WHAT COUNTS IN MOBILITY

Improving Planning Tools for a Multi-Modal Future

Summary

EMERALD NETWORK

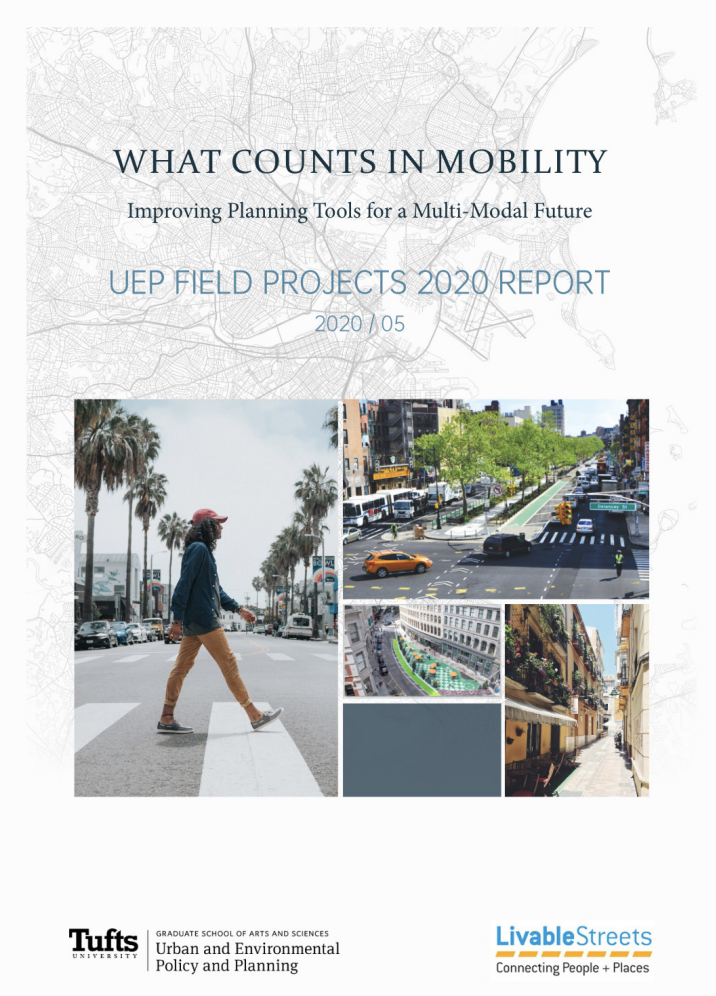
A LivableStreets INITIATIVE

Introduction

Engineers, planners, and politicians rely on travel demand modeling to make important decisions regarding planning, funding, and project prioritization. From bridges to bike lanes, the impact of these decisions last for generations.

Unfortunately, many people outside of transportation engineers do not understand how modeling works or how the results should be interpreted.

Because of this, it is difficult for advocates or community members to push back against a model's results or even to ask clarifying questions.



"What Counts in Mobility" attempts to:

- Demystify the technical aspects of transportation modeling
- Break down the relationship between modeling and decision-making
- Recommend how the Central Transportation Planning Staff's travel demand model and planning process can be improved.

Transportation Modeling 101

Transportation models use mathematical equations to represent and predict human behavior by answering the questions, "where do people go, and how do they get there?"

The outputs of these predictions are extremely influential and inform "every decision about transit schedules, bike lanes, highway width, and bridge height" (pg 6).

In the mid-20th century, travel demand models were developed to help planners predict how various projects would affect vehicular traffic flow in a rapidly expanding interstate highway network.

Many planners and policy makers favor the use of models, particularly the 4-step model, since they produce "hard," quantitative results, lending credibility to various planning decisions.

