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Building a 21st Century Infrastructure

How Setting Clear Goals, Establishing Accountability, and Improving Performance Will Produce Lasting and Sustainable Prosperity

By Kevin DeGood February 2014

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Introduction and summary

"We look at the present through a rear-view mirror. We march backwards into the future."[1] — Marshall McLuhan

In 1956, President Dwight D. Eisenhower signed the Federal-Aid Highway Act into law. This groundbreaking legislation advanced a bold, forward-looking national project to construct highways that would efficiently link cities, towns, and rural areas, ensuring essential connectivity and spurring economic growth. Today, we face fundamentally different transportation challenges. Yet our policies remain locked in an increasingly outdated post-World War II framework that is unable to address the needs of the 21st century. As a result, America's surface transportation policy stands at a crossroads. The federal program, which supports state and local investments in highways, bridges, and public transportation systems, suffers from insufficient investment, a trust fund teetering on the brink of insolvency, and partisan gridlock. This is neither a recipe for success nor sustainable in the long term.

The ongoing debate over how to raise additional revenue for surface transportation programs often misses the deep connection between policy and funding. For years, transportation stakeholders have argued that new money would cure all ills. In reality, Congress has struggled to address funding shortfalls because there is a deficit of consensus on what the federal program should achieve. Developing a shared policy vision will not be easy. Without addressing policy differences, however, there is little chance of finding additional money for the next transportation bill.

A shrinking program will greatly limit the federal government's ability to set national transportation policy objectives and serve as a strong partner to state and local governments. In short, a moribund federal transportation program threatens to derail our economy and prosperity in the broadest sense. By comparison, an invigorated federal program built around a shared national transportation policy vision will support our economy and produce vibrant communities for decades to come.

The choice facing Congress could not be clearer: Extend the failing status quo or increase investment to improve performance and achieve an intermodal surface transportation system that increases economic competitiveness, improves access to opportunity for diverse communities, maintains infrastructure in a state of good repair, reduces injuries and fatalities, minimizes impacts on ecological and social environments, and reduces energy consumption.

The time for decision is upon us. In June 2012, Congress passed the Moving Ahead for Progress in the 21st Century Act, or MAP-21. The surface transportation bill provided only two years of funding and is set to expire on September 30, 2014. The Congressional Budget Office estimates that gas taxes, which capitalize the Highway Trust Fund, will fall short by approximately $15 billion in fiscal year 2015.[2] Since 2008, Congress has backfilled the Highway Trust Fund, or HTF, with more than $54 billion in general fund revenues.[3]

Political support for additional transfers to avoid the HTF's insolvency is tenuous at best. The time for half measures and patchwork solutions has passed. Congress must take on the hard work of forging a federal transportation program that addresses current challenges and lays a foundation for sustainable and long-term prosperity.

Developing a shared vision begins with identifying current policy failures. Federal transportation policy fails in three fundamental ways. First, the program does not specify clear objectives that address today's challenges—especially rapid urbanization. Today, the United States is a predominately urban nation with a mature transportation system that connects rural areas and small towns to markets and links metropolitan areas of all sizes.[4] However, this was not always the case. Transportation policy crafted after World War II addressed the deficit of regional and national connectivity, but the biggest challenges today are urban congestion, a lack of transportation options, and environmental sustainability.

Transportation and the economy

Transportation affects almost every aspect of our economy. Research shows that, in constant 2007 dollars, individuals spend approximately $1.1 trillion on gasoline and vehicles and more than 175 billion hours traveling—time estimated to have a value of $760 billion. Businesses, for their part, spend $1 trillion each year shipping products. Federal, state, and local transportation spending tops $260 billion each year. Taken together, transportation expenditures top $2.4 trillion, or 17 percent of our gross domestic product.

All this movement relies on massive amounts of infrastructure. The national road and highway network is valued at $2.8 trillion; private freight railroad tracks at $340 billion; and airways, public transportation, and waterways at $568 billion.

Source: Clifford Winston, "On the Performance of the U.S. Transportation System: Caution Ahead," *Journal of Economic Literature* 51 (3) (2013): 773–824.

Federal funds are distributed based on formulas that reflect political geography and the power of committee chairs rather than need or return on investment.

Second, metropolitan regions lack sufficient authority and funding to address critical transportation problems that occur on a regional scale. The vast majority of federal funding is distributed to states based on formulas set in law. This ensures transportation funds reward political geography rather than focus on need and the potential return on investment.

Third, the program does not hold grant recipients accountable for the performance outcomes that result from their investment decisions. Project selection authority rests with state departments of transportation and, to a lesser extent, metropolitan regions. Even though the federal government provides $52 billion per year in surface transportation funding, states and regions are not held accountable for achieving specific performance targets informed by clear national policy objectives. Instead, federal regulations focus almost exclusively on process, ensuring funds flow to eligible activities without regard for performance.

Policy recommendations for MAP-21 reauthorization

The Eisenhower administration laid an infrastructure foundation that facilitated a period of great economic expansion and prosperity. However, continuing to pursue transportation policies forged in the years following World War II will not solve our current problems. Fortunately, Congress has the opportunity to enact substantive policy reform when MAP-21 expires in September. The next authorization bill should define a new vision and reform how we plan, fund, and assess the performance of the surface transportation system.

Specifically, a 21st century surface transportation system should increase economic competitiveness, improve access to opportunity for diverse communities, maintain infrastructure in a state of good repair, reduce injuries and fatalities, minimize impacts on ecological and social environments, and reduce energy consumption.

These goals should inform a broad set of progressive performance measures that track performance outcomes over time, holding grant recipients accountable for advancing national priorities. In addition, performance measures should serve as the basis for allocating federal grants and financing to those states and regions that make the most productive investments. Finally, Congress should provide increased local control and project selection authority to metropolitan regions.

In order to advance effective transportation policy that addresses current concerns and meets future needs, Congress should take the following six steps:

1. Expand performance management by including additional measures connected to national economic, social, and environmental policy goals.

2. Increase competition by distributing a larger share of federal funds through competitive programs.

3. Tie grants and financing to performance by connecting performance management to competitive federal grants and financing.

4. Increase mode-neutral shares of funds to provide states and metropolitan regions with greater flexibility.

5. Increase local control by providing more direct funding and project selection authority to metropolitan regions.

6. Increase planning funds and require scenario planning in metropolitan regions with populations of more than 500,000 people.

Together, these reforms increase competition, provide greater accountability, and improve transportation governance through expanded performance management and greater local control. All three elements—competition, performance management, and local control—are critical to achieving a 21st century transportation system. The expansion of competitive grant programs would reform the distribution of federal funds by rewarding the most-innovative projects instead of formula programs based on political geography. Performance management provides specific, quantifiable information that allows for more effective planning and a mechanism to hold grant recipients accountable. Finally, expanding local control provides metropolitan regions with the funding and authority to address urban congestion, increase access to jobs and other amenities, and improve sustainability.

Roots of the problem and the unintended consequences of success

Following World War II, America faced two major transportation challenges: upgrading existing highways and building new networks to more efficiently connect major urban areas and allow farmers to quickly bring goods to market. In addition, the United States needed to expand access to land outside city centers to facilitate industrial development and accommodate a rapidly growing postwar population.

During this period, federal investments focused exclusively on highways, with the goal of increasing connectivity and travel speeds throughout the country. This approach fit the demographic and economic realities of the time. In the early 1950s, 36 percent of Americans lived in rural areas, with nearly half living on farms.[5] Early federal road money flowed through the Department of Agriculture and then through the Department of Commerce in support of federal aid for a primary network of roads to connect cities, county seats, and ports, as well as a secondary network of farm-to-market roads. In 1955, only 20 percent of the secondary network had a high-quality surface of concrete or asphalt.[6] Of the 22,500 miles of roadway projects completed that year, 95 percent were in rural areas.[7]

These early investments, while beneficial, could not keep pace with growing demand. In 1955, President Eisenhower began making his case for building a national system of interstate highways that would connect the nation. Achieving greater regional integration and connectivity, economic competitiveness, and national defense readiness would require robust and sustained federal investment. In a message to Congress, President Eisenhower highlighted the fundamental importance of transportation to the country:

> *Our unity as a nation is sustained by free communication of thought and by easy transportation of people and goods. The ceaseless flow of information throughout the Republic is matched by individual and commercial movement over a vast system of interconnected highways crisscrossing the Country and joining at our national borders with friendly neighbors to the north and south … Together, the united forces of our communication and transportation systems are dynamic elements in the very name we bear—United States. Without them, we would be a mere alliance of many separate parts.*[8]

The resulting Federal-Aid Highway Act of 1956 established a policy and funding framework that would develop the largest infrastructure project in our nation's history. Over more than six decades, Congress funded the construction of 46,000 miles of interstate highways and thousands of miles of other major roadways. This system succeeded in enabling growth and improving connectivity and mobility for businesses and families. The policy approach developed after World War II and advanced through the leadership of President Eisenhower matched the challenges and needs of the country at that time.

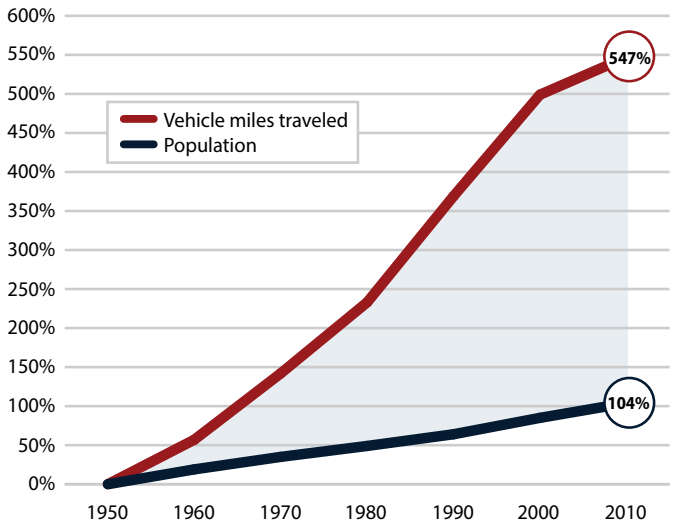
Unintended consequences of success

Unfortunately, our transportation policies and programs have not evolved to meet current needs. Our society and economy have changed substantially since the early days of federal investment. Today, only 19 percent of Americans live in rural areas, and only 1 percent lives on farms.[9] By comparison, the top 100 metropolitan areas account for more than 67 percent of our entire population.[10]

Federal investments achieved the goal of efficiently linking communities of all sizes. As a result, we no longer face a deficit of connectivity. Instead, our society is hampered by low-density land use, a lack of transportation options that offer alternatives to driving, and growing congestion within metropolitan regions.

FIGURE 1

Driving growth significantly outpaces population growth



Sources: Author's calculations based on Bureau of the Census, "Table 1. United States - Race and Hispanic Origin: 1790 to 1990," available at http://www.census.gov/population/www/documentation/twps0056/tab01.xls (last accessed January 2014); Federal Highway Administration, "Annual Vehicle Distance Traveled in Miles 1936 - 1995," available at http://www.fhwa.dot.gov/ohim/summary95/vm201.pdf (last accessed January 2014); Office of Highway Policy Information, "Historical Monthly VMT Report," available at http://www.fhwa.dot.gov/policyinformation/travel_monitoring/historicvmt.cfm (last accessed January 2014).

Data from the U.S. Census Bureau highlight these dramatic changes. The population density within metropolitan regions has fallen substantially from its peak in 1950, when cities contained, on average, 7,517 people per square mile. By 2000, this number had fallen to a mere 2,716 people per square mile.[11]

Low-density residential and commercial developments have caused driving levels to grow far faster than the overall population. From 1950 to the present, total vehicle miles traveled, or VMT, have increased by more than five times, from 458 million miles to 2.9 trillion miles per year. Over this same period, the U.S. population doubled, from 152 million to 310 million people.[12]

The rapid growth in driving is not merely the result of increased household income or individual preference but also the consequence of decades of investment in highways to the exclusion of other options. Even though the interstate construction era has come to an end, federal policy has retained its strong focus on only the largest highways.

In 2005, Congress created a national commission to study transportation needs and financing options. The final report stated its conclusions bluntly:

> *Contributing to the scale of the problem is a deeply entrenched over-reliance on the personal automobile for travel in urban corridors. Strategies to shift more trips to public transit will play a large role in any forward-thinking efforts to reduce congestion.*[13]

Unfortunately, this clear policy mandate went unheeded. MAP-21 doubled down on the major highway focus by requiring states to spend 60 percent of their highway funds on only 5 percent of all public roadways.[14] At the same time, elected officials and planners continue to promote major highway investments as essential to interstate commerce. While highways are a critical element of freight transportation and competitiveness—especially for industries that rely on just-in-time delivery—they overwhelmingly serve local needs.

Remarkably, 74 percent of all trips taken each year are less than nine miles in length.[15] And more than 67 percent of all vehicles miles traveled in 2011—approximately 2 trillion miles—occurred within urban areas.[16] These numbers show that the vast majority of vehicle trips and total driving take place in and around town and that most of these trips are taken by people driving alone. After a sustained period of investment, we have reached a point of diminishing returns for each new dollar spent on major highway expansion projects. Future federal investments must increase transportation options that provide alternatives to driving and support more efficient mixed-use housing and commercial development.

