Scenario Planning
LITE

Guidance for Scenario Planning

prepared for

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GUIDANCE FOR SCENARIO PLANNING

SCENARIO PLANNING

A process that allows you to **plan for an uncertain future**

First, you scan the current reality, identify things that could change, and assess how they could change. These changes allow you to produce scenarios.

Then, you develop initiatives, projects, and policies that support a preferred scenario, multiple scenarios, or all scenarios

RULES-OF-THUMB

Your Mind is (Mostly) Free — Scenario Planning is mostly about imagining the future collaboratively with others in your organization and in your community. **What do you think could happen, and what would that mean for your region?** Imagining doesn't cost a dime.

Start the Conversation — Every community, no matter how big or small, is full of smart folks. **Public outreach and advisory committees** can be very inexpensive and very high-value — not only can they reveal public preferences and beliefs you may not have anticipated, they also lend your effort credibility, integrity, and approachability in the eyes of your public and stakeholders.

Take Your Time and Ask for Help — Your region, state, and country are full of potential partners that can pool resources or share their advantages with you. Also, long-term planning is cyclical, and you don't need to get all the way there the first time. If you don't have the staff time to spend all at once, do one step for this LRTP and make a plan for what you'll tackle next time.

Scenario Planning LITE

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Questions **Predictive** | What do we think is going to happen?
Normative | How can we make something desirable happen?
Explorative | What could possibly happen?
Your question will likely be a combination of these.

WHAT COULD CHANGE?

ACTORS	FACTORS	SECTORS
People, institutions, and organizations whose decisions impact the future	Societal concepts, constructs, or characteristics	Arenas where actors and factors interact

WEAVING SCENARIOS

SINGLE VARIABLE

A global force (climate change), an external human decision (factory closure), or a sector variable (automated vehicles)

INTERACTIONS

Can be intuitive (how would these trends occur together?), thematic (start with concept and work back), or data-based

OUTCOMES

Predictive | We assume we know what will happen, so we pick actions that will help
Normative | We pick actions that make a desired future more likely, while hedging for others
Explorative | We pick robust actions that will help in the most plausible futures
Generating and prioritizing actions will require input from advisors, partners, and stakeholders

SAMPLE SCENARIOS

ENDURING URBANISM

SEVERE CLIMATE

THE U.S. ENERGY BOOM

TECHTOPIA

GENERAL SLOWDOWN

THE FREE AGENT ECONOMY

TRANSPORTATION ON DEMAND

INDUSTRIAL RENAISSANCE

SILVER AGE

Acknowledgements

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1 Introduction

This is a transformative time in transportation. Rapid, unforeseen, and unpredictable change is occurring, driven by new technologies (automated and connected vehicles), industries (transportation network companies such as Uber and Lyft), and models (mobility as-a-service). In addition, a changing climate promises significant impacts to the transportation system in the coming decades. These factors challenge traditional point-to-point forecasting of transportation and land use metrics. Scenario planning helps Departments of Transportation (DOTs) consider multiple plausible futures, anticipate events and trends, understand risk, gather ideas for proactive organizational response, and help managers break out of their established mental models.

The American Planning Association (APA) defines "scenario planning" as:

> A process to support decision-making that helps urban and rural planners navigate the uncertainty of the future in the short and long term.
>
> A scenario planning process begins by scanning the current reality, projected forecasts, and influential internal and external factors to produce a set of plausible potential futures (i.e., scenarios).
>
> It then develops a series of initiatives, projects, and policies that may help support a preferred scenario, a component of a scenario, multiple scenarios, or all scenarios.
>
> Indicators that a scenario component is likely to occur may be established to alert planners that the likelihood of a scenario becoming a reality is higher, prompting them to take action on appropriate tactics such as allocating funding and moving into implementation.

In academic discussions, Scenario planning is typically broken down into three categories based on the question the study seeks to answer:

- *Predictive* | What do you think is going to happen?

- *Normative* | How can you make something desirable happen?

- *Explorative* | What could possibly happen?

Beyond this trichotomy, a real-world scenario planning effort in DOTs and Metropolitan Planning Organizations (MPOs) will inevitably engage in all three types of forecasting. While prior guidance on Scenario planning in transportation, including NCHRP Report 750: Strategic Issues Facing Transportation ("Foresight"), emphasized the value of explorative Scenario planning, an agency will also use predictive reasoning to construct plausible futures and must apply normative forecasting when identifying strategies to address challenges.

As a relatively new concept in transportation planning, Scenario planning has primarily been embraced by agencies with the resources to take risks and tackle untested, potentially data-intensive approaches.

This research seeks to extend the lessons of these larger-scale studies – in addition to some best practice smaller ones – to agencies with limited staffing, funds, technical expertise, and/or time.

This guidance begins with a summary of prior research and discussion on scenario planning, proceed to review lessons from six best-practice scenario plans, provide advice on each step of the process from conception to ensuring ideal outcomes, and identify some helpful tools for agencies to draw upon when performing scenario planning.

1.1   The Process of Scenario Planning

In general, a Scenario plan does the following:

- *Defines a question* that includes a subject (what you're studying), a horizon (how long into the future you're looking), and an objective (what you're trying to influence or accomplish).

- *Identifies a set of variables* whose behavior will drive change out to the horizon. For each of these, the study typically establishes both a snapshot of the current state and the ongoing trend for the variable based on recent history.

- *Envisions scenarios (or plausible futures)* either by establishing a range of possible progressions for the each of the variables and weaving them together in ways that make sense, or by working with expert advisors to define storylines and snapshots of futures and analyzing how variables would evolve to make each a reality.

- *Achieves productive outcomes*, potentially by identifying a desired future and then identifying strategies and actions that will make it more likely, or alternatively by identifying strategies and actions that will be helpful in the widest range of equally plausible futures. It may also be helpful to set some signposts – points at which it will become clear how the future is playing out.

1.2   Foundational Work

This document provides essential guidance for scenario planning, but more information is available through additional work that has been conducted on the topic. For example, the NCHRP 750 *Foresight Series* contains six reports on major topics that are relevant to the future of transportation systems:

- *Freight* | Explore and plan for the future of freight with a scenario planning toolkit.

- *Climate change* | How to prepare for extreme weather events.

- *Future technology* | Select the right technology investments at the right time.

- *Broader focus on societal sustainability in the transportation system* | How to organize DOTs for a sustainable future.

- *Energy and fuel sources* | Identify and assess strategies for a variety of future energy scenarios.

- *Socio-demographics* | Model and envision the transportation impacts of shifting socio-demographics.

The *Foresight Series* also includes a set of tools called *Workshop in a Box*, which provides a template and draft materials that can be tailored for an individual organization's needs (the Massachusetts Institute of Technology (MIT) has developed a similar set of resources). With these materials in hand, organizations can focus more on analysis and less on logistics.

The Federal Highway Administration (FHWA) has published the *Scenario Planning Guidebook* (2011), and the Federal Transit Administration (FTA) developed scenario planning resources that are tailored to the transportation industry. The two Federal agencies collaborated on the Transportation Planning Capacity Building (TPCB) Scenario Planning Program (*Supporting Performance-Based Planning and Programming through Scenario Planning*), which emphasizes partnerships and external collaboration. These resources provide a helpful starting point for efforts of all sizes.

