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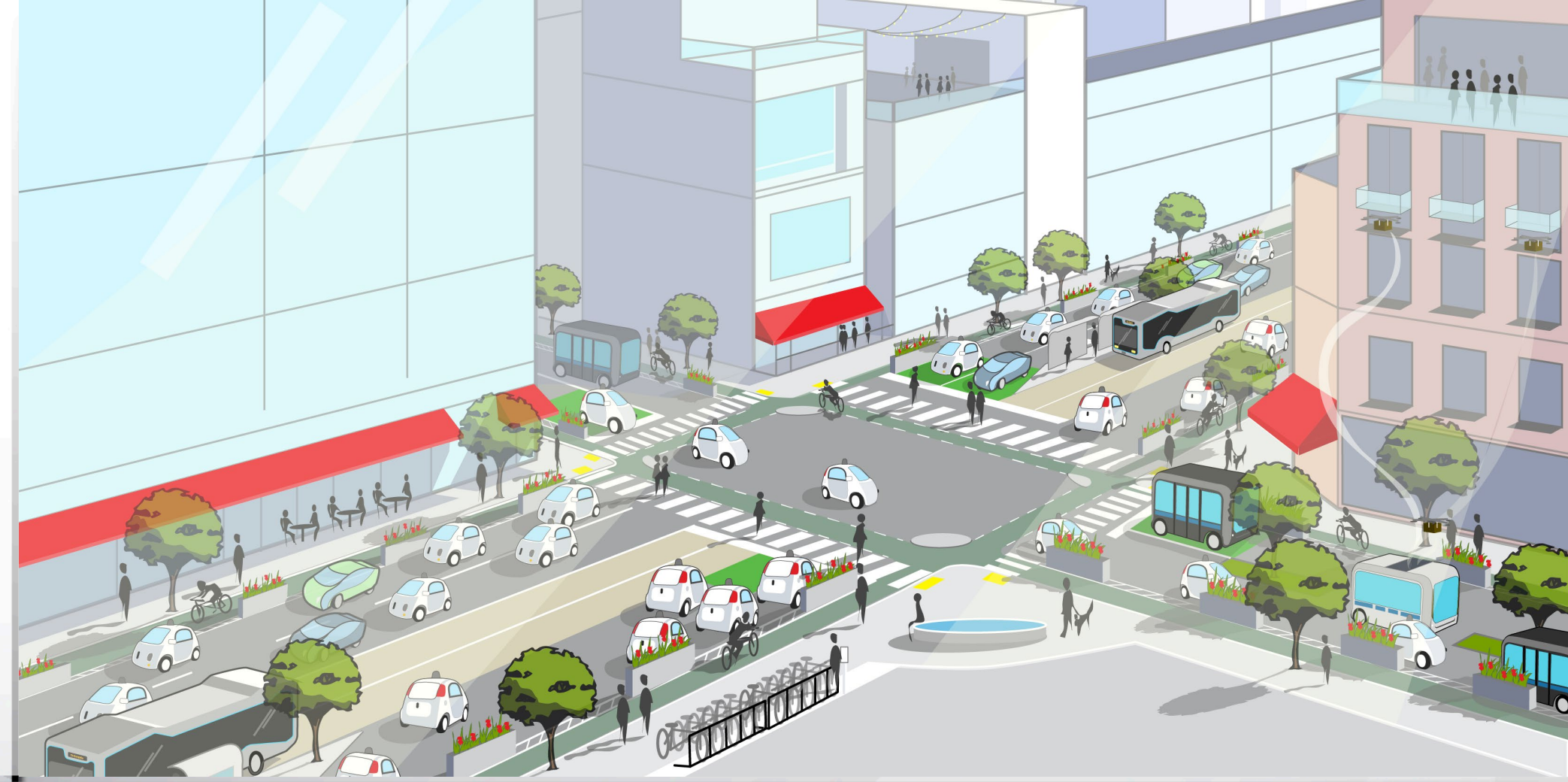


Exploratory Scenario Planning for Disruptive Technologies

AMPO| October 24, 2019

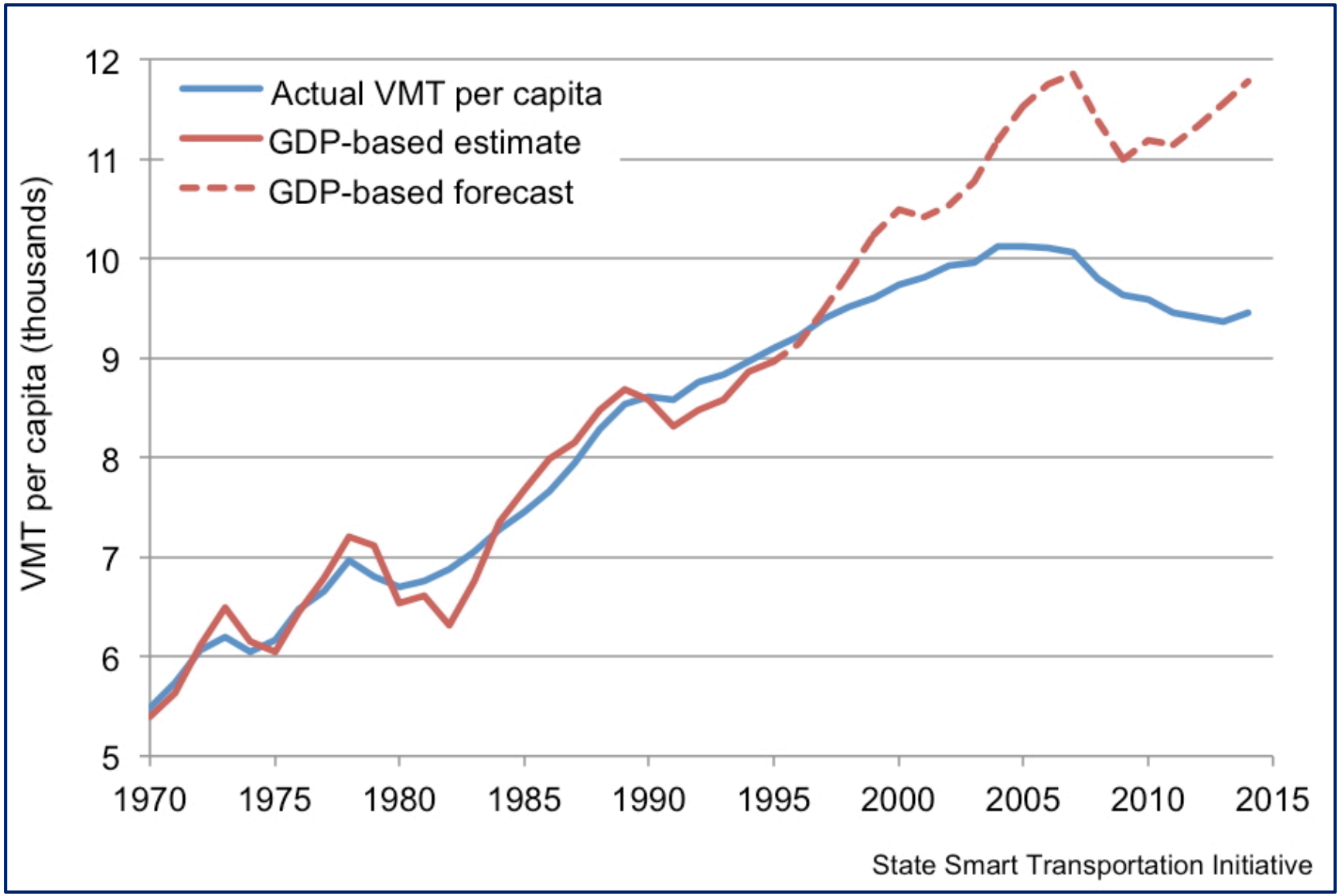
Lorna Parkins AICP, Bill Thomas CPM | Michael Baker International

