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# PAS MEMO

# **Smart Transportation Metrics for Smart Growth**

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Business strategists frequently tell us that what you measure is what you get, and it may, in fact, be *all* you get. Choose the wrong metric, and you may create undesirable incentives, leading to unintended consequences; omit a valuable metric and you may completely miss problems in an area that is important to you.

The same principle applies to planning and designing our cities, where we constantly make trade-offs to find the right balance among competing priorities. If we don't measure our performance against all of our goals and values, we may not fully understand the effects of our choices.

Throughout the United States, from Manhattan, New York, to Manhattan Beach, California, our transportation systems have all been designed based not just on what we say we value, but on what we actually measure. In many circumstances, communities have identified values that include prioritizing public transit, walkability, encouraging vibrant neighborhoods, efficient traffic flow, maintaining a good state of repair of our transportation network, and protecting the environment.

Despite these legitimate and sometimes competing goals, localized traffic congestion, measured using a concept known as vehicle Level of Service (LOS), is commonly the item that has the heaviest influence over planning decisions. This practice has resulted in many unintended consequences, including sprawl, less walkability, more vehicle travel, and inefficient public transit, to name a few. Some planners and engineers have even argued that this focus on minimizing localized traffic congestion at intersections has ultimately led to *more* traffic congestion overall, which, ironically, is the one thing that LOS was designed to measure.

While LOS can still be a valuable metric, many communities are supplementing LOS with other important metrics that better capture their community values and allow decision makers to more clearly evaluate tradeoffs between competing priorities. This *PAS Memo* provides more detail about the unintended consequences of over-reliance on LOS; summarizes several alternative or additional emerging metrics; highlights some of the technical challenges with implementing new metrics; and provides three case studies of communities that have recently implemented, or are evaluating, comprehensive changes to the way in which they measure their transportation system performance.

# **Challenges With Reliance on LOS**

The concept of LOS has been used by traffic and transportation engineers for over 50 years to describe operating conditions for automobile travel on existing or planned roads. LOS is most commonly measured using average vehicle delay at an intersection. It is expressed as a letter grade, ranging from LOS A to LOS F, where LOS A represents completely free-flow conditions, LOS E represents capacity conditions, and LOS F represents over-capacity conditions with considerable delay (Table 1, p. 2).

This report-card grading is based on a driver's perspective and the notion that delay is to be minimized. The grading ignores intersection performance from the perspective of other users such as bicyclists and pedestrians. Further, LOS grades below LOS E also represent a low level of utilization, which normally would constitute a poor rating for public infrastructure. Many cities have adopted policies to maintain LOS D or better conditions during peak hours, based on guidance from *A Policy on Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials 2011) and other sources.

LOS can be a very useful and effective metric for designing infrastructure and understanding the consequences *to automobile traffic* of planning and design decisions. However, that is generally the extent of its utility. It does not help to inform us about a number of other factors that may be important to some communities.

If communities have not adopted specific, measurable goals or standards for other values, then the tradeoffs with traffic congestion are never well understood. In fact, LOS can actually be in direct conflict with several other often-stated community values:

 Other Modes. Roadway capacity expansion to minimize vehicle delay can make it more difficult to safely use other modes of travel. Figure 1 (p. 3) illustrates

LOS	Average Control Delay (seconds/vehicle)	Description
А	<u>≤</u> 10.0	Operations with very slight delay, with no approach phase fully utilized.
В	10.1 – 20.0	Operations with slight delay, with occasional full utilization of approach phase.
С	20.1 - 35.0	Operations with moderate delay. Individual cycle failures begin to appear.
D	35.1 – 55.0	Operations with heavier, but frequently tolerable delay. Many vehicles stop and individual cycle failures are noticeable.
E	55.1 - 80.0	Operations with high delay, and frequent cycle failures. Long queues form upstream of intersection.
F	> 80.0	Operation with very high delays and congestion. Volumes vary widely depending on downstream queue conditions.
Source	Highway Capacity Manual Transpo	rtation Research Roard 2000

#### **Table 1. Signalized Intersection LOS Criteria**

the consequences of such expansions: a facility that is much more difficult for pedestrians to cross. And although bicycle lanes could be incorporated into this roadway expansion, bicycling adjacent to multiple lanes of swiftly moving traffic can be quite stressful. The wider roadway under construction in the figure is likely serving only the most serious and able-bodied cyclists. Likewise, attempts to remove auto capacity in favor of other modes, such as bicycle lanes or transit-only lanes, may achieve some community goals, but will frequently result in worse LOS for autos, making such improvements difficult to implement.

