

The Why and How of Measuring Access to Opportunity

A Guide to Performance Management



GOVERNORS'
INSTITUTE
on community design



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Executive Summary

Access to jobs, education, healthcare, and other essential services may be regarded as the primary purpose of transportation. Not surprisingly, transportation agencies across the country are increasingly interested in considering this as a key part of measuring system performance. Unfortunately, many transportation practitioners are not sure how to measure how well their system links people to their daily destinations and broader opportunity.

All state and metropolitan planning organizations will be required to publicly evaluate and measure the performance of their transportation system and the effectiveness of their investments. While federal rules will require them to measure factors such as congestion, safety, and infrastructure condition, there is a wide array of other priority areas that transportation agencies should also consider measuring if performance measurement is to help achieve state and regional transportation goals.

This guidebook is written to help transportation agencies integrate measurements of “access to opportunity” into their planning and investment decisions. It provides information about how some transportation agencies are already incorporating measures of access into their programs, and discusses the data and tools available to support measuring it. This guidebook might also be useful to elected and civic leaders, policy-makers, and stakeholders who wish to work with transportation agencies to address these important priorities.

Measuring the transportation network is essential to building an effective system. Transportation agencies need to measure changes in the condition of the transportation system to determine where to invest or improve it. They have historically invested in developing tools and approaches to measure priorities like safety, system condition, and traffic flow because those outcomes rose to national importance among decision-makers and the public.

National and local priorities for the country’s transportation system are evolving. This is prompting an evolution in the state of the practice in transportation performance management. Decision-makers are placing growing importance on the vital role transportation infrastructure and services play in determining the quality of life of the people served. Multimodal transportation networks connect people to employment and other economic opportunities, contribute to the overall livability and prosperity of communities, and impact many aspects of the environment, including reduced greenhouse gas emissions, air pollution, and stormwater runoff. They also provide or reduce opportunities for physical activity, influence how affordable it is to live in a community, and mitigate or perpetuate socioeconomic inequities in a region.

Transportation should help *everyone* get where they need to go. A transportation system is not successful unless everyone can reach the things they need within a reasonable period of time. Even robust systems are failing if some residents still face significant transportation challenges. This is a particular problem for low-income households, young people, and older adults with limited or no access to a vehicle, who often live in communities that are physically isolated from job centers and where transit service does not connect them to appropriate jobs and other destinations safely and conveniently. Sometimes transportation infrastructure itself (like a highway or rail line) is what separates these neighborhoods from the rest of the community.

Some transportation agencies are already measuring access to destinations.

Transportation agencies on the frontier of performance management are already integrating analysis of access to opportunity at several levels of decision-making, from establishing performance targets to evaluating investment scenarios and their complex impacts in long-range planning. Systematically considering these impacts helps agencies build a more robust understanding of the long-term implications of potential investments and make informed decisions about the best use of funds; more measures of performance provide greater insight, leading to more efficient operations. By establishing performance targets, agencies will be able to demonstrate how well their investments are helping regions achieve a broad range of goals, show how different funding levels would affect the ability to meet these goals, and engage leaders and the public in a conversation about how best to use scarce resources. This would ultimately increase public confidence in the transportation decision-making process and build support for funding increases as agencies make progress toward their identified goals.

New data and tools can help evaluate transportation access. The research community has made significant leaps in recent years in developing the data and methodologies necessary to measure the complex impacts of transportation investments on the factors that shape quality of life. Transportation agencies are building on this progress by moving beyond simply monitoring the impacts of these investments and toward integrating analysis of those impacts into their long-range planning and project prioritization processes.

Transportation agencies have several types of data available to them, from national datasets to household survey data, for measuring access to opportunity. Some agencies work with this data in-house, creating their own analysis tools or applications. There are also a number of new and emerging tools available to evaluate destination access for purchase. However, many of the underlying data sources used by these tools are open source or available for free download.

This guidebook suggests metrics and approaches for measuring access to opportunity to help leaders in state and regional agencies, cities, and counties create transportation systems that work better for all people and businesses.

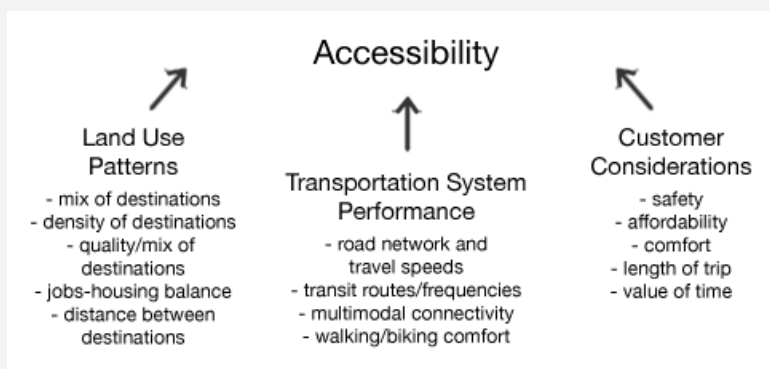


Figure 1. Some of the key variables, each with different data sources that contribute to how we measure accessibility. Projects that call for increased access to achieve community goals like economic development, equity, or connectivity, can be measured by a combination of these example variables. Some variables are controlled by transportation agencies, while they actively influence others. It is important to understand how multiple factors contribute to accessibility.

I. Introduction

In transportation planning, no issue is more cited by public officials and stakeholders than the need to connect people—and people of all abilities—to jobs and education and businesses to customers and talent. The concept of measuring how people access destinations has been around for decades, yet many transportation agencies do not currently measure how well our investments accomplish these crucial goals.

Capital and maintenance resources for transportation have become scarcer while transportation agencies face growing and changing demands on the networks they manage, leaving decision-makers with the challenging task of accomplishing more with less funding. Transportation performance management gives transportation agencies the ability to use resources strategically and efficiently, while demonstrating to the public and stakeholders that transportation investments are producing measurable outcomes. It can also help agencies evaluate whether investments are producing the expected results, and use that information to inform future decisions about how to invest scarce resources.

Definitions and purpose

The Federal Highway Administration (FHWA) defines **Transportation Performance Management** as a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals. Performance management begins by:

- Identifying strategic goals for the transportation network;
- Developing performance measures that evaluate progress toward those goals;
- Setting targets under each of those measures; and
- Analyzing the impacts of potential investments on the goals and using that information to prioritize investments and report back to the public.¹

This is not a new practice among transportation agencies, but most have typically managed a relatively narrow list of outcomes such as pavement and bridge condition, traffic flow, ridership, and fatalities from crashes. While these outcomes are important, they are not comprehensive.²

A growing number of transportation agencies have embraced a broader range of outcomes, including better connecting all residents, particularly disadvantaged populations, to economic opportunity, resources, and essential services. This guidebook is designed to help decision-makers within state departments of transportation (DOTs), metropolitan planning organizations (MPOs), transit agencies, and other local governments expand their existing performance management practices to incorporate measures of **access to opportunity**, as well as related measures of multimodal system connectivity.

1 FHWA's 2013 Performance Measures Guidebook:

2 FHWA's Model Long-Range Transportation Plans: A Guide for Incorporating Performance-Based Planning: http://www.fhwa.dot.gov/planning/performance_based_planning/mlrtp_guidebook/chapter06.cfm (more information available in Section 5)

Measuring access to opportunity means evaluating the ease with which people can reach jobs in their communities, businesses can attract customers, and both can reach the other services they need to thrive. Multimodal transportation networks play a vital role in connecting people and businesses to resources and providing safe, affordable access to employment, education, and other daily needs. These are, in fact, the primary purposes of transportation infrastructure and services. The ability to move reliably from one destination to another is only valuable if there are resources and opportunities at the end of the trip. Yet evaluating roadway performance has typically focused on the movement of vehicles rather than on how well the transportation network connects people with these opportunities.

A note on terminology: What we mean by “access to opportunity”

The goal of this guidebook is to help transportation agencies measure how well the transportation network and land use patterns within a community are enabling all members of the community to reach jobs and other resources and services, such as education, healthcare, healthy food, and recreation centers. This guidebook defines that broad concept as **access to opportunity**. It also refers to the concept of **destination access** interchangeably because we are focused on physical access to places, rather than the sociocultural and structural barriers community members face to accessing employment, high-quality education, healthcare, and other services.

This guidebook also refers to several related concepts that can support greater access to opportunity in a community. One such concept is **connectivity**, or the density of connections within a transportation network. This includes connections for each mode of travel—roads, transit routes, bicycle infrastructure, and sidewalks—as well as connections between modes, such as the completeness of sidewalk networks around transit stops. A transportation network with a high level of multimodal connectivity can make it easier and more affordable for community members to access opportunities by providing a variety of options for traveling from one place to another. This helps level the playing field by for all members of a community to access the resources they need to thrive.

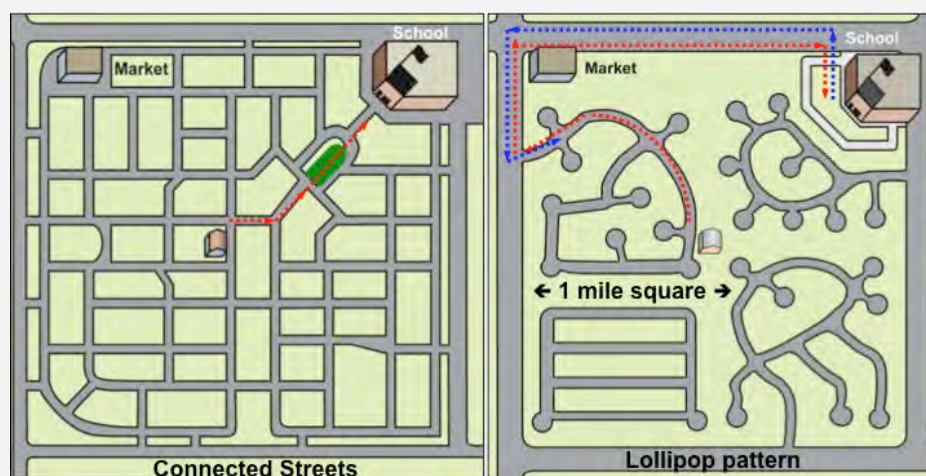


Figure 2. Connectivity influences destination access. Well-connected networks create more direct routes to destinations and provide redundancy for greater efficiency. *Image by James Wagner, INCOG.*

Another concept discussed in this guidebook is the role that land use patterns play in supporting access to opportunity, particularly the density of development and diversity of destinations in an area. Running daily errands will generally take less time and cost less money out of pocket in neighborhoods where a diversity of destinations, such as housing, jobs, schools, grocery stores, parks, and others are all physically close together. This guidebook uses the term location efficiency to refer to the physical proximity between these types of destinations.

Note: The terms “access” and “accessibility” are also used frequently in the transportation industry to refer to compliance with the Americans with Disabilities Act,³ but this guidebook uses those terms more broadly. The focus of this guidebook is on improving access to opportunity for everyone, including people with disabilities as well as other community members.

Understanding transportation as a means to an end—a connection to opportunities—also enables community planners to look holistically at their transportation challenges. In many cases, changes to land-use and development patterns can connect community members to more opportunities and improve transportation system performance and efficiency, without any changes to the transportation infrastructure itself.

Despite this growing awareness, many agencies around the country do not yet measure access to opportunity, nor do they use it as a criterion in their decisions about how to prioritize investments. This is partially because these outcomes have been hard to define and measure on a system-wide scale, let alone in evaluating specific projects. Agencies have not traditionally been able to easily and affordably access the necessary data. However, aided by a wave of new tools developed by the private sector, a number of transportation agencies are piloting approaches for integrating measures of access and connectivity into their investment decisions. These agencies provide a model for others to follow.

This guidebook provides information to help transportation decision-makers:

- Understand the benefits of measuring access to opportunity
- Integrate measures of access to opportunity into decisions about how to invest limited resources
- Learn about transportation agencies already incorporating destination access measures into their programs
- Understand the data and tools available to measure access to opportunity
- Incorporate land-use considerations into transportation decision-making

This guidebook includes four sections. **Section I** provides information on ways transportation agencies have traditionally managed performance, new measures some agencies are beginning to integrate into decision-making, and how the Fixing America’s Surface Transportation (FAST) Act and the Moving Ahead for Progress in the 21st Century (MAP-21) Act impact how transportation

3 <http://www.ada.gov>

agencies manage the performance of their systems moving forward. **Section II** discusses why and how decision-makers are incorporating access to opportunity measures into their planning and investment decisions, begins to explain the process for implementation, and profiles a number of state and local agencies around the country that are already doing so. **Section III** of this guide discusses ways to measure access to opportunity, including an overview of the factors that shape accessibility as well as approaches, data, and emerging tools agencies can use to measure access to opportunity. Section III also briefly outlines implementation strategies, and **Section IV** provides a list of relevant research, guidance, technical assistance, and other resources on performance management and measuring access to opportunity.

Background

What we have managed in the past

To effectively manage the performance of their networks, transportation agencies need to measure

changes in conditions and operations over time, which means collecting reliable and up-to-date information about the system. They must invest resources and effort to collect the right information upfront and maintain it over time.

Transportation leaders have historically invested in developing tools and approaches to measure specific results because those outcomes rose to national importance among decision-makers and the public.

For example, transportation agencies have traditionally collected traffic count data and measured traffic flow and roadway capacity to determine when additional capacity is needed. The definition of a congested transportation system varies across the nation based on the size of the community and the typical length of trips, but agencies seek to identify appropriate local standards based on expectations for traffic flow and use that as a basis for selecting projects and designing roadways.

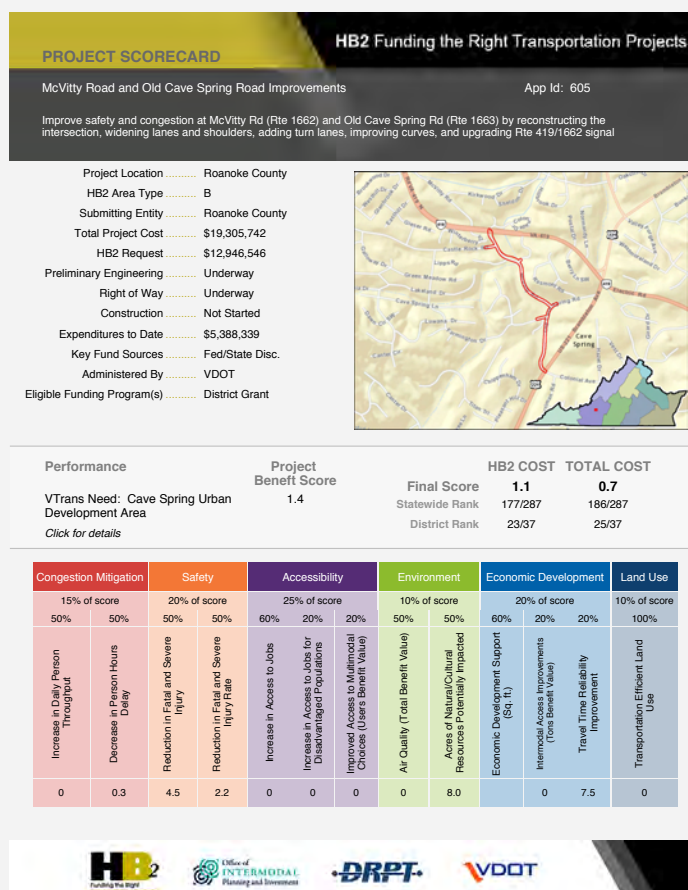


Figure 3. Virginia DOT's project scorecard. The highlighted section outlines how 25% of the score comes from a project's impact on accessibility. From <http://vasmartscale.org/documents/scorecards/salem.pdf>.

Transportation agencies also monitor infrastructure condition over time to determine when to invest in repair or replacement. In recent years many agencies have developed more robust asset management programs in response to growing concerns about the country's aging infrastructure coupled with shrinking transportation budgets. These programs help agencies track the lifecycles of the pavement, bridges, and buses they maintain to set schedules for routine maintenance, more costly rehabilitation, and procurements. Many agencies also assign different economic values to different roads and bridges based on traffic volume. Together, these practices help agencies systematically determine how to prioritize investments in existing infrastructure.

Many DOTs and transit agencies also currently engage in performance management through their safety programs by monitoring fatalities and serious injuries from vehicle crashes over time. Performance management is a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals. Like asset management, this performance-based investment approach arose out of a growing national focus on safety issues. The federal government developed programs and required data collection to better identify and track safety challenges.

Transit agencies also utilize transportation performance management to select projects and evaluate the performance of their investments. For example, agencies utilize ridership forecasts when selecting the most viable stop locations for projects funded through the federal New Starts program,⁴ and then measure ridership after the project has been in operation for a period of time to determine whether it is on track to achieve the projection.⁵

In addition to helping agencies use limited resources strategically, these applications of transportation performance management have also helped to highlight the challenges decision-makers face in meeting all of a state's transportation needs, and to communicate those challenges to decision-makers and residents. For example, engaging in asset management can help transportation agencies recognize that they may not be able to keep up with the maintenance and repair needs of their road networks at a sustainable rate given current funding levels.

MAP-21 performance management rules

MAP-21, enacted in 2012, established a performance- and outcome-based framework for the federal program to help transportation agencies invest resources in ways that support national priorities and state and regional goals. MAP-21 represented a broad shift away from creating programs that fund particular types of projects and toward a system to produce the most efficient investment of federal resources while giving agencies the flexibility to address unique local needs and priorities. The FAST Act, signed into law in December 2015, continues the performance-based framework established under MAP-21 and includes provisions that will lead to the development of tools and guidance that can assist agencies in implementing performance-based planning.

The federal transportation program has, in the past, required transportation agencies to collect information about the state of good repair of the system and the causes and rates of fatalities.

4 About the New Starts Program: <https://www.transit.dot.gov/funding/grant-programs/capital-investments/about-program>

5 Before and After Studies of New Starts Projects: <https://www.transit.dot.gov/funding/grant-programs/capital-investments/and-after-studies-new-starts-projects>

Under the current program, agencies will be engaging in performance management to a greater degree and on a broader scale than most have previously.