30 Years of Planning & Forecasting

Explain the past → Predict the future

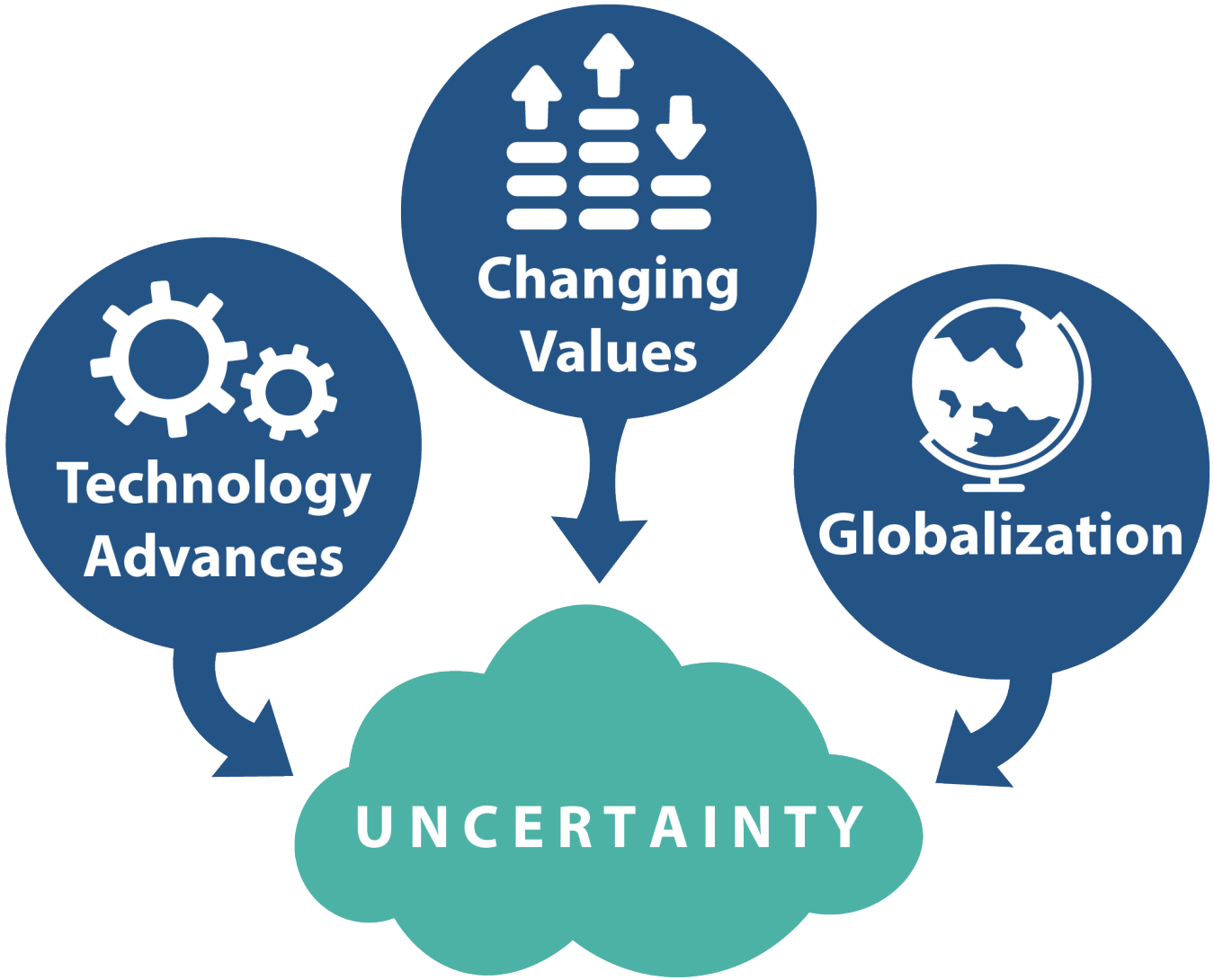
What happens when predictors stop predicting?

Estimate/Forecast of US Vehicle Miles Traveled (VMT) per capita based on Gross Domestic Product (GDP) 1970-2014



Where do we go from here?