Land use and driving

Transportation investments that push housing developments far from jobs and other commercial centers require more driving than mixed-use developments, which allow people to live closer to where they work and shop. The Atlanta and Denver metropolitan areas represent two different approaches to land use and transportation investments. The Denver region has invested heavily in public transportation and focused land use around transit corridors and town centers.[17] Atlanta, by comparison, has aggressively pursued a low-density, highway-based growth pattern. Data from the federal government show that the Denver area has an average household density 2.5 times greater than that of the Atlanta region.[18] Furthermore, an estimated 55 percent of households in the Atlanta region drive more than 22,000 miles per year, compared to only 15 percent of households in the Denver area.[19]

Lack of transportation options and low-density development patterns have increased driving and congestion, which has significant negative impacts on the economy, the environment, families, and businesses. According to research done by Texas A&M University, urban congestion added 5.5 billion hours of additional driving last year, which burned 2.9 billion gallons of additional fuel for a total economic cost of $121 billion.[20] The U.S. Department of Transportation estimates that within the next 10 years, medium-sized cities will begin to experience congestion levels currently reserved for the largest regions.[21]

The Environmental Protection Agency, or EPA, classifies 122 regions as exceeding pollution limits established under the Clean Air Act for ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead.[22] Across the country, 154 million people live with air pollution well in excess of national standards.[23] Among the pollutants controlled by the Clean Air Act, excessive ozone exposure is the most common violation. Ozone is a serious respiratory irritant that causes decreased lung function, which can lead to heart attacks, strokes, severe asthma attacks, and pneumonia, among other medical conditions.[24]

In addition to congestion and poor air quality, our transportation policy creates a burden for families. Transportation ranks second only to housing as the largest share of household expenditures.[25] The average American household now spends 19 percent of its income on transportation.[26] The federal government estimates that the average total cost of operating a car in 2012 was $7,710,[27] while the national median household income that same year was $51,324.[28] Transit access can save households thousands of dollars in transportation costs each year.[29] According to data from the U.S. Department of Transportation, however, 47 percent of households have no access to public transportation.[30]

The transportation burden is even greater for low- and moderate-income households. Working families often search for affordable housing far away from job centers that have little or no access to public transportation. Research shows that for every dollar a working family saves on housing, it spends 77 cents more on transportation.[31]

The lack of transit service creates structural barriers that prevent many poor and moderate-income households from accessing economic opportunity. Nationwide, 20 percent of households living in poverty lack access to a car. The percentages are even higher for African American and Latino households living in poverty—33 percent and 25 percent, respectively.[32] From 2000 to 2010, the share of jobs

Metropolitan congestion is the defining challenge of our time, costing the economy billions of dollars every year. Yet our federal policies have not kept pace with rapid urbanization and the need for greater mobility options.

located more than 10 miles from downtown rose in 85 of the top 100 metropolitan regions.[33] Low-density land-use patterns and job sprawl make providing high-quality public transportation difficult. Nationally, only 5 percent of commuters use transit, while the vast majority of Americans—more than 80 percent—make their commutes driving alone.[34] Within the average metropolitan region, only 25 percent of low- and middle-skill jobs are accessible by transit within 90 minutes.[35]

The reliance on highways as the only means of providing mobility also overlooks major demographic changes that are fundamentally reshaping our communities. Both the preferences of the younger Millennial generation, born between 1983 and 2000, and the aging Baby Boom generation, born between 1946 and 1964, will significantly shift travel demand.

Today, more than 40 million Americans are ages 65 and older.[36] By 2030, nearly one in five Americans will be ages 65 and older.[37] Each year, approximately 600,000 seniors cease driving. As a result, older men depend on other people and public transportation to get around for approximately seven years, while senior women depend on others and public transit for closer to 10 years.[38] Yet research shows that the transition is far from seamless. When people cease driving, their level of social isolation increases; this is often due to a lack of mobility options. Seniors who no longer drive make 15 percent fewer trips to the doctor and 65 percent fewer trips to visit friends and family than drivers of the same age.[39] More than 11 million seniors have poor access to transit, and this share will grow as the population continues to age.[40]

Members of the Millennial generation—now a larger population than the Baby Boom generation—are driving less and choosing to live in more mixed-use areas with public transportation and strong biking and walking infrastructure.[41] Data from the National Household Travel Survey show that per-capita passenger miles traveled on transit increased by 40 percent for people ages 16 to 34 between 2001 and 2009.[42] Driver licensure rates among younger Americans are at their lowest levels since the 1960s.[43]

Our transportation policies are failing both generations. The postwar model often means that seniors face increased isolation and rising transportation costs on a fixed income. For Millennials struggling to gain a foothold in a slow-growth economy, finding housing close to public transportation is more than a mere preference. Affordable transportation can mean the difference between employment and continued economic displacement.

Congestion also has important implications for freight shipments and international commerce. Metropolitan congestion increases total travel times and adds uncertainty for businesses that rely on just-in-time shipping. Over the next 30 years, truck freight will increase by 65 percent, reaching more than 18 billion tons annually.[44] Trucks are also the most common way to move freight from ports to inland destinations.[45] International cargo shipments are projected to grow by 3.4 percent each year for the next 30 years.[46] Further highway expansion and right-of-way acquisition is challenging in large measure due to the very development that early highway investments helped create. Moreover, the overwhelming number of local trips taken on urban interstates hampers freight transport. As the national commission report states, shifting these local trips to surface streets and public transportation is essential to address congestion.

Dense development prevents expansion of the I-75/I-85 Connector in downtown Atlanta. Public transportation and surface street improvements can help alleviate congestion and provide local drivers with alternatives. (Flickr/muora)

Without significant policy reforms, metropolitan congestion will only grow worse. Over the next 50 years, the U.S. population will grow by approximately 100 million people.[47] This growth will occur overwhelmingly within urban areas. Between 2000 and 2010, the population growth rate in urban areas substantially outpaced that of the nation—12 percent to 9.7 percent, respectively.[48]

In short, we need new policy approaches that sustainably address modern challenges such as congestion and population growth while ensuring that all residents have affordable access to jobs and other services.

How we distribute money reinforces the failing status quo

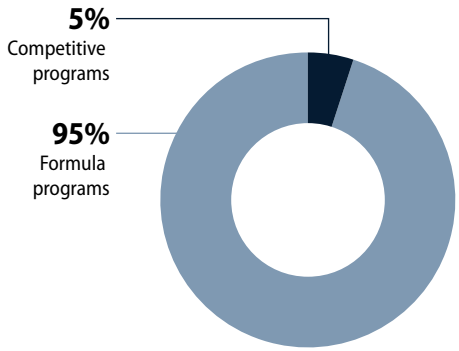
In addition to an outdated program structure, the allocation of federal funds also removes incentives for improved performance. Ninety-five percent of transportation funds flow to states, metropolitan regions, and transit providers through formulas prescribed in law. These formulas are a reflection of political geography and the power of congressional committee chairs. This approach fails to account for significant regional differences in need, construction costs, and return on investment. As the following map shows, there is a significant difference between the share of gross domestic product, or GDP, produced by each state and the share of surface transportation funding each receives.

Federal policy has done little to push states to ensure their capital projects advance national transportation objectives. Instead, the federal program is overwhelmingly concerned with two issues: eligible use and design standards. Grant recipients are not required to demonstrate how a particular investment fits within a long-term strategy or how it will improve system performance. Instead, recipients must show that a project is eligible under the program and that it meets basic design standards, such as adequate lane width, minimum overpass height, and the reflectivity of markings and signs. These common standards guarantee a uniform system from state to state, but they do not address the far more fundamental issue of system-wide performance.

In many ways, the current structure operates much like an unrestricted block grant. The overreliance on formulas to distribute federal funds provides states with little reward for improved performance and no consequences for failure.

FIGURE 2

Share of federal funds distributed by formula and discretionary programs

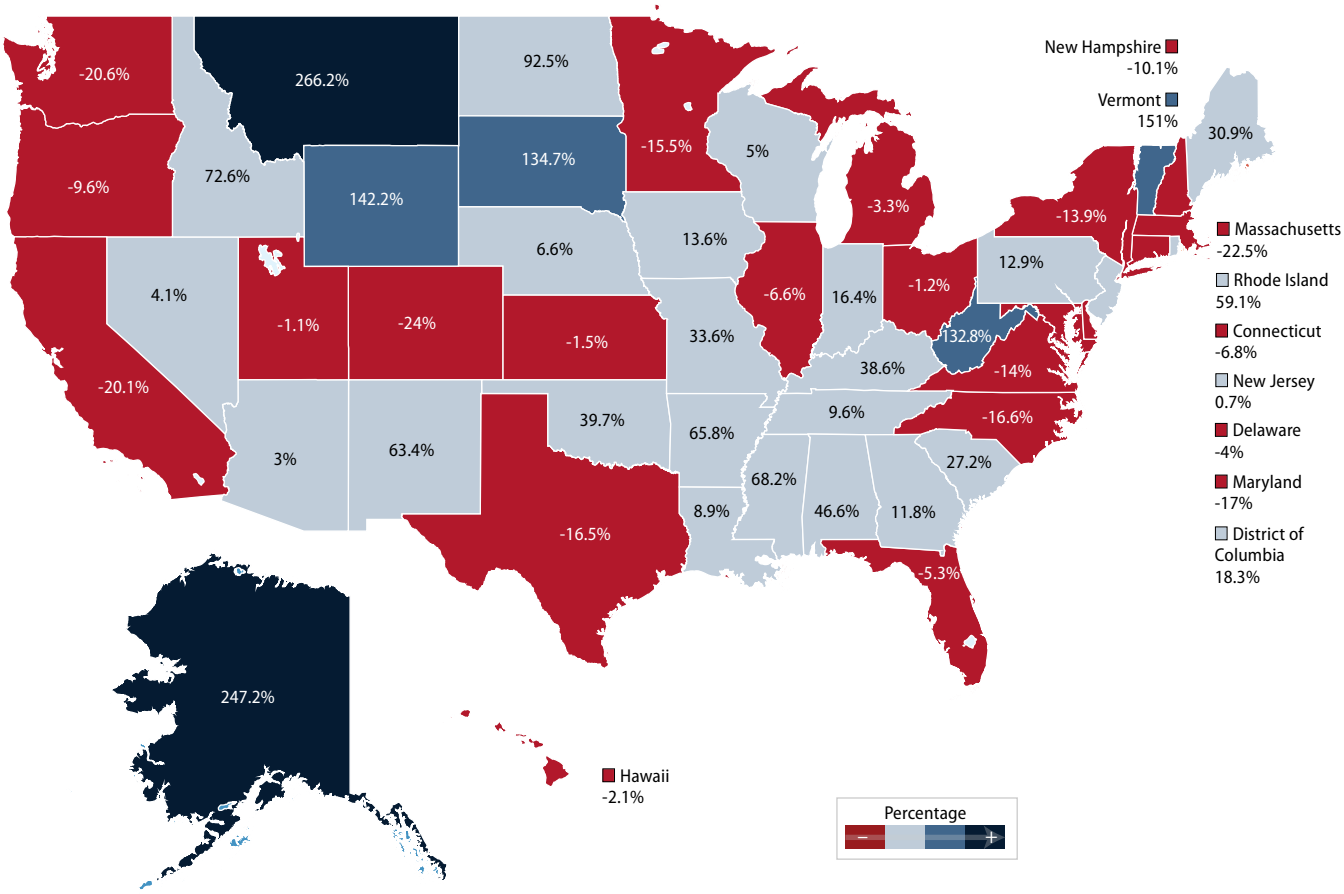


Sources: Author's calculations based on programmatic data from Federal Highway Administration, "MAP-21 Highway Authorizations," available at http://www.fhwa.dot.gov/map21/funding.cfm (last accessed February 2014); Federal Transit Administration, "MAP-21," available at http://www.fta.dot.gov/map21/ (last accessed February 2014); The Library of Congress, "Status of Appropriations Legislation for Fiscal Year 2014," available at http://thomas.loc.gov/home/approp/app14.html (last accessed February 2014).

FIGURE 3

Ratio of surface transportation funding to GDP

Percentages reflect how much transportation funding each state receives compared to the GDP it generates



Source: Results based on author's calculations of 2013 GDP data from the Bureau of Economic Analysis and 2013 apportionment data from the U.S. Department of Transportation.

Defining the essential characteristics of a 21st century transportation system

In order to advance transportation policies that will meet our needs in the 21st century, we must begin with a fundamental paradigm shift. For too long, transportation policy has focused on the development of infrastructure with little attempt to understand how transportation investments affect our economy, society, and environment. In many ways, transportation planners have treated infrastructure assets as their own end. Transportation is not about assets. Properly understood, transportation policy should be defined by what it accomplishes, not what it builds.

A 21st century transportation system should increase economic competitiveness, improve access to opportunity for diverse communities, maintain the system in a state of good repair, reduce major injuries and fatalities, minimize impacts on ecological and social environments, and reduce energy consumption.

A successful surface transportation system capable of achieving these goals will be defined by four essential characteristics: pricing, choice, reliability, and equality of access.

Pricing

With the exception of a few toll roads, our transportation system is defined by unrestricted free access.[49] Economic analysis shows the cost that users impose on the transportation system is not the same at all times. Highways have a limited capacity. Open access fails to send appropriate signals to system users for the external impacts of their driving during the morning and evening rushes. During these peak periods in demand, highways and major arterial roadways slow as more and more users enter the system. Eventually the system breaks down and vehicles slow significantly or stop moving altogether.

The above chain of events points to a fundamental aspect of transportation. As systems reach their capacity, the congestion-producing impact of an additional vehicle is exponentially greater than when the system is operating well below capacity. In effect, the marginal cost of the additional vehicle is much higher during peak periods because the resulting congestion affects many more drivers. Conversely, removing even a small fraction of total users can dramatically reduce burdensome congestion.[50]

This same concept applies to major public transportation systems that face overcrowding during morning and evening periods. With transit, high demand pushes bus and rail systems to capacity, causing other commuters to watch helplessly as completely full vehicles pass them by. While congestion has multiple causes, a primary source is the presence of drivers and riders making trips that could occur at other times. Shifting a portion of these discretionary trips through congestion pricing—charging higher usage fees during peak hours—would substantially improve overall system performance. Pricing transportation facilities harnesses the power of price signals to effectively charge drivers and riders for the marginal congestion costs that they impose.