2   Summary of Best Practices

The team identified case study examples of best practices in scenario planning, which included five MPOs and one DOT:

- The team reviewed the presentations from the Transportation Research Board's scenario planning Conference in Portland, Oregon (August 2016). Some of these efforts were in-progress at the time and have advanced since. We learned about work at the *Delaware Valley Regional Planning Council (DVRPC)*, the *Atlanta Regional Commission (ARC)*, the *Hillsborough MPO*, and Virginia's *VTrans 2040* from the conference materials.

- The Panel suggested the *Macatawa Area Coordinating Council (MACC)* and the *Champaign County Regional Planning Council* as best practices among small and medium-sized MPOs.

The team conducted one-hour phone interviews with each of these study teams in September and October 2018, discussing the logistics of the effort (budget and staffing), the warrant, scope, and mission of the study, the process followed, the tools used, and the lessons learned. The teams generously shared their products and supporting documentation. Excerpts and helpful illustrations from these documents are reproduced throughout Chapters 3 and 4 of this document.

While some of these efforts are more expensive than would be typical for a "lite" approach, the guidance notes ways in which more expensive projects can be streamlined for smaller organizations. Lessons from each case study include:

Atlanta Regional Commission | ARC used the Delphi Method [1] to engage subject matter experts, narrowing a wide range of potential future trends down to a subset of nine. Staff then developed scenarios using professional judgment, considering plausible interactions among the drivers of change. ARC collaborated with the Oregon Department of Transportation (ODOT) to use that agency's Regional Strategic Planning Model (RSPM) to model the impacts of scenarios and to begin building a framework for prioritizing projects.

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[1] The Delphi method solicits the opinions of experts through a series of carefully designed questionnaires interspersed with information and opinion feedback in order to establish a convergence of opinion.

Champaign County Regional Planning Commission | CCRPC has leveraged grant funds (from its State DOT) and "consulting" fees from local governments to develop a robust suite of modeling tools for regional use. These include models for travel demand, land use, equity, emissions, mobility, and health impacts. None of these tools is commercial (i.e., subject to high license fees) and many of them are open source. CCRPC also has developed a creative and robust outreach practice, using a branded bus at public festivals and a live graphic recorder for meetings with stakeholders.

Delaware Valley Regional Planning Commission | DVRPC has convened a "Forces Group" made up of subject matter experts from academia, industry, and non-profit foundations. Forces were directly translated into scenarios – each of the five forces developed and selected by the group formed was the theme of a plausible future. While the specific experts available for DVRPC might be different than for smaller regions, staff noted that there are community sages in all communities – regardless of size, that could both provide deep and useful insight and lend their credibility to the products of a Scenario plan.

Hillsborough Metropolitan Planning Organization | Hillsborough MPO (Tampa, FL) used the MetroQuest public involvement software tool to allow their community to rate the desirability of three development scenarios (where growth in population and employment would occur within the region). In addition, the scenarios were modeled on 12 analytic and geospatial performance measures. These initial steps allowed the development of a "preferred hybrid" scenario and a normative process to identify regional strategies that would both encourage that outcome and serve its anticipated needs.

Macatawa Area Coordinating Council | MACC is a small MPO for a region centered on Holland, Michigan that leveraged partnerships with a consultant looking for test beds and a State DOT looking for local data at a higher level of granularity. As a result, the agency was able to produce in-depth modeling of the transportation, economic, emissions, and health impacts of multiple distributions of development in its region. MACC is interested in a peer exchange of MPOs, on a formal or informal basis, on the topic of scenario planning. They suggested that the Association of Metropolitan Planning Organizations (AMPO) could be a venue for such an exchange.

Commonwealth of Virginia | The Commonwealth of Virginia performs scenario planning at the Office of Intermodal Planning and Investment (OIPI), which has in the past consisted of staff loaned from the Virginia Department of Transportation (VDOT) and other agencies for the duration of Long Range Transportation Plan (LRTP) development cycles. For VTrans 2040, the team consisted of only one or two agency staff, supported heavily by consultants, driving a fairly high cost. The methods used, however, need not be expensive. In this case, they included in-person outreach and stated preference surveys about which types of communities residents envision living in at the horizon year, literature reviews about technological trends, and Excel-based spreadsheet modeling tools.

3 Advice for Scenario Planning

This chapter is designed to help you, the transportation planner or analyst considering a scenario planning approach, get the most from your time, effort, and money. It opens with some rules-of-thumb, then work through the process step-by-step, with observations on each drawn from research and case studies.

3.1 Rules-of-Thumb

Our highest-level rule-of-thumb for scenario planning is: *the most important stuff is free*. Intuition is free. Local knowledge is free. Advice is free. Collaboration is free (though facilitation may not be). Scenario planning projects with unlimited funds still would need to devote significant effort to all these things as the foundation for expensive modeling, data analysis, consulting, etc. If you focus on the intuitive and interpersonal steps that are often free (and fun), you will already be most of the way there. Other rules-of-thumb include:

- *Your Mind Is (Mostly) Free |* You might associate scenario planning with great expense in terms of modeling tools, consultant support, and data, but your mind is free! scenario planning is mostly about imagining the future collaboratively with others in your organization and in your community. What do you think could happen, and what would that mean for your region? Modeling tools can help you to visualize the implications and consequences of those futures; imagining them doesn't cost a dime.

- *You've Got All the Time in the World |* Building a scenario planning process in an organization begins with starting dialogue and succeeds through persistence as new language and values take hold. Long-term planning in MPOs and DOTs is cyclical, and you don't need to get all the way there the first time. If you don't have the staff time to spend on building technical working groups, community outreach, modeling, etc. all at once, do one of those things for this LRTP and plan for what you'll tackle next time. This idea pairs well with open source software – focus on developing in-house competence on one system or package at a time, and over time you can achieve a modeling infrastructure that puts a limited strain on your resources.

- *It's All (Mostly) Local |* Scenario planning is often tied to futurism, which trades in big, global ideas. These concepts may not sing for everyone in your region, because they seem too big or tied to demographic groups and regions that the participants don't identify with. Indeed, some worldwide futurist trends may not touch the lives of your community, but some do. Your region may not be served by Uber or Lyft, but should it be? Sea level rise may not impact your inland region, but it could impact its nearest port and your supply chain. Your regional university is impacted by some of the same trends as your state university. Tying future trends to your neighbors' daily lives can make them relevant, and naming scenarios with pithy local references will make them engaging.

- *Listen to the Wise Owls |* Every community, no matter how big or small, is full of smart people. These can include transportation engineers and planners, but also sheriffs, professors, pastors, librarians, non-profit or business leaders, or simply people who have lived their whole lives in a place. A subset of these wise owls will be ready, willing, and able to talk about the future constructively in a group setting. These perspectives are invaluable, and often available on a volunteer basis to serve on a technical committee. If your community includes experts in fields that drive your community's future development, including them from early days enhances both the quality and the credibility of your study.

- *Start the Conversation* | Common types of outreach include poster sessions at public events (county/state fairs, block parties, the library) and online surveys facilitated by software. Performing this outreach can be very inexpensive and very high-value – not only can it reveal public preferences and beliefs you may not have anticipated, it also lends your effort credibility, integrity, and approachability in the eyes of your public and stakeholders.