Disruptors cause uncertainty



Generational Changes

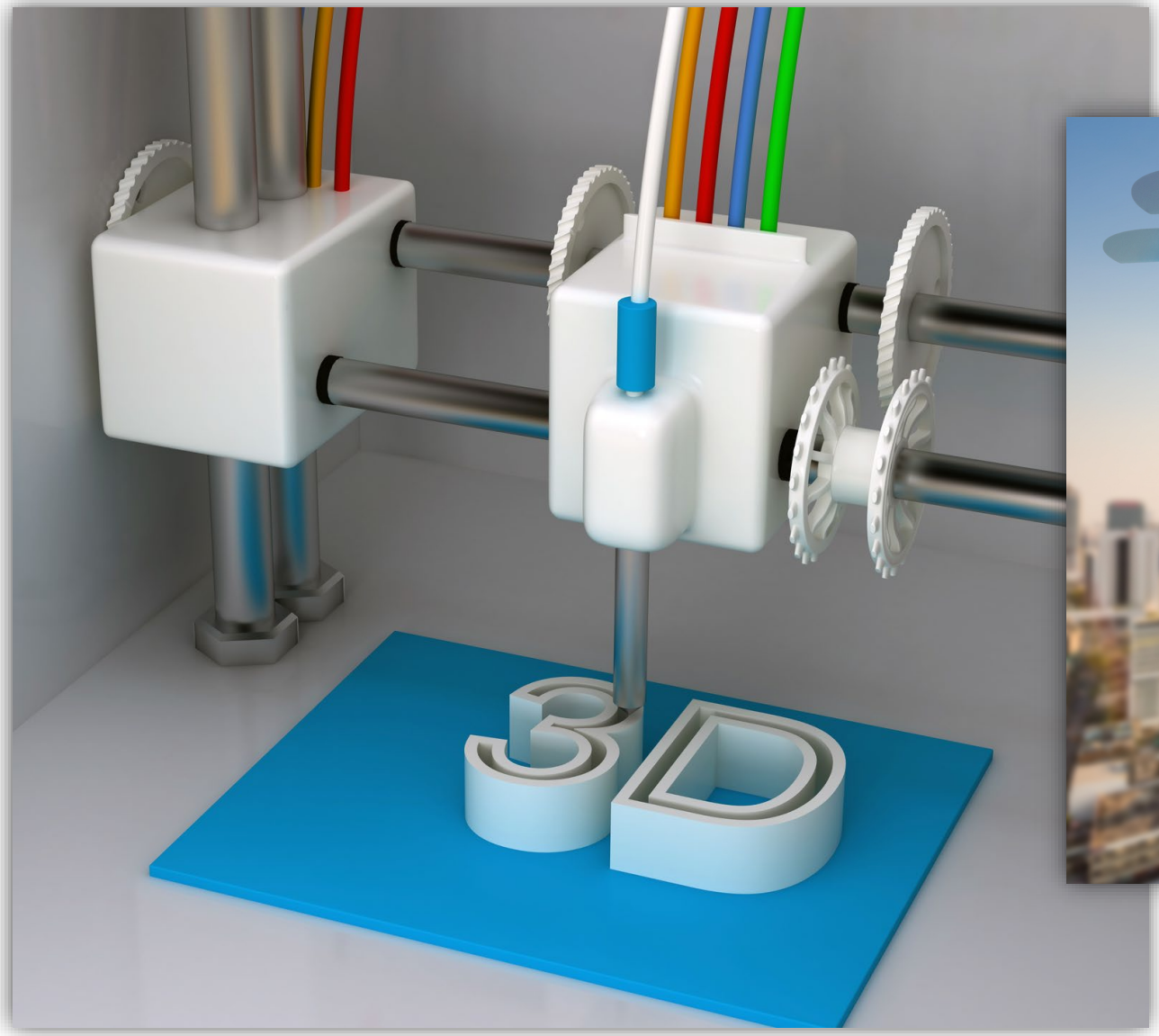
Different Values Govern Life Choices

airbnb

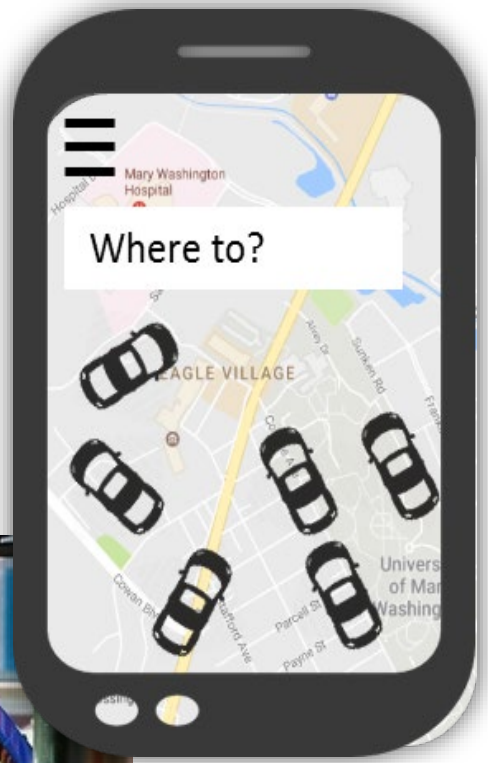
UBER

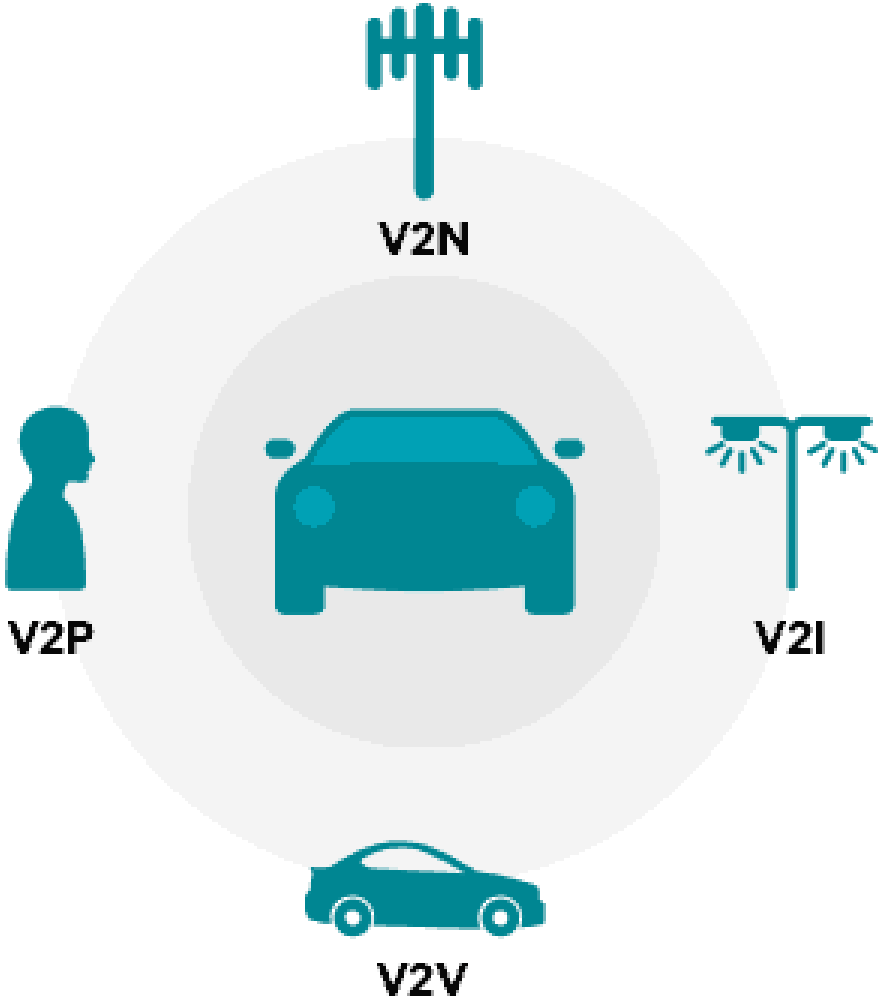
lyft

Economic Disruptors

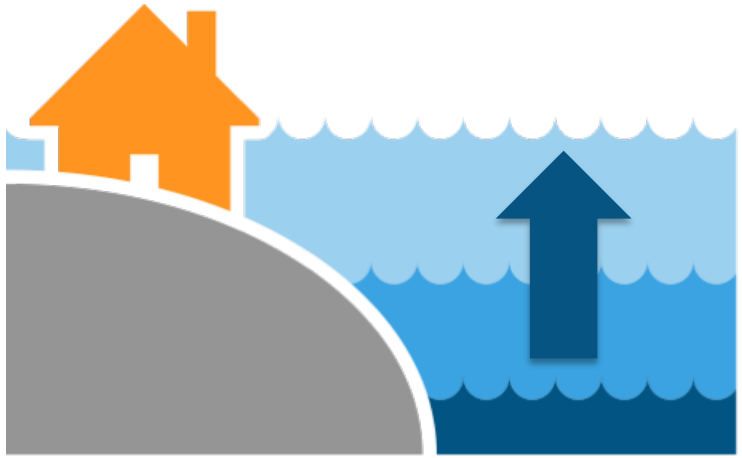


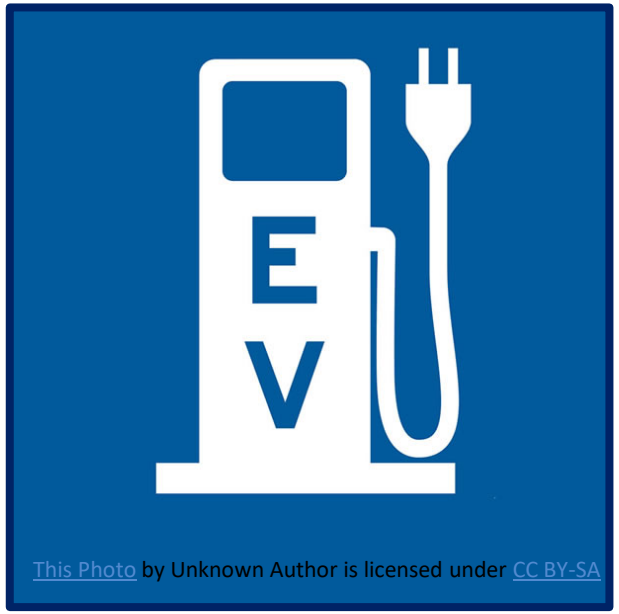