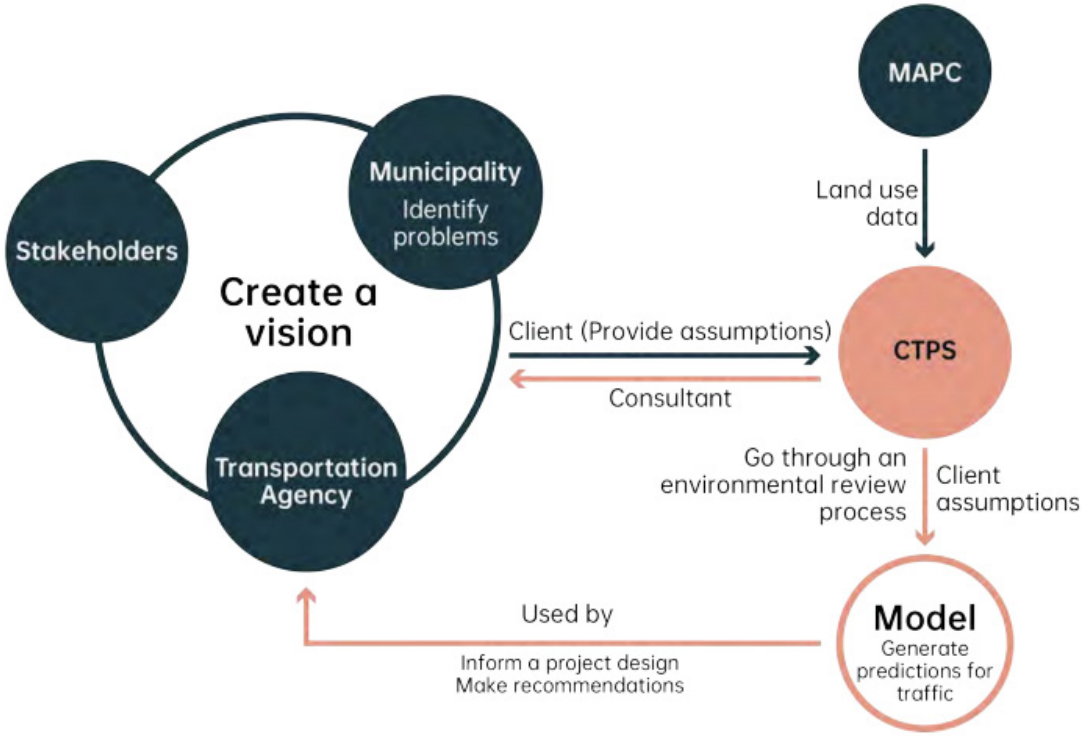
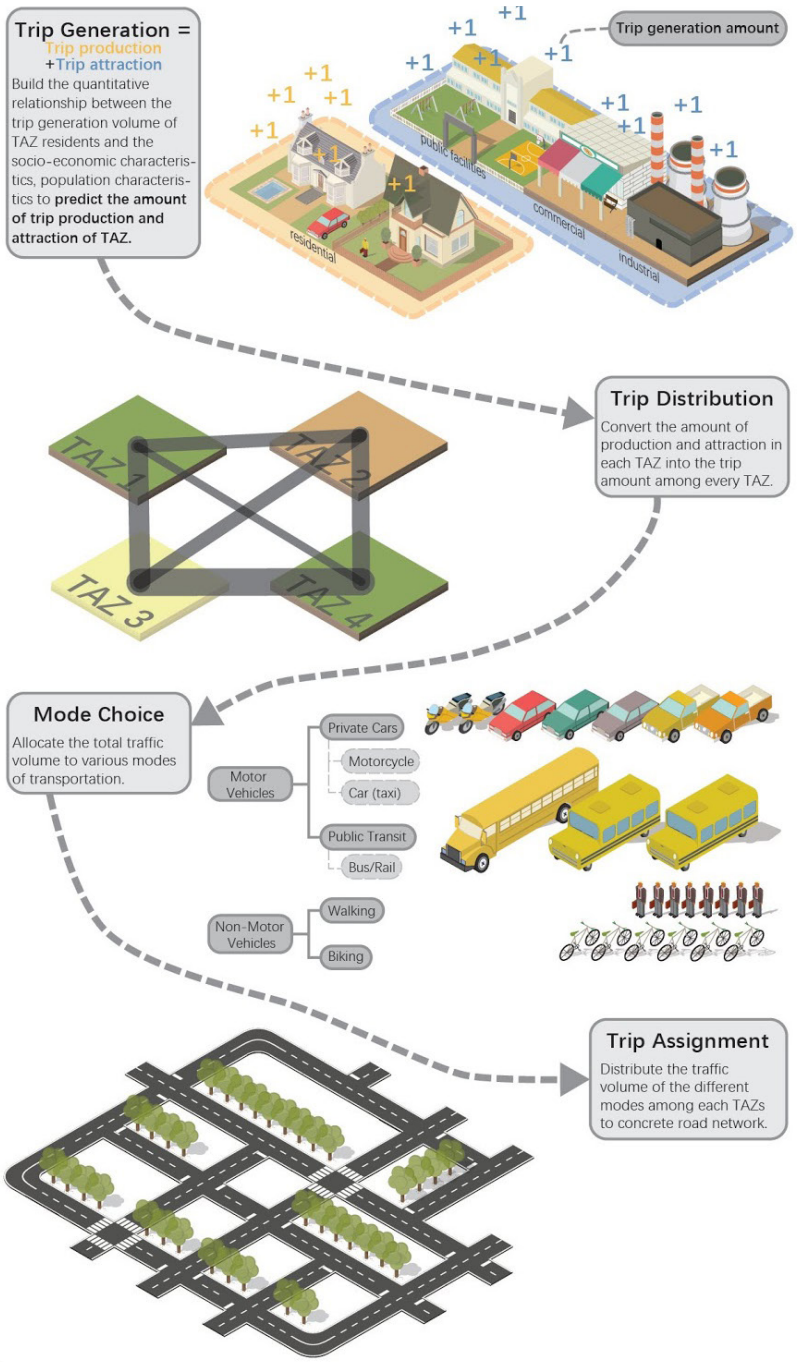


