Transportation Authority (VTA) in San Jose, CA[16]

Fare Capping Benefits

Transit agencies and riders can see multiple benefits from implementing fare capping.

- ***Increased Ridership***: Riders may choose to ride services more often if they are motivated to take a "free" option once they have earned a pass. Off-peak ridership may increase which could impact funding received from formula-based grants.[17]
- ***Increased Boarding Speeds and Throughput***: Automatic application of fare pass products can reduce lines at fare machines and fare boxes because riders no longer need to manually purchase passes or request paper transfers.
- ***Reduced Fare Complexity***: Simplifies fare structures for visitors and riders by guaranteeing that they will pay the "best value" fare for the trips they take. Riders no longer need to do the "math" to determine if they should purchase a pass. This could improve public opinion of transit and build political support for the system.
- ***Lowered Rider Cost Burden***: In addition to getting a discount, fare capping allows riders

8 St. Louis's new Gateway card caps at the price of a Day Pass. See more at https://mygatewaycard.com/#faq.

9 County Connection automatically caps daily fares at the price of a day pass when riders use a Clipper card. See more at https://countyconnection.com/fares/clipper-card/.

10 DART caps daily fares paid with the GoPass® app or GoPass® Tap card at the price of a day pass and a monthly pass is automatically applied after 16 day passes are used in a month. See more at https://www.dart.org/new/.

11 The new MyKey fare system implements daily and weekly fare caps. See more at https://www.indygo.net/mykey/.

12 The Rapid uses daily, weekly, and monthly fare capping. See more at https://www.ridetherapid.org/the-wave.

13 When using the METRO Day Pass card, a cap will be reached on the third ride of the day (at $3 total) but does not apply on the Metro Q card. See more at https://www.ridemetro.org/Pages/FareFAQs.aspx.

14 Customers using contactless payment methods on Metrorail services caps the daily fare at $5.65, but it doesn't apply to customers using the Easy Pay card. See more at https://www.miamidade.gov/global/transportation/contactless-payment-faqs.page.

15 TriMet, Portland and C-TRAN's Hop app and card have different capping depending on the fare media or mobile wallet used. See more at https://myhopcard.com/home/save-as-you-ride.

16 VTA uses a "daily pass accumulator" to allow Clipper® cards utilizing stored value to activate a Day Pass once the price of a Day Pass has been reached. See more at https://www.vta.org/go/fares#accordion-day-pass-accumulator.

17 One research project analyzing fare data in Chicago noted that using pass products can increase the number of trips a rider takes by at least 10%.

to spread the cost of a pass over multiple days or weeks, rather than needing to purchase the pass in advance in a lump sum payment. This allows more users of all income levels and financial situations to receive benefits of using pass products.

Fare Capping Challenges

Transit agencies and riders can also see challenges when planning to implement fare capping.

- ***Reduced Total Fare Collection***: Instituting any policy where fares are reduced for all users or specific groups (such as discounted fares for older adults, people with disabilities, or users with low incomes) can be considered a risky strategy for a transit agency because it can reduce overall fare collections, which for many agencies is budget cut that they cannot afford or one that a board of directors may not approve. Shortfalls can be addressed through local, regional, or state-level funding policies that prioritize non-single occupancy vehicle modes.
- ***Expensive Fare Collection Technology Upgrades***: The fare system needs to be modernized to have the technological capability to implement fare capping, including real-time connectivity between the fare box/fare gate and the payment backend. Upgrades can cost hundreds of millions of dollars, which are a significant capital investment for transit agencies. Gaining financial and political support for a significant capital investment such as fare collection system upgrades may be easier to achieve if it is pitched as an overall IPS vision which can achieve many mobility, equity, and environmental benefits for the region.
- ***Increased Number of Cards/Accounts***: The same card cannot be used for multiple riders taking the same trip, such as a parent and two elementary school-aged children, since the fare capping processes can only count one rider at a time. This can increase the operating costs beyond current systems where users can more easily share a card and swipe or tap multiple times for multiple riders. The fare system must keep track of more cards in circulation and card management websites should ideally allow riders to manage multiple cards under a single account to ease the burden for riders.
- ***Increased Customer Confusion***: While a system may accept multiple fare media options (e.g. agency smart card, agency app, mobile wallet, and contactless payment cards), the user typically needs to use the same payment method throughout the trip and usually for the full pass period in order for the system to recognize that the cap has been reached and to apply the pass. Some of the most advanced systems with open payments should only require that a single payment method be used for the trip, but not the period.
- ***Extensive Marketing Campaigns***: Public awareness marketing campaigns may be needed to inform frequent users at the start of the program. However, casual users, new riders, and visitors may need additional information at other times to quickly and easily understand the fare system. Customer ambassadors, print materials, and websites are all useful tools to convey that information, but requires an on-going investment to make sure materials are up to date and targeted in-person assistance is performed at key locations and events.