Roadway pricing, information technology, and system efficiency in Orange County and Los Angeles, California

Modest reductions in demand during peak periods can dramatically improve overall system performance. Data from the Federal Highway Administration, or FHWA, show that total highway travel is far greater throughout the day than during morning and evening peak periods. Yet because these trips are more spread out, highways remain at or near free-flow conditions.[51]

Moreover, FHWA data also show that the majority of rush hour drivers on a typical urban highway are not commuters. In fact, removing even a small fraction of these discretionary trips—as little as 5 percent—would allow the highway to flow more freely, moving far more cars through the same space per hour.[52]

Our transportation system has substantial carrying capacity that is often overshadowed by rush hour congestion. Congestion pricing and other policies that reduce travel demand can delay or even eliminate the need for costly expansion projects. The U.S. Department of Transportation estimates that the adoption of congestion pricing on a large scale could reduce the amount of investment needed to keep our system operating at current levels by 25 percent.[53]

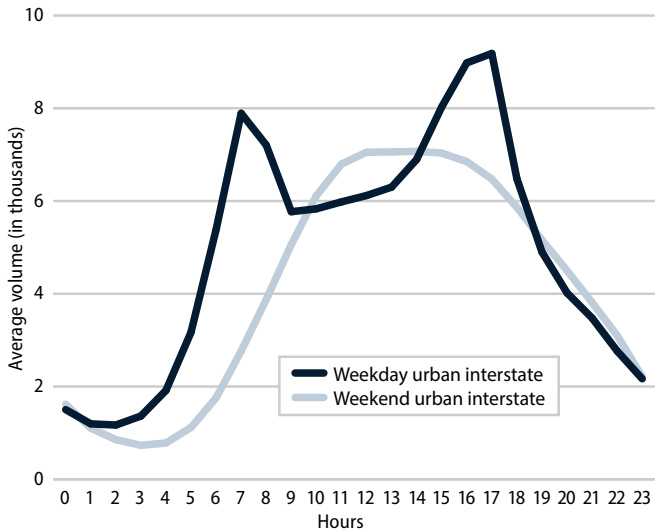
The State Route 91 express-lanes corridor in Southern California is a powerful example of the performance improvements that result from dynamic roadway pricing. State Route 91 runs east to west from Riverside to Orange County. The express-lanes corridor is a four-lane, 10-mile toll road built in the median of State Route 91, also known as the Riverside Freeway.[54] The fully automated toll system enables the toll to fluctuate throughout the day to ensure that travel speeds within the express lanes remain free flowing.

Free-flowing traffic is key to the success of the express-lanes corridor. During the morning and evening rushes, the express lanes carry twice as many vehicles at travel speeds between two and four times as fast as the rest of the highway.[55] Furthermore, when congestion in the open lanes reaches a breakdown point, it can cause delays that can last for several hours after the commuting rush has ended. Since 2003, drivers have taken more than 100 million trips through the express-lanes corridor.[56]

FIGURE 4

Urban interstate travel levels by time of day

More total interstate trips during non-rush hours than rush hours



Source: Federal Highway Administration, *Our Nation's Highways 2011* (U.S. Department of Transportation, 2012), p. 34, figure 4-8.

The results in Southern California are not unique. According to FHWA estimates, if the average metropolitan commuter had access to a five-mile freeway segment similar to State Route 91 twice each day, he or she would save 120 hours each year.[57]

Improving system performance and extracting additional capacity from existing facilities through information technology is not limited to highways. The Los Angeles region is well known for freeways, driving, and congestion. Less well known is that the majority of driving takes place on surface streets. The city, which covers 469 square miles, has only 181 miles of freeway but 6,500 miles of surface streets.[58] Major intersections in Los Angeles now move between 85,000 and 130,000 cars each day.[59]

From 1980 to 2010, the city's population increased by 30 percent, from 2.9 million to 3.8 million people.[60] This growth helped push the Los Angeles area to become the most densely populated area

in the United States, with almost 7,000 residents per square mile. By comparison, the New York metropolitan area, which encompasses parts of New Jersey, has 5,300 people per square mile—a difference of 24 percent.[61]

In short, Los Angeles is heavily populated, with a built-out roadway and highway network surrounded by dense residential and commercial development. The challenge facing the city is to squeeze more performance from existing infrastructure. Often overlooked is the cost-effective and transformative power of information technology to allow real-time system management. Advanced telecommunications, data processing, and modeling software provide transportation agencies with tools to keep systems running at optimal levels.

In the run-up to the 1984 Summer Olympics in Los Angeles, transportation planners began searching for ways to ease the congestion that the games would produce. Officials decided to apply advanced information technology to traffic lights that would allow them to manage demand and keep the roadways from breaking down into gridlock. The ambitious plan started with 115 intersections around the Los Angeles Memorial Coliseum. The investments made an important difference, and local leaders decided to expand the effort to cover every intersection in the city.

In 2006, California voters approved Proposition 1B, which provided $20 billion for transportation projects designed to relieve congestion and improve air quality, among other purposes.[62] Former Los Angeles Mayor Antonio Villaraigosa campaigned hard in favor of the ballot initiative, promising to dedicate $150 million to complete the synchronization project, which would cover all 4,398 intersections in the city.[63]

Independent research by Texas A&M University shows that the fully operational Los Angeles system has increased travel speeds by 16 percent and reduced delays at major intersections by 12 percent—all for a fraction of the cost of capacity expansion projects.[64]

Express lanes allow traffic to move freely even as general travel lanes grind to a halt. (Orange County Transportation Authority)

Traditional traffic signals follow preprogrammed schedules that assume driving demand will follow a predictable pattern, spiking during the morning and evening rushes. The problem with preprogrammed systems is that they keep the same schedule even when conditions on the ground change dramatically.

The advanced system in Los Angeles, known as Automated Traffic Surveillance and Control, or ATSAC, produces significant travel-time savings by being adaptive. The traffic signals adjust automatically by changing their timing in response to different travel volumes at different times of the day.[65] The Los Angeles Department of Transportation can monitor traffic flows and corridor speeds with the help of magnetic sensors embedded in the roadway.[66] From a single command center, it can remotely adjust light timing; before it, a worker had to physically travel to an intersection to make the timing adjustment. The technology also prioritizes lights to allow public transportation vehicles to stay on schedule.[67]

The State Route 91 express-lanes and traffic-signal synchronization projects demonstrate the power of roadway pricing and information technology to deliver significant, cost-effective benefits. Transportation in the 21st century is as much about systems as it is about physical infrastructure.

Choice

An efficient transportation system is one that provides robust choices. When residents are provided with multiple options, including walking, biking, public transportation, and driving, they are able to match their trip purposes and distances with the appropriate mode. Unfortunately, less than 5 percent of households are located within a half mile of rail transit such as streetcars, light rail, or commuter rail, and a little less than half of all Americans have access to any form of public transportation.[68] Furthermore, nearly one-third of them live in neighborhoods without sidewalks.[69]

This lack of choice forces people to drive even when other options would better meet their needs. Consider the following: 10 percent of all vehicle trips nationwide are less than one mile in length.[70] And approximately 40 percent of all trips within urban areas are less than two miles in length.[71] With adequate investments in transportation choices, many of these trips could be fulfilled without driving, providing a cheaper, more environmentally sustainable, and healthy option to millions of people.

Reliability

Reliability is an essential element of a 21st century transportation system. Every transportation system has natural fluctuations in demand and unforeseen events such as accidents or severe weather that affect performance and cause uncertainty. For systems stretched thin by near-constant high levels of demand, reliability becomes an even greater concern, as modest disruptions can ripple throughout the region.[72]

For households, the uncertainty means adding extra time to commutes and other travel just to ensure an on-time arrival. For the freight transportation industry and businesses that rely on just-in-time shipping, the uncertainty can have damaging effects. In the most congested regions, freight operators have to employ extreme strategies to deliver to customers on time, including scheduling trucks in the middle of the night. Moreover, while long-haul trucks account for only 6 percent of total VMT in the United States each year, they must absorb 26 percent of the cost of congestion.[73] Freight carriers are disproportionately affected because they travel overwhelmingly on highways with few route alternatives.[74] As we move into the future, the cost of system unreliability and congestion will only grow.

In 2011, trucks carried more than 11 billion tons of goods valued at a staggering $10.5 trillion.[75] Over the next 30 years, the volume of goods moved by truck will increase by 65 percent, or more than 7 billion tons.[76] These freight flows are essential to the continued growth of our economy, and only some operations can shift their delivery to off-peak hours. Without greater system reliability, individuals and businesses will continue to suffer the economic and time consequences of unpredictable performance.

Equality of access

Infrastructure investments convey substantial social, economic, and mobility benefits. Yet resources are limited, and the distribution of investments and benefits is highly uneven. A 21st century transportation system is one that more equitably distributes these benefits with a focus on ensuring that all residents, regardless of age, ability level, or income, have affordable access to the system.

Nationwide, 20 percent of households living in poverty lack access to a car. The percentages are even higher for African American and Latino households—33 percent and 25 percent, respectively.[77] As these data show, different investments will affect some communities more than others. Simply building new highway infrastructure is not sufficient to deliver benefits to all residents. A 21st century system must work for everyone.

Policy reform: Performance management, competition, and local control

Realizing a 21st century transportation system will require three substantial reforms: expanded performance management to ensure accountability, increased local control, and more competition for federal funding and financing.

Performance management is a strategic approach to making transportation investments that seeks to maximize performance outcomes through detailed analysis of system data.[78] This process requires elected officials, senior public managers, and planners to explicitly state the goals informing transportation investments and operational policies. These goals serve as the foundation for developing specific, quantifiable performance measures to chart progress over time. Performance management is a transparent, data-driven, and rational approach to infrastructure investments.

In effect, performance management is a means to realizing the full potential of transportation investments. Quantifiable performance measures provide the analytical foundation to hold grant recipients accountable for advancing national policy objectives. Unfortunately, current performance management requirements are insufficient to produce meaningful change. For the first time, MAP-21 contains new performance measures that focus on system repair and safety. This step, while important for introducing performance management to the federal program, extends the historical view of performance as a measure of assets, not outcomes. Furthermore, MAP-21 does not connect federal funding and financing to performance outcomes. Without a link to funding and financing, this approach does not institute real accountability. Decoupling performance management from federal resources relegates the process to a technical concern focused on collecting and reporting data, rather than a core driver of agency decision making.

Reforming transportation governance should also include expanding local control. National transportation policy is based on a federal-state partnership, with the vast majority of funds flowing to state departments of transportation, which plan and build most of our infrastructure. This model proved effective when the overarching goal of transportation policy was to improve connections

We should define transportation policy by what it accomplishes, not what it builds. Transportation is about outcomes, not assets.

between regions and efficiently move rural products to market. In effect, the scale of the transportation challenge was statewide, and the federal program structure matched this need by providing resources to states.

Today, the most pressing transportation challenges exist on a metropolitan scale. Congress first recognized the special role of metropolitan regions and their unique planning needs in the early 1960s. Beginning with the Federal-Aid Highway Act of 1973, Congress required urban areas with populations topping 50,000 people to establish metropolitan planning organizations, or MPOs.[79] Metropolitan planning organizations produce long-range transportation plans and serve as regional forums for the political bargaining needed to unify competing local priorities. For the most part, these plans languish due to a lack of funding, as federal resources still flow to states. In essence, the federal program has not evolved to match resources to the scale of metropolitan needs.

Finally, reform must include expanded competition for federal funding and financing. The overwhelming reliance on formula programs removes the incentive for grant recipients to improve performance. Competition, by comparison, allows the federal government to reward the most effective and innovative states, regions, and transit providers with additional resources.

The following policy recommendations translate these broad ideas into specific actions for Congress to implement as part of the next surface transportation authorization.

1. **Expand performance management.** The next transportation bill should expand the use of performance management by including additional measures connected to the national goals of economic competitiveness, access to opportunity, asset maintenance, safety, environmental sustainability, and energy consumption.

2. **Increase competition.** The federal program should reward states, regions, and transit providers that advance innovative plans and projects. The most effective way to reward innovation is to expand the nationally competitive Transportation Investment Generating Economic Recovery, or TIGER, grant program. The TIGER program supports all types of surface transportation projects, allowing the U.S. Department of Transportation to provide assistance to projects that make the most progress, regardless of mode, toward achieving national objectives. Moreover, an expanded TIGER program offers local communities direct access to federal funds, allowing for a highly effective federal-local partnership model.

3. **Tie grants and financing to performance.** In order for performance management to be effective, it must be tied to federal support. The U.S. Department of Transportation should consider anticipated performance improvements when scoring project applications for the TIGER grant and Transportation Infrastructure Finance and Innovation Act, or TIFIA, loan programs. Adding performance measures to the project scoring process would provide a strong incentive to states and regions to advance projects that improve performance in accordance with national objectives.

4. **Increase the mode-neutral share of funds.** A true shift to performance management and greater accountability should also provide states and metropolitan regions with greater flexibility. The next bill should increase the share of formula funds distributed through the mode-neutral Surface Transportation Program, or STP. The STP can support highway, bridge, and public transportation projects, allowing recipients to pursue the project mix that fits their unique needs.

5. **Increase local control.** The federal program should provide more direct funding to metropolitan regions through a process known as suballocation. Metropolitan regions are hubs of innovation and economic growth. The current federal program relies too heavily on state planning and project selection authority. Increased local control is an important step to reforming transportation governance, allowing communities to advance balanced investments that meet their needs.

6. **Increase planning funds and require scenario planning.** The shift to performance management will require states and regions to expand their analytical and technical planning capabilities. Current planning funds are inadequate to meet the needs of performance management and scenario planning. Furthermore, states and metropolitan regions that are home to more than 500,000 people should be required to use scenario planning when developing their long-range plans.