MAP-21 included new performance measurement requirements within the national highways, transit, and traffic safety programs. For the highway program, it established seven performance goals in the categories of safety, infrastructure condition, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays. It tasked FHWA with oversight for establishing performance measures within the following areas:

- Pavement condition on the Interstate System and on remainder of the National Highway System
- Performance of the Interstate System and the remainder of the National Highway System
- Bridge condition on the National Highway System
- Fatalities and serious injuries on all public roads
- Traffic congestion
- On-road mobile source emissions
- Freight movement on the Interstate System

FHWA is in the process of developing and releasing rules that define how to measure performance in each of these areas. Within one year of each of those final rules on performance measures, state agencies across the country will be required to establish performance targets tied to each of these new measures. MPOs will have an additional 180 days to establish their own targets or commit to supporting those established by the states. Agencies will have flexibility to tailor the targets for the performance measures established under MAP-21 to match local conditions and needs. The Federal Transit Administration (FTA) and National Highway Traffic Safety Administration (NHTSA) underwent parallel processes to establish performance measures for transit asset management and operations, and highway traffic safety, respectively.⁶ FTA has released rules for transit asset management and safety. Now, transit agencies will work with MPOs to develop performance targets specific to their regions. Transit agencies will have 3 months to set targets, and MPOs will have an additional 180 days.

Once agencies establish performance targets, MAP-21 requires that they publicly report on their progress in reaching these targets by including System Performance Reports in their long-range transportation plans.⁷ For example, a state could choose to set a target to improve the condition of 25 percent of its highway miles within four years. The agency would then announce this target to the U.S. Department of Transportation (USDOT) and the public, along with the investments the agency plans to make to accomplish the goal. After four years, the agency would report on whether or not it achieved the established target.

6 <https://www.federalregister.gov/documents/2016/07/26/2016-16883/transit-asset-management-national-transit-database>; <https://www.federalregister.gov/documents/2016/02/05/2016-02017/public-transportation-agency-safety-plan>

7 Both states and MPOs will need to include the system performance report in their long-range plan, which will discuss their targets and their progress. The final safety rule requires states to report their target to FHWA and discuss their progress annually in their Highway Safety Improvement Program report. The proposed rules for pavements, bridges, system performance, traffic congestion, emissions, and freight movement would require states to report their targets and discuss progress in a biennial report (23 USC 150(e)) beginning in 2016.

These reporting requirements are designed to give transportation agencies tools to help track progress and achieve their goals. By setting performance targets and periodically reporting on progress, agencies can identify if their investments are producing the intended results and make adjustments if needed. FHWA is developing resources and tools to help states continue to make progress if they find themselves unable to make improvements in certain areas, many of which are listed in the Appendix. MAP-21 requires that agencies revise their performance plans if they do not meet their targets. In the case of infrastructure condition and safety deficiencies, State DOTs and MPOs will be required to dedicate a certain amount of funding toward addressing the gap.

Some transportation decision-makers are concerned about the additional public scrutiny that comes with reporting on specific performance targets, while others are welcoming the process as a way of engaging the public on challenging decisions that transportation leaders have to make every day as they prioritize scarce resources. Much of the public—and many elected officials—are not aware of the full costs needed to maintain the transportation infrastructure and services they rely on, and can develop unrealistic expectations. By establishing performance targets, transportation agencies will be able to demonstrate how well their transportation investments are helping regions achieve a broad range of goals, show how different funding levels would affect the ability to meet these goals, and engage leaders and the public in a conversation about how best to use scarce resources. This can ultimately increase public confidence in the transportation decision-making process and build support for funding increases as agencies make progress toward their identified goals.

Building on MAP-21: Opportunities to measure additional areas

Under MAP-21, states and metropolitan areas are allowed to go beyond the categories of performance measures prescribed in the legislation. This creates a window of opportunity for transportation agencies to integrate equally important state and local priorities into their long-range planning along with the MAP-21 measures. Addressing these priorities along with the MAP-21 measures will require lower effort and cost than would be needed to develop separate systems of measurement for them, or to belatedly integrate them into the systems developed under MAP-21.

Developing access and connectivity performance measures and other measures beyond those required under MAP-21 can also provide a number of additional benefits to transportation agencies, as well as the users they serve. By establishing measures that reflect other state and regional goals—such as public health or social equity goals—agencies can demonstrate a commitment to



Figure 4. Transit island and bike lane in Seattle, WA. Photo by NACTO.

investing in travelers' priorities and producing results that decision-makers and the public value. Additionally, developing measures beyond those required under MAP-21 can provide transportation agencies with a means for coordinating investment decisions more effectively with partner agencies like departments of health, environment, housing, and economic development, reducing silos and ensuring that public funds are used efficiently on a broader scale to accomplish state goals.

Several states are already working to develop performance measures that fall outside of those required by MAP-21 and integrate those measures into their criteria for making investment decisions. These measures address the priorities discussed in this guidebook as well as a broad range of state and local priorities, including:

- Mode neutral travel time
- Mobility, focusing on person throughput as opposed to vehicle throughput
- Access to jobs and other essential services
- Economic investment around transportation infrastructure
- Preservation of natural and cultural resources
- Reduction in impervious surface area and stormwater runoff
- Promotion of physical activity
- Provision of a comfortable and convenient travel experience for all modes
- Alignment of transportation investments with local and regional plans and visions
- Support for mixed-use and infill development
- Resilience to disruptions (such as natural disasters and economic downturns)

Some agencies are also looking at how the impacts of transportation projects—positive impacts such as improved access to employment, as well as negative impacts such as increased noise and air pollution—disproportionately affect different populations within a region. Integrating demographic and geographic categories into agency performance measures can help decision-makers weigh the tradeoffs of potential transportation investments according to who benefits and who is adversely impacted. This can help transportation agencies direct resources to address regional inequities over time by providing new transportation services for the people who need them most.

New priorities in performance management

Providing access to opportunity through transportation investments has been a major focus of these efforts because it gets to the heart of what makes communities livable, and regions economically prosperous and equitable. It is not enough for a community to simply contain the resources necessary to support a high quality of life for residents—employment, housing, education centers, medical care, grocery stores, and opportunities for recreation and socializing. It must also provide all of the members of a community with ways to reach those resources conveniently, safely, reliably, and affordably to fulfill their daily needs. Improving access to opportunity also supports environmental goals like reducing air pollution and greenhouse gas emissions by reducing the distances people need to travel by car.

Research on the factors that shape destination accessibility on a regional scale has highlighted the need for well-connected multimodal transportation networks. Many community members, including aging residents and people with disabilities, are may not be physically able to drive, while others

cannot afford to travel by car. Additionally, a growing number of people are seeking to live in communities where driving is not a requirement for getting around, creating strong market demand for better, multimodal connections to destinations. Because the supply of such communities has not kept up with demand, only those that can afford higher priced housing units in these communities tend to occupy them, leaving vulnerable populations in less connected areas.

Connecting people to opportunities in their region means providing reasonable cost travel options with reasonable travel times for reaching jobs and other needs, including well-connected transit networks with reliable service headways and safe routes to walk and bike between destinations. It also means ensuring that these multimodal networks actually connect people to the places they need to go, such as diverse types of jobs to meet a range of community employment needs.

While providing people with access to the right destinations to meet their needs is a relatively simple concept, in practice it can be challenging to measure how well connected people are to opportunities and resources in their region, and, therefore, how to direct investments to improve access. The factors involved are complex and some fall outside the direct purview of transportation agencies.⁸

Furthermore, different communities and populations within a region can face different barriers to accessing the resources they need to thrive. For example, the construction of elevated and limited access highways have physically divided some neighborhoods in urban areas, leading to geographic isolation of those communities. Failing to identify and address those disparities on a community-by-community basis can perpetuate systemic inequalities in the region.

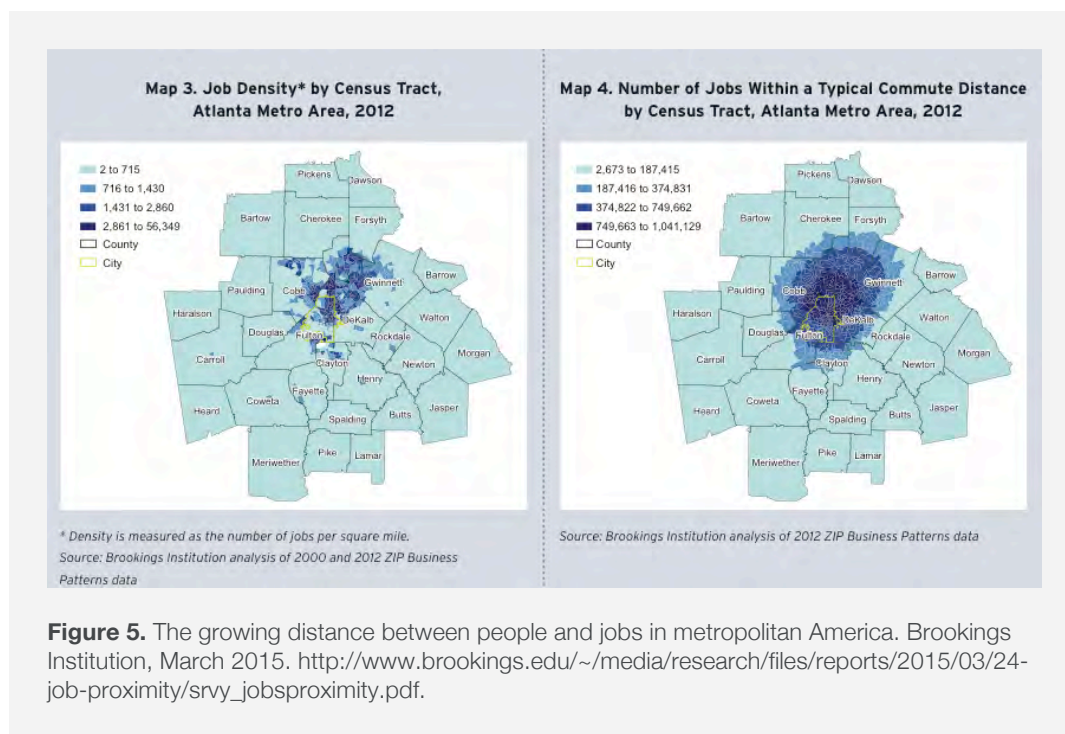
Despite these challenges, a number of agencies have developed and are refining strategies for measuring or modeling access to opportunity. This guide profiles a number of regional and state agencies that have gone a step further by using measures of access and connectivity to inform investment decisions, either in the development of programs, project prioritization processes, selection processes for competitive grant programs, or evaluation of alternatives during project development. These agencies are the case studies for others to integrate connectivity and access measures into their performance management practices.

Why incorporate destination access into transportation programs?

Destination access is the ultimate goal of transportation. If we are not measuring access to destinations, and evaluating system enhancements accordingly, we risk spending large amounts of money implementing projects that, although they may improve “performance” in some particular category, ultimately do not improve the experience of system users. While it is important that travel

8 The laws governing the federal transportation planning process are found in Title 23 of the United States Code, Sections 134 and 135 (23 USC 134 and 135) and Title 49 chapters 53. The regulations derived from those laws which further define the planning requirements are contained in Title 23, Code of Federal Regulations, Section 450 (23 CFR 450). Both the statute and regulations include references to the role of land use, accessibility and intermodal considerations and related issues when transportation stakeholders, elected officials, and the public make decisions regarding the maintenance, operations, and expansion of transportation systems. 23 USC 134 (c) The plans and TIPs for each metropolitan area shall provide for the development and integrated management and operation of transportation systems and facilities.

be safe and smooth, the system cannot be considered successful unless travelers reach their destination within a reasonable period of time. Many communities around the country face significant challenges to providing all residents with access to jobs, medical care, day care, groceries and other necessities, particularly for low-income and economically disadvantaged populations. Low-income households may have limited or no access to a vehicle, and while they may rely on transit and non-motorized travel, fewer destinations fully meeting their daily needs can be reached safely and conveniently without a car. For most households, the cost of transportation is the second largest expense behind housing—greater than food or health care. A household living in an auto-dependent area may spend 25% of its income on transportation costs while a household located in a more location efficient environment closer to employment and other amenities may reduce this cost to 9%.⁹



Research by Raj Chetty of Stanford University examined the connection between geographic isolation and the ability of youth to escape poverty and earn higher incomes than their parents—referred to as intergenerational mobility.¹⁰ Chetty's research showed that intergenerational mobility varies widely across the United States, and that areas with high intergenerational mobility have less residential segregation from jobs and other destinations. His analysis showed a correlation between upward mobility and a measure of residential segregation: reduced sprawl, defined as work commutes of less than 15 minutes. Areas where commutes were shorter correlated with higher income mobility. Longer commutes can be caused by poor transportation connections or traffic congestion, but they can also be caused by transportation and land use practices that push destinations far from homes.

9 http://www.fhwa.dot.gov/livability/fact_sheets/transandhousing.cfm

10 http://www.rajchetty.com/chettyfiles/mobility_geo.pdf

Some communities do not have access to transit service. And where there is transit, it often fails to link people with work. The Brookings Institution analyzed data from 371 transit providers in the nation's 100 largest metropolitan areas, where over 95 percent of all public transit trips take place.¹¹ Brookings' research profiled each metropolitan area and showed that only about 30 percent of jobs in the 100 largest metropolitan areas are accessible by public transit trips of less than 90 minutes by the typical resident. The study also found that the accessible jobs were more likely to be in high-skill industries: about one third of the jobs in high-skill industries are accessible by transit within 90 minutes, while only one quarter of the jobs in low- or middle-skill industries are accessible via a transit trip of 90 minutes or less.

Transportation agencies often evaluate the quality of available transit service by looking at transit frequency, but that is only half of the story. The Brookings report shows that, regardless of metropolitan area, many of the highest income households are located in neighborhoods with the lowest transit coverage, yet that transit service connects them to a larger number of suitable job opportunities. Conversely, the lowest income households are located in neighborhoods with the best transit coverage but have fewer employment opportunities easily accessible via transit.

The data collected by the Brookings Institution echoes the findings of Chetty's research. Accessing low- and middle-skill jobs by public transit may be challenging for workers seeking those jobs, leading to limited opportunities for intergenerational income mobility. Workers living in growing low-income suburban communities may experience particular difficulty in accessing jobs for which they are qualified. It is an economic and transportation failure to create jobs that are not accessible to the workers who would fill them.

Many transportation agencies measuring destination access began doing so to address the challenges faced by low-income and transit-dependent households, but the issue is broader. Research shows that more and more people want to live in communities with a high level of destination access—particularly access that does not always require a vehicle. A recent survey by the Urban Land Institute found that just over half of all Americans and 63 percent of Millennials want to live where they don't often need a car to access amenities.¹² A 2014 American Planning Association study found that fewer than 10 percent of those surveyed want to live in a neighborhood where people have to drive most of the time, though 40 percent currently live in such a neighborhood.¹³

Moreover, employers are increasingly looking to locate in areas with good transit access. The success of innovation districts—clusters of knowledge-focused businesses and institutions such as information technology, biotechnology, pharmaceuticals, and health research—may hinge upon public transit access. In a study of three such districts in the United States (Silicon Beach Innovation District in Los Angeles; the Historic Technology District in Austin, TX; and Research Triangle Park, NC), the American Public Transportation Association noted that local officials in these three regions expect public transit to be the determining factor by 2045 in:

- More than \$177.83 billion of cumulative business sales through 2040;
- \$78.8 billion in wage income; and
- \$106.3 billion in gross domestic product (GDP) in the U.S. economy.

11 <http://www.brookings.edu/research/reports/2011/05/12-jobs-and-transit>

12 <http://uli.org/research/centers-initiatives/terwilliger-center-for-housing/research/community-survey/>

13 <https://www.planning.org/policy/polls/investing/pdf/pollinvestingreport.pdf>

The study cites three main reasons for these economic trends:

- High tech, high value industries seek locations providing public transit access to attract the needed workforce;
- Better access to workers enhances efficiency and therefore generates net new economic activity;
- Transportation efficiency gains create additional economic activity.^{14,15}

Not only are we failing to supply the kind of communities that so many employers and employees want, the growing demand for communities with high destination access combined with a continuing low level of supply drives up rents and pushes lower-income households to areas of lower access.

Equity

The term **transportation equity** relates to how transportation planners can provide access to affordable and reliable transportation to meet the needs of all community members, particularly traditionally underserved populations.¹⁶ Decision-makers are placing a growing focus nationally on environmental justice and the need to identify and address disproportionately high and adverse impacts of public policies and investments on minority populations and low-income populations.

This focus is particularly important in measuring how well transportation systems connect people to opportunities, resources, and essential services. Transportation agencies that measure destination access should take care not to look only at neighborhood or regional averages. While a region might perform well in general, specific neighborhoods may face significant gaps in affordable access to opportunities and services, particularly lower income neighborhoods in suburban and rural communities with poor or limited transit access.

Moreover, the high demand for walkable neighborhoods with good destination access for persons of all abilities, coupled with a housing supply in walkable neighborhoods that has not kept pace with that demand, has pushed rents to climb in many communities as destination access improves. This can exclude the people from communities that need access the most.

To address gaps in access to opportunity for vulnerable and underserved populations, transportation decision-makers should look specifically at the performance of their transportation system in providing destination access to low-income households, persons

14 <http://www.apta.com/resources/reportsandpublications/Documents/APTA-PT-Knowledge-Economy.pdf>

15 <http://www.apta.com/resources/reportsandpublications/Documents/TransitHighGrowthClustersUS-Final2013-1124.pdf>

16 Pursuing Equity in Pedestrian and Bicycle Planning:
http://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/equity_paper/

of all abilities, and non-drivers. Transportation agencies should also explore partnerships with other local agencies and the private sector to create affordable transit-oriented development and implement other strategies to address gentrification.^{17,18}

In measuring destination access, transportation agencies should also identify gaps in the network for persons of all abilities and consider ways to reduce those gaps, such as extending pedestrian signal timing and installing curb ramps.