- Safety. While there are certainly some safety benefits of reduced traffic congestion and smooth traffic flow, increasing the capacity of roadways often means increasing travel speeds, which can have substantial effects to the severity of collisions. For example, as shown in Figure 2 (p. 3), a pedestrian hit by a motorist traveling at 40 mph is roughly 15 times more likely to die than if the motorist were traveling at 20 mph (Ewing and Dumbaugh 2009). Taken alone, an evaluation of design alternatives based on LOS would not capture the potential safety effects of the options.
- **Open Space.** Widening roads to achieve LOS targets often comes at the expense of adjacent open space.
- Infill Development. Infill development, which is a goal in many communities, tends to be in areas that have more congestion than greenfield development, so the likelihood of exceeding a city's LOS threshold is increased.
- **Cost.** Most communities (and state and federal governments) struggle to fully fund maintenance of their

existing infrastructure. The delay-based letter grading system for LOS implies that a roadway that is substantially under-utilized (i.e., over-built) receives the best possible grade. This type of analysis does not account for the increased cost associated with constructing more capacity than is required. Further, even if private parties are responsible for the capital construction costs as part of development agreements, for example, the local jurisdictions are ultimately responsible for maintaining the facilities. Decisions made solely to achieve a specific LOS target may not adequately account for the increase costs to the local jurisdiction.

# **Emerging Alternative Metrics**

Because LOS does not account for — and actually can be in conflict with — a number of other values that communities may have, several jurisdictions across the U.S. have begun to develop new metrics that can be used instead of, or as supplements to, LOS to better capture their priorities.

# Vehicle Miles Traveled

One of the consequences of over-reliance on LOS is that land development is often less expensive and therefore more desirable in lower-density areas with less traffic congestion and fewer localized intersection LOS problems. Frequently, this is greenfield development. This may reduce a development project's effect on localized intersection congestion, but may have other unintended consequences. For example, auto trips from this lower-density development further from the city center tend to be longer and are more likely by auto since transit options are limited. So, while accomplishing the goal of reduced localized intersection congestion, regional travel facilities that



Figure 1. Aerial photo of intersection widening in California. Courtesy Fehr & Peers.

carry travelers on longer distances tend to become more congested. In addition, more roadway space must be constructed to support lower-density travel patterns, which increases the cost burden on public agencies.

In response to this, some communities are exploring use of vehicle miles traveled (VMT) as a metric to evaluate the performance of the transportation system. VMT includes both the number of vehicle trips generated and the length of those trips. Instead of measuring the performance of specific locations in the system, VMT measures the efficiency of the overall system especially when expressed as VMT per capita or per employee.

Figure 3 (p. 4) illustrates a map prepared by the San Francisco County Transportation Authority indicating locations in San Francisco where VMT rates for retail uses will exceed acceptable ranges as defined by the City (San Francisco County Transportation Authority 2016). Development proposed within these areas would be considered to have environmental impacts, unless other measures such as Travel Demand Management (TDM) were implemented to reduce overall vehicle trip generation. Development in the other areas would not cause environmental traffic impacts because the areas already exhibit low VMT generation.

VMT is not a perfect metric and does not measure all the qualities of the transportation system that jurisdictions may be interested in. One five-mile trip in heavy traffic may not be the same, qualitatively, as one five-mile trip in free-flowing conditions,



Pedestrian Fatality Rates for Collisions at Different Speeds

*Figure 2. Pedestrian fatality rates by vehicle speed. Courtesy Fehr & Peers.* 

for example. Fortunately, VMT does not preclude use of LOS; in fact, many communities are implementing VMT in conjunction with LOS to augment their understanding of the transportation



Figure 3. Retail VMT per capita in San Francisco. Courtesy San Francisco County Transportation Authority.

system and to make more informed decisions. LOS helps communities understand the localized performance of transportation facilities, while VMT helps them understand the efficiency of transporting people and goods from one place to another.