Fare Capping Spotlight: Grand Rapids, Michigan

The Rapid transit system in Grand Rapids, Michigan implemented fare capping as part of their fare collection system upgrade with the launch of their Wave cards in August 2018.[18] Prior to the launch of the Wave cards, Rapid accepted cash and paper tickets, and issued over one million paper transfers annually to customers changing to other bus lines within the system. The new system caps fares at a daily, weekly, and monthly maximum, which eliminates the need for a rider to determine the "right" pass product for their individual travel needs and allows for paperless, free transfers between bus routes.

The cards can be purchased online, at the central station, or one of 60+ participating retail locations near bus stops throughout the system. The value on the cards can be managed online or in-person at the same locations, including the ability to use cash to add value to the card. All cards for a family or group can be managed under a single online account. Registering a card also allows riders to replace lost cards for a $3 fee (the same cost as a new card), while allowing them to transfer the balance to the replacement card, instead of losing the value as they did with the paper tickets in the old system.

The Wave was funded through grants from the Federal Transit Administration and Michigan Department of Transportation (DOT) and is the first Michigan public transportation agency to introduce this type of electronic fare payment system.[19][20]

The Rapid's Wave Card

Source: The Rapid

The Rapid's Fare Caps

Daily: Spend $3.50 (reached on the 2nd trip) in one day and receive unlimited rides for the rest of the day.

Weekly: Spend $16 (reached on the 10th trip) and receive unlimited rides within 7 days from the first trip.

Monthly: Spend $47 (reached on the 27th trip) and receive unlimited rides within 31 days from the first trip.

18 The Wave: More Than a Smart Card, The Rapid website: https://www.ridetherapid.org/the-wave

19 https://www.mlive.com/news/grand-rapids/2018/08/the_rapid_launching_electronic.html

20 https://www.therapidian.org/rapids-new-e-fare-system-wave-debuts-tuesday-august-14

Linking Mobility Options: Equitable Access to More Mobility Options

An additional way to provide more equitable transportation to riders is to provide them with the ability to purchase mobility from more types of services beyond transit services. A popular phrase in mobility is "first-mile/last-mile solutions" which means a modal option (personally owned or shared) that provides connections between the origin, the transit system, and the destination. In many cases, a transit agency cannot efficiently operate service in a door-to-door way that a taxi can, but encouraging access to transit with walking, biking, and shared vehicles can reduce overall single-occupancy vehicle travel and congestion. The integration of payment across multiple mobility modes will increase the proportion of the population that has access to those first-mile/last-mile solutions.

Linking Transit and Bikeshare

The logical next steps would be to integrate payment across multiple publicly owned mobility options, such as transit and bikesharing systems. Many transit agencies and bikesharing systems will provide information about the other system on their website, in their app, and on maps. In theory, these types of partnerships should be "low-hanging fruit" due to somewhat shared funding sources, typically a local or state department of transportation. However, since bikeshare systems are typically contracted out for operations and maintenance, there has been minimal traction in the US to accomplish this. Additionally, proprietary transit fare system technology can make installation of fare card readers at bikeshare stations cost prohibitive. A few agencies have overcome this hurdle, most notably Los Angeles Metro (LA Metro).