The role of land use in destination access

Transportation agencies have typically focused on the direct impact of the transportation system on destination access, such as roadway speed, congestion, and level of transit service. They have resisted considering land use and development patterns because they do not have any authority in this area. But working with the local land use authorities and coordinating approaches can lead to more affordable transportation alternatives and improved destination access. Conversely, failing to consider land use impacts during transportation investment decisions can sometimes interrupt community connectivity and push development out. For these reasons, many of the transportation agencies profiled in this section have begun to incorporate land use goals and considerations more directly into their long-range plans and investment priorities.

The national highway system was built with the goal to increase connections between cities and towns and provide people with access to more destinations and businesses with access to more customers. This was an important improvement and provided regions with greater economic reach. However, in many cases, the construction of large limited access highways through urban and suburban communities cut off direct local access between destinations on either side of the highway, lengthening trips and removing the option for non-motorized modes of travel between those destinations. In some cases these highways bisected existing neighborhoods, damaging the cohesion of those communities and creating a physical barrier to accessing the opportunities on the other side.

Over time, the standards used in highway design also crept into the design of arterial roads and main streets. These standards focus on the speed and flow of vehicle travel, an important factor, but only part of what creates destination access. The proximity and mix of types of destinations, combined with development density, also improves access not only by shortening trips and making non-auto modes viable, but also by reducing the reliance on more expensive transportation infrastructure needed to support high speed vehicle travel. It is often more appropriate to design roadways for slower speeds in the core of cities and towns with dense development patterns and location efficiency because people can walk and take transit to destinations more easily.

However, this context is not considered in current speed-based transportation planning methods,

17 FTA is providing technical assistance and resources on transit-oriented development issues to help communities grow their economies, advance equity, and improve quality of life for everyone. For information on this initiative, see <http://www.todresources.org>.

18 The National Transit Institute offers courses on TOD and transportation and land use: <http://www.ntionline.com/transit-oriented-development/>, <http://www.ntionline.com/transportation-and-land-use/>

which treat speed as equally important regardless of the context of the surrounding community. Some agencies have adopted roadway design criteria that reflect that surrounding context—building on guidance from the Institute of Transportation Engineers¹⁹ and the Congress for the New Urbanism²⁰—but vehicle speed still underlies the predominant transportation planning approach. Focusing on vehicle speed leaves out those moving by other modes of transportation and does not account for the impact of proximity on the traveler’s ability to make connections.

This shortcoming is most evident when a community or a developer proposes a project that will increase the density of development. Speed, as opposed to destination access, underlies the development rules in most places, discouraging land use patterns that bring destinations closer to people. Development projects that increase density typically estimate an increase in congestion and slower vehicle speeds. As a result, they are viewed as damaging to the transportation system regardless of whether people have better or quicker access to their needs, which now are often closer. New development that brings destinations closer together is, therefore, often prohibited, or only permitted if accompanied by roadway expansions that undercut connectivity needed for the improved access.



Figure 6. A Complete Streets approach in Austin, TX.

Congestion and vehicle flow are important goals to measure and address. As the previous section pointed out, federal rules will soon require transportation agencies to measure the performance of their transportation system in these areas. But transportation agencies that do not simultaneously consider the reliability of other transportation modes and the impact of the transportation system on destination densities could build a free flowing transportation system for vehicles that pushes destinations farther from reach and reduces access to opportunity.

Focusing on destination access means looking at the whole picture: the reliability of the transportation system, the availability of transportation alternatives, and the distance to essential services.²¹ Doing so can help agencies avoid high-cost transportation solutions that could be addressed by less expensive development solutions—for example, bringing a grocery closer to communities that need one rather than expanding an arterial road to a grocery farther away.

19 <http://www.ite.org/css/>

20 http://contextsensitivesolutions.org/network/one?party_id=8036

21 <http://www.ops.fhwa.dot.gov/publications/fhwahop14034/fhwahop14034.pdf>

II. Incorporating Measures of Destination Access into Transportation Programs

One way to incorporate destination access is to include accessibility performance measures in the process for developing long-range plans. A growing number of transportation agencies are using a performance-based process to develop their plans by defining goals and then using criteria tied to those goals to develop a broad investment strategy. This performance-based approach supports the reporting DOTs and MPOs will be doing within new system performance reports in their long-range plans under MAP-21.

Many transportation agencies have already identified improving equitable access to opportunities as one of the key goals in their visions and long-range planning documents. Performance measures for destination access can help these agencies evaluate progress in meeting their goals, tailor their investment approaches, and demonstrate success.

Steps for incorporating destination access measures into transportation programs

The process for developing performance measures for destination access will vary from agency to agency, particularly based on how the measures will be used to inform planning and investment decisions. However, the following basic implementation steps can help agencies that are interested in access to opportunity measures determine how to start:

1. Come to an agreement on how destination access measures will be used to inform decision-making. Assessing barriers and setting goals may be followed by:
 - a. Evaluating scenarios
 - b. Prioritizing projects for funding
 - c. Evaluating project alternatives
2. Think about which partners will need to be engaged in the development of the metrics or informed about the changes being made to the decision-making process.
3. Identify the right metric(s) to use based on specific state or local goals and availability of data.
4. Identify potential sources of data and any major data gaps, and reach out to partners to collect the necessary data.
5. Develop an approach, methodology, or tool that agency staff can use to measure and evaluate destination access consistently over time.
6. Collect data on current conditions to serve as a baseline
7. Train agency staff.
8. Adjust the approach as necessary to better fit with local conditions and needs.

This section discusses how to begin the process of incorporating measures of destination access into transportation programs (steps 1-3) and provides guidance on how transportation agencies can do so to ensure that their planning and investment decisions improve the connections

between people and opportunities over time. Section III will explore methods for measuring destination access (steps 4 and 5) and introduce implementation strategies (steps 6-8). Section IV provides more resources.

This section also provides examples of transportation agencies that are already integrating destination accessibility measures into their planning and investment decisions. A number of the agencies leading the way in this area have adopted a broad performance management approach and integrated destination access measures at several levels of decision-making, from establishing performance targets to evaluating investment scenarios in long-range planning.²²

Another excellent resource that provides information on the decision-making process is FHWA's ²³ Planworks: Better Planning, Better Projects Decision Guide—it identifies key decision points from long range planning through permitting and outlines the purpose and outcome, roles, questions that support decision-making, data needs, input from stakeholders, and more for each decision point.

Decide how to approach destination access

States are taking several approaches to incorporating destination access into their transportation programs. These include evaluating investment scenarios within the planning process, incorporating access into the criteria for project selection, and incorporating access into the project development process.

Selecting an approach will depend on how far the state or agency wants to go with destination access. Depending on goals and resources, small steps can be taken before diving into metrics, or several of these approaches can work together to support one another.

Assessing current barriers and setting goals

A valuable first step to incorporating destination access is to evaluate the current gaps and barriers to accessing opportunities and then use the results to develop the priorities in their plans. The Metropolitan Council, the MPO for the Minneapolis/St. Paul region, recently conducted a study to identify where opportunities in the region are located, which residents have the best access to those opportunities, and how to improve equitable access for all residents of the region. The study, Choice, Place and Opportunity: An Equity Assessment of the Twin Cities Region, helped the Metropolitan Council develop the priority areas in its current regional vision, Thrive MSP 2040, adopted in May of 2014.²⁴

The Southeast Michigan Council of Governments (SEMCOG) recently conducted an analysis, Access to Core Services in Southeast Michigan, which will be used to help guide transportation investments in the Detroit region moving forward. Published in January 2016, the purpose of the

22 FHWA Scenario Planning Guidebook: https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/scenario_planning_guidebook/. And FHWA Scenario planning for Operations: <http://www.ops.fhwa.dot.gov/publications/fhwahop16016/ch3.htm> (more information on scenario planning available in Section 5)

23 FHWA PlanWorks Decision Guide <https://fhwaapps.fhwa.dot.gov/planworks/DecisionGuide>

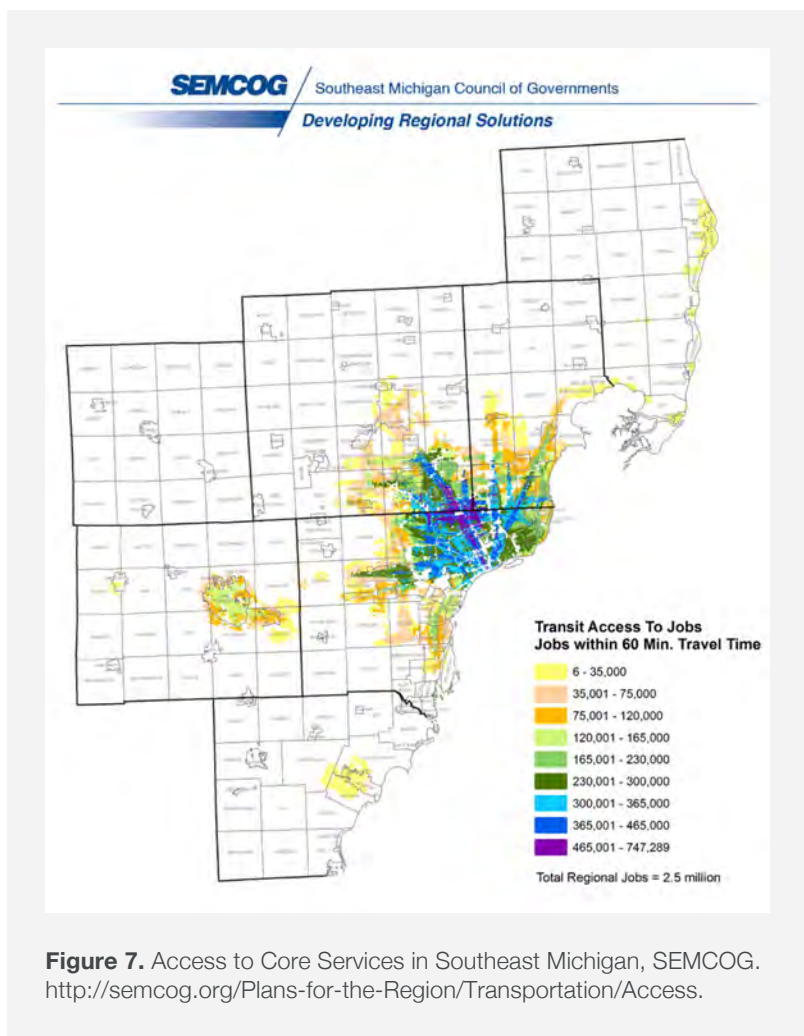
24 <http://www.metrocouncil.org/Planning/Projects/Thrive-2040/Choice-Place-and-Opportunity.aspx>

study was “to develop common measures of accessibility for comparison across the region, establish benchmarks to identify gaps and challenges where accessibility is low, set regional policies and local actions to be implemented by various stakeholders, and integrate accessibility measures and policies into regional transportation planning and decision-making processes.”

The study measured regional access to “core services”—which SEMCOG defined as fixed-route transit, jobs, supermarkets, healthcare facilities, parks, schools, and libraries—by calculating travel times from households by car, transit, biking, and walking. For each core service, the study evaluated the percentage of households able to access that service by each of the four

transportation modes within a reasonable travel time. The study included different travel time thresholds for the four modes and for each core service (for example, the study assumes people will be willing to travel for longer to reach jobs than other core services). The study also includes more specific results for specific populations: all households; transit-dependent households; households in poverty; households of older adults; households with children (for access to parks and schools only); working age population (for access to jobs only).

SEMCOG’s study found that residents of the region generally have moderate to high levels of accessibility to all of the core services in southeastern Michigan by car, although some gaps exist. By contrast, residents of the region face significant gaps when it comes to accessing core services by transit, walking and bicycling. The study concludes by proposing 10 regional policies and associated actions to



improve and expand transportation options, better align the location of core services to meet the needs and demands of residents, and improve coordination and planning to decrease accessibility barriers. SEMCOG will use the findings of the study to guide future investments.²⁵

²⁵ <http://semcog.org/Plans-for-the-Region/Transportation/Access>

Beyond assessing the current system and barriers, each of the following approaches will require agencies to set goals for their program related to accessibility. The case studies included in each approach identify the goals the relevant agency has set and how they are using specific metrics to measure progress towards those goals. More discussion on selecting metrics and setting targets follows the approaches.

Evaluating scenarios

Agencies can incorporate destination access into their long-term planning by using accessibility performance measures as criteria for evaluating potential investment scenarios. This approach—known as scenario planning—helps agencies weigh tradeoffs between different goals and identify the best path forward.

A growing number of transportation agencies around the country are developing their regional plans by conducting a stakeholder engagement process to identify several potential long-term investment strategies for the region, and then evaluating and comparing those investment scenarios using criteria tied to regional goals. FHWA and FTA offer technical assistance to support these efforts.²⁶ Agencies that use this scenario planning approach generally evaluate the performance of each investment scenario by modeling the likely impacts in areas such as congestion, mode split, vehicle miles traveled (VMT), greenhouse gas emissions, levels of physical activity, housing costs, and other criteria identified as regional priorities. Modeling destination accessibility along with these other criteria can help agencies anticipate the short- and long-term impacts their investments will have on regional access to opportunity and weigh these impacts against other objectives.

There are several examples of agencies that have already incorporated accessibility measures of some kind into their criteria for evaluating different investment scenarios in planning. Many of the tools for mapping accessibility described in Section III will make it easier for other agencies to do so, particularly those that allow the user to model how changes to the existing transportation network and land use patterns impact destination access in the region.

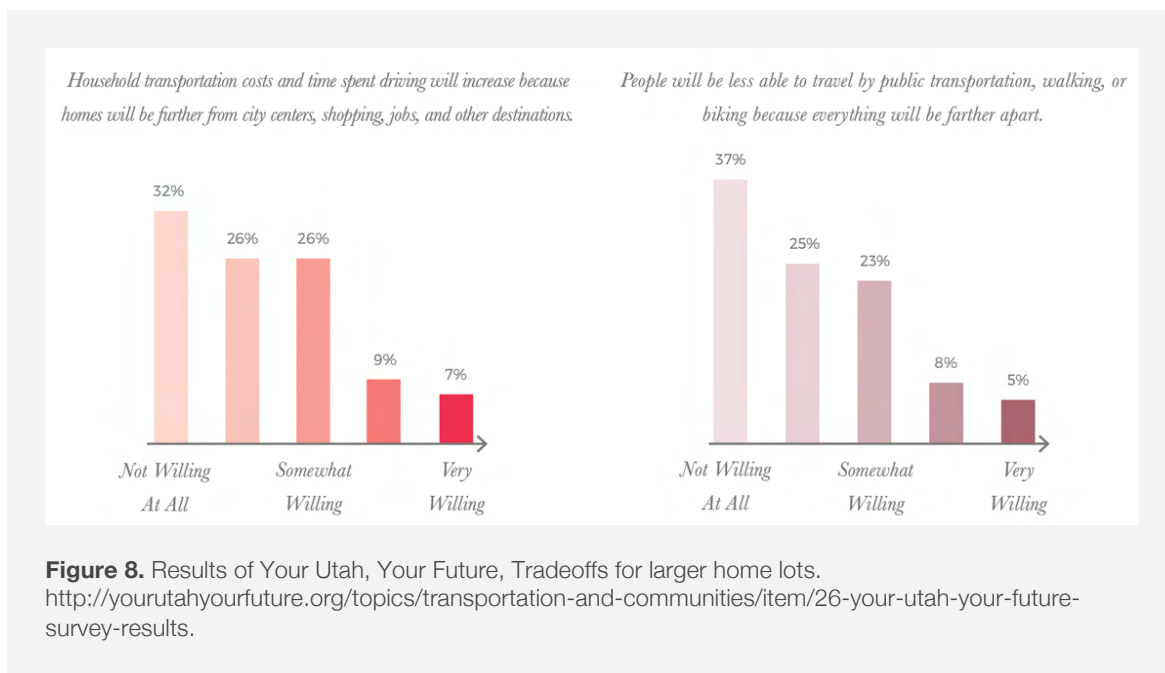
Envision Utah helped pioneer the scenario planning approach in the 1990s and has since facilitated stakeholder driven visioning efforts in communities throughout the state. These efforts help citizens provide input on how they would like to see their region grow by working with them to develop several growth scenarios, modeling the impacts of those scenarios, and then surveying residents about which scenarios they prefer. Envision Utah has used accessibility-related criteria in some of these visioning projects, including modeling impacts on household transportation costs and access to parks and recreational opportunities.²⁷

Envision Utah recently facilitated a statewide initiative, Your Utah, Your Future, to create a vision for growth in the state through the year 2050. This effort involved the development and evaluation of five alternative growth scenarios. Envision Utah used projected transportation costs per household as one of several criteria to compare the five scenarios. Scenarios with a greater percentage of households located within ½ mile of public transportation and/or within 1 mile of a development

26 For information on USDOT's scenario planning technical assistance and other scenario planning resources, see http://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/

27 <http://www.envisionutah.org/process/envision-utah-s-proces>

center with daily services were expected to have lower transportation costs. About 82% of Utah residents surveyed selected the two scenarios with the lowest transportation costs.²⁸



The City of Austin, Texas incorporated scenario planning tied to its performance targets into the Imagine Austin comprehensive plan visioning process. Based on community input, the city created five alternative scenarios for future growth. Austin assessed each scenario using a variety of sustainability indicators and then facilitated a public rating process before selecting a preferred scenario. These sustainability indicators included accessibility measures such as percentage of residents living within ¼ mile of transit routes and stops. The preferred growth scenario that the city ultimately included in the plan will focus development in a series of compact and walkable mixed-use activity centers, corridors, and job centers.²⁹

The Metropolitan Transportation Commission (MTC) in the San Francisco Bay Area has used scenario analysis to develop its regional transportation plans since 2001. MTC refines its approach with the development of each plan, and has incorporated accessibility-related measures as the region has become increasingly focused on issues of equity and displacement.