Performance measures

The measures outlined below extend performance management to include economic competitiveness, access and equity, environmental sustainability, safety, and system repair. Many of these measures could fit within multiple categories.

With respect to equity, aggregate performance measures do not provide information about the distribution of benefits and burdens of different transportation investments along geographic, racial, or socioeconomic lines. Aggregate measures can miss that certain decisions disproportionally affect some communities more than others. An expanded performance evaluation can highlight important equity concerns that would otherwise remain unnoticed. Equity considerations can inform specific measures or serve as a crosscutting framework with which to assess the entire performance management system. Let's examine more closely performance measures related to specific areas and the hoped-for goal to be attained by each measure.

Economic competitiveness

- **System reliability.** System reliability measures variations from average travel time, typically as either the additional, or buffer, time or total travel time needed to ensure an on-time arrival. In effect, the system reliability measure uses historical delay information to estimate a confidence interval that travel times will exceed only 5 percent of the time—that is to say, a confidence interval of 95 percent. For instance, a typical commute may take 25 minutes, with the majority of unexpected delays adding no more than 10 minutes to the commute. The buffer time is therefore 10 minutes, and the total travel time is 35 minutes. This means that planning for a trip of 35 minutes will result in an on-time arrival 95 percent of the time.[80] Reliability provides a more complete picture of performance. Projects and management practices that improve reliability may only modestly lower average travel time but nonetheless significantly improve performance by reducing uncertainty. Addressing system reliability is important because significant unexpected delays cause economic inefficiencies either by adding too much buffer time to schedules or missing appointment windows. *The goal:* Reduce the frequency and severity of fluctuations in travel time.

- **Total travel time.** This measures the time needed to complete a single trip from one origin to one destination. Total travel time is affected by both travel speed and distance, as opposed to delay, which simply measures changes in travel speed. Looking only at travel speed often presents an incomplete picture of system performance, as reductions in speed may be more than offset by shorter distances.[81] Total travel time is a more comprehensive performance measure because it captures the impacts of transportation investments and land use. A state or region can improve total travel time by investing in new facilities and pursuing land-use policies that balance the location of jobs, housing, health care, education, and other consumer needs. *The goal:* Reduce total travel time.

- **Intermodal connections.** Intermodal connections measure the presence of facilities that allow people and freight to seamlessly transition from one mode of transportation to another. Increasingly, freight travels across multiple modes as part of the production chain and delivery to market. For instance, goods may arrive at a seaport, transition to a train, and move to a long-haul truck before finally finding their way to a short-haul truck for delivery to consumers. Similarly, an individual may travel over multiple modes to get to work, starting with driving to a commuter rail station, riding the train, and then walking to his or her office. The absence of intermodal connections creates inefficiencies and economic costs for businesses and individuals. Bottlenecks often emerge when goods transition from one mode to another. An intermodal measure tracks the presence of facilities that allow for seamless movement from one mode to another. *The goal:* Increase the number and quality of intermodal connections.

- **Transit productivity.** Transit productivity measures the ratio of ridership to transit service. This measure recognizes that not all public transportation services deliver the same return on investment. Some routes receive heavy ridership, while others struggle to generate demand. Planners may measure productivity at a system-wide or route level. An example of transit productivity would be the average annual transit boardings per vehicle revenue hour of service. Transit productivity may also weight trips taken by low-income or transit-dependent residents. By adding a weight, planners can balance the dual mission of ensuring that transit service meets the mobility needs of all residents and maximizing system effectiveness. *The goal:* Increase transit productivity, including service for transit-dependent communities.

- **Roadway connectivity.** Connectivity measures how directly the roadway network connects destinations, often measured as a ratio of roadway segments to intersections, with a higher number indicating greater connectivity. The analysis can be applied at any geographic scale. For instance, within a square mile, this approach would divide the number of intersections by the number of segments. If the area had 17 intersections and 11 segments, the resulting ratio would be 1.54. The higher the ratio, the greater the level of connectivity. Improved connectivity increases route choice and reduces travel distances, allowing drivers and pedestrians to reach more destinations without moving up the roadway hierarchy—local, collector, and arterial roadways.[82] All roadways are classified according to their design and purpose. Local streets provide a high degree of land access with low speeds. Collector roads provide increased travel speeds and help funnel traffic from local streets to arterial roadways. Arterial roads, including limited-access highways, provide little or no land access and high travel speeds.[83] Increased roadway connectivity allows travel demand to disperse over a greater number of roadways. Conversely, limited connectivity forces drivers to travel on higher-speed arterials regardless of the distance or trip purpose. As a result, many local trips compete with and impede longer-distance drivers and freight carriers, degrading system performance. *The goal:* Increase roadway connectivity by raising the ratio of roadway segments to intersections.

The Sacramento Area Council of Governments, or SACOG, serves as the metropolitan planning organization for the Sacramento, California, region. In 2005, SACOG completed a visioning process that engaged with residents, businesses, and local elected officials to determine how the Sacramento region should grow in the future. The engagement resulted in a series of growth principles, including greater transportation choice through investments in a balanced system, more compact and mixed-use housing and commercial development, improved natural resource conservation, and more efficient use of existing facilities, among others. These principles informed the development of the region's long-range transportation plan, known as the Metropolitan Transportation Plan/Sustainable Communities Strategy, or MTP/SCS. In order to determine overall impacts, SACOG planners assessed the MTP/SCS against numerous performance measures, including transit productivity.

The plan calls for investing $11.3 billion in public transportation over the next 30 years, focusing capital and operational improvements along those corridors with compact development and mixed land uses.[84] These investments will produce a 72 percent improvement in transit productivity—defined as passenger boardings per service hour provided when compared to a 2008 baseline.[85] In addition, overall transit trips will increase by an estimated 256 percent by 2035, while only increasing transit service hours by 98 percent from 2008 levels.[86]

The MTP/SCS investments will also decrease per-capita vehicle miles traveled by 7 percent and increase trips by transit, walking, and biking by 33 percent compared to the 2008 baseline.[87] Analysis also shows that for every 1 percent increase in the share of trips taken by transit, total miles of congested driving decrease by 5 percent. Residential density is projected to increase by 27 percent, with the average distance to service estimated to fall from the current level of 0.72 miles to 0.55 miles by 2035.[88] These performance measures allow residents and local leaders to better understand how their investment decisions will affect the region for decades to come. Moreover, these estimates will allow planners to identify areas of underperformance over time, providing an analytical basis for altering investment strategies to maximize outcomes moving forward.

Access to opportunity and transportation equity

- **Transit accessibility.** Transit accessibility is defined as the share of households, jobs, and other destinations accessible by transit within a given period of time—typically 45 minutes. Accessibility measures the extent and frequency of transit service, as well as the number of jobs and other destinations accessible within the defined period of time. Less than 5 percent of households are located within a half mile of rail transit, and a little less than half of all Americans have access to any form of public transportation.[89] Increasing the number of routes, frequency of service, and density of development all affect accessibility. *The goal:* Increase the share of households, employment, and other key destinations accessible by transit over a defined period of time.

- **Average distance to transit stops.** Public transportation riders are pedestrians at the start and end of every journey. Access, broadly understood, encompasses both the provision of service by a local agency as well as the ability of people to reach that service. Research shows that ridership drops off significantly when people must walk more than half a mile.[90] Regions can reduce the average dis-

tance to access transit by expanding service coverage and zoning for housing and employment development around transit stations. *The goal:* Reduce the average distance to transit stops.

- **Housing-to-employment ratios.** The location of housing and employment affects driving levels and overall demand for transportation infrastructure.[91] The housing-to-employment ratio measures the relative growth of each sector. If either sector grows substantially faster than the other, the ratio moves further away from 1-to-1. The greater the imbalance, the greater the amount of driving.[92] This measure captures the deep connection between transportation and land use. Transportation investments can either facilitate development patterns that push housing and employment apart or allow them to grow in tandem. The aim of this measure is to facilitate balanced growth. *The goal:* Bring housing and employment ratios closer to 1-to-1.

- **Transportation affordability.** Transportation affordability measures transportation costs, including transit fares and vehicle costs, relative to income. Transportation is the second-largest household expenditure, consuming 19 percent of income on average.[93] However, that share increases substantially for lower-income households. Multiple factors influence transportation costs, not all of which state and local authorities can affect. However, transportation investments and land-use policies can help lower costs by allowing households to reduce vehicle ownership and use. Research indicates that variable costs, such as fuel, account for 34 percent of a vehicle's total cost.[94] States and regions can reduce transportation costs by reducing transit fares and providing subsidized passes, building pedestrian infrastructure to reduce the need for expensive car trips, and pursuing land-use policies that reduce trip distances by locating housing in close proximity to jobs and other services. *The goal:* Reduce the share of household income spent on transportation.

The San Diego Association of Governments, or SANDAG, serves as the metropolitan planning organization for the greater San Diego region. As part of its comprehensive planning efforts, SANDAG has implemented a system of performance measures that captures multiple aspects of transportation accessibility and land use. The 2050 Regional Transportation Plan, for example, measures the share of peak-period work and higher-education trips—trips to campuses that are not covered by K-12 school busing—that are accessible within 30 minutes by driving, carpooling, or taking public transportation. Modeling by SANDAG estimates that by 2035 transit accessibility will roughly double as a result of its long-term investments.[95]

SANDAG also looks at development patterns and accessibility by measuring the share of new housing units and jobs located within Smart Growth Opportunity Areas, defined as "places that accommodate, or have the potential to accommodate, higher residential and/or employment densities near public transit."[96] Through collaboration with the 18 cities in the region and San Diego County, the association identified almost 200 Smart Growth Opportunity Areas. In 2005, the most recent year for which data are publicly available, 15 percent of all housing units were located in Smart Growth Opportunity Areas, including 32 percent of new housing units.[97]

SANDAG created an incentives program to encourage local governments that control zoning and land-use decisions to submit projects that will facilitate smart growth. Through a competitive grant process, SANDAG allocates 2 percent of voter-approved regional sales-tax revenues to projects that integrate transportation and land use.[98]

Environmental sustainability and energy efficiency

- **Transit mode share.** Transit mode share measures the percentage of all trips that use public transportation. The comparatively low mode share for public transportation contributes to metropolitan congestion, especially during morning and evening commutes. Nationally, individuals driving alone take 76 percent of all commuting trips; individuals take only 5 percent of trips by public transportation.[99] *The goal:* Increase the share of total trips that use public transportation, especially for commuting.

- **Bicycle and pedestrian mode share.** Bicycle and walking mode share measures the percentage of all trips taken by either biking or walking—also called nonmotorized transportation. Walking is the second-most common mode of transportation, but many communities lack the basic infrastructure needed to safely accommodate pedestrians and bicycle riders. As a result, people who are forced to take unacceptable risks to walk or bike end up driving. *The goal:* Increase the share of total trips made by biking or walking.

- **Land efficiency and consumption.** Land efficiency and consumption looks at the acres of land consumed per residential unit—a measure of regional housing density—as well as the amount of farmland or greenfield land consumed by new development each year—a measure of the impacts of growth. Research shows that over the past few decades the average lot size for residential homes has grown significantly, pushing down overall density levels.[100] Nationally, from 1982 to 2003, the number of newly developed acres of land grew almost twice as fast as the population.[101] Low-density development patterns not only place additional strain on the natural environment, but they also increase driving and congestion.[102] Conversely, increased residential density and the presence of biking and walking infrastructure can reduce driving levels by 26 percent compared to people living in less compact areas.[103] *The goal:* Reduce both the acres of land consumed per unit of housing and the acres of farm or greenfield land developed each year.

- **Carbon dioxide emissions from transportation.** This measure estimates carbon dioxide emissions from the transportation sector. Transportation represents the second-largest source of greenhouse gas emissions behind electricity production.[104] In 2011, transportation was responsible for 28 percent of total U.S. emissions.[105] Mobile-source emissions are the result of infrastructure investments, land use, vehicle-fleet composition, and the carbon intensity of different transportation fuels. Mobile-source emissions modeling allows planners to

understand the share of greenhouse gas emissions attributable to each of these factors. Understanding the relative share allows planners to make cost-effective emissions reductions. For instance, modeling may show that a diesel engine retrofit program is more cost effective at reducing harmful emissions than building a new transit line or requiring different fuel additives. *The goal:* Reduce total mobile-source carbon emissions.

- **Per-capita VMT.** Per-capita VMT looks at the ratio of total driving to population. Measuring per-capita driving provides a more accurate measure of individual travel behavior than overall VMT, which tends to rise with population growth. In effect, per-capita driving captures the impacts of transportation investments and land-use policies. Moreover, measuring per-capita driving does not penalize states and regions for population growth or economic development. *The goal:* Reduce per-capita vehicle miles driven.

- **Average vehicle occupancy.** Average vehicle occupancy measures the efficiency of the roadway system by looking at how many people ride in a car on average. Driving alone, particularly during morning and evening commutes, is a substantial source of metropolitan congestion. In fact, people driving alone take 76 percent of commuting trips.[106] When people carpool or vanpool, the existing roadway network is capable of moving more people and goods per hour, significantly increasing system efficiency and productivity. *The goal:* Increase average vehicle occupancy, with a focus on peak-period driving.