- *Brainstorm, but Focus* | When thinking about your area, start with a broad range of local trends (land use, housing, employment, water, energy, agriculture) and global trends (e.g., shared mobility, electrification, automated and connected vehicles, global trade, workforce automation, 3D printing, climate change, urbanization, aging, and mobility as a service). You can then use your advisors, your local knowledge, and your research to focus on a smaller, manageable number of change agents.

- *You're Not in this Alone* | Your region, state, and country are full of potential partners that can pool resources or share their advantages with you. Local high schools, colleges, and universities can contribute students to help you collect data, develop artwork, graphics, and digital content, and connect with the community. Your State DOT can be a source of expertise and funding. Non-profit foundations can provide funds and bring attention and credibility to your efforts.

This section will work through the scenario planning process – identifying variables, defining a question, envisioning scenarios, and achieving outcomes – and offer advice for each phase gleaned from research and best practices. First, however, it should be noted that the process of gaining buy-in and support occurs throughout the phases of a study.

3.1.1 Finding Partners

Forming partnerships can be a source of technical expertise, funding (either directly or through support on grant applications) and labor (particularly for small and medium-sized MPOs), and they can broaden the impact of scenario plans. Perhaps most importantly, partnerships provide opportunities to lend *credibility* to a study, its assumptions, and its conclusions by broadening both its base of insight and the range of people and organizations invested in its success.

The question or questions that a study team wants to answer in scenario planning will almost always be relevant to other organizations with resources to pool or to share. *Specifically, a study team may seek out partners with a mission or stake in the major issues addressed by the scenario plan.* These organizations may include:

- *NCHRP* | NCHRP projects (such as this one) are intended to develop practical, implementable solutions to address the needs of public agencies. To facilitate the implementation of NCHRP research projects, funding is available from the NCHRP Implementation Support Program. MPOs have been specifically encouraged to apply for grants to carry out scenario plans and test this report's recommendations in the real world.

- *Departments of Transportation (DOTs)* | If a study is being carried out by an MPO or municipality, DOTs provide resources such as funding (through State Planning and Research [SP&R] Federal funds or other sources), models and model design expertise, cooperation on grant applications, and data (e.g., population, employment, traffic volume, congestion, and reliability). Note that DOT headquarters and district staff may be able to provide distinct types of support.

- *Other State Agencies |* In addition to the DOT, other agencies with a mission relevant to variables, trends, and scenarios may make valuable partners, including environmental protection agencies, labor and workforce development agencies, energy regulators, statewide planning agencies, health departments emergency management agencies, and economic development administrators.

- *Metropolitan Planning Organizations (MPOs) |* If a study is being carried out by a DOT or municipality, MPOs may be able to support a study with local expertise and credibility and serve as an intermediary between state and local staffs. Under Federal law, MPOs have authority to prioritize investments and may therefore be sources of funding. In many cases, they maintain regional transportation demand models that will be critical for transportation scenario planning studies. One of the case study MPOs directly offers its modeling and outreach services as a consultant to municipalities.

- *Municipalities |* Municipal departments of transportation and public works (DPWs) can provide MPOs and DOTs with access to and understanding of local investment prioritization and project management processes. This insight may be important if a scenario planning process is intended to influence investment priorities. Partnerships with municipal government can also offer credibility with municipal leaders and potentially with the public.

- *Colleges and Universities |* Institutions of higher education can support all public sector study teams with labor (graduate and undergraduate students), expertise and credibility, and funding and grant partnerships. Study teams need not feel limited to working with colleges and universities within their regions – one of the case studies is being conducted on an ongoing basis with the support of a [university transportation center (UTC)](#)[2] at an out-of-state institution.

3.1.2 Attracting Advisors

Input and involvement from stakeholder organizations and individuals is critical for data-driven and strategic decision-making[3]. This section will function as a summary of best practices for organizing future groups of local experts, academics, futurists, legislators, non-profits, and other stakeholders for envisioning and developing a scenario planning approach. If you don't have a committee of knowledgeable advisors already in place, they can be challenging to find. A suggested process:

- *Create the charge for a committee |* Name a committee and give it a purpose, as you will need to sell this to your candidates.

- *Identify your key issues and identify perspectives that matter |* If you spend time to identify key issues, you'll understand the perspectives you might need. For example, if filling manufacturing jobs is a critical part of your future economy, you should consider finding people with manufacturing business strategy and management experience and you may want a person with global trade experience.

- *Identify the people with those perspectives |* Look for people in the executive suite, people who are responsible for thinking about the future of their organization or business. Take advantage of your connections – your neighbors could be excellent advisors, as could professional contacts, longstanding friends of your organization, or members of your boss' professional network. You can

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[2] Each UTC is a consortium of colleges and universities that come together advance U.S. technology and expertise through education, solutions-oriented research and technology transfer, and the exploration and sharing of cutting-edge ideas and approaches. (USDOT)

[3] http://onlinepubs.trb.org/onlinepubs/conferences/2015/performancemeasurement/Grant-PosterSP.pdf

also reach out to non-profits or business groups such as regional development councils or chambers of commerce. In a pinch, you can look for advisors on LinkedIn or corporate/non-profit/institutional websites.

One challenge you may face in developing an advisory panel from the advocacy or private sectors is that these individuals or organizations may bring their own agendas to the table. While some amount of preexisting concern is necessary and desirable for panelists, you may also need to be wary of candidates overly-focused on pre-determined talking points, policy proposals, or lobbying pitches. To mitigate this issue, you may want to consider limiting membership to primary sources (e.g., individual business or non-profit executives) as opposed to secondary ones (e.g., industry lobbyists).

- *Reach out |* Go see the people in their space, this will make them more comfortable and willing to talk. Ask them about the future and test their willingness and ability to have the conversation. If you think they can contribute to your study, sell them on your study's value and the committee charge.

Figure 1 (next page) highlights some stakeholder outreach techniques and efforts, which can be interpreted as a guidance tool for advisor engagement.

FIGURE 1 | PROCESS EXAMPLES FOR FINDING AND ENGAGING ADVISORS

Organization	Why? | What?	Where | How?	Outcome
Florida Department of Transportation (FDOT)	Once their goals and vision were identified, FDOT needed the input from local partners in the public, private, and civic sector to envision ways to achieve these goals and vision.	FDOT collected input from state, regional, and local partners through a State Summit, a 35-member Steering Committee, five regional workshops, local partner meetings, and online comment forms.	With input from stakeholders, FDOT organized their Florida Transportation Plan intro three elements: The *Policy*, *Vision*, and *Implementation Elements*.
Delaware Valley Regional Planning Commission (DVRPC)	DVRPC formed high-level and technical advisory panels to support their most recent LRTP from the private sector, social service agencies, environmental organizations, and other parties, focusing on organizations that have not participated in previous exercises and on those representing environmental justice issues and underserved communities.	Some of the taskforces/committees developed by the DVRPC include: • The Public Participation Task Force which provides citizen access and participation in the regional planning and decision-making process. • The Regional Safety Task Force which encompasses a group of professionals working together to reduce the number of crashes and casualties in the region. • The Transportation Operations Task Force, made up of technical staff representatives from over 35 regional stakeholders. This task force is a forum for agencies to share information on ITS.	The DVRPC's Connections *2040* could not have been completed without the input from regional stakeholders and experts in diverse transportation areas. As such, DVRPC will continue to work with regional stakeholders and the public to make the Plan's vision a reality.

| Organization | Why? | What? | Where | How? | Outcome |
|---|---|---|---|
| **Atlanta Regional Commission (ARC)** | The ARC's SHRP2 scenario development consisted of extensive stakeholder engagement, including a national and regional expert survey to help assist scenario drivers, and a core team Project Steering Committee (PSC) that met throughout the grant term to keep technical aspects of the process on track.