In the past, MTC has developed its visioning scenarios more-or-less concurrently with the project evaluation process, but MTC now has more data available upfront on each proposed project. As a result, MTC will be able to use that data to inform decisions about projects to include in each visioning scenario for Plan Bay Area 2040, which will be completed in mid-2017.

For this update to its regional transportation plan, MTC used its performance targets to develop three “visioning” scenarios combining specific land use patterns and transportation network

28 <http://www.envisionutah.org/projects/your-utah-your-future>

29 <http://www.austintexas.gov/sites/default/files/files/Planning/ImagineAustin/webiacpreduced.pdf>

investments. Each scenario reflected different types of housing, commercial growth, and varying levels of transportation funding. MTC evaluated each scenario against regional goals and performance targets, including several equity criteria to evaluate impacts on specific populations compared to the region as a whole. Some of the accessibility-focused measures used during the scenario analysis included changes to housing and transportation affordability for low-income residents versus the rest of the region, and commute and non-commute travel times for communities of concern versus the rest of the region. Regional land use and travel demand models helped MTC perform this analysis. MTC used this evaluation and an extensive public outreach process to select a preferred investment scenario for the region. The MTC Commission and the Association of Bay Area Governments' Executive Board approved the Final Preferred Scenario in December 2016. It is now undergoing an environmental assessment as required by state law.³⁰

Prioritizing projects for funding

There is rarely enough funding to build every transportation project or make every improvement needed. Performance measures can be a powerful way to identify priorities for the investment of limited funds. Applying performance measures to project prioritization allows transportation agencies to demonstrate that their investments track their priorities and to bring transparency to a process that is often poorly understood.

Transportation agencies can use performance measures to identify projects for funding through scoring and competition. In addition to the scenario analysis described above, MTC conducted a project-level evaluation of potential (uncommitted) transportation projects using similar performance measures, representing billions of dollars in proposed investments. This included a benefit-cost analysis and targets assessment for major capacity-increasing projects, and a scoring process for smaller projects. State of good repair investments were also included.

Based on this analysis, high-performing projects were prioritized for regional funding while low-performing projects were subjected to additional analysis. Project sponsors were required to make a compelling case for including low-performing projects in the Plan. Medium performers, the majority of projects, were subject to county congestion management agencies' discretion.³¹

One metric for scoring accessibility:
change in cumulative jobs accessible
within 45 minutes for road projects
or 60 minutes for transit projects

The State of Virginia has also recently applied this method of project evaluation to all new capacity projects. In 2014, the Virginia legislature unanimously passed House Bill 2 (HB2) requiring the Virginia Department of Transportation (VDOT) and the Commonwealth Transportation Board (CTB) to develop a quantifiable and transparent prioritization process for making funding decisions for capacity enhancing projects within the six-year improvement program. The legislation required the CTB to prioritize projects based on enumerated priorities: congestion mitigation, economic

30 <http://mtc.ca.gov/whats-happening/news/special-features/plan-bay-area-2040-final-preferred-scenario-approved>

31 <http://data.mtc.ca.gov/performance/dashboard/>

development, “accessibility,” safety, and environmental quality. Land use coordination is also identified as a priority in areas with a population over 200,000.

In response to the legislation, VDOT and CTB researched best practices from other state DOTs and MPOs, held a peer exchange workshop, and held extensive outreach meetings with key stakeholders. From this, they developed six guiding principles for the application of the HB2 scoring framework:

- Analyze what matters to people and has a meaningful impact
- Ensure fair and accurate benefit-cost analysis
- Be both transparent and understandable
- Work for both urban and rural areas
- Work for all modes of transportation
- Minimize overlap between measures

The prioritization process that CTB now uses evaluates eligible projects against the goals set out by HB2, now called Smart Scale³² with up to 100 points assigned to a project under each category. In terms of the “accessibility” criterion, Virginia looked at jobs access during its first round of applying Smart Scale, giving 60 percent of the accessibility score based on the change in cumulative jobs accessibility within 45 minutes for road projects or 60 minutes for transit projects. Another 20 percent of the score was an equity breakout, considering the change in jobs access for disadvantaged populations. The final 20 percent is based on an assessment of the project support for connections between modes, and promotion of multiple transportation choices.

Each of the criteria is applied to projects differently based on the type of community where each project is located. For example, jobs access is 15 percent of the overall score in large urban areas, where congestion mitigation is the top priority. Jobs access is 25 percent of the score and the top

priority in medium size areas like Richmond. It is also 25 percent of the score for small cities, like Charlottesville, but just 15 percent in rural areas where economic development is the top priority.

Rather than wait until they had all the data needed to assess full destination access, Virginia started with jobs access to capture this state priority and are building to a more comprehensive standard

Projects are chosen based on a comparison of their total scores divided by the Smart Scale-funded cost of the project to determine the value for every dollar invested (in \$10 millions) to capture their cost-effectiveness.

While jobs access was the focus in the first round of Smart Scale, VDOT and CTB are considering expanding this criterion to look at broader

destination access in future rounds. Doing so will require the state to gather new data. But rather than wait until they had all the data needed to assess full destination access, Virginia started with jobs access to capture this state priority and are building to a more comprehensive standard.

32 More information on other scoring areas can be found here: <http://vasmartscale.org/>

The Smart Scale project prioritization process has been greeted positively as taking politics out of the process³³ and has made clear to the taxpayers why projects are funded and how projects not chosen for funding can be improved in order to receive funding in the future. It has allowed the state to put priorities like jobs access on par with other, more typical transportation measures, like congestion mitigation and safety.

Several MPOs also evaluate projects for funding in their TIPs based on scoring procedures that include jobs access. One example is the Sacramento Council of Governments (SACOG), whose solicitation of projects for funding includes an evaluation of projects based on seven criteria, including VMT reduction, congestion relief, multimodal options, long-term economic benefits, improved goods movement, safety and security, and state of good repair benefits.

Jobs access shows up under two of these criteria: VMT reduction and long-term economic benefits. Under VMT reduction, projects are rated as high, medium or low for the extent to which a project serves an area with employment density and how well its design will help reduce VMT in that area. In the long-term economic benefits criterion, projects are rated on the extent the project improves access to jobs within the sponsoring jurisdiction.

Another example comes from the latest solicitation³⁴ from the Metropolitan Council in the Minneapolis/St. Paul region for projects under the Surface Transportation Block Grant program. In this solicitation, the Metropolitan Council lays out nine priority criteria including jobs access. For example, the “Role in the Regional Transportation System and Economy” criterion includes a measure of the connection to jobs and manufacturing. To measure connection to jobs, applicants use a regional economy map provided by the Metropolitan Council to show existing employment within a mile, existing manufacturing and distribution-related employment within a mile and existing students in the project area.

Additionally, under the “Equity and Housing” criterion, applications are reviewed based on the housing performance score of the area in which the project is located. This score is based on housing affordability and diversification in the area as local initiatives to facilitate affordable housing creation and preservation. The weight of these factors on the overall score of each project changes based on the type of project, such as roadway expansion, roadway management, bridge rehabilitation, transit system modernization and pedestrian facilities.

At the state level, the Minnesota Department of Transportation (MnDOT) used a competitive program in 2013 called Corridors Investment Management Strategy (CIMS) to target funding to state priorities that are unlikely to be addressed through the normal programming process.³⁵ Under this program, MnDOT evaluated projects based on three areas: a benefit-cost evaluation, other qualitative factors and funding match.

While MnDOT assessed common engineering benefits (like travel time reliability) in its benefit-cost evaluation, the agency also quantified benefits areas like bicycle/pedestrian-related health benefits,

33 http://www.roanoke.com/news/politics/virginia-plans-to-pull-politics-out-of-transportation-spending/article_5d7518b5-5c77-5457-806d-37ed5f294594.html

34 <http://www.metrocouncil.org/Transportation/Planning-2/Transportation-Funding/Regional-Solicitation/DraftRegionalSolicitation2016.aspx>

35 <http://www.dot.state.mn.us/cims/pdf/CIMS%20Solicitation%20Criteria%20Summary.pdf>

noise, runoff and agricultural land protection. For areas that were difficult to quantify, MnDOT qualitatively considered other factors, including improved destination access to tourist destinations, schools, health care facilities and recreational areas.

At the federal level, the USDOT's popular Transportation Investment Generating Economic Recovery (TIGER) program has also prioritized access to opportunity. Under TIGER, projects are evaluated based on the extent to which proposed projects improve safety, state of good repair, economic competitiveness, quality of life and environmental sustainability. Additionally, for the 2016 grants, applicants demonstrated these priorities in terms of access to opportunity. For example, economic benefits were demonstrated for residents of all incomes by improving access to jobs, education and other necessities. Additionally, applicants showed that projects provide quality of life benefits, such as access to transit and bicycle/pedestrian facilities, and connections to jobs and necessities, not just recreation and entertainment.

These benefits are not quantified but are rated as highly recommended, recommended, acceptable and not recommended. These ratings are given based on the information provided by the project sponsor in the application. Projects that perform well in 2-3 benefit areas move to a finalist group to be evaluated on secondary criteria (innovation and partnership), project schedule, a benefit-cost analysis and geographic distribution. A key element of the TIGER Program is the predictability of the evaluation process.

Evaluating project alternatives

Performance measures can also be used to evaluate project alternatives. In many cases, project sponsors do this informally to prepare for competitive grant programs. Applicants know their project will be evaluated for its performance in goal areas, like destination access, and design their project to be most competitive for funding.

This evaluation can be done more formally too. For example, if two different transit alternatives are under consideration for investment in a region, an agency could develop or use an existing mapping tool to evaluate how each alternative will change the number of destinations reachable within a 45-minute travel time threshold compared to the base case. An online version of such a tool could be used to collect public input on the project alternatives by allowing individuals to click on any location in the region and quickly see how different alternatives change his or her "travel time contour". If a new BRT service is proposed, residents could see for themselves how the area reachable within 45 minutes from their home will change. Businesses could also see how the potential customers accessible within 45 minutes might change.



Figure 9. Funded by TIGER, Memorial Bridge connects Portsmouth, NH and Kittery, ME and is the only bicycle and pedestrian connection between the two states in the region. Image by walkportsmouth.blogspot.com.

At the state level, one example of applying performance to evaluating project alternatives can be found in Tennessee, though this evaluation focused on safety and cost, not destination access. In 2012, the Tennessee Department of Transportation (TDOT) had a backlog of more than 800 roadway projects in various stages of development, with total cost estimates at \$8.5 billion. As a pay-as-you-go state, it became challenging to plan and deliver projects quickly, which led to the creation of this project backlog. Higher cost projects particularly tended to stay on the books for years until funding became available. TDOT conducted a series of Expedited Project Delivery (EPD)³⁶ reviews of state highway projects to evaluate proposed projects for which funding was not available in order to address immediate safety and congestion needs and effectively lower project cost. This review also provided recommendations for longer-term improvements.

For each project, TDOT used the EPD process to identify immediate low-cost safety improvements such as new lane striping, curve warning signs, guard-rails, raised pavement markers, and tailored road widening and intersection re-alignments based on operational analysis of future traffic demand and field review observations. Doing so allowed TDOT to identify funding in the near future and deliver project benefits more quickly.

This same kind of procedure could be applied to additional performance areas when reviewing project alternatives. Alternatives considered in the National Environmental Protection Act are evaluated for their impact on transportation outcomes and their impact on the environment. Going forward, transportation agencies that prioritize destination access could add this important outcome area to their evaluation of project options.

A transportation agency can also set priorities for the types of projects that it wishes to see constructed in a region. For example, the Miami-Dade MPO's Governing Board has prioritized the advancement of rapid transit corridor projects by passing two resolutions in 2016. The first resolution set rapid transit corridor projects as highest priority. The second resolution endorsed the Strategic Miami Area Rapid Transit (SMART) Plan, including six bus rapid transit and six express bus corridors. The MPO then overlaid the funded projects in its TIP that are within one half mile radius of the 12 identified transit corridors to determine which projects should consider transit solutions in support of the SMART Plan.

Engage partners

Access to opportunity can mean different things to different people and entities. It is important to come to an agreement among stakeholders and the public about what it means in each community.

Once everyone agrees on exactly what the agency should measure, these partners could be key in developing data. Some of them may have access to essential data or resources for gathering it.

Partners are also important to the implementation of performance management, especially when it is used to evaluate and select projects for funding. Stakeholders should be a part of identifying methods used to ensure the application of performance measures are open and transparent. If all stakeholders understand how measures are used, they can support and explain them and bolster projects that will fit the evaluation.

36 <http://www.greshamsmith.com/showcase/projects/showcase-7/tdot-expedited-proj-delivery>

Several strategies can increase understanding of the application of destinations access performance measures and the perception of transparency. If access is part of a larger project evaluation process: 1) make the tool available online; 2) develop and distribute a simplified, non-technical version aimed at the broader public; and, 3) create a full presentation and take it “on the road” — promulgate at forums throughout the state for major stakeholders and interested parties.

If transportation agencies are seeking submissions from districts or other agencies, these strategies may still apply, and it is also important to ensure that applicants understand the evaluation process and believe they could apply it themselves. If applicants see how some projects are evaluated as improving access and others are not, they can also see how to turn a failure to receive funds in one round into an award in a future round. The best way to achieve this is to make time to meet with every applicant that does not receive funding to walk through their evaluation and give them information and support to make their project and application more competitive.

Metro in Portland, Oregon is currently updating its regional transportation plan (RTP), finalizing plan in 2018. This three-year process began with the release of a work plan in November 2015.³⁷ The work plan divides the RTP update into five phases. For each phase, the work plan includes key policy and technical partnership and engagement activities with both stakeholder partners and the public.

Policy partnerships include the agency’s standing advisory committees, which include transportation and land use technical committees that advise corresponding policy committees that, in turn, advise the Metro Council. The agency is holding a series of regional leadership forums to further engage its policy partnerships, bringing together stakeholders to explore funding, technology, and other emerging issues in depth. These forums include facilitated discussion between elected officials, community members and business leaders to provide policy direction to staff. On the technical partnership side, Metro has convened eight technical work groups on topics related to the RTP update such as transit, equity, freight, and safety. These work groups, comprised of technical experts and advisory committee representatives, will help staff prepare for the advisory committees and regional leadership forums and implement policy direction coming from them. The agency publishes advisory committee and technical work group member names and affiliations on its website as well as a calendar of meetings of each one. In addition, it posts meeting agendas in advance of meetings and meeting minutes following their approval.

These partnerships will contribute to each phase of the update process. For example, during Phase 1, partners contributed to identifying priorities to be addressed in the update. Phase 2 included identification of regional transportation needs and possible solutions. During Phase 3, Metro will begin to work with its partners to update the performance evaluation framework. Partners will review a draft list of transportation investment priorities during Phase 4 based on performance and other factors. Finally, in Phase 5, after public review of the draft RTP, regional advisory committees will finalize recommendations to the Metro Council.³⁸

Metro’s website provides content for the regional transportation plan update that is accessible and understandable by both technical and non-technical audiences.³⁹

37 <http://www.oregonmetro.gov/sites/default/files/RTP2018-WorkPlan-Nov20150final.pdf>

38 <http://www.oregonmetro.gov/sites/default/files/RTP2018-PublicEngagementPlan-Nov2015.pdf>

39 <http://www.oregonmetro.gov/public-projects/2018-regional-transportation-plan>

Identify the right metrics and set targets

A key first step transportation agencies should take to help improve the connections between people and opportunities over time is to establish performance targets for access to opportunity and track progress in meeting those targets. State DOTs, MPOs, and transit agencies will already be setting targets in the areas required under MAP-21, so this is simply a matter of incorporating destination access within this process.

While the concept of destination access is meaningful primarily on a regional scale, state agencies play a significant role in impacting regional access to opportunity. Establishing performance targets can help them direct investments to connect people to more opportunities in their regions. Like congestion, a single statewide target for destination access will be relatively meaningless by itself, but can be valuable as the sum of a number of regional targets. For example, the Chicago metropolitan area faces very different congestion challenges than southern Illinois, so a statewide congestion target would need to reflect that difference. States can consider establishing several

State agencies can use data to identify regions with significant destination access challenges.

regional targets for destination access or compiling regional goals into a single statewide target. In either case, they will need to coordinate with MPOs and local agencies to ensure that the targets reflect regional conditions and needs.

Selecting the right performance targets will depend on specific state or regional goals and challenges. There are a number of ways to define and measure access to opportunity, which means transportation agencies can take many different approaches in developing performance targets. For example, an agency that has

established a goal to improve job access for low-income populations in the region or state might consider targets such as:

- Increase by 25 percent the share of jobs in the area accessible within a 30-minute commute for low-income households
- Increase the share of low-income households living within one half mile of high frequency transit service by 15 percent
- Reduce average commute times for low-income households in the region by 20 percent
- Decrease the portion of low-income household income going toward transportation costs by 10 percent

Appropriate targets will vary to some extent depending on the type of agency. Transit agencies will generally be well-positioned to set targets for monitoring how easily people in the region can access transit service, and how well that service connects them to work and other needs. State transportation agencies may want to select targets that can be measured and easily explained on a statewide level, such as the share of household incomes statewide going toward combined housing and transportation costs.

Where statewide targets for access to opportunity may not be appropriate, state agencies can use data to identify regions with significant destination access challenges and then work with MPOs in

that area to develop regionally specific targets. Many transportation challenges do not affect entire states evenly, such as congestion, but that does not make those issues any less a state priority.

Agencies will need a clear understanding of current conditions in the state or region in order to set targets that are ambitious yet achievable, which will mean collecting data that can be used as a baseline if that information does not already exist. The Southeast Michigan Council of Governments (SEMCOG) recently conducted a regional assessment, described earlier, of the barriers residents of the Detroit metropolitan area face in reaching key services using different transportation modes. SEMCOG set benchmarks for access to opportunity in the study and will be using the results to identify priorities for future transportation projects and inform the development of future regional transportation plans.⁴⁰ See page 18 for more details on SEMCOG's analysis, Access to Core Services in Southeast Michigan.