Metro, the metropolitan planning organization for the Portland, Oregon, region, uses a broad set of environmental sustainability and efficiency performance measures, including per-capita VMT, transit-, biking, and walking mode share, and transportation-related greenhouse gas emissions.[107]

The Oregon State Legislature has also pushed for transportation investments to advance environmental sustainability objectives. In 2007, the state set aggressive greenhouse gas emissions reduction targets, calling on statewide emissions to fall to 10 percent below and then to 75 percent below 1990 levels by 2020 and 2050, respectively.[108] Two years later, the state passed legislation that requires Metro to evaluate multiple land-use and transportation scenarios to understand their impacts on greenhouse gas emissions.[109]

In keeping with these mandates, Metro set quantifiable targets for VMT transit use and nonmotorized travel, and greenhouse gas emissions from the transportation sector within the long-range transportation plan known as the 2035 Regional Transportation Plan. Specifically, Metro set a goal of reducing carbon dioxide emissions by 40 percent below 1990 levels by 2035. Its modeling of the 2035 long-range plan shows that carbon emissions will increase by 50 percent above 2005 levels unless changes are instituted. In addition, Metro set the goal of tripling walking, biking, and transit mode share by 2035. The modeling shows that transit will increase by 4 percent compared to the 10 percent target. Walking will increase by 7 percent compared to a target of 19 percent. And biking will increase by 1 percent compared to a target of 3 percent. Finally, Metro called for a decrease of 10 percent in per-capita VMT. It estimates that per-capita VMT will decline by 4 percent.

These results reflect the tension between highly aggressive goals for the region and the reality of constrained transportation budgets that limit how much may be accomplished by 2035.

Safety

- **Presence of pedestrian and bicycle infrastructure.** This measure looks at the share of roadways with pedestrian and bicycle infrastructure, such as sidewalks, bike lanes, crosswalks, and signals, among other elements. This measure excludes those highways that prohibit pedestrian access. For decades, state and local governments have designed and built roadways for the exclusive use of automobiles. The lack of adequate infrastructure for pedestrians and cyclists either forces people to drive to meet all of their mobility needs or to take unacceptable risks. Each year, more than 5,000 pedestrians and cyclists are killed on our roadways.[110] More than 40 percent of pedestrian fatalities occur where no crosswalk is available.[111] To reduce these numbers, we must look to provide what are termed "complete streets"—roadways that safely accommodate all system users regardless of age, income, or ability level. Complete streets also support public transportation, since riders are pedestrians at the start and the end of each trip. *The goal:* Increase the share of facilities with dedicated pedestrian and bicycle infrastructure and design features.

- **Major injuries and fatalities by mode.** This measure looks at serious injuries and fatalities for pedestrians, cyclists, and individuals in a motor vehicle. Sixteen percent of all transportation-related fatalities involve someone walking or riding a bicycle.[112] This measure would require states and regions to set a performance target for each mode. The factors underlying major injuries and fatalities for pedestrians and motorists are often substantially different. Requiring targets by mode will contribute to the identification of system design elements and enforcement policies required to improve safety for all users. *The goal:* Reduce the number of severe injuries and fatalities.

System repair

- **Structurally deficient deck area.** This measure calculates the total deck area—the surface area of a bridge, calculated by taking its width times its length—of structurally deficient bridges. Focusing on deck area, as opposed to the number of deficient bridges, incentivizes states and regions to fix the largest and most costly facilities. By comparison, a performance measure based on the number of deficient bridges would provide an incentive to repair smaller, cheaper bridges while avoiding costlier structures. Nationally, more than 66,000 bridges are classified

as structurally deficient.[113] In recent years, the rate of repair has slowed substantially.[114] Failure to repair bridges may lead to unsafe conditions or require states to post weight limits, causing freight carriers to take costly and time-consuming detours. *The goal:* Reduce the total deck area of structurally deficient bridges.

- **Pavement quality.** Pavement quality looks at the overall condition of roadways. The most common measure of pavement condition is the International Roughness Index, or IRI. Poor roadway conditions increase repair costs. Research by the National Academy of Sciences estimates that a 20 percent improvement in pavement conditions could reduce overall annual vehicle repair costs by between $24 billion and $73 billion.[115] *The goal:* Increase the share of pavement classified as being in a state of good repair.

- **Transit facilities and vehicles.** Transit repair measures the share of capital assets such as buses, trains, and maintenance facilities classified as being in a state of good repair. In 2010, the Federal Transit Administration estimated a national transit capital repair backlog of $77 billion.[116] Transit asset performance measures allow planners to understand the costs of maintaining existing facilities and the long-term fiscal impacts of adding new capacity. *The goal:* Increase the share of transit vehicles and facilities classified as being in a state of good repair.

Leveraging performance management through scenario planning and project scoring

Simply reporting performance data will not ensure that future transportation investments produce significant improvements. Instead, performance measures should serve as a framework for assessing the benefits and tradeoffs of alternative policies, system management practices, and capital investments. Scenario planning represents a powerful long-term planning method that incorporates performance measures to analyze alternative approaches to growth and investment.

As population and business activity increase over time, planners must make difficult decisions about how to cost effectively manage the resulting impacts. Historically, this process has relied heavily on extrapolating current conditions into the future. Transportation planning often fails to consider alternative growth possibilities or the role of transportation investments in shaping growth in specific ways. Moreover, planning tends to look at current facilities with an eye to incremental adjustments and additions, as opposed to determining what the region should look like years out into the future and then aligning investments to achieve that vision.

Incrementalism in the absence of a compelling vision for the future has pernicious side effects. For one, this approach looks at transportation planning through the narrow lens of solving problems on a small scale. Traffic congestion and slow travel speeds along a corridor become exercises in adding turn lanes and changing light timing rather than looking to the root cause of why people drive—land-use and development patterns. Without a guiding vision, limited resources are gobbled up chasing the elusive dream that this year's incremental improvements will be the long-term fix to the problem.

Scenario planning offers a way to overcome many of the limitations of traditional planning. At its core, scenario planning studies multiple future growth scenarios and how different bundles of investments would affect overall performance. Importantly, scenario planning does not weigh different projects but rather alternative ways for a region or state to grow and develop. This approach moves

the focus from looking at transportation as a set of potential projects to a consideration of the results of different investments. The debate shifts from whether to build Project A or Project B to a more profound discussion about the future of residential communities and economic centers.

Using this process, a region would look at multiple alternatives to carefully weigh the benefits and performance of different investment and development approaches. At the heart of scenario planning is a focus on quantitative analysis of performance measures that derive from regional goals. For instance, a community may prioritize access to transportation options that provide an alternative to driving for every need. This community goal would translate into a specific measure, such as the share of households with access to quality public transportation within a quarter-mile or half-mile walk. Each alternative scenario would be assessed to determine its relative improvement to transit access.

Scenario planning: Tulsa, Oklahoma

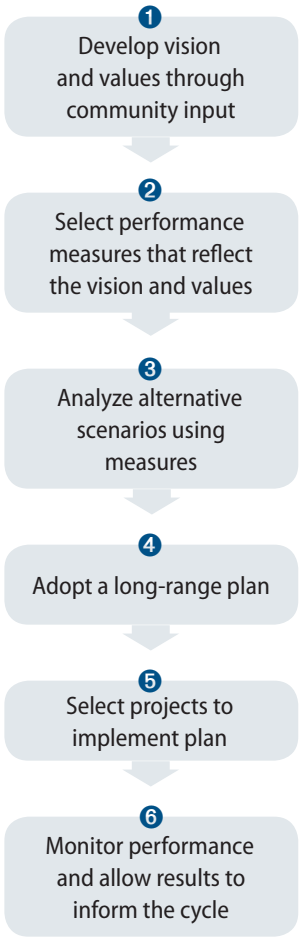
Tulsa, Oklahoma, recently engaged in a robust scenario-planning process with strong community involvement. A 2007 study determined that Tulsa was facing major long-term maintenance costs. The community would need to raise more than $1 billion to keep the current roadway network in a state of good repair. Tulsa, like many cities, developed over decades with low-density land use. As a result, the high cost of maintenance is spread over relatively few taxpayers. The city has approximately 150 residents per lane mile, whereas cities such as Denver, Colorado, and Portland, Oregon, have more than 250 people per lane mile.[117] Residents and local leaders had three choices: grow in a sustainable way, raise taxes substantially to support business as usual, or allow infrastructure to deteriorate.

Local leaders chose to pursue a transportation and land-use strategy with a goal of attracting three times as many people to the city by 2030. Planners started by asking one simple question: "What should Tulsa look and feel like in the future?"[118] The answer was determined by focusing on six areas:

- **Housing:** Protect historic buildings and established neighborhoods while developing centers that are new, vibrant, mixed-use, and walkable.

- **Transportation:** The system should serve all Tulsans regardless of age, income, or ability level with a mix of options, including walking, biking, driving, and public transportation.

Scenario-planning process



- **Economy:** Create a vibrant, thriving economy with a particular focus on downtown.

- **Equity and opportunity:** Create a safe, healthy, viable life for all Tulsans with housing, employment, transportation, education, and health care available across socioeconomic groups.

- **Environment:** Become a leader in sustainability, carbon neutrality, and the efficient use of natural resources. Protect green spaces, and provide low-energy options such as walking, biking, and public transportation.

- **Planning process:** Planning should be inclusive and transparent.

Tulsa translated these key community priorities into a series of performance measures that reflect the connection of transportation to development, community amenities, and the environment. Scenario assessment moved beyond a narrow focus on infrastructure measures such as pavement quality to understand the role that transportation plays in shaping larger social, economic, and environmental objectives.

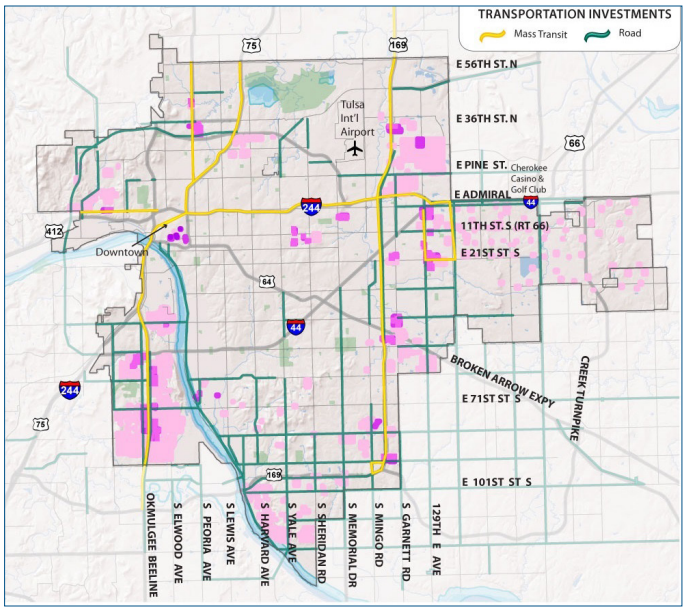
City planners developed four possible scenarios for Tulsa's future. Scenario A would continue current trends into the future. Scenario B would concentrate development along the major arterial roadways. Scenario C would look to focus development in multiple activity centers, including downtown. Finally, Scenario D would heavily focus new job and housing growth in and around downtown Tulsa.

Each scenario presented significantly different outcomes when assessed against the performance measures selected in keeping with resident preferences. For instance, the baseline Scenario A would add more than 600 new lane miles, while Scenario D would add 434 lane miles—almost 30 percent fewer.[119] These same two scenarios also differed greatly in the share of residents that would take public transportation each day. Scenario A would see only 1 percent of residents using transit, while Scenario D would grow the share to 9 percent. Finally, Scenario A would bring about 28,000 new residents and $5 billion in new construction, while Scenario D would add more than 100,000 people to the city's population and $11 billion in new development.[120]

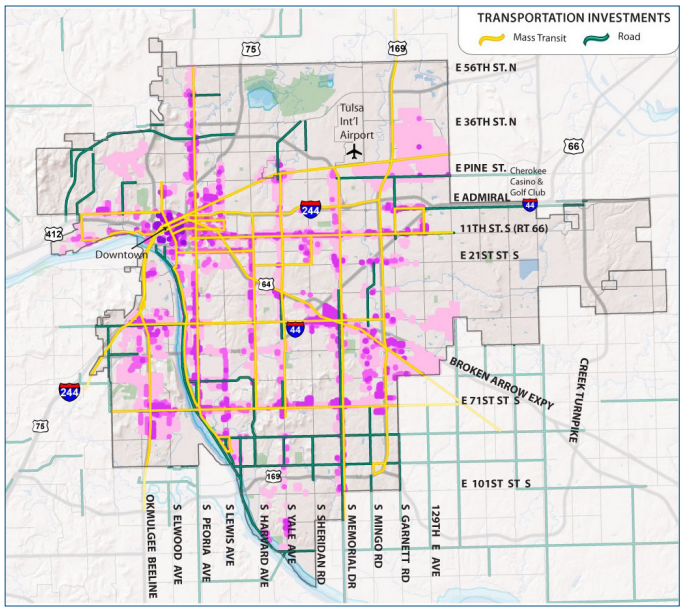
In the end, local leaders chose a blended approach that combined the very best and most popular elements from the different scenarios to maximize growth and performance.