# Safety

Safety is important to all communities and is a key consideration in a jurisdiction's design decisions. In that sense it is not a new or emerging metric. However, it is becoming a greater priority in many jurisdictions, as evidenced through the emergence of "Vision Zero" policies in the U.S. Vision Zero is a concept originally conceived in Sweden in the 1990s that aims to eliminate fatalities and serious injuries on the roadway system, with a particular focus on bicycle and pedestrian safety. Chicago, San Francisco, New York City, Boston, Los Angeles, and many other U.S. cities have recently introduced Vision Zero policies, and many more are considering such moves.

Examples of safety metrics include:

- Collision rates measured over time, perhaps with a • goal of a particular degree of reduction in the rate
- Changes in the land-use context, or an increase in



Figure 4. 20-minute travel area for a location in Sacramento, California. Courtesy Fehr & Peers.

trips, along a roadway such that the volume, mix, or speed of traffic was not anticipated as part of the original roadway design

- Changes in speed differentials between users or modes sharing the same facility, which contributes to collision potential
- Lengths of queues at freeway off-ramps, which may create unsafe conditions when they reach the freeway mainline

VMT can also serve as a proxy for safety based on research indicating the low VMT-generating areas that are designed for a pedestrian environment tend to have fewer and less severe collisions. The California Governor's Office of Planning and Research (OPR) has just released revised proposal for updates to the state's environmental laws with a detailed summary of VMT research related to safety (California Governor's Office of Planning and Research 2016).

#### Access vs. Mobility

When transportation planners think about moving people, they primarily consider two factors: accessibility and mobil-

ity. *Accessibility* in this context refers to the ability of people to reach destinations. *Mobility* refers to the relative ease with which people move through the transportation network, regardless of destination.

In terms of these factors, LOS is fundamentally a measure of mobility, designed to answer the question: How quickly does a vehicle move through a transportation facility, typically an intersection? And it makes sense that moving people with less congestion and delay tends to decrease overall travel times. But measuring mobility through measures of congestion such as LOS does not tell the full story about how much access people have to destinations. For example, is traveling two miles that include a single congested intersection with poor LOS worse than driving through 25 miles of uncongested freeway? Many commuters would prefer the former, with less overall travel time because the origin and destination are closer together, even though there is some congestion on the route.

Accessibility metrics are not as useful at exclusively evaluating transportation infrastructure projects, unless a detailed forecast of the associated land-use changes resulting from infrastructure investment is prepared simultaneously. For example, a new highway may serve to improve accessibility for some trips; however, it could encourage growth to be further from a city center, increasing the length of trips, and ultimately decreasing accessibility. Figure 4 (p. 5) is one of several figures used in an accessibility study in the Sacramento, California, region showing how a given set of land-use and transportation changes would affect the area in which a traveler could access destinations within 20 minutes from a given origin.

# Livability

Livability can mean a number of different things to different people and different communities. There is no single metric that captures "livability," although the general concept is gaining momentum in transportation practice. Clearer definitions have evolved recently, such as the following from the Federal Highway Administration (2016):

Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safer streets and roads.

It will be up to each community to determine what qualities are important in their respective cases. As it relates to transportation, specifically, there is a wide range of criteria that could be identified. A few that have gained some traction recently include:

- Level of Traffic Stress: A methodology developed by the Mineta Transportation Institute at San Jose State University to evaluate how comfortable bicycling is in certain corridors (Mekuria 2012).
- Walkscore: An index that evaluates walking accessibility, the availability of transit and carsharing pods (where applicable), bikeability, and personal security (through crime statistics). These elements combine to formulate a score that can be compared to other locations. Some communities use Walkscore directly (www.walkscore.com) or have developed their own calculation methodology.
- **Public Health:** Many communities are viewing their transportation choices through the lens of public health. Personal security and safety are two key components of public health affected by the transportation system. And options that permit travelers to better move about using active modes, such as bicycling and walking, serve to encourage public health through exercise.