Several transportation agencies are already incorporating performance targets related to access to opportunity into their planning. In many cases, these agencies have developed a number of performance targets that measure destination access in some way to support a variety of the goals identified within their long-range plans. For example, job accessibility measures can be used to track progress toward economic development goals, while agencies can track public health goals by measuring access to parks, trails, healthcare facilities, and grocery stores.

Some of the agencies at the forefront in this area are in California as a result of the state's Sustainable Communities and Climate Protection Act of 2008 (SB 375).⁴¹ SB 375 set regional greenhouse gas emission reduction targets for the state, and required California's metropolitan areas to develop Sustainable Communities Strategies outlining an approach for achieving the regional targets. Some California MPOs have gone beyond the requirements in SB 375 by setting other performance targets for achieving broader state and regional goals.

The Metropolitan Transportation Commission (MTC) in the San Francisco Bay Area, for example, has included performance targets in the regional transportation plans for the Bay Area since 2001. MTC develops the targets for each plan through an extensive stakeholder engagement process by first defining goals for the region and then selecting targets that will help the region evaluate progress toward achieving those goals. During the development of its most recent approved regional transportation plan for 2040, Plan Bay Area, MTC utilized performance measures based on the identified targets at three levels:

- Evaluating projects for inclusion in the plan;
- Comparing scenarios at the regional level;
- Monitoring performance after finalizing the plan.⁴²

Plan Bay Area was the first of MTC's regional transportation plans to integrate transportation, housing, and land use strategies to meet regional goals. As noted previously, MTC is currently updating Plan Bay Area in partnership with the Association of Bay Area Governments, and plans to complete the update in mid-2017. In September 2015, after a stakeholder engagement process, MTC adopted seven goals for the updated plan and approved 13 performance targets that

40 <http://semcog.org/Plans-for-the-Region/Transportation/Access>

41 <http://www.arb.ca.gov/cc/sb375/sb375.htm>

42 <http://vitalsigns.mtc.ca.gov>

November.⁴³ The targets were used to compare potential scenarios in the plan, analyze the impacts of proposed projects, and weigh tradeoffs between the different goals of the plan. Some of MTC's 13 current targets address access to opportunity, including:

- Decrease the share of lower-income residents' household income consumed by transportation and housing by 10 percent (Goal: Equitable Access)
- Increase by 20 percent the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit in congested conditions (Goal: Economic Vitality)

MTC will develop an Action Plan with near- and medium-term action items to improve progress on the performance targets – focusing on those *Plan Bay Area 2040* is having trouble meeting. These include housing affordability, displacement risk, and access to jobs. This Action Plan will be adopted concurrently with *Plan Bay Area 2040*.⁴⁴

The Southern California Association of Governments (SCAG) also uses a performance-based approach to develop its Regional Transportation Plans/Sustainable Communities Strategies. The most recent 2016 draft plan includes nine goals. SCAG developed two sets of measures tied to these goals for the plan: 1) Measures for evaluating alternative investment scenarios and selecting a preferred scenario for the plan, which can be readily measured and forecasted into the future; and 2) Performance indicators which cannot be readily forecasted but can be used to monitor progress over time toward the goals/targets identified in the plan.

While MTC's performance targets are numeric, SCAG's targets are generally directional except quantitative targets required by federal and state statutes. For example, SCAG's 2016 regional transportation plan includes the following indicators related to destination access, each of which has a performance target of "improvement over base year":

- Share of growth in High Quality Transit Areas
- Percent of income spent on housing and transportation
- Travel time to work
- Percent of residents within one half mile walk to parks and open space⁴⁵

The City of Austin, Texas is another example of an agency monitoring accessibility-related performance indicators. The city adopted its Imagine Austin comprehensive plan, described earlier, in 2012 and developed several numeric indicators tied to the vision principles in the plan.⁴⁶ Austin will use these indicators to measure progress toward achieving the plan's goals every five years. Each of the seven vision principles has at least one destination accessibility performance indicator, some of which include:

- Households within one half mile of full-service supermarkets/grocery stores (percent)
- Households within one half mile of park or accessible open space (percent)
- Households within one half mile of art/cultural venue (percent)
- Households within one half mile of library or community center

43 <http://planbayarea.org/the-plan/plan-details/goals-and-targets.html>

44 <http://mtc.ca.gov/whats-happening/news/special-features/next-steps>

45 http://scagrtpscs.net/Documents/2016/draft/d2016RTPSCS_PerformanceMeasures.pdf

46 <http://www.austintexas.gov/sites/default/files/files/Planning/ImagineAustin/webiacpreduced.pdf>

- Households within one half mile of a school, public and/or private (percent)
- Households within one quarter mile of an urban trail (percent)
- Households between one quarter and one half mile of transit and high capacity transit (percent)
- Employees between one quarter and one half mile of transit and high capacity transit
- Households within one half mile of retail and mixed-use centers (percent)
- Households within one half mile of medical services (percent)

III. Methods of Measuring Access to Opportunity

Section II provided an overview of ways transportation agencies can incorporate measures of destination access into their programs to improve the connections between people and opportunities, resources, and essential services. This section discusses a variety of approaches transportation agencies can use to measure and evaluate how well people can access destinations.

As defined in Section I, **access to opportunity** or **destination access** is the degree to which the transportation system provides people with access to jobs, schools, healthcare, recreation, and other resources and essential services. It measures the ease with which people can connect to the places they need to go. A number of factors impact destination access, including:

- The reliability of the transportation system;
- The availability of reliable and safe transportation alternatives to driving, such as transit, bicycle, and pedestrian facilities; and
- Distance and travel time to the destination, which is impacted by development patterns, or the geographic distribution of goods and services.

Transportation agencies have several types of data available to them for measuring access to opportunity, including data collected by their own staff as well as datasets available from other entities. Some agencies work with this data in-house, creating their own analysis tools or applications. A number of new and emerging tools can make it easier to do so by providing transportation agencies with a platform for robust data analysis. Transportation agencies can purchase one of these tools to help measure destination accessibility or use the approach taken by these tools to develop their own applications tailored to local conditions and specific decision-making needs. Many of the underlying data sources used by these tools are open source or available for free download.

Destination access is generally measured on a regional or local scale, but state DOTs play a significant role in impacting regional access to opportunity with their investments and have an important role to play in measuring it. Rather than doing so on a statewide basis, state DOTs can measure destination access region by region and use the results to inform statewide policy and investment decisions. For example, as described in greater detail in Section II of this guide, the Virginia Department of Transportation evaluates all proposed new capacity projects based on how they impact regional access to opportunity and uses that and other criteria to score and prioritize investments. Some of the new and emerging tools can help provide the data necessary to perform this type of analysis consistently around a state, but states will also need to collaborate with MPOs, transit agencies, and other local agencies to collect the necessary data.

This section presents types of data that a transportation agency may collect and analyze in order to make decisions regarding its transportation system. For each, this section includes some examples of third party data sources available for download or purchase, as well as case studies of how agencies have made use of each type of data. This section also examines tools that are available to assist transportation agencies with analyzing their transportation system needs. Finally, this section discusses proxy measures for access to opportunity that can help capture the concept of destination access without measuring it directly.

Types of data used in measuring access to opportunity

One way to evaluate access to destinations in a region is to analyze existing data from providers such as the U.S. Census Bureau. A transportation agency may also collect and maintain new data. Data can include transportation system characteristics such as commute trip lengths, modes of travel, transit usage, employment, household demographics, and employee travel flows. This data helps transportation agencies identify major destination access trends and challenges in a region and make planning decisions. This section discusses types and sources of data available to transportation agencies.

Demographic data includes statistical data about the population of a given study area, such as race, age, gender, marital status, geographic distribution, and citizenship. Many of these data are applicable to understanding the impacts of access to destinations on transportation equity.

The U.S. Census Bureau⁴⁷ is the most widely recognized source of demographic data in the United States. In addition to its well-known decennial Census, the Census Bureau's American Community Survey (ACS)⁴⁸ provides broad social, economic, housing and demographic profiles of regions across the United States. The ACS is updated annually, with 1 year, 3 year (discontinued in 2015), and 5 year data estimates provided. These ACS products cover various geographic levels and have differing margins of errors. Thus, it is critical for a transportation agency to select a dataset appropriate for the analysis to be performed in order to produce meaningful results.

Transportation agencies can use the ACS to help understand the changing demographic makeup of their region in addition to and beyond the data provided by the decennial Census. The ACS provides several key types of data that are critical to measuring access to opportunity and can be tracked over time, including data on the population's occupations, place of work and commute, housing costs, and access to vehicles. The ACS data is available for free download through the American Fact Finder site, as is the decennial Census data.

Many MPOs generate their own demographic forecasts for their region. They prepare reports and update tools on an annual basis describing the population trends of their region. For example, the San Diego Association of Governments (SANDAG) prepares an annual report detailing the region's demographic trends.⁴⁹ SANDAG's Data Surfer tool⁵⁰ also incorporates U.S. Census data into demographic reports that can be generated for a variety of geographic levels within the region.

Economic data includes employment and other quantitative data describing the labor market and economy of a geographic area.

The U.S. Census Bureau offers several sophisticated tools for retrieving and tracking economic data. Its Center for Economic Studies offers the Longitudinal Employer-Household Dynamics (LEHD) program,⁵¹ prepared under the Local Employment Dynamics (LED) Partnership with state governments. The LEHD program provides labor market data such as unemployment rates,

47 <http://www.census.gov>

48 <https://www.census.gov/programs-surveys/acs/>

49 http://www.sandag.org/uploads/publicationid/publicationid_2001_20213.pdf

50 <http://datasurfer.sandag.org/>

51 <http://lehd.ces.census.gov/>

wages, and job flows into and out of a particular geographic area. Under the LED Partnership, all states share Unemployment Insurance earnings data as well as their Quarterly Census of Employment and Wages data with the Census Bureau. The LEHD program combines this information with other administrative, census, and survey data to create more detailed statistics on unemployment, wages, job flows at detailed levels of geography and industry and for different demographic groups, as well as workers' residential patterns. The LED Partnership's flagship product is the Quarterly Workforce Indicators (QWI), which provides trends in employment and industry as far back as 1990. Another data product, the LEHD Origin-Destination Employment Statistics (LODES), provides annual employment statistics linking home and work locations down to the Census block level. The LED Partnership also offers Job-to-Job Flows (J2J), which offers data on worker flows between states, industries, and non-employment. LEHD offers several online tools to view and download these datasets.

In measuring Access to Opportunity, employment data, such as that provided by LEHD and LODES, is critical as it allows the identification of commute patterns and available jobs in a particular region. It shows connections between workers and jobs. Like other U.S. Census data, the LEHD and LODES datasets are available for free download.

Portland, Oregon's Metro made extensive use of LEHD and LODES data in its Mobility Corridor Atlas,⁵² which divides the Portland Metro area into 24 unique travel corridors intended to represent current mobility patterns. For each of the 24 travel corridors, the atlas provides a set of maps and charts that show a variety of information regarding the travel corridor's land use, economic, and transportation network characteristics and performance, as well as future plans. The tool presents data, such as major industries and commuter inflow/outflow in a highly graphical format to easily convey the current economic conditions of the travel corridor being studied.



Figure 10. Portland Metro Mobility Corridor Atlas for the Portland City Central Loop. All data from LEHD. <http://www.oregonmetro.gov/mobility-corridors-atlas>.

Geospatial and land use data includes Geographic Information System (GIS) datasets as well as data from other electronic sources, such as GPS, satellite imagery, and geotagging. Local

52 <http://www.oregonmetro.gov/mobility-corridors-atlas>

governments may maintain their own GIS data for their communities, or access such data for free or for a nominal cost from third parties.

OpenStreetMap⁵³ is an open source data repository maintained by a community of contributors. It provides downloadable map data showing roads, trails, rail stations, and other transportation infrastructure created using aerial imagery, GPS devices, and field maps. In urban areas, it often can provide more detailed and up-to-date information on existing pedestrian networks than other data sources.⁵⁴ The data can be downloaded for free then imported into GIS or other tools for use in further analysis.

Another provider of geospatial data for transportation is HERE (formerly known as NAVTEQ).^{55,56} HERE's pedestrian and roadway network data is collected via satellites and GPS data points as well as its own vehicle fleet and local field offices.

GPS data provider TomTom also provides roadway network data to be used in data analysis through its MultiNet service.⁵⁷ The data is compiled from aerial images, paper maps, field surveys, satellite imagery, community input, and the company's mobile mapping vehicles. InfoUSA is another provider of land use data.⁵⁸

Finally, the U.S. Census Bureau, through its Topologically Integrated Geographic Encoding and Referencing (TIGER) products⁵⁹ provides GIS and mapping data for download showing features such as roads, railroads, rivers, legal and statistical geographic areas.

One successful local example is the Louisville / Jefferson County (Kentucky) Information Consortium. This multiagency partnership offers a variety of land use and other maps and GIS data for the region.⁶⁰ At the state level, many states maintain a GIS data repository. For example, New York State maintains a GIS Clearinghouse containing statewide data available for download.⁶¹

Safety data includes factors such as the number of crashes (as well as their severity), fatalities, and injuries. MPOs, state DOTs, and other transportation agencies generally track this information to locate crash "hot spots".

Transportation agencies routinely collect **traffic count data** during peak travel periods to understand the volume of vehicles traveling through a roadway section or intersection. A local government or MPO, a state DOT, or a third party consultant may collect this information.

Transit route and schedule data may be available for analysis from local transit agencies using the General Transit Feed Specification (GTFS) format⁶², originally created through a partnership

53 <https://www.openstreetmap.org>

54 <http://access.umn.edu/research/america/walking/2014/documents/CTS15-04.pdf>

55 <https://company.here.com/enterprise/location-content/overview/>

56 <http://www.navmart.com/here-navstreets.php>

57 http://www.tomtom.com/en_gb/licensing/products/maps/multinet/?WT.ac_id=ttlic_footer_multinet

58 <https://www.infousa.com/data-quality/>

59 <https://www.census.gov/geo/maps-data/data/tiger.html>

60 <http://www.lojic.org/main/>

61 <http://gis.ny.gov/>

62 <https://developers.google.com/transit/gtfs/reference>

between Google and TriMet in Portland, Oregon. These data files, consisting of multiple text files saved in a single ZIP file, include information on the routing, stop locations, and service schedules or frequencies. Many transit agencies have taken advantage of this standard to provide their route and schedule information for data analysis purposes or to be included in software developers' route planning tools such as Google Maps or mobile phone applications. In 2016, U.S. DOT released the first National Transit Map based on GTFS data from 270 transit agencies, with plans to update as additional agencies contribute.⁶³

Travel behavior data tracks the choices people make regarding transportation. Examples include transportation mode share, the number of trips taken and minutes per day spent in travel, destinations, route choices and time of day. This information is used to inform transportation planning models and traffic forecasts prepared by transportation agencies.

Transportation agencies also generally conduct **public outreach** to collect the opinions of the public and other stakeholders. Through techniques such as surveys, public meetings, and social media, the agencies gain an understanding of the public's opinion of a proposed project, how the public uses transportation and the issues they face when doing so. In addition, a number of transit agencies currently collect data on transit accessibility through ridership surveys. In evaluating access to opportunity, it is critical that modeling tools and data sources do not take the place of public outreach. Conducting effective outreach helps reach diverse populations in the community and build a greater understanding of their transportation challenges.

Table 1, on the following page, provides a summary of the major data sources discussed in this section.

63 <http://www.rita.dot.gov/bts/ntm>

Table 1. Summary of Data Sources

	U.S. Census Data, including Decennial Census and American Community Survey data	Longitudinal Employer-Household Dynamics (LEHD) Program	LEHD Origin-Destination Statistics (LODES)	OpenStreet Map	HERE Map Data (formerly NAVTEQ)	Transit Routes and Schedules	MultiNet datasets	InfoUSA	Topologically Integrated Geographic Encoding and Referencing (TIGER) datasets	Local government, state DOT and MPO data
Provider	U.S. Census Bureau	U.S. Census Bureau	U.S. Census Bureau	Hosted by University College London VR Centre, Imperial College London, and Bytemark Hosting	HERE	Local transit agencies, U.S. DOT National Transit Map	TomTom	Infogroup	U.S. Census Bureau	Various
Cost (Free/Paid)	Free	Free	Free	Free	Paid	Free	Paid	Paid	Free	Free
Type of data provided	Broad social, economic, housing, and demographic profiles	Labor market data including unemployment, wages, job flows at detailed levels of geography and industry and for different demographic groups, workers' residential patterns	Annual employment statistics linking home and work locations at the Census Block level	Roads, trails, transit stations, points of interest, and other infrastructure	Roads, trails, transit stations, points of interest, and other infrastructure	Transit route and schedule / service frequency information in General Transit Feed Specification (GTFS) format	Digital mapping information including road signage, intersections, and navigational information	Location-based data	Spatial extracts including features such as roads, railroads, rivers, legal and statistical geographic areas	Travel speed data, GIS files showing bicycle and pedestrian infrastructure, other local transportation network information
Source of information	U.S. Census Bureau surveys	Federal, state, and U.S. Census Bureau data including state-level unemployment insurance earnings data and quarterly Census of Employment and Wage data	LEHD data	Open source data maintained by a community of contributors using aerial imagery, GPS devices, personal knowledge, and field maps	Satellites, GPS data points, HERE's vehicle fleet, local field offices	Local transit agencies	Aerial images, paper maps, field surveys, satellite imagery, community input, mobile mapping vehicles	Yellow Page directories, business data, user feedback	U.S. Census Bureau's MAF/TIGER database	Local governments, regional MPOs, and state DOTs

Introduction to data tools

The types of data described above form the basis of more sophisticated analysis tools that help measure access to opportunity. In recent years, a number of private firms and research institutions have developed tools and software platforms that make it easier to evaluate destination access at a variety of geographic scales. These tools typically use geospatial modeling to map destinations that can be reached from a given location by car, transit, bicycling, and walking. Using these tools can make it easier for transportation agencies to evaluate access on a more consistent basis over time than they have in the past, which opens up greater possibilities for integrating destination access into investment decisions. These tools also have applications for land use planning and can support a more integrated approach to cross-agency land use and transportation decision-making.

