Smart Growth America
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on community design

Addressing assumptions and expanding flexibility

Why?

For close to a century, transportation agencies have followed fairly strict guidelines and formulas to maximize the utility of the networks they manage, to meet driver expectations, and to manage risk (as perceived in the past).

Typical engineering standards are built around the objective of moving vehicles quickly through an area, and engineers generally default to using the maximum ends of the ranges in their design standards. This results in the application of the same basic roadway design approach to all of their projects—one-size fits all solutions—whether the project is in a rural area, a small town main street, a transitioning or suburban area, or an urban downtown. This comes from embedded assumptions that faster is better, and wider lanes allow vehicles to travel safely at higher speeds. These standards were developed for a specific purpose when we were building the interstate and national highway system, but many states continue to apply them to all projects regardless of the context.

Assumptions and rigidity built into every aspect of this work have produced overbuilt, costly projects that have huge impacts on accessibility, health, and affordability in communities. Further, they have had negative impacts on the local and regional economy by prioritizing traffic moving through a community rather than bringing economic activity to a corridor.

State DOTs should consider the aspects of the transportation planning process that have become obstacles to cost-effective, common sense designs and solutions. They include predictions around transportation needs for 20-plus years into the future, how models are used and what data they rely on, and rigid design guidelines.

Reconsider design year assumptions

To anticipate future needs, DOTs typically attempt to forecast the future and anticipate what might be necessary over 20 years. Part of the goal of this practice is to avoid having to revisit the same corridor a few years later. The intent behind a 20-year projection is noble—it would be irresponsible to build something we know will be obsolete halfway through its lifecycle. However, overbuilding is wasteful of taxpayer money and harmful to the environment and the adjacent communities. Besides, predicting traffic in 20 years is impossible. We simply do not and cannot know what the transportation needs that far into the future will be, especially with the arrival of new technology and modes that no one predicted even a couple years ago. In 1999, no one thought we would be carrying around small, touch screen computers in our pockets, let alone that each would carry the technology to summon a driver for us. Though we had no way to predict it, ride sharing has had a major impact on transportation. Transportation Network Companies brought 2.6

new vehicle miles on the road for each mile of personal driving removed, and that number was 2.8 before the sharing and carpooling features were introduced.[1]

Relying on 20-year models will often prescribe large, expensive projects that are not yet necessary—and may never be. Such large projects may also induce demand that would not otherwise have occurred, requiring still further investments in the future. Traditional models predict steady growth of vehicle miles traveled (VMT), yet VMT decreased during the 2008 recession, and has largely flattened in recent years. The transportation industry did not anticipate ridesharing, nor can it be sure how autonomous vehicles will impact demand. Rather, planning for what is needed now and addressing today's issues will allow DOTs to do more projects, through smaller improvements, and conserve resources to add enhancements later should it become necessary.

Evaluate how the 4-step model is used

The 4-step travel demand model is a blunt tool and can only measure trips between larger zones. In smaller communities, especially those with an active main street or small downtown, the model would ignore trips within those areas.

State DOTs should reevaluate how they use the 4-step model for future decision-making, especially in more urban areas and small town centers where trips are likely to be shorter. There are alternatives, including more advanced, activity-based models. These are powerful tools and can be extremely effective, but can also be a big undertaking. Another option is to change the way current demand models are used—including the information fed into those models—and how they influence decisions.

It is important to consider the assumptions made within the traditional model. Too often, models include consistent, high levels of growth, as well as assumptions around where people will be living and what their activities will be. Reevaluating these assumptions can allow transportation agencies to think about the interaction between land use and transportation, and run models with different growth and development scenarios. Comparing different scenarios will provide a better understanding of which transportation investments are beneficial regardless of future growth, and which should be reconsidered.

A few options for how to reconsider the 4-step model are below:

1. Run the travel demand model using alternative land use assumptions, i.e. scenario planning, particularly with parcel-level land use scenarios.