These are just a small handful of metrics related to livability that illustrate the wide range of values and priorities that communities may wish to measure.

#### Technical Considerations for New Metrics

One of the constraints for choosing new metrics is our technical ability to meaningfully and reliably forecast the effects of decisions. Further, sometimes we select metrics that are subjective and qualitative, which can lead to less transparency and controversy. Fortunately, the transportation industry has made substantial progress toward improving its technical capabilities, opening up a wide range of new possibilities for how planners can measure performance.

# Getting Trip Generation Right

Historically, transportation planners and engineers have used relatively static trip generation rates from the *Trip Generation* manual (Institute of Transportation Engineers 2012) or other local sources to forecast vehicle trips from new development projects. These rates are based on surveys conducted across the U.S., but are typically based on lower-density, suburban land uses, and most often are simply multiplied by the size of a particular development (such as square feet, number of employees, etc.). Those forecasts are then used to evaluate the impacts of new development, often resulting in a conclusion that traffic congestion will be worsened.

Under traditional approaches, projects that are higher density, mixed use, and located near high-quality transit service may be forecasted to have the same trip generation characteristics as those located in lower-density areas without access to transit. This represents somewhat of a bias against developments that may, in reality, have lower traffic generation. Fortunately, more recent research, such as that described in a previous <u>PAS Memo</u>, (Walters, Bochner, and Ewing 2013) has presented evidence enabling us to quantify the effects of a number of additional variables, such as density, diversity of uses, distance to transit, and others (sometimes referred to as the 8Ds) in a way that produces much more accurate forecasts of travel behavior and eliminates the bias.

# Quantifying Benefits of TDM

Whether focused on vehicle trip reduction to reduce congestion or lessen VMT, the interest in Transportation Demand Management (TDM) is growing. TDM is an umbrella term that encompasses a wide variety of physical and operational strategies that ultimately serve to better manage our transportation system. TDM measures can include such programmatic elements as enhanced wayfinding, real-time transit information, transit subsidies, and ride-matching services. TDM also includes physical elements aimed at reducing auto travel by generally making travel by other modes more convenient, such as lockers and showers to encourage bicycling, secure bike parking, shuttle services, and reductions in permitted auto parking.

Historically, each of these elements has been challenging to reliably quantify, either individually or in combination with each other, because the range of measures is so broad and their application has been somewhat inconsistent. However, as TDM has become a more essential part of managing growth, particularly in areas where there are constraints to expanding the transportation system, more studies have been conducted to identify TDM effectiveness. For example, the California Air Pollution Control Officers Association (CAPCOA) recently commissioned the study *Quantifying the Effects of Greenhouse Gas Mitigation Measures* (CAPCOA 2010) that examines the effectiveness of a wide variety of measures designed to reduce greenhouse gas emissions, including those associated with TDM. The ability to more accurately forecast the efficacy of TDM measures allows cities to right-size requirements for new developments to achieve specific outcomes with a much higher level of confidence. Further, it allows a better understanding of travel demand, leading to better decisions about where to make investments in the transportation system.

*Quick-Response Tools vs. Detailed Forecasting Models* Some of the metrics that communities may wish to evaluate, such as VMT, can be best measured using complex travel demand forecasting or microsimulation models. While these tools are certainly useful to measure and forecast system performance, they can be cost-prohibitive to develop and not efficient for smaller applications or for quick-response scenario testing.

Fortunately use of alternative metrics that better reflect a community's values does not necessarily require substantial investment in new, complex tools. There are a number of "sketch model"



Figure 5. Seattle 2035: Challenges of Accommodating Growth in Limited Space. Courtesy City of Seattle.

tools on the market that use survey data to quickly give a rough estimate of a number of metrics, such as trip generation, mode share, and trip length/VMT. Examples include <u>CalEEMod</u>, <u>Urban</u>. <u>Footprint</u>, and the <u>ASAP Platform</u>. These sorts of quick-response tools are quite valuable for scenario development and comparison, where a relative comparison is most appropriate.

# **Case Studies**

Several communities have begun to either shift away from LOS altogether as a primary transportation metric or have added other metrics that reflect other priorities, changing the way land use and transportation planning is evaluated. Below are three case studies from the West Coast.