• The PSC included the project's key ARC staff, the Georgia Department of Transportation, FHWA, and consultants.

A Stakeholder Advisory Committee included select members of the ARC Board and committees and important partner organizations from the Atlanta region. | The team surveyed stakeholders including academics and national experts with relevant technical skills. The surveys followed the Delphi Method approach and weight was allocated on diverse subjects/topic areas based on the results. | Stakeholders functioned as advisors to the scenario planning process, by providing feedback pertaining to their fields and expertise. |

3.1.3   Reaching Out

One of the best practice analysts, when asked what advice they would give to someone considering a transportation Scenario plan, said:

> *"If an agency has only $10,000 or $20,000 to spend on scenario planning,*
> *it should spend it talking to the public."*

Our best practice study participants in general cited a wide range of strategies for public engagement. Several attended local fairs, block parties, farmers markets, and other public gatherings with visual aids and hands-on activities to help the attendees contribute to the scenario planning process. One unique and striking example was CCRPC's live visual recorder, a caricature artist who attended focus group meetings and drew participants' thoughts and preferences in real-time, as shown in Figure 2.

FIGURE 2 | REAL-TIME GRAPHIC RECORDING OF A CRRPC OUTREACH EVENT
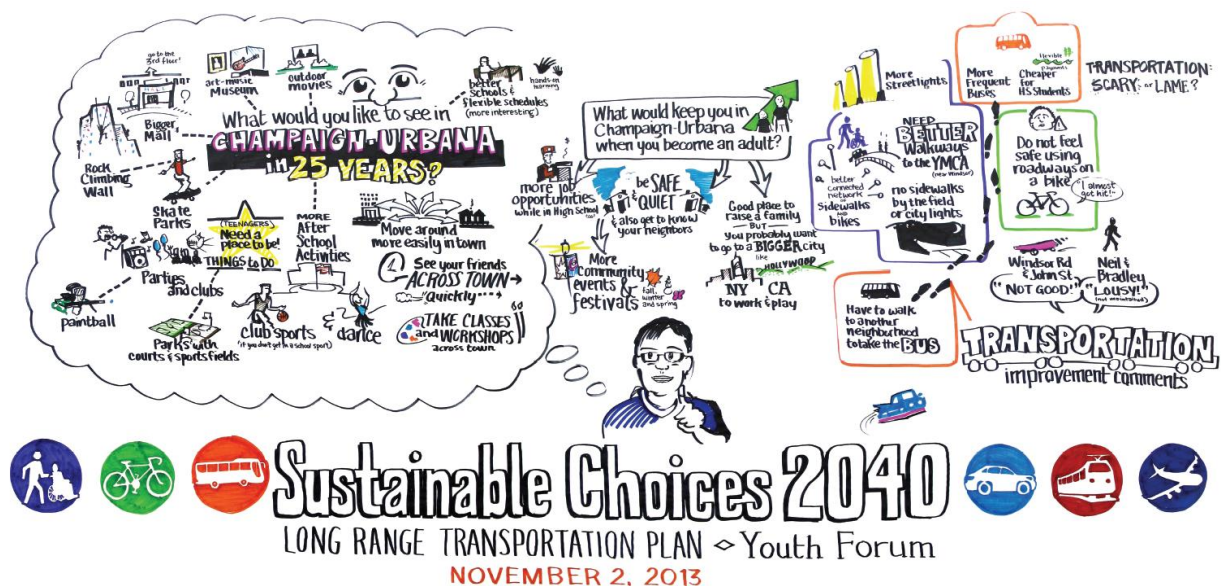
Our best practice study members also discussed the use of CommunityViz and other web-based survey and outreach tools. These are discussed in more detail in Section 4.1.

3.2   Defining a Question

For a scenario plan, a question is defined by a subject, a timescale or horizon, and an objective. For example: "Our objective is to prioritize investment strategies for the upcoming 2050 LRTP for our region" – the study is about the region (subject) and what could influence it by 2050 (timeframe), in order to prioritize investment strategies in an LRTP (objective). A subject may not always be a geographic region writ large – it may be a transit system, a tollway network, or a subsector of the economy and infrastructure (e.g., the statewide freight system).

In academic discussions, scenario planning is typically broken down into three categories based on the question the study seeks to answer:

- *Predictive* | What do you think is going to happen?

- *Normative* | How can you make something desirable happen?

- *Explorative* | What could possibly happen?

In practice, transportation organizations ask questions that combine these broad philosophies: "what if we invested entirely in transit and reduced or eliminated our investment in highway expansions?" or "What if we expanded our urban development boundary?" A fully predictive process might be perceived as lacking imagination, while a fully normative one might be perceived as biased toward a predetermined outcome. On the other hand, a truly explorative process might be perceived as a waste of resources if an organization has access to local and subject matter expertise and insight.

It's important to clearly communicate the question of a study to its partners, advisors, and stakeholders. For example, explorative plans often clarify for stakeholders that "none of our scenarios represent a 'good' or a 'bad' future," as a way of keeping the effort focused on the defined question.

3.3   Identifying Variables

In "An Updated Scenario Typology," Philip W.F. Van Notten et. al.[4] state that variables in scenario planning can be *actors*, *factors*, and *sectors*:

- Actors are people, institutions, or organizations whose actions impact the future.

- Factors are societal concepts, constructs, or characteristics, such as population or climate change.

- Sectors are arenas where actors and factors interact, such as the propagation of automated vehicles.

This section discusses some future variables commonly cited in transportation scenario planning studies. It then expands this discussion into how to make these large-scale trends relevant a local audience.

3.3.1   Commonly-Cited Future Trends

Scenario planning helps organizations address uncertainty in the future. There are many sources of uncertainty. Some are within your control, such as zoning, transportation investments, and roadway improvements. It is more difficult to address factors that are outside the control of planners and decision-makers, such as climate change, technology advancement, or the preferences of citizens. The *NCHRP 750 Foresight Series* identified significant questions pertaining to the future of transportation: *Will DOTs work differently in the future? Will the economy stay global? What is resilient infrastructure and how much does it cost? What if there is not more driving, but vehicle miles traveled (VMT) still rises? Where are the next boomtowns? Will cars*

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[4] P.W.F van Notten et al / Futures 35 (2003) 423-443.

fill up or plug-in? What is the relationship between more senior Americans and transportation? Figure 3 lists other variables identified in *Foresight.*