This guidebook describes several tools that are currently available in more detail on the following pages, including datasets developed by the University of Minnesota's Accessibility Observatory, as well as Citilabs' Sugar Access tool, Renaissance Planning Group's GIS tool, and Conveyal's Transport Analyst platform. Agencies can purchase these tools or build on the approaches to conduct their own internal analyses within their region. There are significant overlaps in the sources of data used by these tools, many of which are open source or can otherwise be accessed for free. This means that transportation agencies can utilize their own staff or consultant resources to perform this type of analysis; the acquisition of a sophisticated tool is not a prerequisite.

The four tools profiled below build on the same basic principle: destination access is measured in terms of the time it takes to travel from one key location to another. Measuring travel times between destinations offers a more complete representation of access to opportunity than measures typically used to evaluate mobility, such as travel delay and level of service.

Under this approach, measuring destination access involves: 1) defining the types of destinations to include, 2) mapping or geocoding where those destinations are located, and 3) calculating the time it takes to travel between destinations by different modes based on the existing transportation network. Some of these tools can also measure quantities of destinations, such as the number of jobs, schools, or grocery stores, accessible within a specified travel time from an origin.

The tools described below all perform this analysis, but there are varying nuances at each step. For example, some tools include a single travel time threshold chosen based on observed travel behavior to determine whether a destination is accessible, such as 45 minutes of travel or less. Others incorporate "decay" curves that account for the rates at which willingness to travel to a destination drops off as travel times increase. Tools that integrate decay curves generally also account for the fact that willingness drops off more quickly for some modes of travel than others (for example, people are generally willing to travel longer by car than by transit, bicycle, or on foot).

These tools also vary in terms of the types of destinations included. Some tools focus exclusively on modeling household access to jobs and employer access to workers, while others include access to other destinations, such as schools, grocery stores, healthcare facilities, parks and other recreation centers, and cultural amenities.

The tools profiled in this section generally require minimal data collection on the part of the transportation agency. Sugar Access⁶⁴ by Citilabs, for example, is an ArcGIS tool that comes preloaded with the basic necessary demographic and economic data for destination access analysis and is essentially ready to use nationwide. The Renaissance Planning Group has worked with agencies to customize their tool with the necessary GIS datasets based on the agency's specific goals. However, these tools may assume the user has ArcGIS, data analysis, or programming knowledge.

These tools generally pull data from sources such as OpenStreetMap or HERE (formerly NAVTEQ) point of interest, pedestrian and roadway network data. They also typically rely on some data provided by the U.S. Census Bureau, as well as transportation and other agencies throughout the area, including GTFS data from transit agencies, GIS data from local governments, and travel speed data compiled from state DOTs and MPOs. As noted above, many of these data sources are free or open source and a transportation agency can utilize them for analysis without purchasing one of these tools.

Some tools incorporate or allow the agency to input data on demographics to help evaluate the accessibility challenges faced by specific groups. Those tools that are GIS-based also allow decision-makers to input and overlay additional data points such as types of jobs accessible from a given neighborhood, wage categories, household income levels, education levels, and health trends. In addition to the demographic and employment data available through the U.S. Census Bureau, local data collected from travel surveys can produce a more nuanced picture of accessibility challenges in an area. These surveys show the trips that people actually make in the real world. This data can help decision-makers identify areas with poor access to specific types of opportunities or services and make policy and investment decisions to address those challenges. By making investments in transit and other infrastructure, people may be able to reach additional destinations not previously accessible within a specified travel time. This could mean connecting disadvantaged populations to higher-paying jobs, addressing food deserts, improving access to healthcare, and diagnosing and addressing other regional challenges.

The GTFS data utilized as a model of the transit system being analyzed using one of these tools generally consist of scheduled route times or service frequencies. This schedule information does not necessarily reflect real world conditions such as traffic or weather. To rectify this limitation, other data sources showing actual or average service levels can be used to help the GTFS data better reflect service reliability and to approximate delays. For example, a transit agency may publish average on-time performance for its system during the previous calendar year or actual performance data may be collected in the field. By updating the GTFS data to factor in these observed or averaged conditions over a period of time, the destination accessibility calculated by one of these tools more realistically reflects what a rider may experience. It would be inaccurate to assume that the transit system will consistently operate as scheduled despite adverse traffic and weather conditions or other operational challenges.

Some of these tools also allow users to take their analysis one step further by modeling changes to the existing land use patterns and transportation networks and observing projected changes in destination accessibility. This carries major potential to help advance performance-based

64 <http://www.citilabs.com/software/sugar/sugar-access/>

transportation and land use decision-making, particularly as these tools continue to improve. Several regional planning agencies are already starting to use this capability to evaluate alternative scenarios in regional visions and long-range transportation plans.

It is worth repeating that while these tools can provide valuable insight to inform decision-making, they cannot be used as a shortcut or replacement for robust stakeholder engagement to develop a deep understanding of a region's accessibility needs. Members of a community will always be the foremost experts on the accessibility challenges they face. Some of the biggest benefits of the tools described below are, in fact, their potential applications for public engagement during long-range planning. Most of these tools can be used to visually map and display the specific accessibility barriers communities face, providing a starting point—rather than the endpoint—for discussions about priorities and solutions.

Profiles of data tools

As previously noted, numerous tools exist to assist transportation agencies with measuring access to opportunity. Several such tools are profiled in this section. The inclusion or exclusion of any tool from this guidebook is not intended to indicate an endorsement or judgment regarding the effectiveness of the tool in measuring access to opportunity. Table 2, on the following page, provides a summary of the major features and differences between the tools.

Table 2. Summary of Data Tools

	Accessibility Observatory	Sugar Access	Transport Analyst	GIS Tool
Provider	University of Minnesota	Citilabs	Conveyal	Renaissance Planning Group
Cost (Free/Paid)	Some data available for free download; state DOTs, MPOs, local governments, and transit agencies may join project to receive data sets	Paid	Free (open source) but transportation agencies may pay for Conveyal to customize / host if they do not have in-house technical capacity to do so	Paid
Data sources	<p><u>National Access Evaluation Pooled-Fund Study</u> GTFS data (transit schedules); OpenStreetMap (pedestrian network); TomTom's MultiNet and SpeedProfile datasets (road network and historical speed data)</p> <p><u>Access Across America Pooled-Fund Study</u> U.S. Census Bureau's TIGER datasets (geography and street network; U.S. Census Bureau's LEHD 2011 LODES dataset (employment and worker</p>	<ul style="list-style-type: none"> • Points of interest, pedestrian facilities, and roadways: HERE • Transit agency route and schedule data • U.S. Census Bureau data • Data from local, state, and regional agencies may be imported as GIS shapefiles 	<ul style="list-style-type: none"> • OpenStreetMap • Transit agency route and schedule data • U.S. Census Bureau demographic, economic, and land use data (such as LEHD - LODES dataset) • Data from local, state, and regional agencies may be imported as GIS shapefiles 	<ul style="list-style-type: none"> • Land use: InfoUSA employment data • Transportation network: HERE (formerly NAVTEQ) • U.S. Census Bureau demographic, economic, and land use data (such as LEHD - LODES dataset) • Data from local, state, and regional agencies may be imported as
Interface (GIS-based or web-based)	Data may be downloaded for offline analysis in GIS or other tools	GIS-based	Web-based	GIS-based
Geographic limitations of tool	Certain cities excluded from analysis where data are unavailable	None—customizable for any location	None—data is available worldwide	None—customizable for any location
Visual representation of data	Yes	Yes	Yes	Yes
Incorporates trip "decay" into analysis	No	Yes	No	Yes
Model household access to jobs/Employer access to workers	Yes	Yes	Yes	Yes
Model access to other destinations (schools, grocery stores, healthcare	No	Yes	Yes	Yes
Model changes to existing land use patterns and transportation networks (scenario analysis)	No	Yes	Yes	Yes
Ready to use - transportation network data, points of interest, roadway travel times, and transit information are all built in	No	Yes	Yes	Yes
Incorporate agency's own data into analysis	Via offline analysis	Yes	Yes	Yes

University of Minnesota's Accessibility Observatory

The University of Minnesota's Accessibility Observatory conducts research and develops tools to advance the use and communication of accessibility-based metrics in transportation planning, engineering, and evaluation.

The Accessibility Observatory recently launched a National Accessibility Evaluation Pooled-Fund Study⁶⁵ led by the Minnesota Department of Transportation. The study will measure accessibility to jobs across the entire U.S. It will calculate the number of jobs that can be reached by driving or transit within various travel time thresholds for every Census block. Other organizations are invited to join the project, including state DOTs, MPOs, local governments, and transit agencies. The output of the study will be an accessibility dataset at the Census block level that will be available to its transportation agency partners. Participating agencies will have digital access to the accessibility datasets generated by the study.

The second part of the Observatory's study is the continuation of the Observatory's existing Access Across America⁶⁶ project. This effort evaluates and ranks the 50 largest U.S. metropolitan areas periodically according to their job accessibility by automobile, transit, bicycle, and walking. The project uses Census block data to calculate the number of jobs available from any given point weighted by the number of workers in the Census block and averaged across the metro area.

Both of these projects advance earlier evaluations of transit accessibility by assuming multiple departure times for transit trips rather than a single one, reflecting transit service frequency. They also factor in the impact of walking times in transit trip calculations by calculating travel times at the Census block, rather than block group, level.

The analysis includes accessibility metrics for multiple travel time thresholds of 10-60 minutes of travel time (representing the number of destinations accessible within each window of travel time), rather than a single threshold. However, unlike some of the tools described below, it does not incorporate trip decay, which is the declining likelihood of a traveler to use a particular mode of travel as travel time increases.

Sugar Access

Sugar Access⁶⁷ is an ArcGIS tool for transportation planners and engineers developed by Citilabs, a firm that provides software, data analysis, and professional services to help understand, model, and predict the movement of people and goods.

Sugar Access allows a transportation agency to model accessibility to employment and other destinations via driving, transit, biking, and walking. The tool can be setup to evaluate any one of these transportation modes individually, whichever mode offers the shortest travel time, or the user can weight the percentage of trips taken via driving, walking, and transit based on observed conditions. Transportation network data, points of interest, roadway travel times, U.S. Census Bureau data, and transit information are all built into the tool, meaning that it is ready-to-use

65 <http://access.umn.edu/research/pooledfund/index.html>

66 <http://access.umn.edu/research/america/index.html>

67 <http://www.citilabs.com/software/sugar/sugar-access/>

throughout the U.S. The agency may add local data or points of interest for more precise analysis of their existing or future transportation network.

Decision-makers can use the tool in a number of ways. It can provide scores that rate access to destinations such as jobs, schools, errands, recreation, hospitals, and government services for a community, including specific scores for each travel mode. It can also calculate travel times to certain types of destinations (such as restaurants) or calculate the quantity of a certain type of destination (such as jobs or schools) within a certain travel time from the origin point.

Sugar Access also allows simple scenario analysis to test the impacts of proposed transportation and land use changes in the user's community. For example, the agency could input the route of a future BRT line or the locations of bicycle infrastructure improvements to compare present versus future accessibility. The software can also model small changes to existing transit lines to calculate the impact on accessibility to destinations.

Finally, the tool also allows the default decay rates for each mode of transportation to be adjusted based on local conditions or populations. The decay rates are taken from observed travel behaviors and represent the rate at which willingness to use a particular mode of transportation drops off based on time and/or distance.

Transport Analyst tool

Transport Analyst⁶⁸ is a web-based application designed to help transportation practitioners analyze accessibility to destinations. Conveyal, a consulting firm specializing in open data and open source technology for the transport sector, originally developed the tool in collaboration with the World Bank. Transport Analyst is powered by and adds new functionality to OpenTripPlanner (OTP), a tool providing multimodal trip planning and analysis. The source code for the tool may be downloaded free of charge and Conveyal also offers a paid version of the program hosted on their servers.

Transport Analyst allows transportation agencies to measure accessibility to or from a specific point (or origin) to job centers and other locations that can be reached in a given timeframe via best and worst case scenarios using public transit, walking, biking, driving (if traffic speed data is available), or combinations of these modes. The tool can also perform regional analysis to show variations in accessibility between Census blocks throughout a study area. Decision-makers can create composite regional measures (such as population-weighted average job access for a neighborhood or city) by combining indicators. Transport Analyst is able to perform scenario analysis of two or more future potential transportation systems. It can also be used to create public outreach and consultation websites, allowing the public to see how a scenario will affect their city.

The Regional Plan Association (RPA)—a research and advocacy organization working in the New York/New Jersey/Connecticut metropolitan region—worked with Conveyal to develop two customized versions of the tool for RPA's Fourth Regional Plan initiative.⁶⁹ One version of RPA's mapping tool allows the public to see the estimated number of accessible jobs in the tri-state

68 <http://conveyal.com/projects/analyst/>

69 First version of RPA tool: <http://fragile-success.rpa.org/maps/jobs.html> and second version of RPA tool: <http://library.rpa.org/interactive/access-to-workforce/>

region from any origin point. The user may customize the place of origin, travel mode, and maximum travel time (15-90 minutes). The tool can display jobs color-coded by either industry classification or workforce level of education. The second version of the tool allows employers to see the accessible and qualified labor pool within the tri-state region from their location using the same variables and providing the same type of output as the accessible jobs tool. The tools were developed for RPA as a public engagement resource and have worked well in that capacity.

Renaissance Planning Group's accessibility tool

Renaissance Planning Group (RPG),⁷⁰ a consulting firm that works on the intersection between land use, transportation, design, and technology, has developed a tool for modeling accessibility and related factors, including mode choice. RPG has worked with a number of agencies in the Washington, DC metropolitan area to pilot the use of the tool in transportation and land use planning and investment decision-making.

The tool originated through research led primarily by Richard Kuzmyak and focused on developing responsive tools for estimating bicycle and walk demand to destinations. The goal was to factor in the effects of land use, the quality of available facilities, and impacts on motorized travel into the model. Kuzmyak's research led to the development of a GIS Walk Accessibility Model, made available in conjunction with the National Cooperative Highway Research Program (NCHRP) project 08-78, Estimating Bicycling and Walking for Planning and Project Development: A Guidebook.⁷¹

Based on the results of this study, RPG developed a GIS-based accessibility tool initially developed from data in the Washington DC region. The tool takes into account the number of opportunities (including jobs, retail, and service establishments) from a particular starting point as well as the travel time to those destinations. It can also model mode choice by calculating the likelihood that individuals will drive versus use other modes of transportation. Based on these calculations, the tool has been able to predict the overall mode share with a high level of accuracy for a particular corridor based on these calculations.

RPG's tool applies a "decay" factor representing the decreased value of destinations located farther away. For example, based on MPO travel surveys in the Washington, DC area, work trips that require 15 minutes of walking have only 37% of the value of trips with less than 1 minute of walking. For non-work trips, 15 minutes of walking reduces the value to 23% of trips with less than 1 minute of walking. The decay value is different for other modes of transportation.

RPG has applied the tool in coordination with several agencies, including the Virginia Department of Transportation (VDOT), which uses the tool within a new capital project scoring process, described in greater detail in Section II of this guide. RPG has also worked with the Maryland Department of Transportation to test the tool on a pilot corridor in the state and has used the tool to create a VMT model for a greenhouse gas reduction study for the Metropolitan Washington Council of Governments.

70 <http://www.citiesthatwork.com/>

71 http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_770.pdf

RPG's GIS tool was found to be useful in several ways during these pilot projects:

- **Diagnostics:** It can help diagnose transportation issues such as gaps between areas of trip production and areas of major attractions or destinations. The tool can also help demonstrate the best solution to accessibility challenges, which might not always be transportation improvements. For example, if a portion of a study area is located too far from existing supermarkets, the best solution might be a new market rather than transportation improvements.
- **Planning:** The tool can inform planning decisions in a variety of ways. For example, it can help planners determine where to locate new developments, such as affordable housing, based on desirable factors such as multimodal transportation opportunities to connect to key destinations. The tool has also been applied to consider adverse effects of proximity, such as locating affordable housing further away from environmental contamination or certain business types, such as liquor stores.
- **RPG's tool** can also be used for scenario planning, such as to evaluate alternative land use strategies to meet regional greenhouse gas reduction goals. It also has applications in corridor planning, and has been used to predict mode share of transportation options and better understand transportation and land use interactions.
- **Programming:** Finally, the tool can help transportation agencies prioritize transportation projects based on measures of accessibility improvement of each project relative to the others. (See the discussion of VDOT's Smart Scale project scoring process in Section II of this guide, which utilized this tool.)

Proxy measures for destination access

In addition to the tools described in the previous section, transportation agencies have used a number of approaches to evaluate and track how connected people are to opportunities and services in their region without measuring or modeling travel times between destinations. Areas that have good accessibility tend to have a variety of transportation choices and lower household transportation cost, so some agencies have evaluated these qualities as a means for identifying and addressing accessibility barriers.

This section discusses “proxy measures,” which do not measure access to opportunity directly but still help capture the concept. Using these measures can provide a valuable starting point for agencies that are not currently in a position to use the tools described above.

For example, as discussed below, a number of agencies have assessed destination access in their region by measuring distance to transit stops. This enables agencies to approximate how easily people can reach jobs and services without the need for more detailed transportation network data, and without the additional step of calculating travel times.