Figure 14. Transportation project decision-making process. *Created by Yingran Li.*



The most widely used version of the model consists of four steps.

Step 1: Trip generation: how many trips does an average household take per day?

This calculation is based on land use, population, and economic data (e.g. income, household size, and car ownership).

Step 2: Trip distribution: where will people go?

Once the model estimates the total number of trips, it then predicts the destinations.

Step 3: Mode split: how will people get there?

In theory the answer could be any transportation mode, although the model struggles to predict anything other than automobile travel. This calculation is based on travel time and cost of the trip.

Step 4: Trip assignment: which routes will people take?

Once everything else has been calculated, the model predicts the routes that people will take to their destinations. This is relatively simple for automobile traffic, but trickier for transit, walking, and biking trips.

In each step of the modeling process, there are inputs that transportation engineers use as the "raw material" that the model eventually turns into its end result.

This raw material includes quantitative data, like demographics or land use statistics.

It also includes assumptions about behavior, future conditions, and people's preferences.

It is important for these data to be accurate, since inaccurate inputs will lead to inaccurate outputs.

Different assumptions leads to much different results. For example, assuming that a potential subway line only runs every 15 minutes will lead to different outputs compared to modelling 5 minute headways.

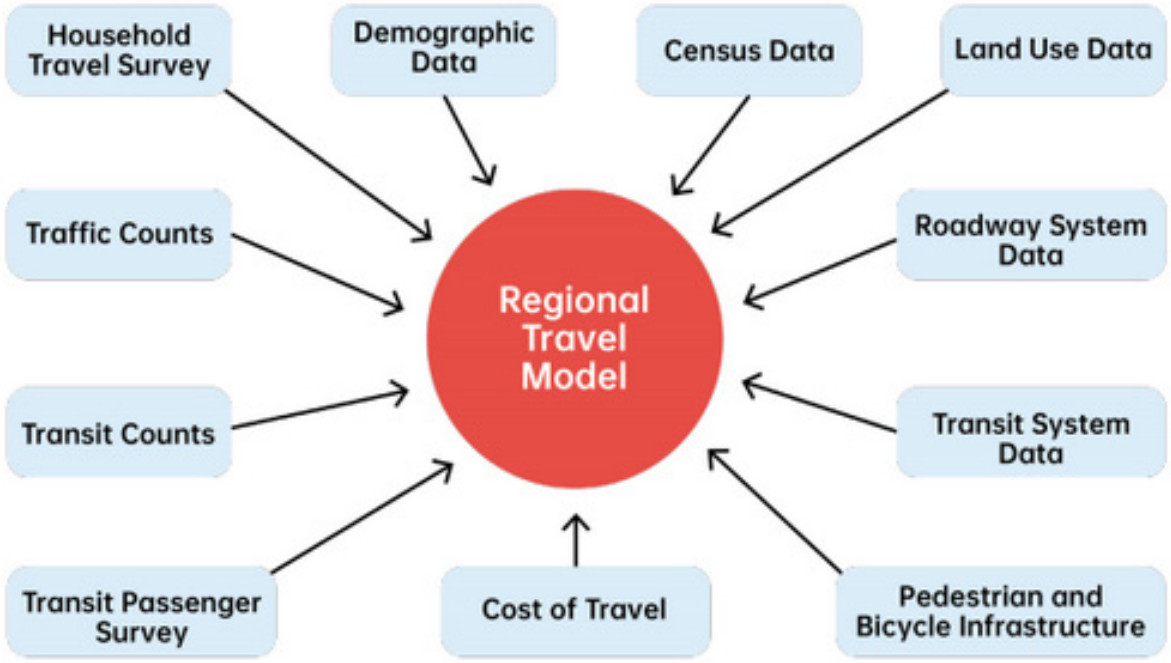
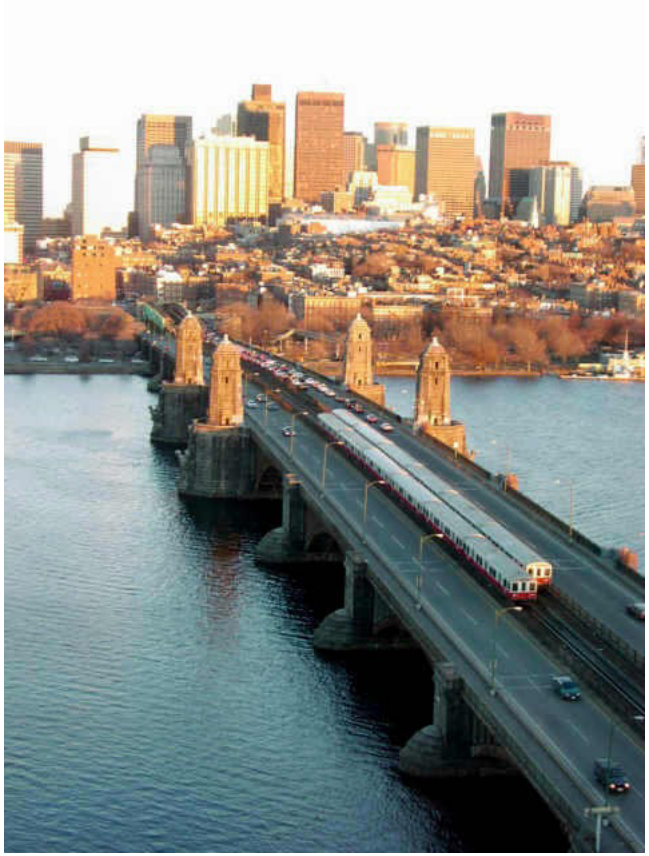


Figure 15: Inputs for the Regional Travel Demand Model. *Adapted from CTPS, Boston Regional MPO's presentation titled: Regional Travel Modeling Conducted by the Boston Region MPO, March 2020 ,25*

Current Challenges