FIGURE 3 | SIGNIFICANT TRENDS IN THE *NCHRP 750 FORESIGHT SERIES*

Significant Trends in the NCHRP 750 Foresight Series	
Economics	• Measures of economic growth (personal income, unemployment, GDP, etc.) • Wage levels/income inequality • Growth rate in global trade • Growth rate in online retailing • International regulation of trade; growth rate of protectionism • Growth rate in emerging markets • Commodity prices and price volatility levels • Growth rate of domestic manufacturing • Per mile cost of driving • Truck volume trends
Environment and Land Use	• Growth rate of water scarcity • Greenhouse gas emissions/air quality • International regulation of climate change • International regulation of sustainability • Growth rate for "green" demand • Growth of mega cities • Growth of mid-size cities • Housing statistics
Technology	• Printed fabrication technology • Use of wireless sensors on products, vehicles, and infrastructure • Remote working capability • Virtual social networks • Vehicle safety • Adoption of driverless-car technology • These issues can cause significant changes to the transportation system and are largely outside the control of transportation planners
Transportation	• Transit trips • Congestion • Bike/pedestrian trips • Carpooling/car-sharing • VMT growth • Work trips • Auto ownership • Vehicle age/cost

Significant Trends in the NCHRP 750 Foresight Series	
Energy	• United States' dependence on foreign energy sources • Energy prices and energy price volatility • Growth in alternative fuel vehicle technology • Fueling infrastructure • Fuel tax revenue
Demographics	• Aging of United States' population/age structure/dependency ratio • Population growth rate • Population diversity • Labor force size/participation rate • Immigration rate • Fertility rate • Longevity • Household population • Population health
Other	• Growth rate in global security concerns

3.3.2   Making Things Local

One of the best practice study participants noted that when the results of a study were presented to local government stakeholders, they had difficulty seeing how popularly-discussed national and worldwide trends (e.g., electric and autonomous vehicles, the gig economy, and mobility as-a-service) would impact their rural counties and towns. This has challenged the ability of the study to have a lasting impact, as these stakeholders saw the status quo as a "preferred" scenario and chose not to pursue actions and investments recommended by the study team. In order to address this challenge, it may be helpful to reframe "fads" or "buzzwords" around local issues:

• If Uber, Lyft, or other transportation network companies (TNCs) do not operate in a region, what are the consequences of their absence? What would a TNC initiating service mean for the community? TNCs do not always give local governments ample notice before commencing service, so working through these issues in advance through scenario planning could pay off later.

• If stakeholders associate the "gig economy" with Silicon Valley, can you find examples of gig economies operating in suburban, exurban, or rural areas across the country? Are there nearby regions active in promoting different models of labor that will compete with the study region for workers and investment?

• An inland region may find that international shipping will affect supply chains, or in some cases directly impact the local economy. One best practice study for an inland region noted that the warehousing facilities for a major port in a different part of the state were all located locally, with the consequence that the health of that port was tied directly into the inland region's economy and was a key consideration in scenario planning.

In addition to the framing of popular, widespread trends, scenario planning should also consider local variables with special relevance to the study region. DVRPC, for instance, considered the implications of shale energy in Western Pennsylvania under their "US Energy Boom" scenario, while the Atlanta Regional Commission considered the viability of their region's water supply. Not only are these local variables critical drivers of the future but including them signals to residents and stakeholders that a study was done specifically for them, by locals, to benefit their hometown, increasing credibility and hopefully aiding engagement.

3.4 Envisioning Scenarios

Scenarios are built by extending a trend or a combination of trends into the future. Van Notten suggests thinking of scenarios as *intuitive* or *formal*:

- Intuitive scenarios are founded in a qualitative understanding and can be expressed as snapshots or storylines. In some cases, a scenario will begin as an intuitive endpoint and the study team will need to build a path to that endpoint through variables and trends.

- Formal scenarios are built from projections, analytical forecasting, and modeling. This could mean a range of possible degrees of growth in population, employment, economic activity, etc., or the output of a multivariate simulation under differing sets of assumptions or constraints.

The *Foresight Series* introduces several hypothetical scenarios. Rather than following a formal methodology for the scenario generation, the scenarios are organized around combinations, collisions, and interaction of different drivers of change to create interesting and thought-provoking scenarios that help managers break out of their established mental models:

- *Momentum* | Travel grows modestly. Auto safety and travel reliability remain critical concerns. Less federal funding. Rising power of state and local agencies in transportation decision-making.

- *Global Chaos* | Travel slows due to economic crisis. Congestion shrinks. Failure to maintain sustainability of transportation revenue sources. Fuel prices rise. Little infrastructure investment. Deteriorating transportation system.

- *Tech Triumph* | Safety is greatly improved. Transportation's carbon footprint is smaller. Economic growth and self-driving vehicles increase demand for new kinds of transportation infrastructure.

- *Gentle Footprint* | High-speed rail, transit, bicycle, and pedestrian networks are expanded instead of increasing highway capacity. Land use planning redefines transportation investment.

Regardless of whether your scenarios are based on intuition or analysis, they should be made accessible and memorable to the audience. Figure 4 provides an example from the *Florida Transportation Plan Vision Element* of a scenario that has been given a catchy but descriptive name, and has been illustrated with a simulated postcard from someone living in that future. Other scenarios in that document are illustrated with a simulated email and text thread.

FIGURE 4 | SCENARIO FROM FLORIDA TRANSPORTATION PLAN

3.4.1 Differentiating Trends

For each variable, there exists a current trend defined by recent or long-term history. These trends can be analytical (e.g., growth in population, employment, or trade over the past ten years) or conceptual (e.g., the recent development and adoption of new electric vehicle technology). In order to make sense of the wide range of possibilities, it may be helpful to think of three possibilities for each trend:

- *The trend accelerates* | An upward trend runs away positively or a downward trend negatively.

- *The trend maintains* | The trend changes as it is currently changing to the horizon year.

- *The trend plateaus, decelerates, or reverses* | Change in a variable becomes neutral or begins to change in the opposite of the historical manner.

For example: in many American urban areas over the past ten years, young adults have relocated to dense urban areas and inner suburbs. This has caused a gradual shift in population from exterior suburbs and rural areas to urban ones. An acceleration of this trend would see a precipitous drop in population in less-dense areas as residents of all ages chased urban employment opportunities, cultural resources, and proximity to family already living there. A maintenance of the trend would see some young people moving

back to less-dense areas as they age in search of living space, lower costs, or simply a change of pace. A plateau or reverse of the trend could see urban areas failing to meet the demand for housing, causing price spikes and a mass exodus to less-dense areas similar in scale to the first half of the 20th Century.

3.4.2 Weaving Plausible Futures

Most of the best practice study members cited some amount of intuition in building scenarios from expertise and data. The types of scenarios they produced, however, varied widely. They included:

- Scenarios based around *a single variable, trend, or event*. This could be a global force such as climate change/sea level rise/extreme weather, an external human decision such as a factory closure or high-speed rail project, or a sector variable such as automated/connected vehicles or rapid development of regional energy production.

- Scenarios based around *multiple variables interacting*. Generally, these interactions were intuitive for the best practice study members, but they could also be informed by data-based analysis to identify correlation among quantitative trends.

- Scenarios based around *land use patterns*. In these studies, a constant assumption of population and employment growth is distributed multiple ways around a region and the impacts on traffic, tax revenue, school crowding, and other financial and other quality of life and fiscal health concerns.