LA Metro TAP card unlocking a Metro Bike

Source: Metro Bike

The LA Metro transit and bikeshare systems both utilize the TAP card, which allows a user to tap their transit smart card on the bike kiosk or bike to unlock it.[21] Other systems that integrate transit and bikesharing include Pittsburgh, PA; Milwaukee, WI; and Kansas City, MO, although they do not necessarily have a true accounting integration pulling from shared stored value on a transit card. Open payment systems for transit agencies can increase opportunities for linking between systems since readers to accept mobile wallets and contactless payment cards are more affordable and universal than proprietary transit fare card readers.

Linking Micromobility and Ridesourcing

Over the past few years, many of the largest US metro areas have been hit by waves of micromobility devices arriving on their sidewalks seemingly overnight. First it was the dockless bikeshares arriving in 2017 with several providers with nearly the same product and pricing. The bikes were "self-locking" which meant that the locking mechanism locked to itself and not any bicycle parking infrastructure. Pedestrians complained about the dockless bicycles being

21 https://bikeshare.metro.net/how-it-works/

littered on sidewalks and blocking curb ramps, causing accessibility issues for people with disabilities. In most cases, the dockless bikes were largely gone by the time e-scooters arrived in 2018 with similar issues of locking mechanisms and blocking sidewalks.

The synergies of "on-demand" mobility between micromobility companies and ridesourcing companies led to acquisitions of micromobility companies and operators by Uber and Lyft. These additional modes are now incorporated into their apps, with Lyft having some government-owned docked bikeshare systems in their app due to their acquisition of Motivate, the US's largest bikeshare system operator. The aggregation of all a user's favorite mobility options in one app with one payment system helps the ridesourcing company capture larger market share or more dedicated users.

Uber increased access to their services for unbanked and underbanked customers through the sale of gift cards that can be purchased with cash at many retailers and added to account balances. Uber, Lyft, and Via all offer digital gift cards, which can support social services groups providing their clients funding for mobility services or be purchased via informal exchanges with neighbors and family members who can make online purchases for unbanked and underbanked travelers.

Linking Transit and Ridesourcing

Largely through a partnership between transit ticketing company Masabi and Uber[22], the integration of transit and ridesourcing companies has begun to be rolled out in some US cities, including Denver, CO. Beginning in January 2019, Uber app users could see real-time transit information for Regional Transportation District (RTD), and in July 2019, RTD reported that Uber trips starting or ending at RTD transit station were 11.6% higher than prior to the integration. Once RTD ticketing was fully integrated and released to all Denver-area Uber customers, a press event noted that approximately 200 rides per week were being booked through the Uber app, including nearly a quarter of all rides originating at the airport.[23] Unfortunately no additional metrics on ridership have been publicly released.

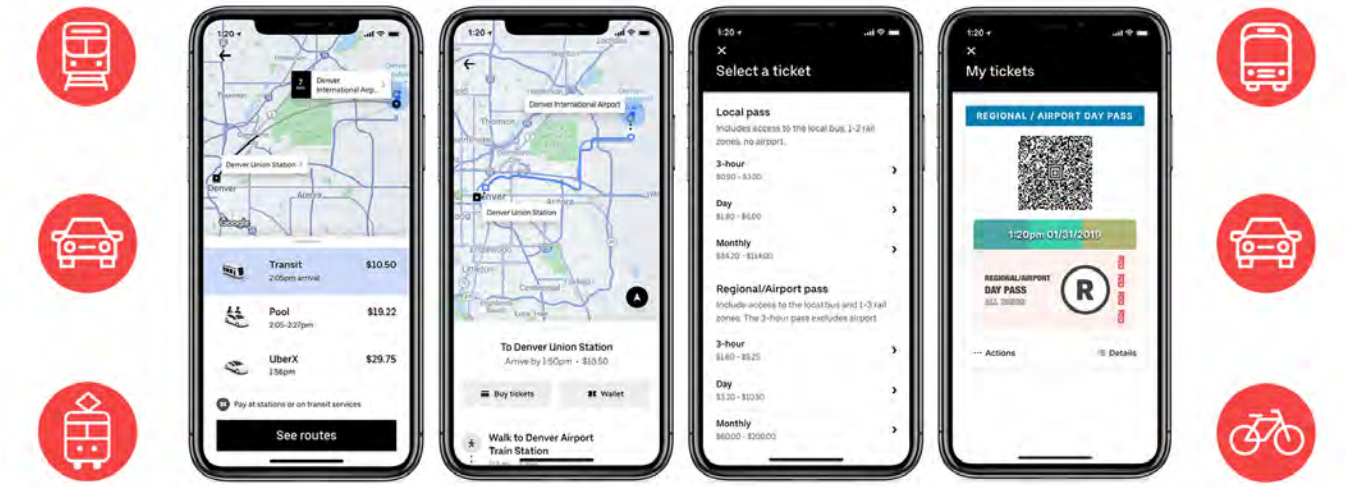
Ridesourcing companies, including Lyft and Via, are also heavily involved in partnerships with individual transit agencies. The Federal Transit Administration's Mobility on Demand (MOD) Sandbox grantee projects feature many examples of partnerships between transit agencies and ridesourcing companies providing first-mile/last-mile connections, late-night supplemental service, and on-demand paratransit services.[24] Grantees have noted that a major barrier to implementation has been data sharing agreements between the agencies and the ridesourcing companies (determining which data would be shared). In the case of services for people with disabilities, other barriers have been providing accessible vehicles with comparable wait times (for passengers needing wheelchair accessible vehicles) and drivers accommodating the needs of passengers per the instructions of the dispatcher (such as a blind user needing the driver to call when they arrive).[25]