As travel demand models were originally designed to predict highway traffic, they still have a tendency to overestimate automobile traffic while underestimating the demand for other modes of travel. For, example in a study of over 200 projects around the world, researchers found that transportation model results were “highly, systematically, and significantly misleading” (Flyvbjerg et al) (pg 33).



An example closer to home is the Longfellow Bridge rehabilitation project, which was completed in 2017. Per the MassDOT inbound AM and PM anticipated post construction counts and the actual counts, the original projections for rush hour automobile traffic were nearly triple the amount of counts higher than what has been observed since the bridge re-opened (pg 21-22).

This tendency to overestimate automobile traffic does not set up public transit projects to accommodate different modes from the start, since there is no way for the model to accurately estimate their future ridership, and policymakers are often hesitant to back a project that does not seem to be supported by quantitative projections.

The goal with planning is often to change people's behavior and influence the way they travel. Here are some of the challenges that we identified in modeling:

- **The public needs more education about** the model and how it is used.
- **The unclear process of modeling invites skepticism** of political agendas interfering with project prioritization.

> "If new goals are truly important, new planning tools are needed." (pg 36)

- **Its results are often portrayed as a definitive projection of transportation demand**, leaving advocates little space to question the results.
- **It does not predict multiple futures**, including large disturbances like natural disasters or pandemics.
- **Results do not estimate demand under a different set of conditions**, such as a larger or more efficient transit system, or more automobile congestion.
- Complex factors related to socioeconomics, race, and gender like structural racism or perceived safety for mode choice for users that contribute to a household's transportation decisions are not accounted for.