Tulsa scenario alternatives

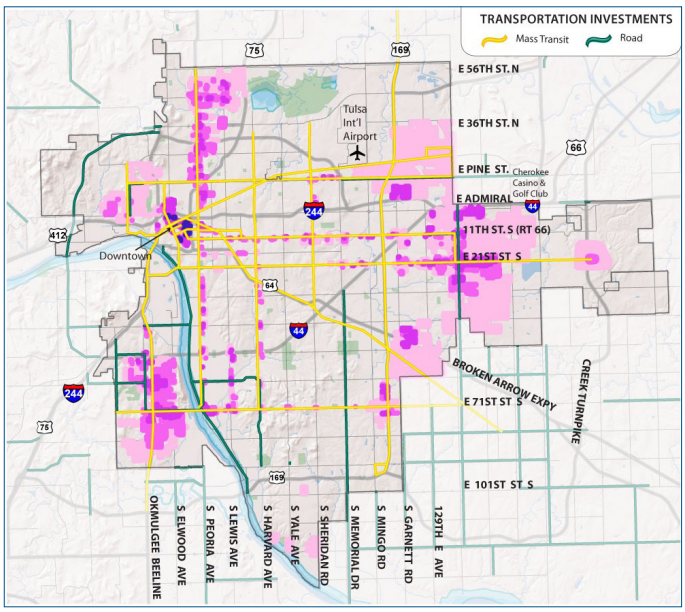
Scenario A: Trends continue



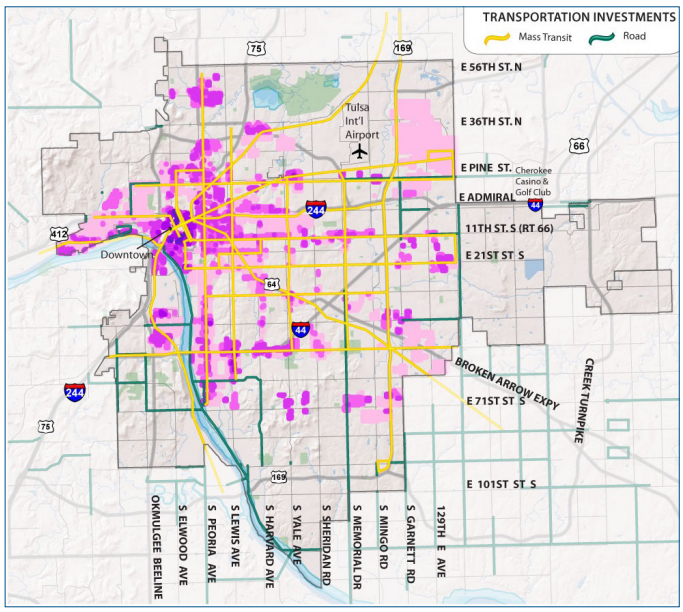
Scenario B: Main streets



Scenario C: New centers



Scenario D: New population and employment growth



Source: PLANiTulsa, "Which Way, Tulsa?", available at http://www.planitulsa.org/whichwaytulsa/ (last accessed February 2014).

The implementation of this vision will take a sustained commitment that directs investments over many years. Tulsa's 1,217 miles of arterial streets and 465 miles of expressways have wide lanes, large intersections, and few facilities for pedestrians.[121] The transportation system's characteristics will not change overnight. Yet the city has ambitious goals: Increase daily transit ridership from 30,000 passengers to 230,000 passengers; reduce wasted fuel each year by 2.5 million gallons; switch 300,000 of the daily 3.2 million vehicle trips to biking and walking; and reduce lane miles per resident by almost 20 percent.[122]

Scenario planning allowed local residents and business leaders to understand how different growth and investment strategies would affect the community in the coming years. In effect, scenario planning replaced a project-level unit of analysis that is typically only useful to technical experts with a community-wide unit of analysis. When looking at the Tulsa region as a whole, residents could understand major decision points and express their opinions. In this way, scenario planning helps create a broad base of political support within the community that will provide durability over the long arc of time needed to realize these changes.

Snapshot of Tulsa scenario performance measures

- Public transportation investments
- New houses within 0.5 miles of public transportation
- Transportation-mode share
- Job growth within the city
- Infill housing
- Share of new housing in mixed-use developments
- Value of new construction
- New lane miles of road construction
- Per-capita vehicle miles traveled
- Wasted fuel due to congestion
- New housing units within 0.5 miles of green space
- Acres of impervious surfaces added

Project scoring: Seattle, Washington, metropolitan region

If scenario planning helps build consensus about the future, performance measures can also guide project prioritization decisions to ensure that states and regions achieve their long-term goals when faced with constrained fiscal resources. The Seattle metropolitan region shows how evaluating projects against specific measures elevates those projects that will have the most impact.

By 2040, the dynamic and fast-growing Seattle region will add approximately 1.5 million people, resulting in a 40 percent increase in travel demand.[123] Faced with limited resources, the Puget Sound Regional Council, or PSRC, which serves as the metropolitan planning organization for the Seattle area, decided to implement an advanced performance management system to evaluate and prioritize different possible investments.

The PSRC prioritization approach is significant because it scores potential investments against performance measures that reflect regional growth and transportation system goals. As a result, performance management is not confined to reviewing data on system outcomes years after a plan has been implemented. Instead, regional performance and growth goals serve as the basis for evaluating projects on the front end, thereby improving the chances that actual outcomes will meet regional objectives.

Expanded performance management began in the Seattle region with the adoption of the Transportation 2040 long-range plan in 2010.[124] The plan calls for a total of $189 billion in investments over the next 30 years, with approximately 30 percent—$54 billion—dedicated to projects that expand system capacity or improve operational performance.

The prioritization process requires local governments within King, Kitsap, Pierce, and Snohomish counties to submit candidate projects to the PRSC. Submissions are then grouped according to the type of infrastructure expansion: arterial roadways, bicycle and pedestrian, highways, or transit. Each capacity project is then evaluated against nine performance categories. Each category is worth 10 points, for a total possible score of 90.

Importantly, high project scores are not a guarantee of funding but rather a way to analytically assess the extent to which specific projects advance long-range plan goals. When making difficult decisions about how to allocate funding, the prioritization score provides another layer of information that may be weighed against other criteria.

In addition to the prioritization scorecard, all expansion projects are assessed for compatibility with the overarching regional growth strategy known as Vision 2040. This process allows planners to understand the geographic distribution of project costs and benefits, as well as whether the project supports future population and employment distributions as envisioned by the growth strategy.

The scorecard categories are as follows:

- **Air quality:** The scorecard rewards projects that improve air quality by reducing levels of Clean Air Act criteria pollutants or increasing the use of clean technologies.
- **Freight:** The scorecard rewards projects that improve travel time, reliability, efficiency, and access for freight carriers.
- **Jobs:** The scorecard rewards projects that improve access to areas with high job concentrations and that support job retention and expansion.
- **Multimodal:** The scorecard rewards projects that provide alternatives to driving alone and connections between transit and nonmotorized transportation.
- **Puget Sound land and water:** The scorecard rewards projects that protect critical lands and habitats and improve water quality.
- **Safety and system security:** The scorecard rewards projects that reduce the number of injuries and fatalities and improve security.
- **Social equity and access to opportunity:** The scorecard rewards projects that improve environmental health or increase access to opportunities for minority, low-income, or other underserved populations.
- **Support for centers:** The scorecard rewards projects that support transit-oriented and other mixed-use development and growth within existing population centers.
- **Travel:** The scorecard rewards projects that reduce congestion.

The "High Capacity Transit Corridor 11" proposal submitted to PSRC by the city of Seattle demonstrates how the scorecard and prioritization process can elevate projects that effectively advance regional goals.

In April of 2012, Seattle released an updated "Transit Master Plan," which calls for investing in multiple corridors that have the potential to generate significant ridership, improve access to opportunity, and help advance environmental goals. The "Transit Master Plan" feeds into the prioritization process by helping the city identify corridors that will compete for regional investment dollars.[125] Furthermore, candidate projects that score highly become more competitive for statewide and federal funding.

Transit helps accommodate growth

The PSRC estimates that the residential population within downtown Seattle and its inner-ring neighborhoods will grow by 60 percent by 2030, from 50,000 residents to 80,000 residents. Without additional transit capacity, this would result in 5,000 additional vehicles on the road for each hour of the morning and evening rushes. In addition to the added congestion, the city would need to house these vehicles with 15,000 new parking spaces—roughly the equivalent of eight 10-story parking garages, or enough to cover an entire downtown Seattle block.

Source: City of Seattle, "City of Seattle Department of Transportation Transit Master Plan Final Summary Report" (2012).

The Corridor 11 proposal calls for adding high-capacity transit between the Loyal Heights neighborhood and downtown Seattle.[126] The city initially studied three different transit technologies: express bus, bus rapid transit, and streetcars. It eventually settled on a rapid streetcar line. By 2030, the new streetcar line will generate an estimated 26,000 daily riders—an increase of 12,500 over existing bus services—with a transit productivity of 170 riders per hour, compared to 100 riders per hour and 60 riders per hour for rapid and express bus options, respectively.[127] Economic modeling shows that the streetcar will have operating costs that are two-and-a-half times lower per each additional new rider than those of the express bus option.

The streetcar's high level of performance results from dedicated right-of-way, traffic-signal priority over general traffic, and stations spaced farther apart.[128] On average, the line will reduce commute times by eight minutes and eliminate 2,000 metric tons of greenhouse gas emissions per year.[129]

The $211 million project received a score of 87 on the prioritization scorecard.[130] In the air quality category, the streetcar project received high scores for reducing vehicles miles traveled, eliminating vehicle trips, and reducing harmful emissions within one-quarter of a mile of sensitive areas such as daycares, schools, and retirement homes. Overall, the streetcar line received perfect scores in seven out of nine categories, including support for jobs, multimodal, land and water protection, safety and system security, equity and access, support for centers, and travel.[131]

Seattle Streetcar map
The corridor from Loyal Heights to downtown connects a high-density residential area, characterized by low vehicle ownership, to the central business district.

Source: City of Seattle, "City of Seattle Department of Transportation Transit Master Plan Final Summary Report" (2012).

The PSRC scorecard, while still in the initial testing phase and limited to prioritizing projects within the long-range plan, represents an innovative and promising approach to performance management that offers both technical planning and political advantages. For planners, the scorecard offers a uniform set of criteria to assess a large number of complex candidate projects. For politicians, the scorecard offers transparency and a level playing field.

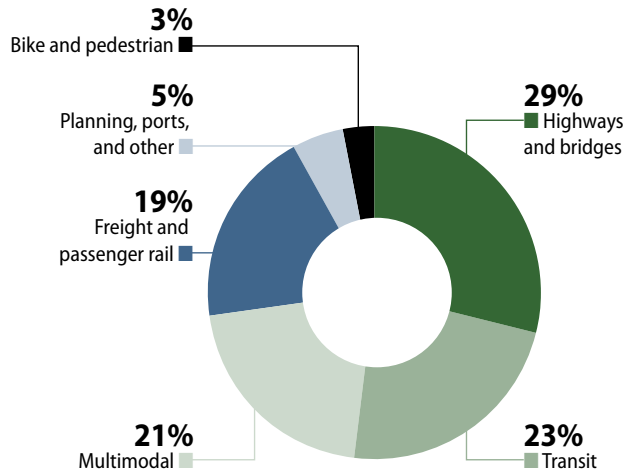
The Seattle metropolitan region faces limited financial resources. This means only a handful of projects can advance beyond the idea stage. For every completed project, many more remain on the shelf. In the absence of a prioritization framework, project selection decisions often have less to do with achieving a coherent transportation vision and more with regional power dynamics. The scorecard provides an objective and transparent process that applies universally to all local authorities. Equally important, the scorecard grew out of a larger political debate about regional growth and transportation. This lends substantial legitimacy to the effort and increases the likelihood that priorities will remain relatively stable over the long period of time needed to build major transportation infrastructure.

Rewarding innovative states and regions

As the Tulsa and Seattle examples show, performance management is a powerful tool for shaping long-term growth and development goals and for prioritizing projects that will make the most progress toward those goals. However, planning and analysis represent only half of the picture. The second half involves resources. Even for regions that make the difficult choice to raise their own revenues, many transportation projects are simply not feasible. Federal policy further hampers innovation and improved performance by maintaining a federal-state partnership that mostly leaves metropolitan regions behind.

FIGURE 5

TIGER grants by mode



Source: Author's calculations based on U.S. Department of Transportation, "TIGER Grants," available at http://www.dot.gov/tiger (last accessed February 2014).

Rewarding innovation through competitive grant programs is essential to achieving national transportation policy goals. In 2009, Congress passed the American Recovery and Reinvestment Act, or ARRA, which provided funding for transportation infrastructure and other priorities. The Obama administration used a portion of the infrastructure spending to create the TIGER program. Unlike traditional funding approaches, which provide grants to only one mode such as highway or rail, the TIGER program is open to all modes. This allows the most innovative and effective projects to advance. Thus far, the program has provided $3.5 billion to a diverse set of 270 projects.[132] The following three projects present some of the best examples of the work states and metropolitan regions have advanced due to the TIGER program.

Tucson, Arizona's, streetcar

Testing the streetcar line in Tucson. (Sun Tran)

In 2006, voters in the Tucson region approved a sales-tax ballot measure to raise funding for transportation projects, including a new streetcar line to provide new transit service between the University of Arizona and downtown Tucson.

The 3.9-mile line has 18 stops and connects multiple major residential, community, and business centers, including the University of Arizona, the El Rio Community Health Center, the Arizona Health Sciences Center, the Tucson Empowerment Zone, and downtown Tucson. The line is also within walking distance of the Amtrak train station and the Ronstadt Transit Center. The El Rio health center is an essential community health institution for low-income residents, with 280,000 medical visits each year.[133] More than 80 percent of the center's patients live at or below the federal poverty line.[134]

In total, 85,000 residents and 50,000 students, faculty, and staff at the University of Arizona live and work within walking distance of the line—approximately 10 percent of the region's population.[135] In addition, one-third of these residents live below the poverty line.[136] For these transit- dependent families, the streetcar will be a vital and affordable connection to educational and employment opportunities.

The TIGER program provided $63 million—approximately half of the capital cost—allowing the Tucson region to directly access federal resources and overcome a state constitutional barrier that prohibits state gas-tax revenues from supporting transit.[137] Without the competitive TIGER program, Tucson would not have been able to pursue this innovation regional mobility solution. The grant program served as an invaluable pathway to reward a region willing to tax itself to raise revenues for a new approach to serve all residents, from university professors to low-income transit-dependent families.

Denver, Colorado's, managed lanes[138]

The Denver metropolitan region is one of the fastest-growing regions in the nation, and it has the traffic congestion to prove it. In addition to an extensive transit-expansion plan, the area is taking steps to expand the capacity of existing highways—an innovative approach known as managed lanes. This is sometimes also referred to as a high-occupancy toll lane, or HOT lane.