#### Seattle

The City of Seattle is revising its transportation LOS standard to be based on single occupancy vehicle (SOV) mode share rather than intersection delay. Seattle is experiencing very rapid growth. The city has determined that widening arterials is not a practical way of accommodating growth in a mature urban environment. Furthermore, it is not consistent with the overall goals of the comprehensive plan, <u>Seattle 2035</u>, which calls for using the current street right-of-way as efficiently as possible by encouraging forms of travel other than SOV.

The proposal to use mode share as a new way of measuring system performance directly ties to this policy goal, as it focuses on reducing travel that uses the least space-efficient mode. By shifting travel from SOVs to more efficient modes operating on less-congested transportation networks, Seattle is allowing more people to travel in the same amount of space. Figure 5 (p. 7) illustrates the relationship between forecasted growth in the city, the associated increases in travel demand, and the space requirements for different modes of travel that might be needed to accommodate that increased demand.

Seattle's overall strategy of setting future mode-share targets is based on the idea that the city has finite capacity to accommodate growth in SOV travel. The city's system can accommodate the number of SOV trips occurring today, but future growth in SOV travel must be limited to maintain reasonable citywide mobility. This is an important concept because Americans tend to drive large vehicles, much larger in fact than needed to carry a single driver or even a driver and passenger. As demand for road space increases, cities will be faced with making tradeoff decisions about how best to utilize their rights-of-way based on the efficiency of the vehicle type.

Seattle 2035 establishes a standard for allowable SOV trips in the city by setting SOV mode-share targets by geographic sector. These SOV mode-share trip caps serve as a quantitative basis to measure whether the city is meeting its goals, much as the city's volume-to-capacity-based LOS thresholds do today.

Shifting travel from SOVs to more space-efficient modes would expand the transportation capacity of the current system without necessarily increasing the vehicular capacity. To quantify this capacity increase, each of the following modes were compared to an SOV in terms of how much less space would be required:

- **Carpools** Using the Puget Sound Regional Council's estimate that the average carpool carries 2.2 people, the city estimated that carpools take up 55 percent less space than an SOV per person trip.
- **Bicyclists** Using a very conservative assumption that bicycles are roughly one-quarter of the size of a car and only one-quarter of cyclists are using arterial travel lanes (the rest are using existing exclusive facilities, including trails, cycle tracks, and bike lanes or quiet residential streets and greenways), a bicyclist uses an estimated 93 percent less space per person trip.
- **Transit** Based on an estimate that an SOV requires approximately 180 square feet per person, and each bus requires five square feet of space per passenger (Transportation Research Board 2013), the city estimated that transit requires roughly 97 percent less space per person trip than an SOV.
- Walking Because most pedestrian travel occurs outside of arterial travel lanes in existing sidewalks, the city's process assumes that pedestrian travel takes 99.9 per-



Figure 6. Seattle 2035: Space Consumption by Mode. Courtesy City of Seattle.



Figure 7. San Francisco's transportation sustainability program. Courtesy City and County of San Francisco.

cent less space per person trip. (The city does acknowledge that additional pedestrian travel may result in lower capacity for turning vehicles or slightly narrower travel lanes where sidewalks are widened — spread across the entire city, most additional pedestrian travel would have no discernable reduction in street capacity).

Figure 6 (p. 8) summarizes these assumptions and illustrates how lowering the SOV mode share will help the city maintain accessibility and mobility in the future with increased demand but without substantially widening roadways.

# San Francisco

Much like Seattle, the City of San Francisco is experiencing rapid growth. With limited ability to increase roadway capacity for SOVs, the city embarked upon a project to study how to improve the overall efficiency of its transportation system to accommodate expected growth.

Until early 2016, San Francisco used intersection LOS as the primary metric by which it evaluated the performance of road-ways. (It also considered transit volume-to-capacity ratios at

key locations, and on a qualitative level, bicycle and pedestrian circulation as well). However, for reasons outlined above and in response to California's switch toward requiring VMT assessment for environmental review, the city sought to identify a process that better aligned with its existing policies aimed at decreasing auto mode share and improving the bicycle and pedestrian realm. The resulting <u>Transportation Sustainability</u> <u>Program</u> offers a three-pronged approach toward rethinking transportation planning (Figure 7).