Transportation Technology Disruptors





Environmental/Energy Disruptors





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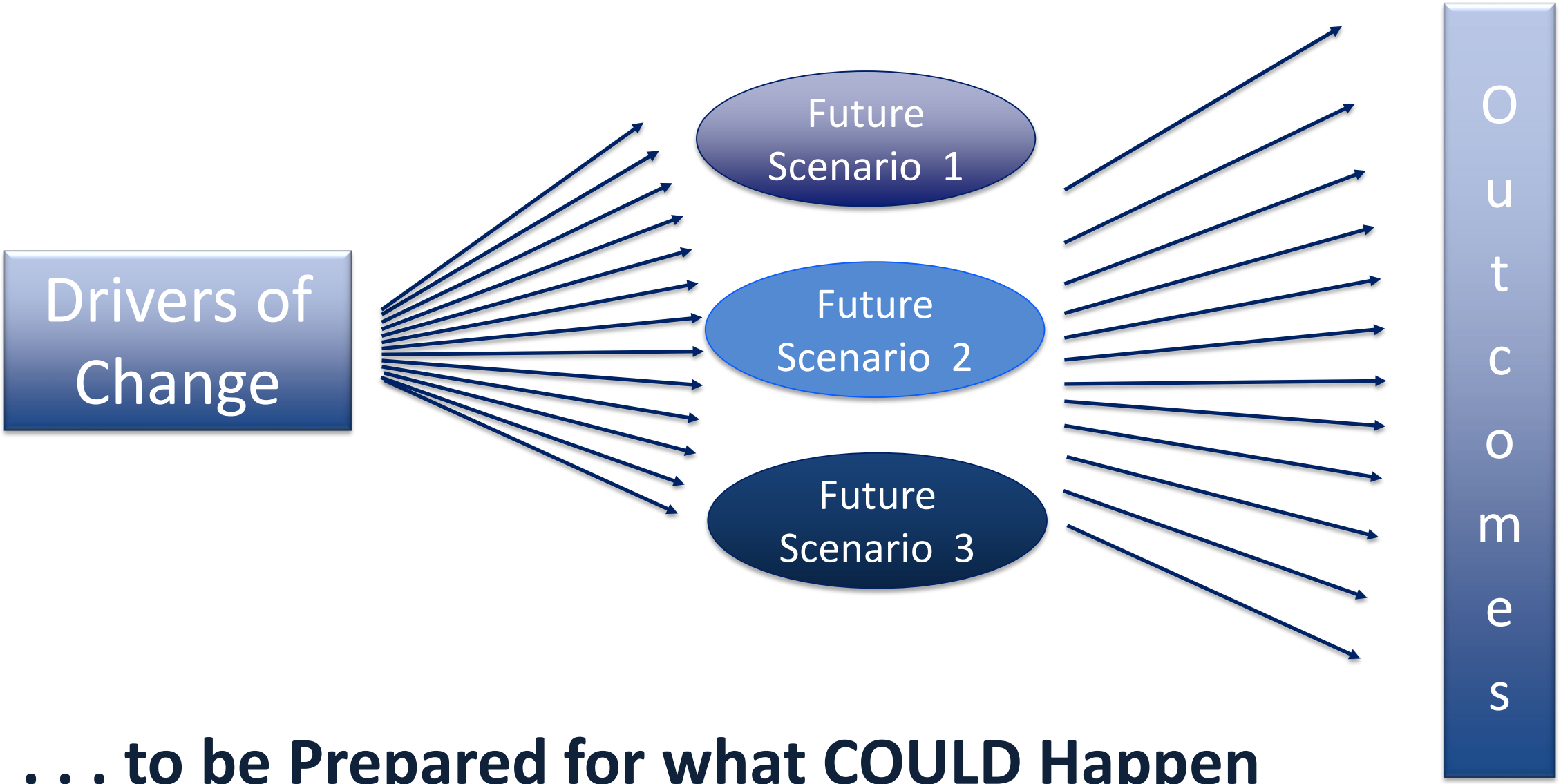
Exploratory Planning for Uncertain Times

What is the range of outcomes?

What are the risks?

What are the opportunities?

Explore a Range of Potential Outcomes . . .