   Examples:

   - CommunityViz: Software from City Explained, Inc. for a parcel-based scenario planning analysis.[2]

[1] Schaller Consulting. The New Automobility: Lyft, Uber and the Future of American Cities. July 2018. http://www.schallerconsult.com/rideservices/automobility.pdf

[2] Kimley-Horn and Associates. Scenario Planning and Travel Demand Modeling. 2015 http://ncampo.org/documents/Toolkits_20130515-1515_Padgett.pdf

- DelDOT and SSTI's Land Use and Transportation Scenario Analysis and Microsimulation (LUTSAM) Tool enables model walking and biking trips and speed scenario analyses. LUTSAM can be used to improve the current 4-step and advanced travel demand models to work at the parcel and building level within the study area.[3]

2. Use an integrated transportation and land use model.

   Examples:

   - Oregon DOT built its Statewide Integrated Model (SWIM) as a cost effective decision making tool, and to evaluate the economic impacts of bottlenecks and inadequate pavement and it could be invaluable in understanding the effects of new technologies like autonomous vehicles and transportation networking companies.[4]
   - NCHRP Synthesis 520: Integrated Transportation and Land Use Models presents information on how select agencies are using sketch planning models and advanced behavioral models to support decision-making. The synthesis describes the performance of these models and the basic principles of land use/transport integration.[5]

3. Consider using an activity-based model, which are generally as useful anywhere the 4-step model would apply. They would also account for shorter trips and would recognize how those trips were made (i.e. walking trips), making them much more effective in a town context.

   Examples:

   - Sacramento Activity-Based Travel Simulation Model[6]
     - Individualized modeling—better accounts for demographic factors (e.g. age, income)
     - Models full-day activity and travel
     - All travel, not just travel to/from home is traceable—models "tours" = chain of trips beginning or ending at home.
     - Used for:
       - Region-wide and subarea estimates of travel: VMT, congestion, and travel by different modes

[3] State Smart Transportation Initiative and Delaware Department of Transportation. Land Use and Transportation Scenario Analysis and Microsimulation (LUTSAM) Tool. June 2012. https://www.ssti.us/2012/06/lutsam/

[4] State Smart Transportation Initiative. Mainstreaming transportation and land use modeling within Oregon DOT. February 2018. https://www.ssti.us/2018/02/mainstreaming-transportation-and-land-use-modeling-within-oregon-dot/

[5] National Cooperative Highway Research Program. Integrated Transportation and Land Use Models. 2018. https://www.nap.edu/catalog/25194/integrated-transportation-and-land-use-models

[6] SACOG's Regional Travel Demand Model Program. March 2014. http://www.sacog.org/sites/main/files/file-attachments/plnrscmte_sacog_travel_model_wkshp_27mar2014.pdf

        - Equity/environmental justice analysis
        - Air quality analysis
        - SB375 GHG analysis
    - Data inputs:
        - Population
        - Land use
        - Transportation network
- DRCOG Focus Travel Model[7][8]
    - Activity-based model; based on Sacramento's activity based model
    - Forecasts individual travel based on personal and travel-related characteristics
    - Compared to 4-step model, includes more:
        - Individual characteristics,
        - Household composition detail
        - More realistic travel purposes (work, school, shop, escort children, etc.)
    - Does not model vehicle type, non-motorized assignment
    - Data inputs:
        - Job location
        - Household location
        - Demographics
        - Road network and traffic counts
        - Transit network and frequencies
- Review of MPOs using activity-based travel models from the Metropolitan Washington Council of Governments/National Capital Region Transportation Planning Board. [9]

Address design assumptions and rigidity

State DOTs should (1) encourage greater use of design flexibility by making it easier to do design exceptions or incorporating commonly used exceptions into the standards and (2) creating design guidelines that vary by context.