- **Outdated or incomplete data** affects the quality of the model's outputs, as the data is only as good as what it is fed.

- **Not enough opportunity for advocates and the general public to weigh in before the model is run.**

- **Lack of coordination between intended outcomes** for State transportation goals for multimodal transportation alternatives and car-centric projects and model outcomes.

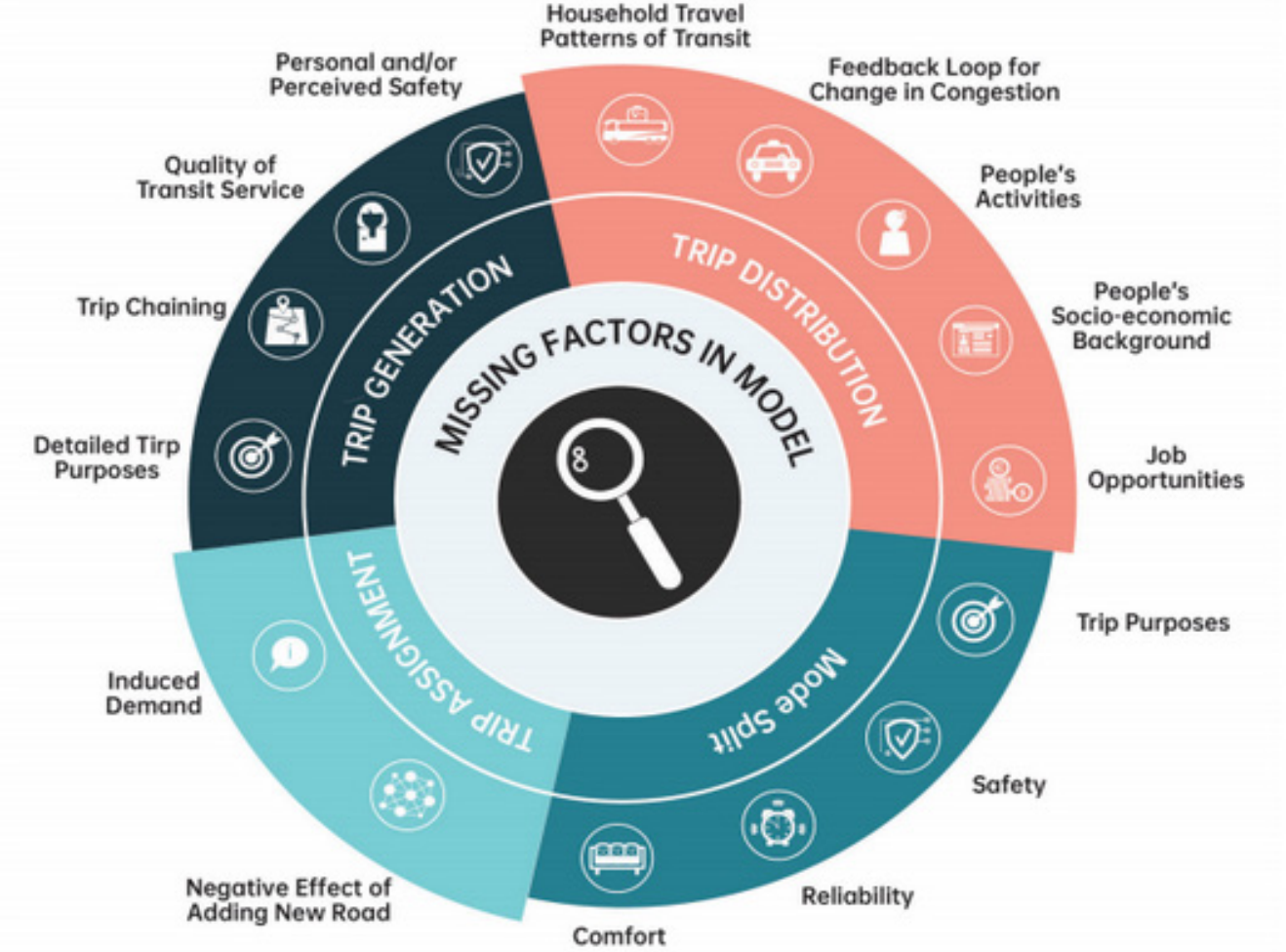
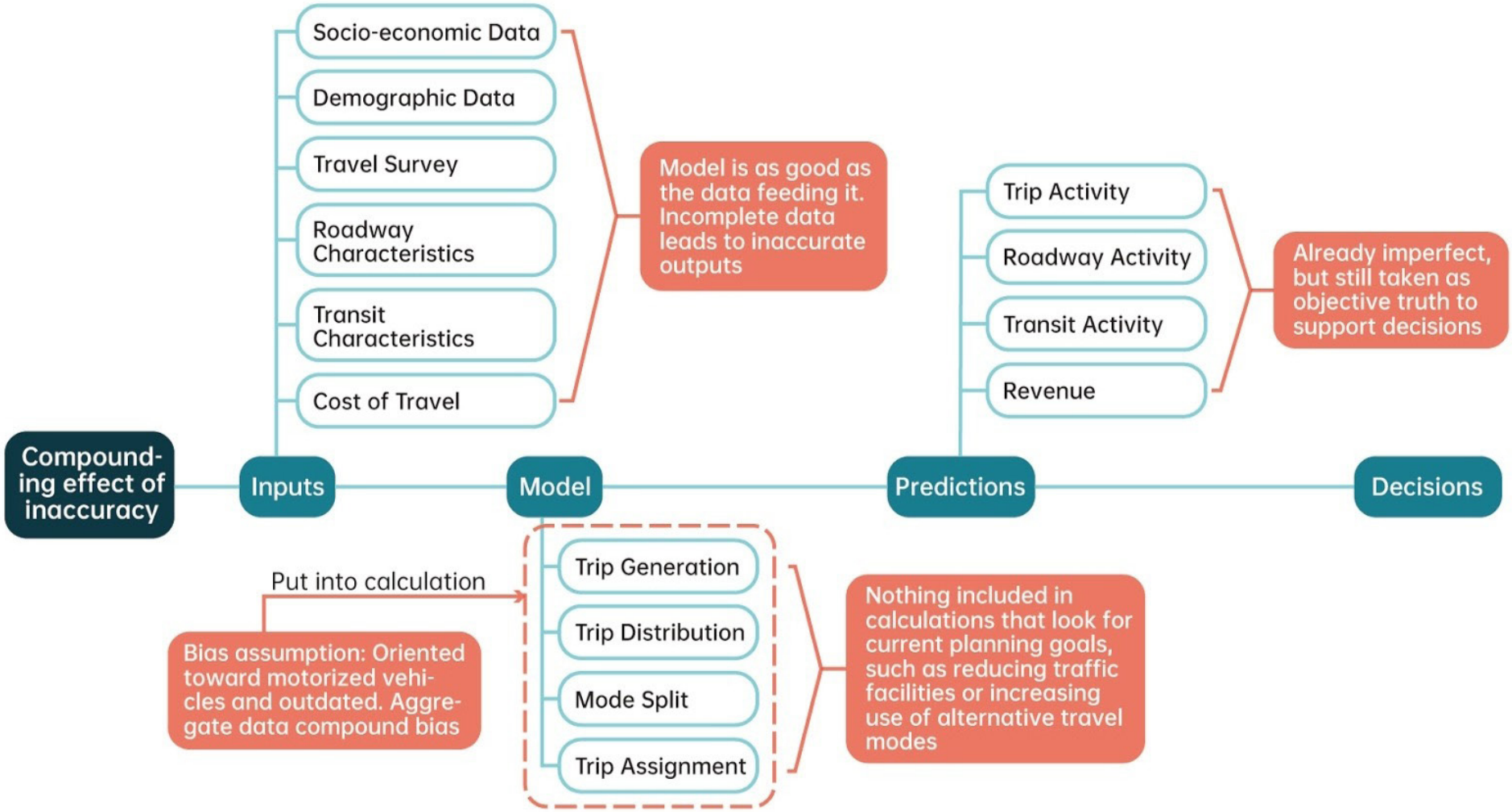