. . . to be Prepared for what COULD Happen

Framework for Exploratory Scenario Planning

Drivers

Economic, Lifestyle/Demographic, Technology, Environment

Scenarios

Organize Drives into a range of potential futures

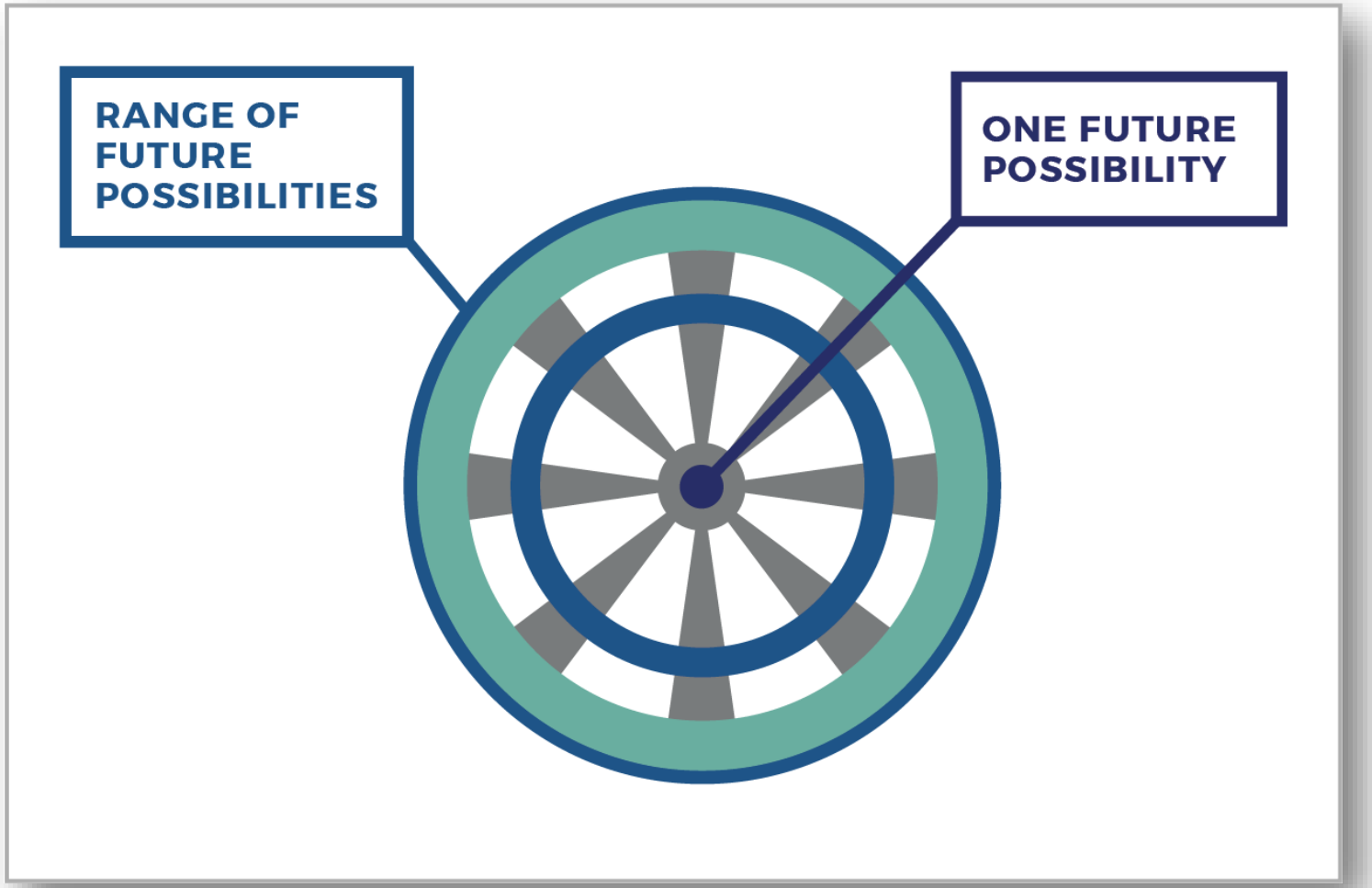
Inputs

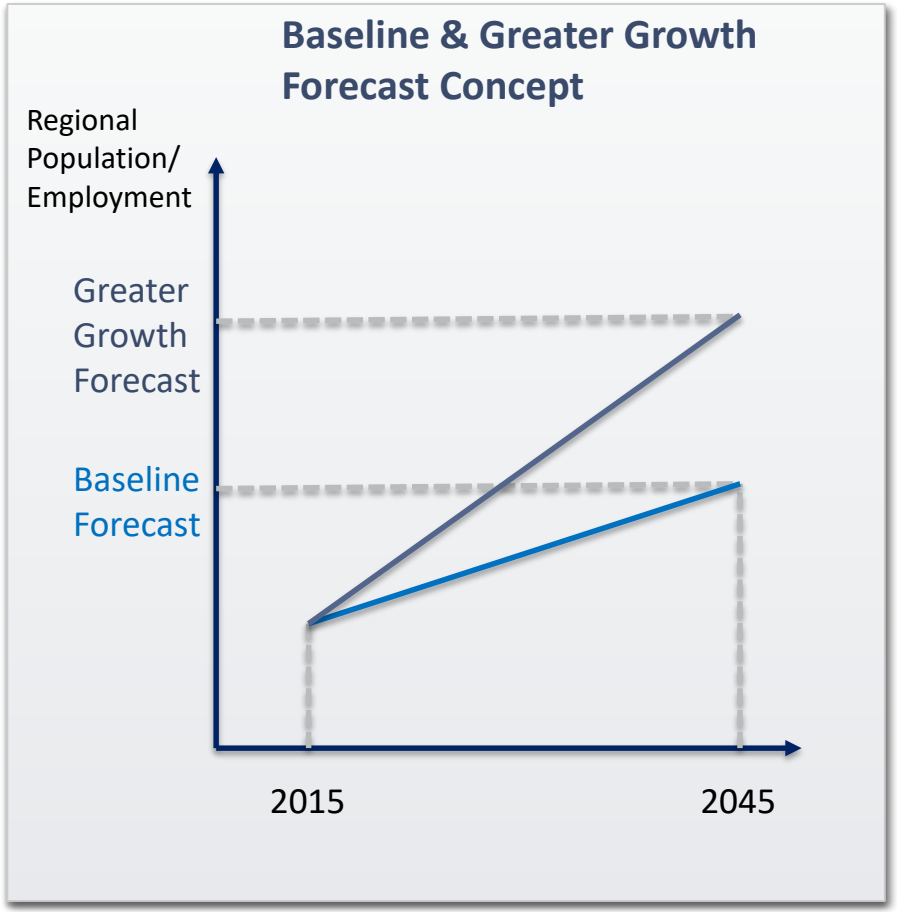
Control totals, assumptions about the drivers, and modeling "Levers"

Outcomes

Performance Measures based on the study Goals and Objectives

Hampton Roads Study Framework





Scenario Narratives – Hampton Roads Study

Greater Growth on the Water	What happens if jobs focus on the waterfront, housing choices are varied, and transportation technology adoption is moderate?
Greater Growth in Urban Centers	What happens if jobs and housing focus in urban areas, with greater multimodal availability and high adoption of connected vehicle technology?
Greater Suburban/ Greenfield Growth	What happens if jobs and housing are developed in dispersed activity centers, with a higher level of truck transportation and high adoption of autonomous vehicle technology?