- *Financial scenarios*. In these studies, the scenarios consist of revenue, cost, and investment distribution conditions, with impacts falling first on program sizes and project selection and then on impacts to the community. Financial scenarios could be low-medium-high assumptions of revenue, availability of whole sources of revenue, cost inflation, or investment decisions.

3.4.3 Predicting Impacts

Helpful as it may be to brainstorm and forecast the futures that could plausibly be approaching, it is even more helpful to make sensible and insightful guesses at how those futures will impact the subject of a Scenario plan, be it a city, region, state, system, or organization.

Often, scenario plans are undertaken in support of a long-range planning document such as an LRTP, modal plan, capital investment plan, or regional development plan. In these cases, the best practice as established in industry and by Congress in the Fixing America's Surface Transportation (FAST) Act is to define performance measures and targets regarding a transportation network's infrastructure condition, congestion and reliability, and safety. Agencies may also decide to define measures and targets for economic development, greenhouse gas emissions, and health, among others.

Predicting outcomes can be a formal data intensive process. For example, land use scenarios may be analyzed by a transportation demand model and other analytical processes to predict impacts on traffic, quality of life, transit ridership, bicycle use, or greenhouse gas emissions.

Impacts of scenarios may also be developed through insight – logically, if "A" happens, what will that do to "B". This presents an opportunity to mine the local knowledge or subject matter expertise on a technical

advisory panel, expert panel, or public survey. While some impacts of scenarios will be intuitive for your team members, casting a wider net for perspectives will help to avoid unintended consequences.

Figure 5 illustrates the predicted impacts for DVRPC's *Connections* 2035 LRTP.

FIGURE 5 | LAND USE SCENARIO IMPACTS FOR DVRPC *CONNECTIONS* 2035 LRTP

3.5 Achieving Objectives

One of the key elements of a plan is its objective – what it is that the organization wanted to *inform*:

- *Policy* | What practices can you change, rules can you make, or efforts can you empower?

- *Investment* | What investments can you make, and what impact will they have?

- *Community* | What should your community be prepared for in their own lives/businesses?

3.5.1 Selecting Strategies

Not all of the best practice study members reported including recommended actions, investments, or policies in their list of deliverables. In some cases, they saw their study as only an input to a larger planning effort, such as an LRTP, which would itself generate and prioritize actions. In other cases, organizations did not see these sorts of recommendations as within their mission or their authority – the insights from their study would inform municipalities, counties, DOTs, or others to act.

Alternatively, the research, modeling, and outreach efforts that make up a scenario planning process form a contained analytical schedule independent from the process of identifying and prioritizing actions, and the team simply must move on to a different activity once they are complete – the actions are left for "next time."

While this research has recommended incremental progress in scenario planning as a strong tool for transportation planning organizations, we also recommend that organizations conducting plans consider implementation as one of their objectives. Recommendations need not take the form of concrete requests – they are anything that answers the hypothetical "so what do I do about this?" from decision-makers or other stakeholders.

A study's approach to recommended actions varies depending on its philosophy:

- *Predictive* | In a predictive study, the future is taken as certain, so the focus should be on finding actions that best mitigate the negative consequences of that future while taking advantage of its benefits.

- *Normative* | In a normative study, the future is taken as desirable but uncertain, so actions should be recommended that make the desired future more likely and the less-desired futures less likely. Actions would be prioritized if they best suit the desired future, although it may be necessary to prioritize actions relevant to less-desired futures if they are considered likely to occur or if their consequences are significant.

- *Explorative* | In an explorative study, the future is uncertain and no plausible future is more or less desirable than another – all have positives to be exploited and negatives to be mitigated. In this case, it may be helpful to use a [Robust Decision-Making](#)[5] (RDM) process that divides a set of possible actions into prioritized buckets based on the number of futures in which they will be helpful:

  - *Immediate Strategies* address a current or near-term need. They are worthwhile ideas today, no matter what the future holds. *Example: investing in the state-of-good repair for assets.*

  - *Robust Strategies* address issues that are expected to arise in the future but should be appropriate no matter what the future holds. *Example: mitigating the impacts of sea level rise.*

  - *Hedging Strategies* might not be needed, but if they become necessary, they will need to have been started today. *Example: purchasing parcels of land for a large infrastructure project.*

  - *Shaping Strategies* allow agencies to influence – and hopefully direct – trends for the future. *Example: providing incentives and investments to shift freight volume to rail from trucks.*

  - *Deferred Strategies* might be necessary, but it is safe to wait and see what happens.

Any of these processes will require input from partners, advisors, stakeholders, and potentially the public - the more involved these parties feel in the decision-making process, and the more buy-in you receive, the

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[5] This application of RDM is highly simplified. RDM was developed by the RAND Corporation to help "identify potential robust strategies, characterize the vulnerabilities of such strategies, and evaluate trade-offs among them. RDM is being used at RAND to help decisionmakers in areas such as water resources planning, energy, and coastal resilience—areas often plagued with 'deep uncertainty,' in which stakeholders do not know or agree on the relationships among actions, consequences, and probabilities." The link above provides RAND's curated examples of RDM application across a wide range of public and private-sector disciplines.

more people will be invested in the long-term impact of your study and the more credibility your recommendations will have behind them.

Input can occur both as the study team gathers potential strategies from both inside and outside of government at multiple levels (as well as from prior studies and plans), as well as in the prioritization of strategies under various degrees of certainty.

RDM provides a helpful framing here even for predictive and normative studies – *prioritize what is helpful, not what is wanted*. For explorative studies, the RDM framework changes the focus from surveys of preference (which may be influenced by emotion or personal/professional interest) to surveys of fact ("would 'A' be necessary if 'X' happens?", or "on a three-point scale, how helpful will 'A' be if 'X' happens?"), then buckets strategies by priority after the fact.

3.5.2   Managing Change

Change is hard, but change is coming. In scenario planning, the team may need to communicate the impact variables will have on the nature of planning work. Machines will do more thinking, software products and tools will evolve, and new hires will have new skills and interest. Scenario planning itself also represents a change in traditional planning methods.

People resist change. If you are interested in trying scenario planning, it is best to understand and plan for that. The traditional change models (e.g., ADKAR[6]) lay out a process for managing significant organizational change. This approach is robust but may not be needed in full for the small- and medium-sized MPO. Following a selection of the basic principles will help:

- *Message |* Articulate the reason that you are exploring scenario planning. Why is this approach important for you relative to the old way of doing things? What will you hope to achieve? Use simple language and make it active and positive. Be succinct – you should be able to explain this in one paragraph of text.

- *People |* Think about all the people in your organization or your standing committees who will be impacted when you move to scenario planning. The statewide travel demand modeler might need to adjust his/her assumptions to the model to accommodate your new future projections, a board of directors might need to think differently about how to make future decisions, or a hiring manager might need to think about new skillsets to include as part of the next resume posting. Think about how these people might be convinced that the change is necessary.

- *Communicators |* These people will understand the value of scenario planning and be willing and able champions and salespeople. They will be the ones to implement the communication plan.