All too often, highway-expansion projects dominate long-range transportation plans when other, more cost-effective options exist that maximize the full potential of an existing highway. The Interstate 25 managed-lanes extension and express-bus project will improve regional mobility within the existing footprint of the highway.

Interstate 25 extends north and south through the heart of the Denver metropolitan region. The highway facility is one of the most congested in the entire region, with slow or stopped traffic lasting for four hours or more during the morning and evening peak commuting periods.[139] Each day, 175,000 vehicles and 4,300 bus passengers use the highway.[140]

The project will convert the inside shoulder lane in both directions into dedicated high occupancy vehicle lanes, or HOV-2 lanes, meaning vehicles with two or more passengers are able to enter for free, while single-occupant vehicles must pay a toll. The six-mile managed-lane project will begin at U.S. Route 36 and extend north to 120th Avenue.[141]

The new managed lanes will provide a congestion-free alternative for travelers when they choose to carpool, take transit, or pay a toll to access the lanes. The managed lanes also provide a direct link for the Denver Regional Transportation District, or RTD—the regional public transportation provider—to refurbished Denver Union Station, which is the hub for all surface transportation in the region.

The TIGER program provided $15 million—34 percent of the capital cost of the conversion.[142] An economic analysis showed that the project will generate an economic benefit in excess of a half billion dollars over the life of the project, principally due to the value of travel-time savings.[143] By 2035, the managed lanes will shave 20 minutes off the commute from Adams County to downtown Denver.[144] In addition, the project will reduce fuel consumption by 10 million gallons and remove 90,000 metric tons of vehicle emissions over a 10-year period.[145]

Saint Paul, Minnesota's, Union Depot multimodal transit and transportation hub

Saint Paul, like many cities around the nation, pursued development plans for decades that focused downtown growth around large commercial office space served by interstate highways and major arterial roadways with ample surface and structured parking. Most downtown activity took place Monday through Friday, with few amenities drawing residents at night and on the weekends.

In recent years, this approach has been replaced by a strong desire to invest in projects that create a more mixed-used, walkable, transit-oriented, and sustainable downtown that serves both residential and business needs. This shift in thinking complements the new Central Corridor light-rail line—also known as the Green Line—that connects downtown Saint Paul with Minneapolis, providing a high-capacity public transportation service for the region. Metro Transit—the primary public transportation provider for the Twin Cities region—is also expanding bus service to provide feeder access to the rail line and other destinations.

The Union Depot transit hub project represents a critical effort to revitalize downtown and provide a unified transportation center. The historical Union Depot building anchors the city's Lowertown district, an area at the edge of downtown dominated by underutilized warehouse, industrial, and loft buildings. Union Depot stopped serving as a transportation station in the 1970s.[146]

Union Depot will provide a multimodal connection for Amtrak's intercity passenger rail service called the Empire Builder, as well as several long-distance private bus operators. Moreover, the Central Corridor light-rail system terminates in front of Union Depot. When completed, the renovated facility and transportation connections will serve as a multimodal hub that unifies local and regional public transportation with long-distance passenger rail and bus service. Union Depot is also part of an aggressive downtown revitalization plan that looks to generate 6,000 new rental housing units, 1.8 million square feet of office space, and 150,000 square feet of retail.[147]

Economic forecasts show that the Union Depot project will produce $300 million[148] in direct benefits to the region with a benefit-to-cost ratio of 2-to-1, all while contributing to what local leaders describe as a "sustainable, low-carbon urban form."[149]

(Left to right) Flickr/Waltarrrrr; Flickr/Metro Transportation Library and Archive.

Los Angeles: How a transit strike showed that public transportation provides significant benefits to highway user

High-quality public transportation provides substantial benefits not only to riders but drivers as well. A 2003 transit strike in Los Angeles resulted in immediate and significant increases in congestion—especially on highways running parallel to high-capacity transit lines.[150]

In October 2003, thousands of mechanics walked off the job after negotiations with the Los Angeles County Metropolitan Transportation Authority, or LA Metro, failed to resolve contract differences.[151] In solidarity, more than 5,000 bus and rail drivers also struck, causing the nation's third-busiest transit provider to shut down.[152] As a result, more than 400,000 riders making 1.3 million trips each day were forced to find an alternative mode of transportation.[153] The strike lasted 35 days, providing a powerful real-world experiment showing how a transit shutdown would affect highway driving. Research modeled on vehicle-speed data from the Los Angeles region showed that highway delay increased by 47 percent.[154] The results were even worse for highways running parallel to major transit lines. U.S. Route 101—the 101 Freeway—paralleling the Red Line transit line, saw an increase in delay of 90 percent.[155] Interstates 105, 110, 710, and 10 saw an increase in delay of between 53 percent and 81 percent.[156]

The implications for transportation policy are profound. In addition to improving regional mobility and providing affordable access to opportunity for diverse communities, investing in public transportation is an effective strategy for reducing highway congestion.

The transit strike is also important because it addresses a longstanding misconception about how transit improves roadway conditions. Previous studies have attempted to understand how transit affects highway performance on a region-wide scale. The Los Angeles strike shows that this is the wrong framework. A significant share of transit riders commute along corridors that also have the most severe roadway congestion. For these individuals, public transportation offers an efficient and affordable alternative to driving. When transit service is removed, these riders are forced to commute by automobile on the same congested highways. When more cars are added to a highway that is already near capacity, the effect is far worse than if they were added to a free-flowing highway. In short, the marginal impact of adding former transit riders to already-congested parallel highways is significant, though this effect is lost at a regional scale of analysis.

The Los Angeles case also highlights the strong analytical basis for using a share of highway user fees, such as per-gallon gas taxes or tolls, to increase investment in public transportation that runs within the same corridor. Transit is often a more cost-effective and politically feasible alternative to expanding highways within urban areas where heavy commercial and residential development are a serious constraint to right-of-way acquisition.

Conclusion

Congress has the opportunity to enact substantive policy reform when MAP-21 expires on September 30. The next authorization bill should clearly define an overall vision for an intermodal surface transportation system that increases economic competitiveness, improves access to opportunity for diverse communities, maintains infrastructure in a state of good repair, reduces injuries and fatalities, minimizes impacts on ecological and social environments, and reduces energy consumption.

These goals should inform a broad set of progressive performance measures that ensure state and local leaders make project investment decisions that advance national priorities. In addition, performance measures should serve as the basis for directing federal grants and financing to those states and regions making the most-productive investments.

Taken together, these reforms will advance a 21st century transportation system capable of producing lasting and sustainable prosperity. Without these reforms, we will continue with an outdated postwar framework that is inadequate to meet our current challenges. Congress must make the difficult decisions to undertake real reform or continue to "march backwards into the future."[157]

About the author

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Endnotes

1 MarshallMcLuhan.com, "McLuhanisms," available at http://www.marshallmcluhan.com/mcluhanisms/ (last accessed January 2014).

2 Kim P. Cawley, "Status of the Highway Trust Fund," Testimony before the House Transportation and Infrastructure Committee, July 23, 2013, available at http://www.cbo.gov/sites/default/files/cbofiles/attachments/44434-HighwayTrustFund_Testimony.pdf.

3 Ibid.

4 Federal Highway Administration, *Our Nation's Highways 2011* (U.S. Department of Transportation, 2012), p 12.

5 Allison Tarmann, "Fifty Years of Demographic Change in Rural America," Population Reference Bureau, January 2003, available at http://www.prb.org/Publications/Articles/2003/FiftyYearsofDemographicChangeinRuralAmerica.aspx.

6 Bureau of Public Roads, *Highway Statistics 1955* (U.S. Department of Commerce, 1955), p. 153.

7 Ibid.

8 The American Presidency Project, "Dwight D. Eisenhower: 39 - Special Message to the Congress Regarding a National Highway Program," available at http://www.presidency.ucsb.edu/ws/index.php?pid=10415&st=&st1=#ixzz2iNfFtsCq (last accessed October 2013).

9 Tarmann, "Fifty Years of Demographic Change in Rural America."

10 Bureau of the Census, *2012 American Community Survey 1-Year Estimates* (U.S. Department of Commerce, 2012), table B01003.

11 Frank Hobbs and Nicole Stoops, "Demographic Trends in the 20th Century" (Washington: U.S. Department of Commerce, 2002), available at http://www.census.gov/prod/2002pubs/censr-4.pdf.

12 Author's calculations based on Bureau of the Census, "Table 1. United States - Race and Hispanic Origin: 1790 to 1990," available at http://www.census.gov/population/www/documentation/twps0056/tab01.xls (last accessed January 2014); Federal Highway Administration, "Annual Vehicle Distance Traveled in Miles 1936 - 1995," available at http://www.fhwa.dot.gov/ohim/summary95/vm201.pdf (last accessed January 2014); Office of Highway Policy Information, "Historical Monthly VMT Report," available at http://www.fhwa.dot.gov/policyinformation/travel_monitoring/historicvmt.cfm (last accessed January 2014).

13 National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow" (2007).

14 Calculation based on Office of Highway Policy Information, "Highway Statistics 2011," available at http://www.fhwa.dot.gov/policyinformation/statistics/2011/hm220.cfm (last accessed August 2013).

15 Federal Highway Administration, *Our Nation's Highways 2011*, p. 30, figure 4-6.

16 Office of Highway Policy Information, *Functional System Travel 2011/ Annual Vehicle-Miles* (U.S. Department of Transportation, 2012).

17 Denver Regional Transportation District, "RTD 2011 Annual Report to DRCOG on FasTracks" (2012), available at http://www.rtd-fastracks.com/media/uploads/main/SB208_2011_report_4-3-2012.pdf.

18 Results based on author's calculation from Location Affordability Portal, "Location Affordability Index," available at http://www.locationaffordability.info/lai.aspx?url=download.php (last accessed January 2014).

19 Results based on author's calculation from ibid.

20 David Schrank, Bill Eisele, and Tim Lomax, "2012 Urban Mobility Report" (College Station, TX: Texas A&M Transportation Institute, 2012), available at http://tti.tamu.edu/documents/mobility-report-2012-wappx.pdf.

21 Federal Highway Administration, *Congestion Pricing: A Primer* (U.S. Department of Transportation, 2006), p. 1.

22 U.S. Environmental Protection Agency, "Currently Designated Nonattainment Areas for All Criteria Pollutants," available at http://www.epa.gov/oaqps001/greenbk/ancl3.html (last accessed October 2013).

23 U.S. Environmental Protection Agency, "Summary Nonattainment Air Pollution Exposure Report," available at http://www.epa.gov/airquality/greenbk/popexp.html (last accessed January 2014).

24 Helen Suh and others, "Criteria Air Pollutants and Toxic Air Pollutants," *Environmental Health Perspectives* 108 (4) (2000): 625–633.

25 U.S. Department of the Treasury and the Council of Economic Advisers, *An Economic Analysis of Infrastructure Investment* (Executive Office of the President, 2010), p. 10, figure 1, available at http://www.whitehouse.gov/sites/default/files/infrastructure_investment_report.pdf.

26 Center for Transit-Oriented Development, "The Affordability Index Toolbox" (2006).

27 Stacy C. Davis, Susan W. Diegel, and Robert G. Boundy, "Transportation Energy Databook: Edition 32" (Oak Ridge, TN: Oak Ridge National Laboratory, 2013), pp. 10–16, table 10.12.

28 Bureau of the Census, *Household Income: 2012* (U.S. Department of Commerce, 2012), p. 1.

29 Linda Bailey, "Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil" (Washington: ICF International, 2007), available at http://www.apta.com/resources/reportsandpublications/Documents/apta_public_transportation_fuel_savings_final_010807.pdf.

30 Office of the Under Secretary for Policy, *DOT Strategic Plan 2012-2016: Transportation for a New Generation* (U.S. Department of Transportation, 2012), p. 46, available at http://www.dot.gov/dot-strategic-plan.

31 Barbara J. Lipman, "Something's Gotta Give: Working Families and the Cost of Housing" (Washington: Center for Housing Policy, 2005), available at http://www.nhc.org/media/documents/somethings_gotta_give.pdf.

32 Alan Berube, Elizabeth Deakin, and Steven Raphael, "Socioeconomic Differences in Household Automobile Ownership Rates: Implications for Evacuation Policy" (Berkeley, CA: University of California at Berkeley, 2006), available at http://socrates.berkeley.edu/~raphael/BerubeDeakenRaphael.pdf.

33 Elizabeth Kneebone, "Job Sprawl Stalls: The Great Recession and Metropolitan Employment Location" (Washington: Brookings Institution, 2013), available at http://www.brookings.edu/research/reports/2013/04/18-job-sprawl-kneebone.

34 Bureau of the Census, *Commuting in the United States: 2009* (U.S. Department of Commerce, 2011), available at http://www.census.gov/prod/2011pubs/acs-15.pdf.

35 Adie Tomer and others, "Missed Opportunity: Transit and Jobs in Metropolitan America" (Washington: Brookings Institution, 2011), available at http://www.brookings.edu/research/reports/2011/05/12-jobs-and-transit.

36 Carrier Werner, "The Older Population: 2010" (Washington: U.S. Department of Commerce, 2011), available at http://www.census.gov/prod/cen2010/briefs/c2010br-09.pdf.

37 Wan He and others, ˝65+ in the United States: 2005" (Washington: U.S. Department of Commerce, 2005).

38 Daniel J. Foley and others, "Driving Life Expectancy of Persons Aged 70 Years and Older in the United States," *American Journal of Public Health* 92 (8) (2002): 1284–1289.

39 Linda Bailey, "Aging Americans: Stranded without Options" (Washington: Surface Transportation Policy Project, 2004).

40 Transportation for America, "Aging in Place, Stuck Without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation" (2012).