Design guidance and the AASHTO Green Book are critical resources for transportation engineers. However, the options presented in these resources are often 'preferred' or, 'acceptable.' Within those labels is an implication that 'acceptable' is not as safe, or is in

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[7] Denver Retional Council of Governments. Focus Travel Model. Retrieved December 2018. https://drcog.org/services-and-resources/data-maps-and-modeling/travel-modeling/focus-travel-model

[8] Denver Retional Council of Governments. Land Use and Travel Demand Models Presentation to the Institute of Transportation Engineers Colorado/Wyoming Section. December 2014. http://www.cowyite.org/presentations/DRCOG_Models.pdf

[9] Metropolitan Washington Council of Governments/National Capital Region Transportation Planning Board. Status of Activity-Based Models and Dynamic Traffic Assignment at Peer MPOs. October 2015. https://www.mwcog.org/file.aspx?D=4I4c3V5tz1NX%2FJ1mRm8ngNOP2IR2IIINP0s86mxTxP4%3D&A=bwpDgpuaidJbqzIA61InNBxuu%2BQ9vpwRkOWn4SIhySU%3D

some way an inadequate solution. Rather than imposing these assumptions, DOTs have an opportunity to promote a different way of thinking. AASHTO's Roadside Design Guide also states, "if including the highest level of roadside design criteria is routinely required in each highway design project—regardless of cost or safety effectiveness—it is likely that system-wide safety may stay static or even may be degraded."

These assumptions, as well as the utilization of LOS standards in the Practical Solution Memo in this series titled *Reevaluating level-of-service*, make it extremely difficult to consider the other needs of the community. Further, design engineers are hesitant to apply for formal exceptions because the process is difficult and punitive—it can impact the time and cost to deliver a project, currently two of the most important metrics for success at many state DOTs.

Even when a practical solutions approach is utilized, a well-defined need and scope during planning may expand into a larger-scale capacity project because staff are hesitant to deviate from roadway design standards. DOTs should encourage designers and engineers to make design decisions based on proven concepts and expand flexibility.

FHWA, AASHTO, and TRB have been working to clarify the flexibility that is available in existing guidelines and regulations between the Green Book, the Roadway Design Guidelines, FHWA rules, and the Highway Safety Manual.

The foreword of AASHTO's Green Book[10] states:

- "This policy is therefore not intended to be a detailed design manual that could supersede the need for application of sound principles by the knowledgeable design professional. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations."
- "Cost-effective design is also emphasized. The goal of cost- effective design is not merely to give priority to the most beneficial individual projects but to provide the most benefits to the highway system of which each project is part."

AASHTO has plans for major revisions to the Green Book over the coming years in a a paradigm shift toward context-sensitive, multimodal, and performance-based design. The newly released 7th Edition includes an introduction that promotes this design approach explicitly. The 8th Edition, which will be developed over the coming years, will include substantial revision to the rest of the chapters in the Green Book to align with performance-based, multimodal, practical design principles.

A more flexible approach must promote predictable vehicular flow and not allow delay or speed performance metrics to be the only measures of success. Rather, people-moving capacity, safety of all modes, and aesthetics are important outcomes in the urban context. With less additional right-of-way needed for an urban project, costs will be lower and the project will move forward faster to provide on the ground results.

To design a project solution that meets multiple, vague, and conflicting goals, the design guidance will need to be flexible on how to maximize safety, health, and utility to all users

[10] American Association of State Highway and Transportation Officials. A Policy on Geometric Design of Highways and Streets, 7th Edition. 2018. https://store.transportation.org/item/collectiondetail/180

based on flexible design speed guidance as well as requirements related to lane, median, sidewalk widths, etc.; distance between signals and mid-block crossings; and, roundabouts and other traffic calming designs and measures.

While this sounds like a reasonable recommendation, this creates tension between a spoken desire for innovative solutions and a reluctance to relax or deviate from the standards in practice. In addition, the processes for submitting design exceptions and design waivers can be onerous. This creates a deterrent to deviating from the standards, particularly for localities with lower capacity.

Strategies to improve the design waiver and design exception processes:

- Integrate common design exceptions into DOT's standards: If certain categories of designs have been proposed and accepted repeatedly, DOTs should integrate them into what is allowable within the standards. This will allow staff to avoid the exception or waiver process every time. This strategy could include collecting data or documentation to provide more confidence that the approaches are "proven" without additional justification moving forward. There may be good design concepts that are not being utilized because the exceptions process is too onerous.
- Change the terminology around the exception process: Terms like "exceptions" and "waivers" come with connotations that may be discouraging staff from using them. They imply that designs that diverge from the standards are suboptimal or problematic, rather than innovative. Simply changing the words used in the process might help change the culture around it.
- Provide guidance on which circumstances likely warrant a waiver/exception: DOTs can help make the waiver/exception processes easier for lower-capacity regions by providing more straightforward guidance or a 'cheat sheet' that breaks down what types of circumstances are likely to require a waiver and what justification will be necessary. This could help make the exception process less intimidating and onerous.