- *Methods |* Most projects wish they had communicated more and earlier. Use emails, phone calls, in-person meetings, newsletters, and other methods of communication to distribute the message. *One contact is never enough*. It usually takes five-to-seven messages for your message to sink in. Consider

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[6] The Prosci ADKAR® Model is a goal-oriented change management model that guides individual and organizational change. ADKAR is an acronym that represents the five tangible and concrete outcomes that people need to achieve for lasting change: *awareness*, *desire*, *knowledge*, *ability* and *reinforcement*.

the best time to send messages to this target group and the ways in which they prefer receiving information – face-to-face is usually best. Methods of delivery include:

– Newsletters	– Screen saver messages
– Face-to-face meetings	– Social media
– Posters in elevators/stairwells	– Fliers
– Large town halls or project kick-off meetings	– Podcasts
– Emails	– Fact sheets
– Intranet	– Brown bag lunches
– Special social events	– Giveaways
– Presentations	– Pay stub inserts
– Trainings	– Teleconferences
– Chain-of-command	– Testimonials

- *Plan* | Align the message, people, communicators, methods, and frequency. Write them into a plan that answers questions such as:
  - Who is responsible for developing the communication? They should have some familiarity with the target audience.
  - Who has good communication and messaging skills who can review the message?
  - Who is the preferred sender for each audience? Who is trusted and has credibility with this target audience?

- *Implementation* | Change is about forming new habits. Forming habits takes time. For this reason, it is best to start advertising the change early and presenting the value of the change as it is realized – if your process is producing attractive deliverables and wins, make sure you let people know.

3.5.3 Passing It On

One of the most meaningful impacts a Scenario plan can have is providing a consistent outlook, data support, assumptions, and goals and objectives to other planning studies in the region, or State. Among the best practice study members, the Commonwealth of Virginia reported that its findings and approaches have been adopted by MPOs and municipalities for their studies. MACC reported the reverse – that the local insight from their study would help to inform future studies at the State level.

3.5.4 Setting Signposts

As time passes, the study team may have the opportunity to reassess strategies as the events they tried to forecast play out. One way to facilitate this process is to set "signposts", events or observations in performance metrics that will indicate a trend or scenario becoming more likely than others, or that necessitate reevaluating strategies and actions. As an example – if a scenario was driven by the completion of a high-speed rail project, then establishing a set of actions to be taken if funding for the project is approved or denied could ensure that the study remains trusted and relevant regardless of the outcome.

4 Tools for Scenario Planning

This section will discuss software-based tools that can support a Scenario plan. It should be noted, however, that software tools – particularly those with expensive licensing fees – should not be critical or synonymous with forecasting. The best practice studies cited a variety of low-tech and low-cost tools that support communication and outreach, as well as forecasting:

- *Low-Tech Communication |* Every one of the best practice studies conducted by an MPO reported that in-person outreach – attending community events with maps, markers, handouts, and talking points – was the most effective form of communication they performed. If the resources are available, hiring a graphic recorder or a branded bus in the style of CCRPC can increase the visibility and credibility of a study.

- *Low-Tech Modeling |* The best practice study participant reported that variables and trends impacting a region or organization – particularly local ones – can be understood through research and discussion among subject matter experts and advisors. While a formal process may provide credibility for your study, it may also cost you credibility if the future does not play out precisely as you predicted. For instance, in a land use scenario, a model might predict that 1,512 new households will move to a development-prone area. It may have been enough, however, to intuitively predict that "the area will see a significant influx of new families" and avoid a debate about whether the actual number would be 1,512, 1,300, or 1,650, particularly if impacts and recommended actions might not differ greatly among those eventualities.

This section will also acknowledge the growth of pooled development opportunities and open-source tools, both of which provide an opportunity to share development costs with partners and peer organizations.

4.1 Communication Tools

Software can help teams collect feedback, including suggestions, grievances, and responses to specific questions. This section reports on three communication tools developed specifically for public engagement purposes.

Single-Function Software

The market for engagement software includes many tools that support specific outreach activities, often at little or no cost, including:

- *Survey Tools |* Branded surveys can be built for free on a variety of free or inexpensive online platforms.

- *Mapping Tools |* Custom maps can communicate existing conditions, trends, or investment/action opportunities, and can be built on the cheap.

- *Website Builders |* Even if your organization's main website needs a refresh, you can set the tone by building an attractive, clear, and accessible project site.

- *Blogging, Livestreaming, and Podcasting* | Once your project has a website, populate it with a running blog of what your team is thinking, what you've accomplished, or what you've heard from advisors, stakeholders, or the public.

Software Packages

MetroQuest, the tool Hillsborough MPO used to allow their community rate the desirability of development scenarios, is one of the market's most commonly-used public engagement software tools. It functions by optimizing community engagement in three stages:

- *Set-up* | MetroQuest provides users with "MetroQuest Studio" where an engaging public site, survey, can be set up.

- *Engage* | Once the site is created, users can launch it and promote their contents, thus maximizing informed input from a broad demographic in order to aesthetically engage users, MetroQuest offer s a variety of types of questions for surveys ranking from priority ranking, to scenario rating, to a map making tool, among others interactive questions.

- *Analyze* | MetroQuest's dashboard allows the user to monitor, analyze, and report on the results collected.

This tool has the option of an annual subscription, which allows users to create unlimited sites to engage their community year-round. According to their website, an annual subscription enables government agencies and consulting firms to pay a fixed price for an unlimited number of MetroQuest sites. Furthermore, this is a tool promoted by the American Planning Association (APA), which also allows APA certified people to attend MetroQuest tutorials and events for certification maintenance credits.

Similar tools include *Bang The Table* and *Public Input*, which offer capabilities to reach broad audiences and collect their input through interactive dashboards. All these examples of communication tools come in a software format, where the user/consumer is responsible for finding and funding their own kiosks, tablets, or computers for running these tools.

4.2   Modeling Tools

While starting conversations about the future is the most useful aspect of scenario planning, visualizing, quantifying, and evaluating based on those scenarios provides additional utility. Most organizations look at scenarios that extend beyond the conventional measures of level-of-service, delay, and crash rates. Fortunately, there has been significant work done in the last 15 years to incorporate land use into transportation planning, and scenario planning can build on that work.

The FHWA's recent push to implement performance-based planning and programing has motivated the industry to incorporate quantitative analysis through modeling into scenario planning. The impacts of climate change, ride-sharing, electrification, and automation require new assumptions and adjustments to inputs. For example, electrification would alter emissions outputs as well as origin-destination models. An increase in ride-hailing could alter vehicle occupancy, mode, choice, and capacity of small roads if there are no drop-off zones. Automation could affect roadway capacity, trip generation, and urban form.

The ability to adjust these assumptions is more prevalent in complex software that has a higher learning curve, so it is important for organizations to consider functionality versus convenience when choosing tools for their projects. Some of these tools can link to one another, such as the land-use sketch tools that provide trip generation for a travel demand model or depict how a new public transit system or trail may change the type of development desired in an area. These connections may result in an iterative process until planners are satisfied that the scenarios are consistent and aligned with the initial vision.

4.2.1   Useful Tools for Modeling Scenarios

No single tool can perform all the analysis associated with scenario planning, but they provide an additional way to evaluate and understand the future and find strategies and investments that are the most likely to accomplish goals and vision for transportation, no matter how the future unfolds. *These tools evolve rapidly, so you may need to research the most up-to-date applications and information.* For an in-depth discussion of scenario sketch planning tools, their strengths, weaknesses, and potential uses, see *NCHRP 08-36, Task 117 | Sketch Tools for Regional Sustainability Scenario Planning.*[7]

Useful land use modeling tools include:

- **CommunityVIZ** | An extension to ArcGIS Desktop that shows the user the implications of different plans and choices. Planners, resource managers, local and regional governments, and others use CommunityViz as they make decisions about development, land use, transportation, conservation and more. Developed by City Explained, Inc.