Proxy measures can also be used in combination with the tools in the previous section to develop a more complete understanding of access to opportunity in a region. For example, some agencies have approached the question of access by measuring travel affordability. Transportation costs have a significant impact on whether community residents can reach employment and other services they need to thrive. Evaluating affordability can help identify neighborhoods with disproportionately large travel costs and other equity concerns. Rather than replacing measures of access focused on travel time to destinations, it can provide an important counterpart for a more complete understanding of the barriers to accessing opportunities in a region.

These and other approaches for using proxy measures are described in more detail below.

Transit access

A number of agencies have evaluated accessibility by measuring the number of households, jobs, or other destinations located within a certain distance of transit stops, such as ½ mile. This approach builds on the research discussed earlier in this section about the crucial role transit plays in connecting people to jobs and other opportunities. Agencies can use transit access as a proxy measure for access to opportunity because we know that, in general, improving access to transit service can significantly increase the opportunities people can reach. This approach is especially well suited to transit agencies based on the types of data they already collect, but other agencies can measure transit access too.

There are several limitations to this approach because it focuses on whether people in an area have access to public transit, rather than whether they can actually use that service to reach the destinations they need to thrive. For example, simply measuring the distance from households to transit does not reflect the number or types of jobs that neighborhood residents can reach from their specific local transit stop. When used by itself, it also does not account for factors that determine whether people can realistically rely on the available transit service to fulfill their daily needs, such as the length of the transit trips, frequency of service, number of transfers required, and presence of sidewalks connecting stops to surrounding destinations.

Nevertheless, measuring the percentage of a region's population living and working within close proximity to transit stops is a useful approach for estimating access to opportunity and considering access during policy and planning decisions. A number of regional transportation agencies, including San Diego Association of Governments (SANDAG),⁷² Puget Sound Regional Council (PSRC),⁷³ and the Atlanta Regional Commission,⁷⁴ have used access to transit service in some way to evaluate proposed investment scenarios for planning purposes or to select projects to fund.

There are also several tools available that can help agencies go beyond simply evaluating the percentage of people and businesses served by transit. For example, the Center for Transit Oriented Development has created a TOD Database,⁷⁵ which includes geographic, economic, and demographic data for every existing and proposed fixed-route transit station in the U.S.

Decision-makers can also use the U.S. Environmental Protection Agency's Access to Jobs and Workers via Transit tool,⁷⁶ another free and publicly available GIS-based web resource. It allows users to map and compare jobs accessible by public transit from different neighborhoods, as well as households and workers accessible from employment locations. Decision-makers can use the tool to help identify inequities in transit access across a region to inform planning decisions. AllTransit by the Center for Neighborhood Technology⁷⁷ analyzes the benefits provided by transit for any location in the U.S. It helps quantify the value of transit from several distinct performance measures including jobs access, economic benefits, health, equity, transit quality, and mobility.

72 http://www.sdforward.com/pdfs/RP_final/AppendixN-EvaluatingthePerformanceoftheTransportationNetwork.pdf

73 <http://www.psrc.org/funding/selection/fhwa-fta-project-selection/>

74 <http://www.atlantaregional.com/transportation/regional-transportation-plan>

75 <http://toddata.cnt.org>

76 <http://www.epa.gov/smartgrowth/smart-location-mapping#Trans45>

77 <http://alltransit.cnt.org/>

Transportation affordability

Measuring transportation affordability provides another lens for evaluating access to opportunity. Several agencies currently measure transportation affordability by evaluating the portion of household incomes within a region going toward transportation costs and comparing between different neighborhoods or Census blocks. Some agencies have also begun to look at combined housing and transportation costs for a more complete measure of affordability.

This approach is especially valuable for identifying and addressing equity challenges in a region. Low-income families spend a higher portion of household incomes on housing and transportation costs, particularly in neighborhoods that lack key opportunities and services. This can include neighborhoods that are not physically near jobs or contain the wrong types of jobs for residents' education levels and skill sets, neighborhoods with limited grocery stores and healthcare facilities, and neighborhoods with poor transit access or with transit service that does not connect residents to the destinations they need to reach.

The Location Affordability Portal,⁷⁸ developed by the U.S. Department of Transportation and U.S. Department of Housing and Urban Development in partnership with the Center for Neighborhood Technology, can help decision-makers model transportation and housing affordability. The Portal includes a free tool designed for researchers, developers, planners, and policymakers called the Location Affordability Index.⁷⁹ Decision-makers can use the Index to estimate the percentage of a household's income that will likely be dedicated to housing and transportation in a particular location within the U.S based on data from the 2008-2012 American Community Survey (ACS). The Index uses eight different household categories based on income, size, and number of commuters, and it can model the cost of living for each household category across a neighborhood, city, or region. This can help inform decision-making during long-range planning.

Location efficiency and land use mix

Another approach decision-makers can take to evaluate destination access is to look at the density and diversity of land uses within a neighborhood or larger geographic area. People living in location-efficient places with compact development and a mix of destinations (residential development, employment centers, restaurants and businesses, etc.) will tend to be able to access the services they need on a daily basis more easily and at lower transportation cost.

One of the simplest ways to measure land use mix is to look at the balance between jobs and housing in an area, often measured in terms of the proportion of jobs per household. Doing so does not account for whether the types of jobs in an area are the right fit for the workforce, but incorporating demographic and employer data can help address that limitation. Land use entropy indices are another simple way to quantify land use mix in an area, though they have similar limitations. Entropy indices measure dissimilarity of land uses in a geographic area by accounting for the number of land use types and balance between different types on a neighborhood scale.

78 <http://www.locationaffordability.info>

79 <http://www.locationaffordability.info/lai.aspx>

There are also several tools available to help decision-makers perform more complex analyses of location efficiency. The Smart Location Database⁸⁰ is a free nationwide web-based tool that measures accessibility and related attributes for most Census block groups in the United States using GIS data. Developed by the U.S. Environmental Protection Agency in partnership with Renaissance Planning Group, it allows decision-makers to create maps online of any geographic area showing characteristics such as housing density, land use diversity, neighborhood design, destination accessibility, transit service, employment, and demographics. Decision-makers can also download data for more advanced offline analysis using more than 90 available attributes.

Another widely known tool is Walk Score,⁸¹ a free web-based application that allows users to enter any address and provides a score for the location on a scale of 0-100 based on the number of destinations accessible within walking distance. Walk Score is designed primarily to help individuals make decisions about where to live, and the tool itself has limited direct applications for transportation planning, but it offers a useful approach for using GIS data to quantify access based on destination proximity and land use mix. Walk Score also offers several data products for purchase that decision-makers can use to conduct broader analyses to inform public policy.⁸²

Walk Score calculates a location's score based on the number of destinations within one quarter to one-and-a-half-miles walk of the location, with more credit given to locations that are closer. Walk Score also provides a Transit Score and Bike Score for the location searched. The Transit Score is based on a summed "usefulness" value for each nearby transit route, incorporating the frequency of service, type of transit, and distance to nearest transit stop. The Bike Score measures nearby bicycle infrastructure, hills, destinations, road connectivity, and the bike commuter mode share of the area.

Transportation agencies can also develop their own tools for evaluating location efficiency and density to support specific planning and decision-making processes. For example, New Jersey Transit (NJTransit), the state's public transit corporation, developed the tool Transit Score in 2008 for assessing the "transit friendliness" of a region or community in order to help determine whether areas will be able to support potential new transit service. Transit Score incorporated three factors: population density, employment density, and density of households with zero cars. Transit Score also allowed users to incorporate existing conditions, projected future conditions, and planned future conditions.⁸³

Other measures related to multimodal access

Considerations such as the safety, reliability, convenience, and comfort of the travel experience all shape accessibility by influencing whether people are willing to travel to destinations using specific modes. These considerations are, in turn, shaped by a host of characteristics associated with the existing transportation infrastructure and services and land use patterns in the area. Measuring several of these characteristics together can help decision-makers identify barriers community members face in accessing opportunities and resources.

80 <http://www.epa.gov/smartgrowth/smart-location-mapping#SLD>

81 <https://www.walkscore.com/>

82 <https://www.walkscore.com/professional/research.php>

83 <http://www.nj.gov/state/planning/docs/2011-0413-njt-transit-score-guide.pdf>

For walking and bicycling, this can include characteristics such as overall availability and condition of sidewalks and bicycle infrastructure, car travel speeds, level of physical separation from traffic on high-speed arterials, block lengths, street lighting, topography, and surrounding land use. For example, if a school is located close to housing but there is a high level of traffic on adjacent roadways, gaps in the sidewalk networks, a lack of crosswalks at convenient locations, or insufficient street lighting, many families will decide that it is too dangerous for children to walk or bike to school.

For transit, these factors can include the time it takes to reach transit stops, the frequency and reliability of service, quality of transit vehicles and stops, whether information about available service is easy to access, whether people are able to access transit through park and ride lots in more suburban communities, and whether transit stops are connected to destinations by complete pedestrian and bicycle networks.

Other emerging tools

There are a number of additional tools currently under development, or specific to a particular metropolitan area, which address some aspect of accessibility and may be helpful for agencies interested in evaluating access to opportunity. Like the proxy measures described above, most of these tools do not measure destination access directly, but can help agencies capture the concept.

Flow⁸⁴ is a new open platform tool created by Sidewalk Labs in partnership with the U.S. Department of Transportation and the seven finalists of its Smart City Challenge. It is a transportation coordination platform that helps cities work with residents to increase road, parking, and transit efficiency using analytics and messaging. The analytics collected through anonymous cell phone and sensor data allow cities to understand how their roadways are being used as well as simulate the impacts of new transportation infrastructure. It allows transportation infrastructure to be utilized dynamically depending on current conditions and demand.

Opportunity Score⁸⁵ is a new tool developed by real estate company Redfin, which also offers the well-known Walk Score tool. For any address entered, it generates a numeric value representing the availability of jobs (in major employment fields) located within a 30-minute commute from that location, with or without a car. Opportunity Score will also be able to locate affordable homes for sale within a 30-minute commute of a workplace and provides median home and rental prices for the neighborhood.

Opportunity Tool,⁸⁶ developed by data company PolicyMap, shows areas of opportunity based on up to three specific criteria such as housing, education, transportation, and demographics. It is currently available only for Philadelphia.

Transit Analyst,⁸⁷ created by GIS mobile phone application developer Azavea, shows transit access relative to “community assets,” including health clinics, recreation facilities and playgrounds, Head

84 <http://www.flowmobility.io/>

85 <https://www.redfin.com/blog/2016/03/redfin-presents-opportunity-score-at-white-house-open-data-event.html>

86 <http://opportunity.policymap.com/>

87 <http://transitanalyst.com/>

Start locations, and corner stores. The tool, which is limited to Philadelphia, shows locations of these assets reachable between 1 and 90 minutes of travel time from an origin point.

Invest in the Future of Baltimore⁸⁸ is a tool created by real estate company Zillow that provides maps shading Baltimore neighborhoods by Census tract based on opportunity (defined as access to good schools and jobs as well as low crime); development potential; affordability (total cost of living); nearby amenities; and median rent.

How Affordable is Opportunity?⁸⁹ was created by the Heller School for Social Policy and Management at Brandeis University. It compares the costs of opportunity (defined as housing and transportation) to the benefits (educational and economic opportunity and health care access). The tool compares differences in the cost-benefit ratio for children of varied racial identities. Currently, the tool includes data for 15 U.S. metropolitan areas.

Location Opportunity Footprint,⁹⁰ created by data company Community Commons, maps the areas of a city (at the Census block group level) where jobs, good schools, and affordability are present. Customizable thresholds are available for Education Data and School Proficiency Index; Number of Nearby Jobs per Worker; Monthly Cost of Housing and Transportation for Family at 50 percent Area Median Income; and Demographics.

Data2Go.nyc⁹¹ is a mapping tool created by Measure of America, a non-profit program of the Social Science Research Council. It shows more than 300 indicators for New York City including land use (such as percentage of land that is residential, commercial, industrial, or parks) and commute time (average commute time and percentage of workers with average commutes greater than 60 minutes).

National Equity Atlas⁹² aims to show economic and health inequalities in the 100 largest U.S. cities by race and gender. Created by research and advocacy organization PolicyLink, the tool compares U.S. cities and ranks them relative to each other. In terms of accessibility, the tool allows the user to graphically show the breakdown by race and ethnicity for measures such as the percent of households without a vehicle and the average travel time to work (minutes). It also provides general recommendations for expanding transportation access.

Streetwyze⁹³ is an application that will “crowd source” neighborhood amenities, based on the premise that local residents know their own communities better than an outside entity collecting data. The app will help community members determine how walkable their neighborhood is, how well it is served by public transit, where they can buy affordable healthy food, and where they can access other important services.

Affordable Housing Finder,⁹⁴ an online tool from GIS developer ESRI, generates scores for each Census block group for the following indicators: average school proficiency, average job proximity

88 http://files.zillowstatic.com/research/public/Whitehouse_Hackathon/index.html

89 <http://www.diversitydatakids.org/data/library/49/coi-lai-cob-story-maps>

90 <http://maps.communitycommons.org/footprint/?project=LOFT>

91 <http://data2go.nyc/>

92 <http://nationalequityatlas.org/>

93 <http://www.streetwyze.com/>

94 <http://esrifederal.maps.arcgis.com/apps/webappviewer/index.html?id=852f6731b72f465ab2fbbe76d4269f00>

index, average transportation cost, and average market labor index. This tool compares different neighborhoods to present housing options demonstrating tradeoffs between the measured indicators.

Open Data Network⁹⁵ is a resource created by tech start up firm Socrata to compare economic and demographic data at the local, county, and regional levels. It provides data on population information (including population change), high school and college graduation rates, and earnings (broken down by gender and educational level).

Implementation strategies

As discussed earlier, a valuable first step for states or agencies seeking to incorporate destination access is to evaluate the current barriers to accessing opportunity and then use the results to develop state or regional priorities. Once a transportation agency has selected the methods, metrics, data, and tools to measure access, implementation is the next step in the process. These new tools may require a culture shift within the agency, and may need adjustment over time. It is vital not to let the perfect be the enemy of the good in this process.

Agency staff will be the ones to shepherd these priorities and are the ones who will be responsible for implementing changes to their programs. In other words, the entire agency staff, from the director to the project planner, must be engaged in ensuring that this process is managed effectively and efficiently. They understand the demands of the program, the needs of the communities, and the expectations of outside stakeholders. Therefore, they are key to assessing the limitations of the existing processes and identifying ways to improve them.

Proper training can equip agency staff to determine how access will be integrated into project development and evaluation, identify where decision points should change, and embrace access as a departmental priority and positive outcome for the community. Discussion of how access will be incorporated in each office within the agency should be part of the implementation process. Equally important to success is the identification of possible and perceived barriers and how agency staff can overcome them.

A crucial part of measuring access is tracking how it has changed for communities over time. Once an agency begins to measure access to opportunity, they should pick some representative projects from around the state and run them through the new measures to see if the results work as anticipated. If not, it may be because of misunderstandings about what certain types of projects accomplish, or the tool may be poorly calibrated to address the goals laid out.

For example, when VDOT tested a first draft of their project selection system, officials were surprised to find that some metrics provided results contrary to expected outcomes, and that others provided significant opportunity for project sponsors to “game” the system. By testing the tool before finalizing the process, they had the chance to identify where the tool did not work in the way it was intended, in the way the legislature and public had agreed was the priority. Through testing, they found a problem and had the opportunity to fix it before they brought it to the public. As discussed earlier, VDOT is now working to expand their tool. But rather than wait until they had

95 <http://www.opendatanetwork.com/>

all the data needed to assess full destination access, VDOT started with jobs access to capture this state priority and is building toward a more comprehensive standard.

This sort of test should continuously feed an agency's process. As another example, the Tennessee Department of Transportation created a plan to evaluate the effectiveness of Expedited Project Delivery recommendations with a comparison of the estimated expenditures and the actual expenditures once a construction project is closed out. In addition, according to the plan, each route will be analyzed three years after closeout to determine if the EPD solution has in fact met the actual project needs.

IV. Relevant resources

Many of these resources are cited throughout the guide, while others build on the ideas discussed or exemplify the topics covered.

Background resources and academic studies

The Growing Distance Between People and Jobs in Metropolitan America

Brookings Institution (2015, March)

<http://www.brookings.edu/research/reports2/2015/03/24-people-jobs-distance-metropolitan-areas-kneebone-holmes>.

Analysis looking at how proximity to employment can influence a range of economic and social outcomes, from local fiscal health to the employment prospects of residents, particularly low-income and minority workers.

Measuring What We Value: Setting priorities and evaluating success in transportation

Transportation for America (2015, February)

<http://t4america.org/maps-tools/performance-measures-report/>

This guide is designed to support transportation agencies that are relatively new to performance measurement understand the benefits of performance-based decision-making and meet the requirements established in MAP-21. It provides a detailed overview of the performance-based planning framework introduced under MAP-21 and recommends a framework of key performance measures agencies can consider, including several that go beyond the MAP-21 areas. It also profiles DOTs and MPOs experiencing early successes in measuring the performance of their transportation system and making investment decisions based on the results.

Missed Opportunity: Transit and jobs in metropolitan America

Brookings Institution (2011, May)

<http://www.brookings.edu/research/reports/2011/05/12-jobs-and-transit>

A comprehensive database provides the first comparable, detailed look at transit coverage and connectivity across and within the nation's major metro areas.

Guide to Sustainable Transportation Performance Measures

U.S. Environmental Protection Agency (2011)

<https://www.epa.gov/smartgrowth/guide-sustainable-transportation-performance-measures>

This guide is intended to help transportation agencies integrate performance measures into their planning that support economic, environmental, and social sustainability. It describes 12 performance measures, including transit accessibility, bicycle and pedestrian level of service, land use mix, transportation affordability, and benefits by income group, among others. For each measure, the guidebook presents potential metrics, methodologies, and data sources. The guidebook also includes case studies of agencies implementing each of the metrics.