Figure 6. Missing factors in model. *Created by Yingran Li.*


Socio-economic Data
Demographic Data
Travel Survey
Roadway Characteristics
Transit Characteristics
Cost of Travel
Model is as good as the data feeding it. Incomplete data leads to inaccurate outputs
Trip Activity
Roadway Activity
Transit Activity
Revenue
Already imperfect, but still taken as objective truth to support decisions
Compound-ing effect of inaccuracy
Inputs
Model
Predictions
Decisions
Put into calculation
Bias assumption: Oriented toward motorized vehi-cles and outdated. Aggre-gate data compound bias
Trip Generation
Trip Distribution
Mode Split
Trip Assignment
Nothing included in calculations that look for current planning goals, such as reducing traffic facilities or increasing use of alternative travel modes

Recommendations

Despite these challenges in transportation modeling, there are steps that agencies can take to improve the accuracy and transparency of the model and planning process. The table below outlines some of these steps.

Table 4: Challenges and suggestions for CTPS model. *Created by Sarah Saydun.*

Challenges	Suggestions for improvement	Desired outcome and explanation
1. Insufficient data for accurate predictions	Invest in better data collection	Better understanding of how people move, and why, leads to more accurate predictions. Can reduce possibility of over or underpredicting for specific modes.
2. Results are dependent on the quality of inputs	Increase transparency and improve community engagement processes	Community members have a say in which inputs are used, leading to outputs more representative of current travel patterns and community needs.
3. Inability of modeling process to see a different future	Incorporate iterative planning practices	Allows for more course correction and leads to more accurate predictions
4. Limited scope of outputs	Integrate a process to review forecasts: build in room for questioning results, and use feedback loops	Results are not taken at face value, which ultimately improves accuracy of output

In addition to these improvements, the authors suggest that travel demand models and transportation projects at large:

- Have planning agencies like CTPS **undertake studies** to examine travel demand models and planning processes specifically **assessing accuracy and inclusivity**.
- **Increase accessibility regarding outreach**, including but not limited to adopting multilingual outreach, more visuals, and informational displays.
- Incorporate **community feedback** early on, to allow advocates to influence the model's assumptions.
- Adjust the model to **predict multiple futures** aligned with state and municipal transportation goals.
- **Estimate demand under a different set of conditions**, such as a larger or more efficient transit system, or a natural disaster.

Transportation models are developed by people who -- consciously or unconsciously -- embed their own biases, assumptions, and ideas about future conditions.

- Work backwards from a **known transportation goal** to understand what steps are needed to achieve that goal.
- **Incorporate qualitative data points** that influence people's transportation decisions.
- **Diversify the kinds of data it uses, and move away from a purely quantitative approach.**

With updates and improvements to the transportation model and the planning process, these planning tools can meet the needs for an inclusive 21st century, multimodal experience.

How can you engage with the model?