- **CorPlan** | Allows the user to combine different socioeconomic and land-use characteristics in a GIS environment and aggregate the data into spreadsheets for input into a travel demand model. It is available through Renaissance Planning Group.

- **Envisiontomorrow** | Looks at transportation VMT, auto trips, transit trips, bike trips, walk trips, fiscal impact, public health, redevelopment, housing and equity, and location efficiency.

- **SPARC**/INDEX | Helps users understand land-use zoning and development and can be combined with other GIS tools. SPARC lets the user interface with INDEX through a web browser and stores data virtually.

- **Urbanfootprint** | A set of analytical models to consider transportation (sketch tool for VMT and GHG), emissions, land consumption, water use, energy use, household costs, walk accessibility, transit accessibility, conservation, public health, fiscal impacts, risk and resilience.

Regional travel demand modeling tools study projected changes in origin and destination demand to forecast traffic volume and congestion on a road or multimodal network. Options include:

- **Cube** | Developed by Citylabs and available under license.

- **Emme** | Developed by INRO and available under license.

- **TransCAD** | Developed by Caliper Corporation and available under license.

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[7] Uri Avin et al, *NCHRP 08-36, Task 117*. "Sketch Tools for Regional Sustainability Scenario Planning". College Park, MD, May 2016.

- **Visum** | Developed by PTV Group and available under license.

Other useful modeling tools include:

- **Impacts 2050** | A menu-driven spreadsheet model that state and regional transportation decision makers can use to investigate how socio-demographic factors in a region might impact travel demand over time. Developed as a part of *NCHRP Report 750* (Volume 6).

- **LEAM (Land-Use Evolution and Impact Assessment Model)** | A process of modeling, visualization, and testing the impacts of land-use policy decisions. Through dynamic spatial modeling and web-based interface, LEAM simulates land-use change across space and time, providing a basis for discussion and decision-making in planning. Developed by the University of Illinois.

- **MOVES (Motor Vehicle Emission Simulator)** | A state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics. Developed by the Environmental Protection Agency (EPA).

- **TranSight** and **TREDIS** | Commonly-used econometric models. Users test alternative transportation changes and observe the short- and long-term impacts on jobs, income, population, and other economic variables. Proprietary software available under license. TranSight is developed by REMI and TREDIS is developed by EDR Group.

- **VisionEval** | A collaborative project to integrate the GreenSTEP family of strategic tools for performance-based transportation planning, including the GreenSTEP GHG analysis model, the Regional Strategic Planning Model (RSPM), and the Rapid Policy and Analysis Tool (RPAT), into a single open-source programming framework. The common framework enables new model features to be added in a 'plug-and-play' fashion so they can be easily shared among models.

Figure 6 (next page) depicts how CCRPC used multiple models together for evaluation.

FIGURE 6 | CCRPC MODELS AND WORKFLOW FROM THE 2040 LRTP
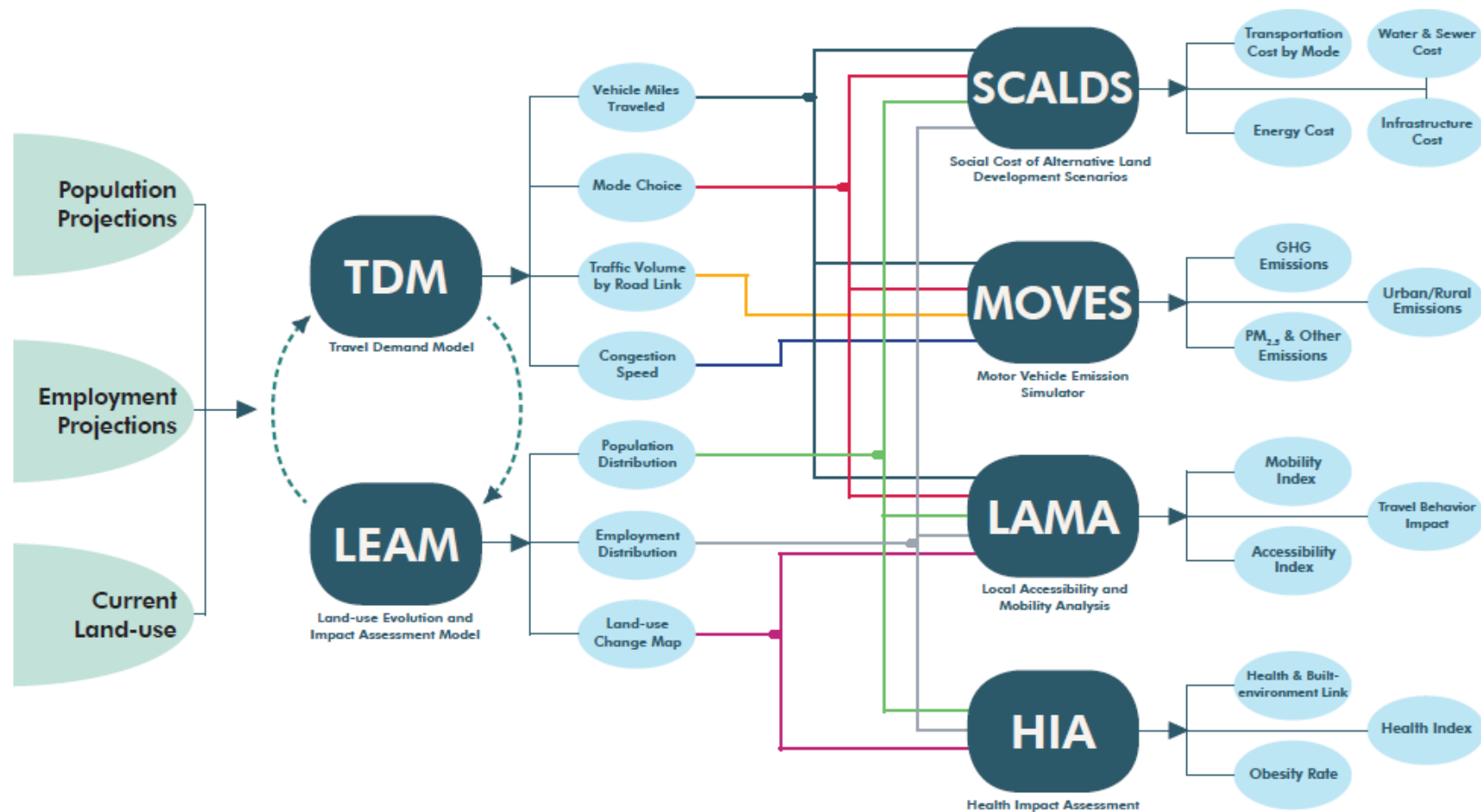
5 Recommendations

As a summation of what has been discussed in this guidance, Figure 7 suggests activities that can make up a Scenario plan based on available budget (down is more), and available time (right is more).

FIGURE 7 | AVAILABLE STRATEGIES FOR SCENARIO PLANNING STUDIES