Oregon DOT: Least cost planning

Oregon's least cost planning may provide some guidance and a starting framework.[11] The project called Mosaic provided a planning framework and technical guidance to be able to weigh trade-offs in a qualitative and quantitative manner.[12,13]

States that have changed their design guidance to promote flexibility include: Pennsylvania, Florida, and Kentucky.

TDOT: Multimodal Project Scoping Manual addresses risk and design flexibility

[11] HDR. Least Cost Planning Methodology for ODOT. Retrived December 2018. https://www.hdrinc.com/portfolio/least-cost-planning-methodology-for-odot

[12] Oregon Department of Transportation. Oregon Mosaic: Value and Cost Informed Planning. Retrived December 2018. https://www.oregon.gov/ODOT/Planning/Pages/mosaic.aspx

[13] State Smart Transportation Initiative. Mosaic Value and Cost Informed Planning: Oregon's new tool for least cost planning (webinar). September 2014. https://www.ssti.us/Events/mosaic-value-and-cost-informed-planning-oregons-new-tool-for-least-cost-planning/

The Tennessee Department of Transportation developed a new Multimodal Project Scoping Manual in spring 2018 to support the state's Multimodal Access Policy.[14] The new manual includes a section that explicitly addresses design flexibility, professional judgment, and risk. The manual notes:

> "Designers sometimes express concern about risk when applying design flexibility. Due to these concerns, some designers adhere strictly to their interpretation of established design criteria, sometimes at the expense of providing adequate bicycle and pedestrian facilities. However, strictly adhering to the most conservative design values without considering other relevant factors may not constitute reasonable care on behalf of the designer. Likewise, a designer who deviates from established design guidance is not necessarily negligent, particularly if the designer follows and documents a clear process, using engineering judgment, when dealing with design exceptions, and experimentation.
>
> "A flexible design approach has three key elements: (1) Engineering Judgment, (2) Documentation and (3) Experimentation."

TDOT's manual also provides guidance on each of the three key elements listed, including how to exercise judgment and when and how to consider experimenting with new and emerging design treatments. Risk is a common and intense concern among roadway designer engineers. However, as Tennessee's guidance points out, strict adherence to conservative designs may create the same or more risk than deviating from design standards using appropriate judgment and documentation—a point many state DOT legal divisions echo when consulted directly. TDOT's guidance around risk and flexibility—especially the note about documentation, which greatly reduces risk and helps bring design "exceptions" into mainstream usage—is a great step towards utilizing flexibility to produce the best designs possible. TDOT has also introduced a multimodal Design Deviation Request Form to make the documentation process clearer for staff.

The Governors' Institute on Community Design worked throughout 2017-2018 helping a small group of state departments of transportation question and assess the underlying assumptions that result in giant highway solutions for every transportation problem. This memo is part of a series about the states that are finding success through what's known as practical solutions, a way for transportation departments to meet changing demands and plan, design, construct, operate, and maintain context-sensitive transportation networks that work for all modes of travel.

The Governors' Institute on Community Design, a program of Smart Growth America, helps state leaders address economic development, housing, transportation, and other pressing issues that relate to how communities grow and develop.

[14] Tennessee Department of Transportation. Multimodal Project Scoping Manual. April 2018. https://www.tn.gov/content/dam/tn/tdot/multimodaltransportation/TDOT%20Multimodal%20Project%20Scoping%20Manual.pdf

This work was made possible with the support of the U.S. Environmental Protection Agency and U.S. Department of Transportation and was informed by work supported by Kaiser Permanente. The perspectives expressed in these memos are those of the authors and do not necessarily reflect the view of the funders.