Scenario Narratives – Hampton Roads Study

Greater Growth on the Water

Growth in water-oriented activity. Port of Virginia becomes even more competitive with freight more multimodal. More dispersed housing locations. Moderate assumptions for CAV adoption and network adaptation.

Greater Growth in Urban Centers

Significant economic diversification. Low space requirements per job. Large role for "digital port." New professionals prefer to live/work in urban settings. High level of CV adoption and low auto ownership/high TNC mode.

Greater Suburban/Greenfield Growth

Growth is suburban/ exurban, but growth includes walkable mixed use centers. Port of Virginia becomes even more competitive. "Digital port" brings additional jobs. Housing is more suburban. High level of AV adoption and network adaptation.

WHAT THESE WILL HELP US TEST

Test greater cross-harbor travel in particular.

Test more urban and multimodal travel patterns.

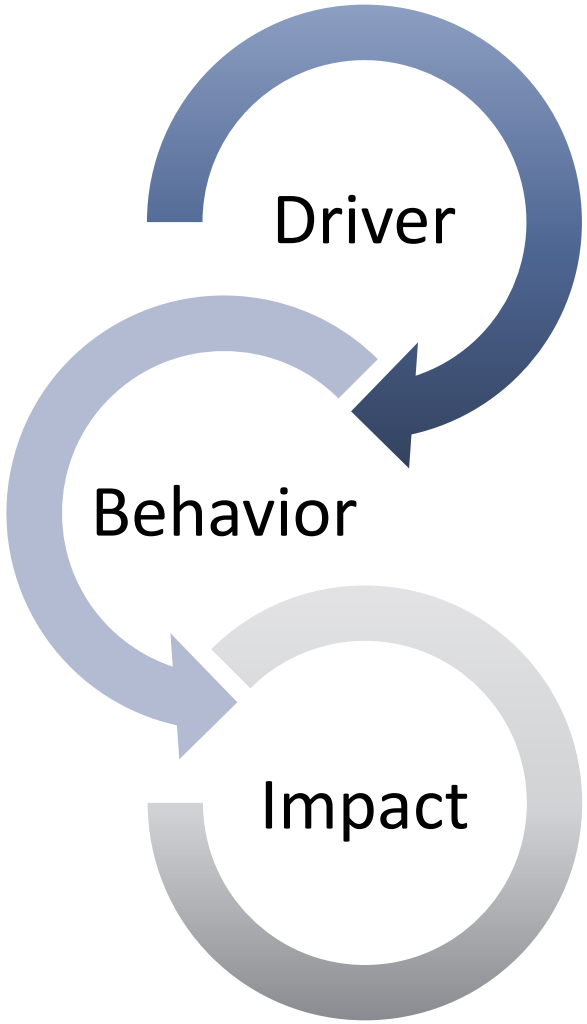
Test more overall regional travel.