Invest: Enhance Transportation to Support Growth. Whichever modes are to accommodate the increased transportation demand in San Francisco, it is clear that a substantial investment in new infrastructure will be necessary. The city determined what level of increases in transit, cycling, and walking would be required to accommodate the majority of growth in transportation demand, and what level of investment would be required to construct and maintain new facilities. It then adopted a Transit Sustainability Fee, which applies to new development in San Francisco, to fund the required investment. Funded projects will increase capacity through new infrastructure, improve efficiency on existing transportation infrastructure, and provide



Figure 8. Los Angeles Mobility Plan 2035. Courtesy Los Angeles Department of City Planning.

a contribution to regional transit, which is essential to San Francisco's vitality.

Align: Modernize Environmental Review. The city recognized the inherent disconnect between its use of LOS to assess transportation impacts and a number of adopted policies that support transit and building at higher densities. After exploring a number of potential alternative metrics, the city settled on VMT per capita as a metric to assess impacts of new development. The city now requires that new development demonstrate that it would generate at least 15 percent less VMT per capita than the existing citywide VMT per capita for a given land-use type, measured using the city's travel demand model. This new metric encourages development in transit-rich areas and supports higher densities that encourage walking and bicycling.

Shift: Encourage Sustainable Travel. The third component of the Transportation Sustainability Project is based on San Francisco's desire to ensure effective TDM measures are core to each project. For those projects that don't meet the 15 percent threshold described above, the city's environmental review process will now call for use of TDM as mitigation to reduce VMT within the threshold. Further, for all projects (even those that do meet the 15 percent reduction threshold), the city has adopted a new TDM ordinance that outlines a menu of TDM measures and an associated number of points (loosely based on the efficacy of each measure at reducing VMT). Based on a proposed development project's proposed parking supply, the city's ordinance will assign a number of points that much be achieved through TDM, and the development will be required to demonstrate that it is including adequate TDM to meet the target set forth by the city.

#### Los Angeles

In a substantial shift away from its 20th century autocentric reputation, Los Angeles is in the process of overhauling its transportation engine to reflect changing community interests and comply with statewide environmental goals. Building on one of the largest transit expansion programs in the country led by LA Metro, the City of Los Angeles reimagined its 15-year-old Transportation Element and created a new Mobility Plan for 2035, also known as LA/2B (Figure 8), to better match the needs and values of a diverse and changing population.

The goals developed for the MP 2035 reflect changing attitudes revealed in a broad outreach and community engagement campaign as well as statewide shifts in legislation around complete streets and climate change. Community goals include:

- Safety First
- World Class Infrastructure
- Access for All Angelenos
- Collaboration, Communication, and Informed Choices
- Clean Environments and Healthy Communities

Performance Metric	Desired Change
Mode Share	Any increase in the peak-period auto mode share would be an undesirable outcome
Transit Boardings	Any increase in the number of daily transit boardings would be a desirable outcome
Vehicle Trips	Any increase in the number of daily vehicle trips would be an undesirable outcome
Vehicle Miles Traveled	Any increase in the total number of vehicle miles traveled citywide would be an undesirable outcome
Vehicle Hours Traveled	Any increase in the total number of vehicle hours traveled citywide would be an undesirable outcome
Accessibility	Any increase in the percent of the city's total population or employment within one-quarter mile of the Bicycle Enhanced Network would be a desirable outcome
Accessionity	Any increase in the percent of the city's total population or employment within one-quarter mile of the Transit Enhanced Network would be a desirable outcome

# Table 2. Mobility Plan 2035 Performance Metrics

Source: Mobility Plan 2035, Los Angeles Department of City Planning.

In response to these new goals, the city recognized the need to change both project evaluation metrics and design standards to achieve the desired outcomes, especially around safety, health, and access goals.