41 U.S. PIRG Education Fund and Frontier Group, "A New Direction: Our Changing Relationship with Driving and the Implications for America's Future" (2013).

42 Ibid.

43 Ibid.

44 Federal Highway Administration, *Freight Facts and Figures 2012* (U.S. Department of Transportation, 2012), p. 9, table 2-1.

45 Ibid., p. 14.

46 Ibid.

47 Bureau of the Census, *Projections of the Population and Components of Change for the United States: 2015 to 2060* (U.S. Department of Commerce, 2013), table NP2012-T1.

48 Bureau of the Census, "Growth in Urban Population Outpaces Rest of Nation, Census Bureau Reports," Press release, March 26, 2012, available at http://www.census.gov/newsroom/releases/archives/2010_census/cb12-50.html.

49 Only 4,841 miles of roadways are tolled, which is less than 1 percent of the more than 4 million miles of public roadways within the United States. See Office of Highway Policy Information, "Toll Facility Length, By State – 2010 1/," available at http://www.fhwa.dot.gov/policyinformation/statistics/2010/hm25.cfm (last accessed January 2014).

50 Federal Highway Administration, *Congestion Pricing: A Primer*, p. 1.

51 From a system efficiency standpoint, moderate highway congestion is a good thing. In fact, moderate congestion increases the number of vehicles that a highway can carry within a given period of time since slow speeds reduce the distance between vehicles, allowing more capacity from the same roadway. See Victoria Transport Policy Institute, "Transportation Cost and Benefit Analysis II – Congestion Costs" (2013), available at http://www.vtpi.org/tca/tca0505.pdf.

52 Federal Highway Administration, *Congestion Pricing: A Primer*, p. 1.

53 Congressional Budget Office, "Using Pricing to Reduce Congestion" (2009), p. VIII, available at http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/97xx/doc9750/03-11-congestionpricing.pdf.

54 91 Express Lanes, "General Information Overview," available at http://www.91expresslanes.com/overview.asp (last accessed January 2014).

55 U.S. Department of Transportation, *Innovation Wave: An Update on the Burgeoning Private Sector Role in U.S. Highway and Transit Infrastructure* (2008), available at http://www.fhwa.dot.gov/reports/pppwave/ppp_innovation_wave.pdf.

56 Orange County Transportation Authority, "Pave it Forward: 91 Express Lanes Fiscal Year 2011-12 Annual Report" (2012), available at http://www.octa.net/pdf/4778_OC_91_EXP_Annual_Report_LR_spds.pdf.

57 Federal Highway Administration, *Congestion Pricing: A Primer*, p. 5.

58 Brian Peteritas, "Inside Los Angeles' Quest to Fix the Nation's Most Congested City," *Governing*, August 2013, available at http://www.governing.com/topics/transportation-infrastructure/gov-inside-los-angeles-quest-to-fight-traffic-congestion.html.

59 Results based on author's calculation from Los Angeles Department of Transportation, "10 Year Summary 2001-2010" (2011), table 1, available at http://ladot.lacity.org/stellent/groups/Departments/@LADOT_Contributor/documents/Contributor_Web_Content/LACITYP_023705.xls.

60 Results based on author's calculation from Los Angeles Almanac, "General Population By City: Los Angeles County, 1960 - 2000, U.S. Census," available at http://www.laalmanac.com/population/po27.htm (last accessed November 2013); Bureau of the Census, *Statistical Abstract of the United States: 2012* (U.S. Department of Commerce, 2012), table 20.

61 Bureau of the Census, "Growth in Urban Population Outpaces Rest of Nation, Census Bureau Reports."

62 California Legislative Analyst's Office, "Proposition 1B: Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006," available at http://www.lao.ca.gov/ballot/2006/1B_11_2006.htm (last accessed November 2013).

63 Peteritas, "Inside Los Angeles' Quest to Fix the Nation's Most Congested City."

64 Ian Lovett, "To Fight Gridlock, Los Angeles Synchronizes Every Red Light," *The New York Times*, April 1, 2013, available at http://www.nytimes.com/2013/04/02/us/to-fight-gridlock-los-angeles-synchronizes-every-red-light.html.

65 Los Angeles Department of Transportation, "Signal Synchronization," available at http://ladot.lacity.org/WhatWeDo/Operations/SignalSynchronization/index.htm (last accessed November 2013).

66 Lovett, "To Fight Gridlock, Los Angeles Synchronizes Every Red Light."

67 Federal Transit Administration, "Operating Speed, LADOT Transit Priority System, Service Quality," available at http://www.fta.dot.gov/12351_4305.html (last accessed November 2013).

68 Office of the Under Secretary for Policy, *DOT Strategic Plan 2012-2016*, p. 46.

69 Ibid., p. 49.

70 Federal Highway Administration, *Our Nation's Highways 2011*, p. 30, figure 4-6.

71 Office of the Under Secretary for Policy, *DOT Strategic Plan 2012-2016*, p. 46.

72 Federal Highway Administration, *Traffic Congestion and Reliability: Linking Problems and Solutions* (U.S. Department of Transportation, 2004), p. ES-6, figure ES-4.

73 William L. Eisele and others, "Estimating Urban Freight Congestion Costs: Methodologies, Measures, and Applications" (Washington: Transportation Research Board, 2013).

74 Ibid.

75 Federal Highway Administration, *Freight Facts and Figures 2012*, p. 9, table 2-1.

76 Ibid.

77 Berube, Deakin, and Raphael, "Socioeconomic Differences in Household Automobile Ownership Rates."

78 Federal Highway Administration, "Transportation Performance Management: What is TPM," available at https://www.fhwa.dot.gov/tpm/about/tpm.cfm (last accessed January 2014).

79 William J. Mallett, "Metropolitan Transportation Planning" (Washington: Congressional Research Service, 2010), available at http://www.fas.org/sgp/crs/misc/R41068.pdf.

80 Federal Highway Administration, *Travel Time Reliability: Making it There On Time, Every Time* (U.S. Department of Transportation, 2006).

81 Tim Lomax and David Schrank, "Developing a Total Travel Time Performance Measure: A Concept Paper" (College Station, TX: Texas Transportation Institute, 2010), available at d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/TTI-2010-7.pdf.

82 Victoria Transportation Policy Institute, "Roadway Connectivity: Creating More Connected Roadway and Pathway Networks" (2012), available at http://www.vtpi.org/tdm/tdm116.htm.

83 Federal Highway Administration, "Flexibility in Highway Design, Chapter 3: Functional Classification," available at http://www.fhwa.dot.gov/environment/publications/flexibility/ch03.cfm (last accessed February 2014).

84 Sacramento Area Council of Governments, "Metropolitan Transportation Plan/Sustainable Communities Strategy" (2012).

85 Ibid.

86 Ibid.

87 Ibid.

88 Ibid.

89 Office of the Under Secretary for Policy, *DOT Strategic Plan 2012-2016*, p. 46.

90 Jed Kolko, "Making the Most of Transit: Density, Employment Growth, and Ridership Around New Stations" (Sacramento, CA: Public Policy Institute of California, 2011), available at http://www.ppic.org/content/pubs/report/r_211jkr.pdf.

91 Todd Litman and Rowan Steele, "Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior" (Victoria, British Columbia: Victoria Transportation Policy Institute, 2013), available at http://www.vtpi.org/landtravel.pdf.

92 Ibid.

93 Center for Transit-Oriented Development, "The Affordability Index Toolbox."

94 Davis, Diegel, and Boundy, "Transportation Energy Databook," p. 10-16, table 10-12.

95 San Diego Association of Governments, "The Regional Comprehensive Plan: Establishing a Baseline for Monitoring Performance" (2006).

96 Ibid.

97 Ibid.

98 San Diego Association of Governments, "TransNet Smart Growth Incentives Program," available at http://www.sandag.org/index.asp?projectid=340&fuseaction=projects.detail (last accessed January 2014).

99 Bureau of the Census, *Commuting in the United States 2009*, p. 2, table 1.

100 Transportation Research Board, "Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions" (2009).

101 Ibid.

102 Ibid.

103 Federal Highway Administration, "Transportation and Land Use," available at http://www.fhwa.dot.gov/livability/fact_sheets/transandlanduse.pdf (last accessed December 2013).

104 U.S. Environmental Protection Agency, "Sources of Greenhouse Gas Emissions," available at http://www.epa.gov/climatechange/ghgemissions/sources/transportation.html (last accessed December 2013).

105 Ibid.

106 Bureau of the Census, *Commuting in the United States 2009*, p. 2, table 1.

107 Metro, "2035 Regional Transportation Plan" (2010), available at http://library.oregonmetro.gov/files//2035_rtp_final_document_as_submitted_and_approved_by_dlcd_usdot_web.pdf.

108 Ibid.

109 Ibid.

110 National Highway Traffic Safety Administration, "Fatality Analysis Reporting System (FARS) Encyclopedia," available at http://www-fars.nhtsa.dot.gov/Main/index.aspx (last accessed January 2014).

111 Michelle Ernst and Lilly Shoup, "Dangerous by Design: Solving the Epidemic of Preventable Pedestrian Deaths (And Making Great Neighborhoods)" (Washington: Transportation for America, 2009), available at http://www.transact.org/PDFs/2009-11-09-Dangerous%20by%20Design.pdf.

112 National Highway Traffic Safety Administration, "Fatality Analysis Reporting System (FARS) Encyclopedia."

113 Federal Highway Administration, "Bridges and Structures," available at http://www.fhwa.dot.gov/bridge/deficient.cfm (last accessed December 2013).

114 Transportation for America, "The Fix We're In For: The State of Our Nation's Bridges 2013" (2013).

115 Karim Chatti and Imen Zaabar, "Estimating the Effects of Pavement Condition on Vehicle Operating Costs" (Washington: Transportation Research Board of the National Academies, 2012), available at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_720.pdf.

116 Federal Transit Administration, *2010 National State of Good Repair Estimate* (U.S. Department of Transportation, 2010), p. 1.

117 PLANiTulsa, "Tulsa Comprehensive Plan: Transportation" (2010), available at http://www.planitulsa.org/files/tulsa-comp-plan-Transpo-062910.pdf.

118 PLANiTulsa, "Tulsa Guiding Principles" (2009), available at http://www.planitulsa.org/files/Guiding%20Principles_021209.pdf.

119 PLANiTulsa, "Scenario Indicators," http://www.planitulsa.org/whichwaytulsa/indicators (last accessed October 2013).

120 PLANiTulsa, "Additional Scenario Indicators" (2009), available at http://www.planitulsa.org/files/planitulsa-additional-indicators-50909_0.ppt.

121 PLANiTulsa, "Tulsa Comprehensive Plan: Transportation."

122 Ibid.

123 Puget Sound Regional Council, "Transportation 2040: toward a sustainable transportation system" (2010), available at http://www.psrc.org/transportation/t2040/t2040-pubs/final-draft-transportation-2040.

124 Ibid.

125 City of Seattle, "City of Seattle Department of Transportation Transit Master Plan Final Summary Report" (2012), available at http://www.seattle.gov/transportation/docs/tmp/final/TMPFinalSummaryReportandAppendices.pdf.

126 City of Seattle, "3 Corridors" (2012), available at http://www.seattle.gov/transportation/docs/tmp/TMP%20Ch3%20Corridors.pdf.

127 City of Seattle, "City of Seattle Department of Transportation Transit Master Plan Final Summary Report."

128 Ibid.

129 Ibid.

130 Puget Sound Regional Council, "Appendix F: Scorecard Report" (2013), available at http://www.psrc.org/assets/9403/PrioritizationScorecard20130807.pdf.

131 Ibid.

132 Based on author's calculation from data provided by the U.S. Department of Transportation. See U.S. Department of Transportation, "TIGER Grants," available at http://www.dot.gov/tiger (last accessed January 2014).

133 City of Tucson Department of Transportation, "Tucson Modern Streetcar Project TIGER Application" (2009), available at http://www.tucsonstreetcar.com/pdf/tiger-application_web.pdf.

134 Ibid.

135 Ibid.

136 U.S. Department of Transportation, *Transportation Investments Generating Economic Recovery (TIGER) Grants* (2010), available at http://www.dot.gov/sites/dot.dev/files/docs/Tiger_I_Awards.pdf.

137 Arizona State Legislature, "Use and distribution of vehicle, user, and gasoline and diesel tax receipts," available at http://www.azleg.gov/FormatDocument.asp?inDoc=/const/9/14.htm (last accessed February 2014).

138 Colorado Department of Transportation, "I-25 North Managed Lanes Extension and Express Bus Project" (2012), available at http://www.coloradodot.info/projects/I25NorthExpressLanes/Documents/North%20I-25%20Managed%20Lanes%20-%20TIGER%20IV%20Application.pdf/view.

139 Ibid.

140 Ibid.

141 Ibid.

142 Ibid.

143 Ibid.

144 Ibid.

145 Ibid.

146 Ramsey County Regional Railroad Authority, "TIGER II Application: Union Depot Multi-Modal Transit Hub" (2010), p. 9.

147 Ramsey County Regional Railroad Authority, "Downtown Saint Paul Station Area Plan" (2010), available at http://www.stpaul.gov/DocumentCenter/Home/View/12184.

148 Ramsey County Regional Railroad Authority, "TIGER II Application," p. 25.

149 Ibid., p. 2.

150 Michael L. Anderson, "Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion" Working Paper 18757 (National Bureau of Economic Research, 2013).

151 Kurt Streeter, "MTA Fails to Reach a Pact," *The Los Angeles Times*, October 13, 2013, available at http://articles.latimes.com/2003/oct/13/local/me-mta13.

152 Streeter, "MTA Fails to Reach a Pact."

153 Anderson, "Subways, Strikes, and Slowdowns."

154 Ibid.

155 Ibid.

156 Ibid.

157 MarshallMcLuhan.com, "McLuhanisms."

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