Chain of logic from inputs to outputs

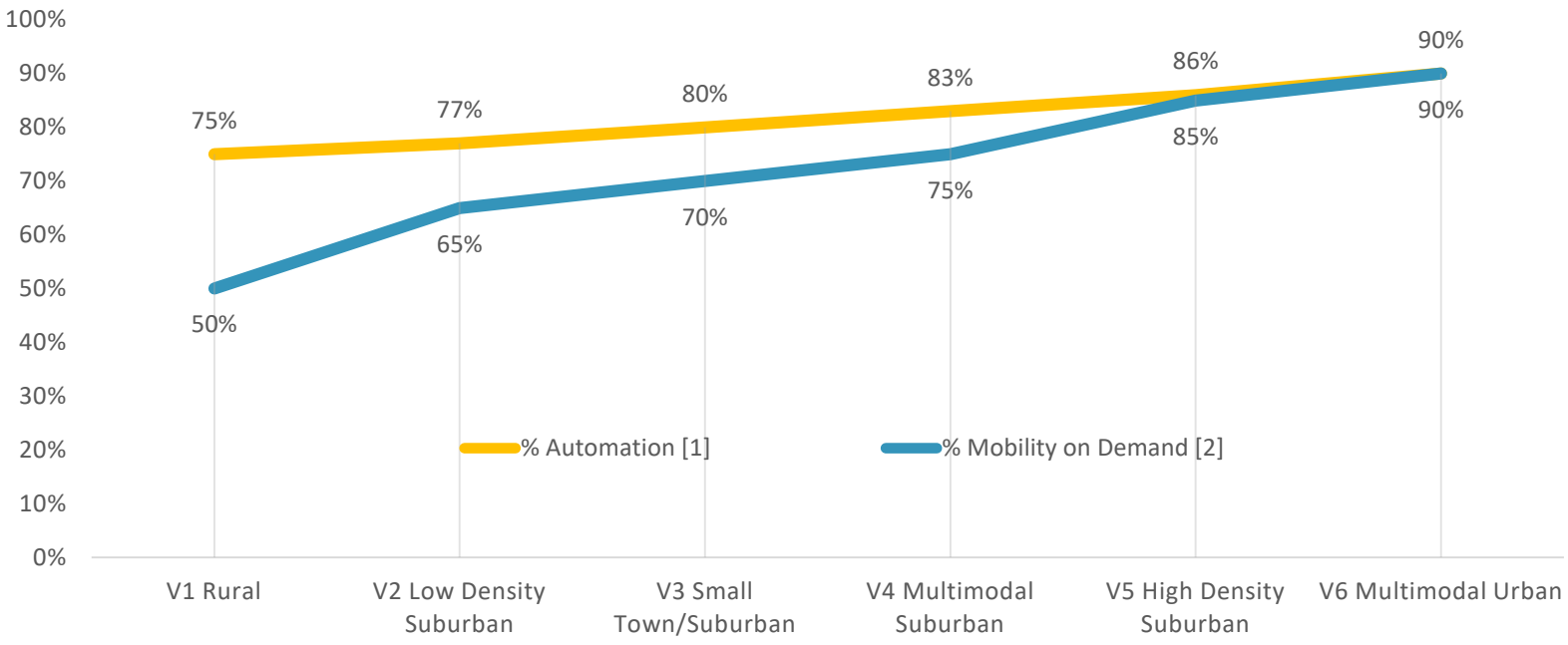
What could happen?

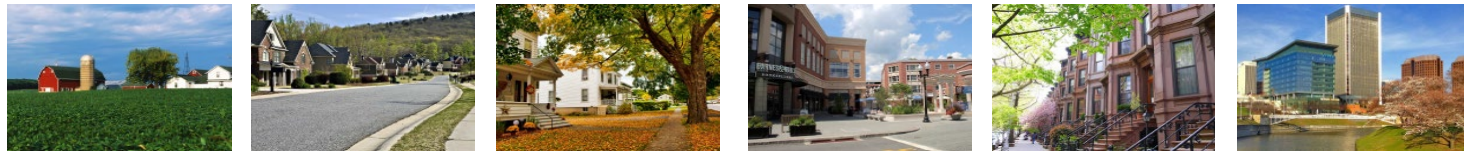
What will change?

What are the effects?



Example : Baseline technology assumptions by placetype





[1] [2] Information above was inspired by public input

- Baseline assumption links land use/ economics to future behavior
- Each scenario adjusts placement of the lines (overall level of adoption)

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Forecasting Transportation Impacts under Technology Uncertainty

Challenges

Adoption

- Timing
- Magnitude
- Type
- Location(s)

Forecasting Tools

- CAV/SAV modes
- Behavioral impacts

CAV Adoption Timelines

Short Term

- Existing planning and modeling tools will suffice.
- Travel behavior changes will not be significant.
- Increasing use of new modes, such as MaaS.
- New types of access and egress options for public transportation systems.

Mid-Term

- CAVs will become more widespread, however non-AVs will still be present.
- Modeling and planning tools need to address problems related to having mixed fleets of CAVs and non-CAVs.

Long-Term

- CAVs will be pervasive and will require a complete set of new assumptions about urban form, land use, parking requirements, and other indirect impacts in addition to the direct impacts on travel behavior and choice.
- Planning tools and the models that support them will need to be based on scenario assumptions for this longer-range timeframe.