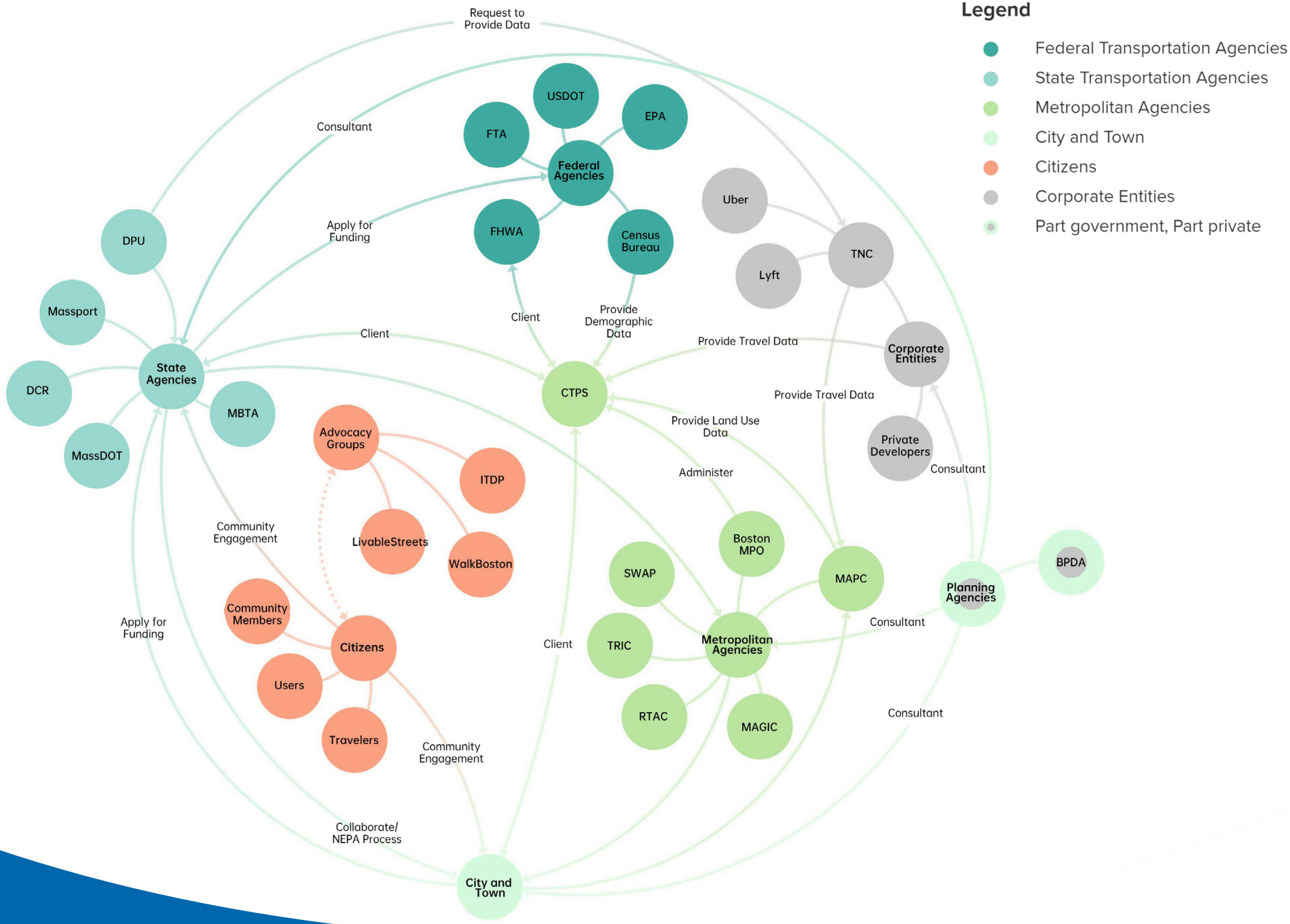
The most effective way to engage with transportation modeling is through asking questions at public meetings and in comment letters. The following table has examples of questions that advocates can ask to dispute or clarify the results of transportation models.

For more questions and definitions of terms, please visit the Appendices in "What Counts in Mobility" (page 70).

Table 5: Questions prepared for advocates. *Created by Sarah Saydun.*

Question to ask:	Reason for asking:
What specific inputs were used when running the model?	If the 2010 census was used instead of the 2020 census, it could produce inaccurate results. Or, if rural land use inputs were used for an urban setting, it could produce inaccurate results. It is important that the most relevant and accurate data are used.
What options did the model account for?	If, for example, road expansion was included as an option, but transit improvement was not, that could yield high traffic volume predictions.
What are you using as your level of service?	If the headway for transit is too long, it can yield low ridership predictions.
Does this reflect what we know of current reality of ridership?	If the forecast is severly over or under current reality, it could be a sign that something went wrong in the modeling process and it needs to be reassessed.

Systems Universe of Massachusetts Planning



References + Acknowledgements

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This brief summary was in collaboration with Tufts UEP and CTPS.

Between 2019 - 2020, LivableStreets had the privilege to work with these students through the Tufts University UEP Fields Project. Through this partnership, we were able to create this report. We would like to thank all who participated in the creation of this report, including our project partners Ambar Johnson (LivableStreets) and Ari Ofsevit (ITDP). We would also like to thank all the transportation practitioners who offered their insights and experiences regarding transportation and travel demand modeling.

We would like to especially thank CTPS, who continues to be an open partner in feedback and collaboration.

Project Partner


Ambar Johnson


Ari Ofsevit

Tufts University | Graduate School of Arts and Sciences | Urban and Environmental Policy and Planning

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The referenced pages refer to "What Counts in Mobility? Improving Planning Tools for a MultiModal Future" which can be found at www.emeraldnetwork.info/resources.

Edited by Ambar Johnson + Lorraine Fryer