22 https://www.masabi.com/2018/04/11/masabi-and-uber-announce-first-of-its-kind-ride-sharing-and-public-transit-ticketing-partnership/

23 https://www.masabi.com/2019/07/09/uber-reveals-strong-initial-performance-of-uber-transit-in-denver/

24 USDOT Federal Transit Administration's MOD Sandbox Program website

25 For more on data sharing agreements, see Eno Center for Transportation's Data on Demand report and the Shared Use Mobility Center's report on Objective-Driven Data Sharing for Transit Agencies in Mobility Partnerships. For more on accommodations and accessible features for people with disabilities, see the MOD Sandbox reports for each site, one by an independent evaluator and the other by the grantee. These reports, which will contain analysis on the performance of the project and lessons learned, are expected to be released throughout 2020. MOD Sandbox reports can be found on the FTA Office of Research, Mobility, and Innovation's Reports and Publications. For example, the BART reports note that due to timelines with their contractor's product, they never were able to incorporate a feature that matched wheelchair users with wheelchair accessible vehicles in their carpooling application. Shared Use Mobility Center's report on Equity and Shared Mobility Services also covers this topic.



RTD tickets are now available for purchase through the Uber app

Source: Masabi

It is important to note that some professionals in the transit industry are skeptical of the benefits of partnering with ridesourcing companies, who are for-profit companies with stated business plans of becoming mobility aggregators, resulting in direct competition with transit services. More research is needed to determine if these partnerships are beneficial to transit agencies and the public good under a variety of circumstances.

Integrating Everything Together: Future Steps in Mobility

The IPS enables establishing a marketplace for mobility. Such a marketplace could be run by a government entity at a regional level, so that subsidized trips and various trip funding sources could be used through a single account.[26] For example, a trip funded by the Veterans Administration (VA) to transport a veteran to their medical appointment could be taken on any qualified service in the market, with the IPS managing the back-end accounting and reporting for VA needs. Subsidies and funding sources from multiple agencies can be settled by back-end systems and allow for relaxation of some existing funding policies that lead to inefficiencies, particularly for paratransit services.[27] Fare policies such as fare capping can also be managed by the back-end system to ensure equitable access to people with varying incomes.