Building on the existing transportation system and overarching goals, the Mobility Plan 2035 established a series of "enhanced networks" to achieve the city's transportation objectives and better connect people walking, cycling, and riding transit. The networks consist of transit, bicycle, and vehicle priority corridors as well as neighborhood and pedestrian street enhancements that prioritize design and operating elements to best serve a particular travel mode. Layered together, they create a complete network of options for any mode of travel throughout the city.

In the environmental review process, analysis was completed using the existing LOS metrics as well as a series of additional performance metrics related to the plan's vision (Table 2) to better reflect the spectrum of community values.

These metrics allowed the city to quantify the benefits associated with the expanded multimodal networks and describe the expected changes in mode share, vehicle travel, and multimodal accessibility.

Additionally, the resulting <u>Complete Streets Design Guide</u> provides a compilation of design concepts and best practices that promote the major tenets of Complete Streets — safety and accessibility. A key innovation in this effort is a shift to design for the "target operating speed" for drivers, not the prevailing or observed speeds, which can work against safety goals for vulnerable roadway users. Ranging from 35 mph for boulevards (previously major arterials) down to five mph for alleys and shared streets, each street designation includes cross section options as well as context-related modifications to the desired operating speed.

#### **Action Steps for Planners**

Given changing priorities in many communities and the availability of new data sources and technical tools, many planners are rethinking how they measure the performance of the transportation system. Here are a few tips for finding the best metric for your community.

# 1. Define community values and recognize trade-offs

Public agencies need goals and objectives that are derived from their community values (i.e., what to avoid, what to protect, what to create, etc.). These goals and objectives should be clearly defined and articulated through their general plans or comprehensive plans. However, when faced with real-world questions, decision makers may discover that some of their well-intentioned goals may compete or conflict. This is not a failure in goal-setting; planning cities is a complex effort. Communities who recognize and acknowledge potential tensions or competing interests in their goals will find it much easier to develop a roadmap for decision makers that reflects public input as to how to resolve those tensions. In the end, tradeoffs need to be recognized and priorities established.

#### 2. Prioritize community values

Once tradeoffs are understood, communities should outline priorities reflecting the relative importance of various values. For example, some communities have identified a goal of reducing traffic congestion and goals supporting an improved pedestrian environment. As noted earlier, projects that increase roadway capacity through widening may degrade the pedestrian environment by increasing pedestrian exposure at intersections, so these goals may be in conflict.

In this example, a community may determine that in certain areas, such as commercial centers, the pedestrian environment should not be compromised to improve traffic flow, but in others, like industrial and warehousing zones, traffic flow and ease of goods movement is a higher priority than a generous sidewalk. Communities that undertake a public and transparent process to prioritize competing interests will have an easier time implementing their plans and measuring their progress.

#### 3. Develop metrics that reflect community values

Given the breadth of new tools and data now available, planners can be much more creative in measuring transportation system performance. New types of data, including satellite imagery, GIS databases, and GPS data; a wealth of new technology to apply that data; and a growing body of research on travel behavior allows planners to measure and predict the effects of community choices on achieving stated goals.

Communities that have clearly articulated goals will have a much easier time developing metrics that support those goals, and will not necessarily have to rely on traditional metrics that may not necessarily reflect their values. Although many communities will certainly find value in traditional metrics, such as LOS, a complete listing of all community values and priorities may allow communities to supplement those traditional metrics with new, creative measures of effectiveness.

#### 4. Measure Performance Regularly

Once a community has defined its goals, identified a roadmap for resolving competing interests, and determined what it wants to measure, the last step is to implement a rigorous and regular process to measure and report on performance. This includes routine measurement, such as an annual report, as well as an evaluation of how various choices (e.g., land use decisions, transportation investment, etc.) would influence the community's ability to achieve its goals as part of the decision-making process.

#### Conclusion

Many communities have found that overreliance on traditional metrics such as LOS has created undesirable secondary effects, such as promoting sprawl and degradation of the pedestrian environment. Several of these communities have developed innovative approaches through use of different metrics to better capture the breadth of values in their community, including, but not exclusively, traffic congestion.

As planners, helping our communities clearly articulate their goals and values and measuring performance against those goals with a full understanding of the trade-offs will help us all plan for and live in communities that are shaped to our needs.

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