Model Long-Range Transportation Plans: A guide for incorporating performance-based planning

Federal Highway Administration (2014, August)

http://www.fhwa.dot.gov/planning/performance_based_planning/mlrtp_guidebook/fhwahep14046.pdf

This guide from the Federal Highway Administration provides staff at State DOTs, MPOs, and Regional Transportation Planning Organizations (RTPOs), and Rural Planning Organizations (RPOs) with information for developing performance-based transportation plans. It identifies the key components present in a “model” transportation plan, as well as process elements necessary to develop plans that reflect the priorities of the community and support achievement of desired goals. The guide also provides example from around the country to illustrate the breadth of approaches agencies can take to develop performance-based plans.

FHWA Key Issues Book

Federal Highway Administration (2015)

http://www.fhwa.dot.gov/planning/publications/briefing_book/

Provides an overview of transportation planning and will be useful for government officials, transportation decision-makers, planning board members, transportation service providers, interested stakeholders, and the public. It covers the basics and key concepts of metropolitan and statewide transportation planning, along with references for additional information.

FWHA PlanWorks: Better Planning, Better Projects

Federal Highway Administration

<https://fhwaapps.fhwa.dot.gov/planworks/>

PlanWorks is a web resource that supports collaborative decision-making in transportation planning and project development. PlanWorks is built around key decision points in long-range planning, programming, corridor planning, and environmental review. PlanWorks suggests when and how to engage cross-disciplinary partners and stakeholder groups. The PlanWorks Decision Guide is a troubleshooting guide describing the common decision points and opportunities for cooperation in the transportation planning and environmental review process and outlines the purpose and outcome, roles, questions that support decision-making, data needs, input from stakeholders, and more for each decision point. It was developed using examples of successful practice and with input from all partners in transportation decision-making. In addition, the PlanWorks Performance Measures Application provides a framework for picking measures organized around five areas of concern – transportation, environment, economic, community, and cost – and 18 specific factors.

FHWA's TPM Toolbox

<https://www.tpmtools.org/>

The tools are intended to assist staff from transportation agencies in learning about and implementing TPM practices. The Guidebook uses case studies and illustrative examples to demonstrate how performance management results in improved decision-making through better-informed planning, programming, monitoring and reporting. The TPM Capability Maturity Model Self-Assessment is a tool for identifying logical next steps for strengthening TPM processes. It allows users to assess current TPM capabilities and identify actions to improve those capabilities. The assessment results are linked to the TPM Guidebook in order to provide clear practical actionable steps that state DOT leadership, management, and staff can implement to enhance performance-management practices. Information within the Toolbox is geared towards both state and local transportation agencies.

Case studies and examples

Case Studies in Delivering Safe, Comfortable, and Connected Pedestrian and Bicycle Networks

Federal Highway Administration (2015, December)

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/network_report/page00.cfm

This report from the Federal Highway Administration provides guidance on how to create multimodal transportation networks that make walking and bicycling viable options in a community. It provides a detailed discussion of the elements necessary in good bicycle and pedestrian networks, including cohesion, directness of routes, accessibility, availability of alternatives, safety and security, and comfort. It also suggests strategies for improving bicycle and pedestrian networks and provides examples from communities around the country.

Connecting to Opportunity: Access to Jobs via Transit in the Washington, DC region

Brookings Institution (2012, November)

<http://www.brookings.edu/research/papers/2012/11/dc-transit-job-access>

This study paper describes the data and methods used to examine transit access and commutes in the Washington, D.C. region, presents a series of measures that characterize transit access and employment opportunities for residents at multiple geographies, and concludes with a range of implications and recommendations for policymakers and other regional stakeholders.

Virginia Smart Scale (House Bill Two) website

<http://vasmartscale.org/>

Smart Scale is about investing limited tax dollars in the right projects that meet the most critical transportation needs in Virginia. This website provides information about the how a scoring process was developed for the Commonwealth Transportation Board to select the right projects for funding and how projects are evaluated with a objective and fair analysis applied statewide.

Metropolitan Transportation Commission website

<http://planbayarea.org/index.php>

Plan Bay Area is the first of the Metropolitan Transportation Commission's regional transportation plans to integrate transportation, housing, and land use strategies to meet regional goals. Seven goals were adopted in September of 2015 following a stakeholder engagement process and 13 performance targets were approved. The targets will be used to compare between potential scenarios in the plan, analyze the impacts of proposed projects, and weigh tradeoffs between the different goals of the plan.

Choice, Place and Opportunity: An Equity Assessment of the Twin Cities Region

Metropolitan Council

<http://www.metrocouncil.org/Planning/Projects/Thrive-2040/Choice-Place-and-Opportunity.aspx>

This study identifies where opportunities in the region are located, which residents have the best access to those opportunities, and how to improve equitable access for all residents of the region, and helped the Metropolitan Council develop the priority areas in its current regional vision, Thrive MSP 2040, adopted in May of 2014.

Access to Core Services in Southeast Michigan

Southeast Michigan Council of Governments

<http://semcog.org/Plans-for-the-Region/Transportation/Access>

A regional assessment of the barriers residents of the Detroit metropolitan area face in reaching key services using different transportation modes. The study set benchmarks for access to opportunity and will be used to identify priorities for future transportation projects and help guide transportation investments in the Detroit region moving forward.

Livability in Transportation Guidebook

Federal Highway Administration

https://www.fhwa.dot.gov/livability/case_studies/guidebook/

This report illustrates how livability principles are incorporated into transportation planning, programming, and project design, using examples from practice.

Applying Performance-Based Practical Design Methods to Complete Streets

Federal Highway Administration

<http://www.ops.fhwa.dot.gov/publications/fhwahop16059/index.htm>

This Primer explains how the application of performance-based practical design principles combined with transportation system management and operations strategies can promote the consideration and application of Complete Street design principles to a wider range of contexts, and includes several case studies. The result is a street system that cost-effectively meets the needs of the diverse users of the streets and the objectives of the agency.

Webinars

Measuring Accessible and Connected Communities

State Smart Transportation Initiative (2016, January 27)

<http://www.ssti.us/Events/measuring-accessible-and-connected-communities/>

Speakers from the State Smart Transportation Initiative and USDOT discuss new measures of accessibility and connectivity and tools available to transportation agencies interested in incorporating these types of measures into their investment decisions.

Accessibility: Towards a new multimodal system performance metric

State Smart Transportation Initiative (2014, December 3)

<http://www.ssti.us/Events/accessibility-towards-a-new-multimodal-system-performance-metric/>

This webinar hosted by SSTI highlights examples of transportation agencies that have begun to use accessibility performance measures, as well as emerging tools and metrics. The webinar includes a discussion of work by the Maryland DOT in partnership with Renaissance Planning Group, as well as the University of Minnesota's Accessibility Observatory.

National Transit Institute Courses on TOD and Transportation and Land Use

<http://www.ntionline.com/transit-oriented-development/> and

<http://www.ntionline.com/transportation-and-land-use/>

NTI's collaborative online learning events are free and are offered throughout the year on a variety of topics. The courses linked are to help professionals (1) effectively participate in the planning, funding, and implementation of transit-oriented projects that improve the environment, create a sense of community, and boost transit ridership and (2) develop a multimodal transportation system that supports desired land uses.

Performance management tools

Minnesota Accessibility Observatory

The University of Minnesota

<http://access.umn.edu/>

The Observatory works to advance the field of transportation system evaluation through research of new data sources and methods for accessibility evaluation; develop standards and tools to facilitate the use and communication of accessibility-based metrics in transportation planning, engineering, and evaluation; and apply tools and expertise in support of continual improvements in the planning, design, engineering, and analysis of transportation systems.

Sugar Access

Citi Labs

<http://www.citilabs.com/software/sugar/sugar-access/>

A customizable tool for purchase to score and understand your community's accessibility to employment opportunities, daily errands, public services, and much more.

Transport Analyst

Conveyal

<http://conveyal.com/projects/analyst/>

A customizable tool for purchase from Conveyal, a consultancy specializing in open data and open source technology for the transport sector.

Renaissance Planning Group

<http://www.citiesthatwork.com/>

A consulting firm that specializes in vision and scenario planning; multimodal systems planning; and strategic planning and citymaking.

Access to Jobs and Workers via Transit Tool

U.S. Environmental Protection Agency

<https://www.epa.gov/smartgrowth/access-jobs-and-workers-transit-technical-documentation-and-user-guide>

A supplementary data product derived from data used to create the transit accessibility variables in the Smart Location Database.

AllTransit

Center for Neighborhood Technology

<http://alltransit.cnt.org/>

AllTransit is the largest source of transit connectivity, access, and frequency data in America. It offers tremendous potential for planning applications to increase our understanding of the value of transit, as well as to enhance service and operations planning.

FHWA Community Vision Tool

Federal Highway Administration

http://www.fhwa.dot.gov/livability/tools/community_vision/

Helps communities select transportation performance indicators based on their goals.

More resources and data sources

FHWA Bicycle and Pedestrian Program—Mapping and GIS

Federal Highway Administration

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/ntpp/mapping_gis.cfm

The Nonmotorized Transportation Pilot Program pilot communities have used geographical information systems (GIS) in a variety of ways to plan and implement their project. GIS allows the pilots to quickly visualize data and see trends, relationships, and patterns that may have otherwise been overlooked, leading to more informed and strategic decision-making. This website provides examples of interesting and effective uses of GIS to support Nonmotorized Transportation Pilot Program projects.

Transportation Alternatives Program Performance Management Guidebook

Federal Highway Administration

http://www.fhwa.dot.gov/environment/transportation_alternatives/performance_management/guidebook/tap_pm_guidebook.pdf

This guidebook assists State Department of Transportation and metropolitan planning organization program managers in implementing a performance-based approach for the Transportation Alternatives Program to ensure that staff and decision-makers understand program goals, and that program actions are making progress towards achieving those goals.

Location Affordability Portal

U.S. Department of Housing and Urban Development and U.S. Department of Transportation

<http://www.locationaffordability.info/>

A reliable, user-friendly source of information on combined housing and transportation costs that can enable families, real estate professionals, housing counselors, policymakers, and developers to make more informed decisions about where to live, work, and invest.

Smart Location Database

U.S. Environmental Protection Agency

<https://www.epa.gov/smartgrowth/smart-location-database-technical-documentation-and-user-guide>

A nationwide geographic data resource for measuring location efficiency. It includes more than 90 attributes summarizing characteristics such as housing density, diversity of land use, neighborhood design, destination accessibility, transit service, employment, and demographics. Most attributes are available for every census block group in the United States.

Multimodal Performance

Federal Highway Administration

<https://www.fhwa.dot.gov/tpm/rule.cfm>

Prior to the issuance of the PM3 NPRM, U.S. DOT gathered public input on possible measures that could be considered to assess traffic congestion where there was strong support for measures that would reflect the movement of people (vs. vehicles) using all modes of travel, a view that FHWA has a history of supporting. Although FHWA expressed a desire in the NPRM to measure multimodal performance, the proposal did not include a multimodal performance measure. FHWA cited the lack of sufficient available data as the limitation that prevented the inclusion of such a measure in the proposal. When the NPRM was published, a number of groups, State DOTs, members of Congress, and citizens submitted comments to strongly oppose the

methodology, but not the intent, of the proposed traffic congestion measure, noting that it should more directly measure multi-modal performance. FHWA is considering these concerns through the comment review process in the determination of the final rule requirements.

Planning for a Healthier Future: Incorporating health, equity and environmental performance measures in regional transportation plans

Transportation for America (2016, March)

<http://t4america.org/docs/planning-for-a-healthier-future-0616.pdf>

This report by Transportation for America in partnership with Calthorpe Analytics discusses the results of a two-year collaborative initiative with MPOs around the country. It profiles health, equity and environmental measures that can be used to evaluate the performance of transportation investments at a regional scale. It provides guidance on selecting measures based on regional goals and includes an extensive list of specific measures, methodologies and data sources that can be used for goals tied to: land consumption, transportation and housing costs, vehicle miles traveled, mode share and transportation options, access to opportunities, safety, public health, and air pollution.

Tools for Measuring Accessibility in an Equity Framework

State Smart Transportation Initiative at the Congress for New Urbanism's 23rd Annual Meeting (2015)

https://www.cnu.org/sites/default/files/ssti_transpo_equity.pdf

This meeting abstract recommends a framework for measuring equity in transportation. It provides a discussion of four categories of equity measures: accessibility, affordability, health and safety, and procedural equity (equity within the transportation decision-making process). It profiles and compares a number of available strategies, tools, and measures for each of the four categories.

NCHRP Report 770: Estimating Bicycling and Walking for Planning and Project Development: A Guidebook

Kuzmyak, J. R., Walters, J., Bradley, M., Kockelman, K.M. (2014). Transportation Research Board.

<http://www.trb.org/Main/Blurbs/171138.aspx>

This report summarizes research on available methods and tools for transportation practitioners to use in estimating bicycling and walking demand as part of regional-, corridor-, or project-level analyses. The tools discussed use existing data and the capabilities in GIS methods to create realistic measures of accessibility. The products of the research include a guidebook for practitioners and a CD-ROM containing a GIS Walk Accessibility Model, spreadsheets, and the contractor's final report. This study led to the development of the Renaissance Planning Group's accessibility modeling tool and has been used by several agencies in the Washington, DC metropolitan area.

FHWA Scenario Planning Guidebook

Federal Highway Administration (2011, February)

http://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/index.cfm

This guidebook provides detailed information to help transportation agencies carry out a scenario planning process from start to finish. It presents a scenario planning framework with six key phases of the process: 1) scoping the effort and engaging the right partners; 2) establishing a baseline analysis by identifying factors and trends that affect the state, region, community, or study area; 3) establishing goals for the future; 4) creating baseline and alternative scenarios for the future; 5)

assessing the impacts of each scenario; and 6) crafting a vision and identifying strategies and performance measures.

Strategic Highway Research Program

Federal Highway Administration

<https://www.fhwa.dot.gov/goshrp2/About>

The second Strategic Highway Research Program (SHRP2) has undertaken more than 100 research projects designed to address critical state and local challenges, such as aging infrastructure, congestion, and safety. The research results are now being made available in a series of effective solutions that will improve the way transportation professionals plan, operate, maintain, and ensure safety on America's roadways.

Guidebook for Developing Pedestrian and Bicycle Performance Measures

Federal Highway Administration (2016, March)

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/performance_measures_guidebook

This guidebook highlights a broad range of ways that walking and bicycling investments, activity, and impacts can be measured and documents how these measures relate to goals identified in a community's planning process. It discusses how the measures can be tracked, while also highlighting data considerations and relevant case studies.

Transportation and Health Tool

U.S. Department of Transportation and Centers for Disease Control and Prevention

<https://www.transportation.gov/transportation-health-tool>

Provides data on a set of transportation and public health indicators for each U.S. state and metropolitan area that describe how the transportation environment affects safety, active transportation, air quality, and connectivity to destinations. You can use the tool to quickly see how your state or metropolitan area compares with others in addressing key transportation and health issues.

Healthy Corridor Framework

Federal Highway Administration (2015)

http://www.fhwa.dot.gov/planning/health_in_transportation/planning_framework/the_framework/step00.cfm

Aims to support transportation agency efforts to incorporate health into corridor planning studies. It is intended to be used within an existing corridor planning process not as a stand-alone or parallel process.

PlaceFit Community Characteristic Database

Federal Highway Administration

<http://www.fhwa.dot.gov/livability/tools/placefit/>

The PlaceFit Tool provides access to a variety of existing websites based on livability characteristics that may appeal to your lifestyle choices.

Multimodal Long Distance Passenger Travel Origin Destination Data

Federal Highway Administration

<http://www.fhwa.dot.gov/policyinformation/analysisframework/01.cfm>

This data is part of FHWA’s Traveler Analysis Framework (TAF) estimating long distance passenger travel—defined as trips greater than 100 miles by various modes (highway (automobile and bus), air, and rail). The TAF integrates data from a variety of sources to create a comprehensive set of trip tables for long distance passenger movements at the county (or equivalent) to county (or equivalent) level. The TAF provides person trip flows for the base year of 2008 and future year 2040. These preliminary or “beta-version” data are deemed to be the starting point for any organization to use for their analysis. FHWA plans to improve and enhance these data in the future, and user feedback will greatly assist FHWA with that effort.

Multimodal System Performance Measures Research and Application

Federal Highway Administration

This research effort, led by Office of Operations, FHWA with a Technical Advisory Group from throughout the Department, is a follow-on to MAP-21 system performance measure rulemaking to identify new data sources and the best approaches to measuring multimodal system performance. The study includes pilot testing of relevant measures beginning in later half of 2017, with the final deliverable, a Research and Innovation plan, due in fall 2018.

Appendix: Summary of Outreach

A draft of this guidebook was shared with an Advisory Panel and at two workshops that included transportation officials from several state DOTs, as well as transit agencies and MPOs from around the country, and our federal partners. Feedback from both events and the Panel was incorporated into the final product as resources and timelines allowed, and is summarized below.

Introduction:

- Title and intro should be more specific about narrow focus on connectivity/destination access.
- Presentation of state role is great.
- More in depth executive summary would be useful at the executive level or to civic leaders.
- Important to define access based on different perspectives (elected leaders, transit providers, DOT leadership, MPOs, etc.).

Structure:

- Add a table of contents, list of charts, and glossary.
- Structure should reflect the process an agency needs to go through to start addressing access.
 - o This includes who is involved where, where are the conversation points, etc.
 - o Break guide into sections that practitioners can jump to based on where they are in the process—a matrix or continuum for the steps and depending on where you are in the process.

Other feedback:

- More real world examples would be helpful.
- More examples of smaller and rural areas using accessibility, i.e. different expectations of travel time depending on context; how to incorporate bike paths/greenways into measures.
- Include more information on public outreach.
- A lot of our MPOs are far ahead of us. Adding information about the interaction between MPOs and DOTs would be helpful.
- Positive reaction to the shift away from an academic and toward practical uses. Suggestion to include a distinction from the academic model and this use.



GOVERNORS'
INSTITUTE
on community design

<http://www.govinstitute.org/>