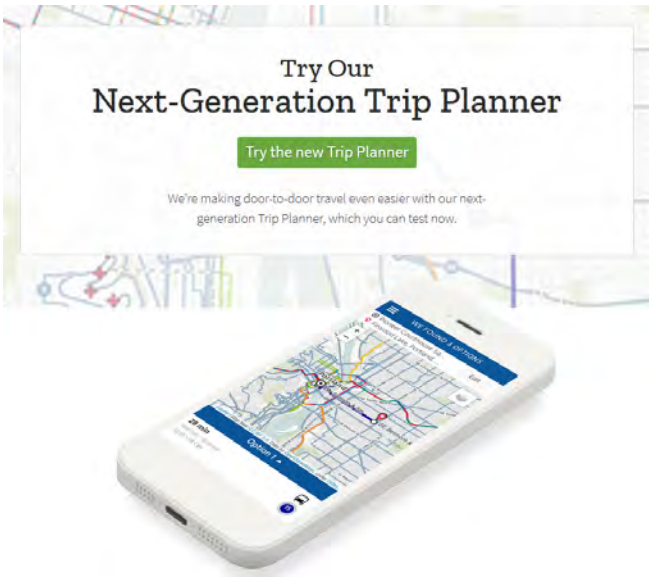
The implementation of mobility marketplace and an IPS is more of an institutional challenge than a technological one, with parties needing to agree on business rules for operators to be included and how reimbursement will apply for trips on multiple operators or multiple funding sources. The rules of use and protection of sensitive data generated by the marketplace are also significant

26 USDOT's Intelligent Transportation Systems Joint Program Office (ITS JPO) funded a project in late 2018 to begin developing a framework for a mobility marketplace. The project is scheduled to conclude by mid-2020. The framework document will be available to the public on the MOD Program website when it is published.

27 Steve Yaffe has presented and written about the concept of "electronic banking transfer (EBT) Mobility Cards" which would allow agencies that provide transportation services to directly add funds to a EBT Mobility Card based on their eligibility and the individual could make their own decisions about how to transport themselves, similar to the EBT cards used to administer food stamps (SNAP) and Woman Infant Child (WIC) food assistance programs.

institutional and policy issues to be resolved before a market can be launched. Recent lawsuits over requirements to provide real-time data of e-scooters through the Mobility Data Specification in LA, bring forth questions of how planners can gather data needed to support policy and infrastructure decisions without compromising the public's right to privacy.

On the technical side, this type of mobility marketplace is enabled heavily by the standardization of the elements of trip requests and trip availability. Fixed route public transit doesn't require reservation, so it does not apply and bikeshare currently uses the General Bikeshare Feed Specification (GBFS) to provide bike and dock availability information. The key mode that needs to be captured through standardization is ridesourcing and taxi services. The Transportation Cooperative Research Program (TCRP) G-16 project recently developed a draft transactional data specification for demand response transportation providers to more easily pool and exchange trip requests.[28] Additionally, TriMet's FTA MOD Sandbox grant funded the development of an extension of the OpenTripPlanner tool that can show real-time transit information, shared mobility information, and route walking paths based on sidewalk information in Open Street Map. It remains to be seen how widely and effectively these efforts will be adopted, but if enacted as part of an overall marketplace with an IPS, many users who do not have access to ride sourcing services today because they are unbanked, underbanked, or lack smartphones or data plans would gain access to a broad spectrum of mobility options. A government entity managing the business rules of the mobility marketplace can ensure equitable service for lower income and minority areas and for people with disabilities.



TriMet enhanced their Trip Planner to include shared mobility modes in addition to transit

Source: TriMet

So, where do transportation planners fit into the concept of an inclusive mobility marketplace? The late years of the 2010s had a breakneck pace of innovations in mobility, pushed by the private sector. Now is the time for planners to continue (or begin) outreach to these largely excluded populations in their communities, establish working groups with other government entities funding transportation services, and educate themselves on private mobility services and their various business models. It is the role of planners to bring the needs of all travelers to the table, amplifying those that may have been neglected in the rush to implement the Next Big Thing in mobility. Developing a transportation network that allows equal access to all travelers will require more coordination between institutional partners, oversight of private mobility services, and political will to change the status quo. This is not a trivial undertaking, and laying the groundwork for a system that may require policy

28 The TCRP G-16 Project website includes links to the project report, an opensource tool, and a framework for the specification development.

changes by several government agencies takes time, effort, and political capital. There is hope that with research occurring on these issues within USDOT that federal funding opportunities may arise and changes to funding eligibility could change to allow for extensive, multimodal IPS implementations. Together, we can achieve the goal of inclusive mobility for all.

About the Author

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