Source: NCHRP Research Report 896: Updating Regional Transportation Planning and Modeling Tools to Address Impacts of Connected and Automated Vehicles

Behavioral Impacts

- CAVs drive up to carsharing users, reducing access time.
- Self-parking, increase ease of use.
- Reduction in vehicle accidents; increased travel time reliability.
- Changes in roadway capacities.
- Increased travel due to latent demand.
- Provide easier first and last mile connections with major public transit corridors.
- Change in travelers' values-of-time.
- Introduction of zero-occupant vehicles (ZOVs).

Impact on the 4-Step Planning Process

Step	Impact/Adjustment	Issues/Effects
Trip Generation	Auto Ownership • Overall ownership level. • CAV vs. Conventional ratio. Induced Trips • Trips by seniors, children (non-work trips).	• Level of CAV adoption. • Private vs. shared vehicles. • Account for latent travel demand.
External/Truck Trip Generation	Induced Trips • Factor trip rates. Time-of-Day • Adjust diurnal distributions.	• Potential increased mobility. • Passengers sleep during long distance trips. • Shift in truck trips to overnight to avoid daytime congestion.

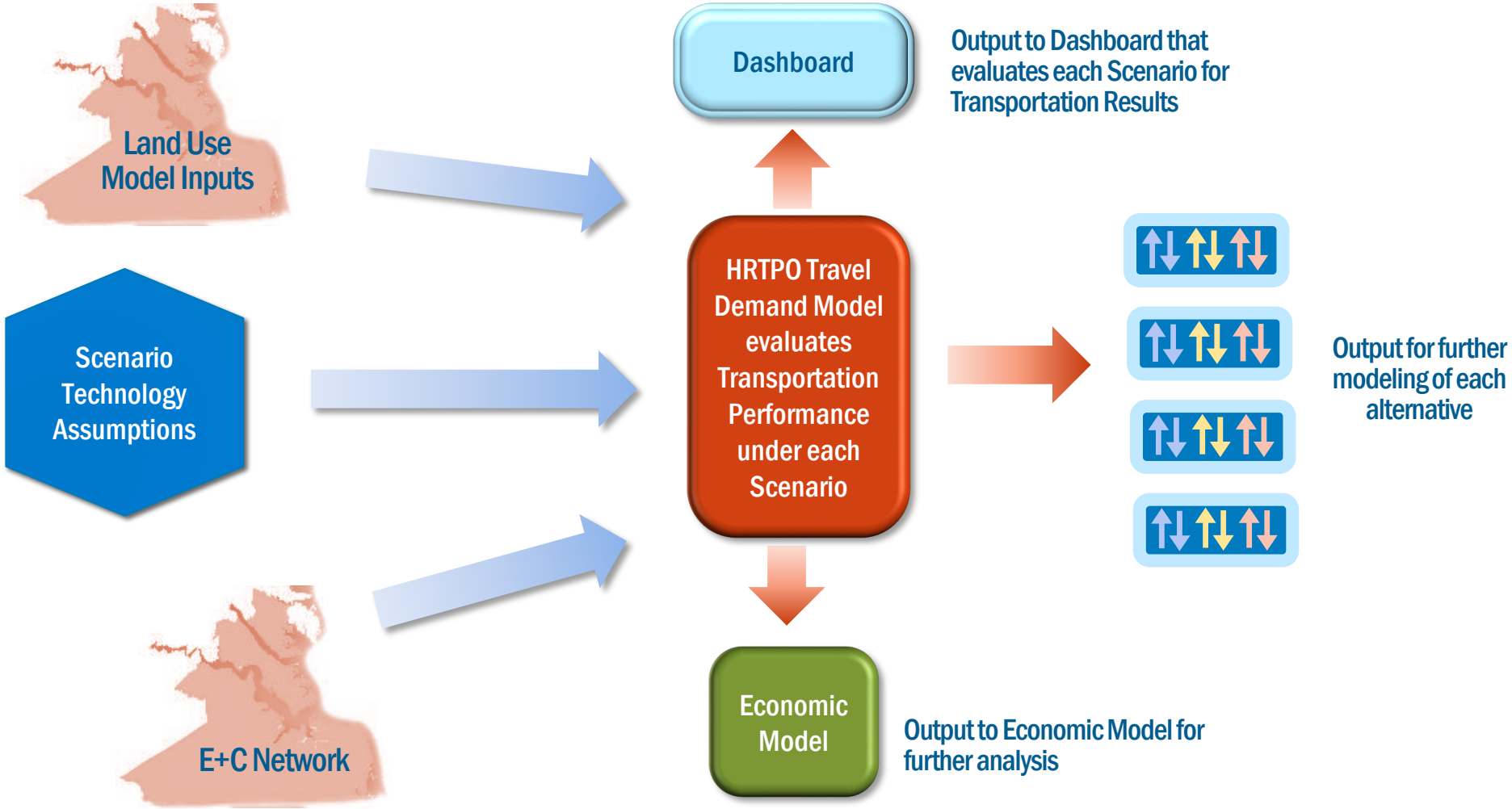
Impact on the 4-Step Planning Process

Step	Impact/Adjustment	Issues/Effects
Trip Distribution	• Adjust trip lengths for home-base work travel.	• Longer commutes. • Added productivity.
Mode Choice	• Add MaaS modes. • Add CAV & conventional submodes.	• Ride hailing. • Micro transit. • First/last mile -public transport.
ZOV Trip Generation	• Add vehicle trips to account for new trip tours with driverless vehicles.	• HH CAV to family, home. • MaaS CAV to next pickup, depot.

Impact on the 4-Step Planning Process

Step	Impact/Adjustment	Issues/Effects
Trip Assignment	• Adjust passenger car equivalencies to reflect mixture of CAVs and conventional vehicles. • Designate CAV only lanes/facilities.	• Tech lanes. • Changes in speeds and capacities.

Hampton Roads Study – Technology Impacts



Accounting for Technology in the Demand Model

Recent update to the HRTPO travel model included a framework to account for the behavioral impact of technology.

- ✓ Ability to adjust existing components and the addition of zero occupant vehicle (ZOV) trips.
- ✓ Addresses both privately owned CAVs and shared CAVs.
- ✓ Able to specify assumptions about how each behavioral parameter may change for various market segments.

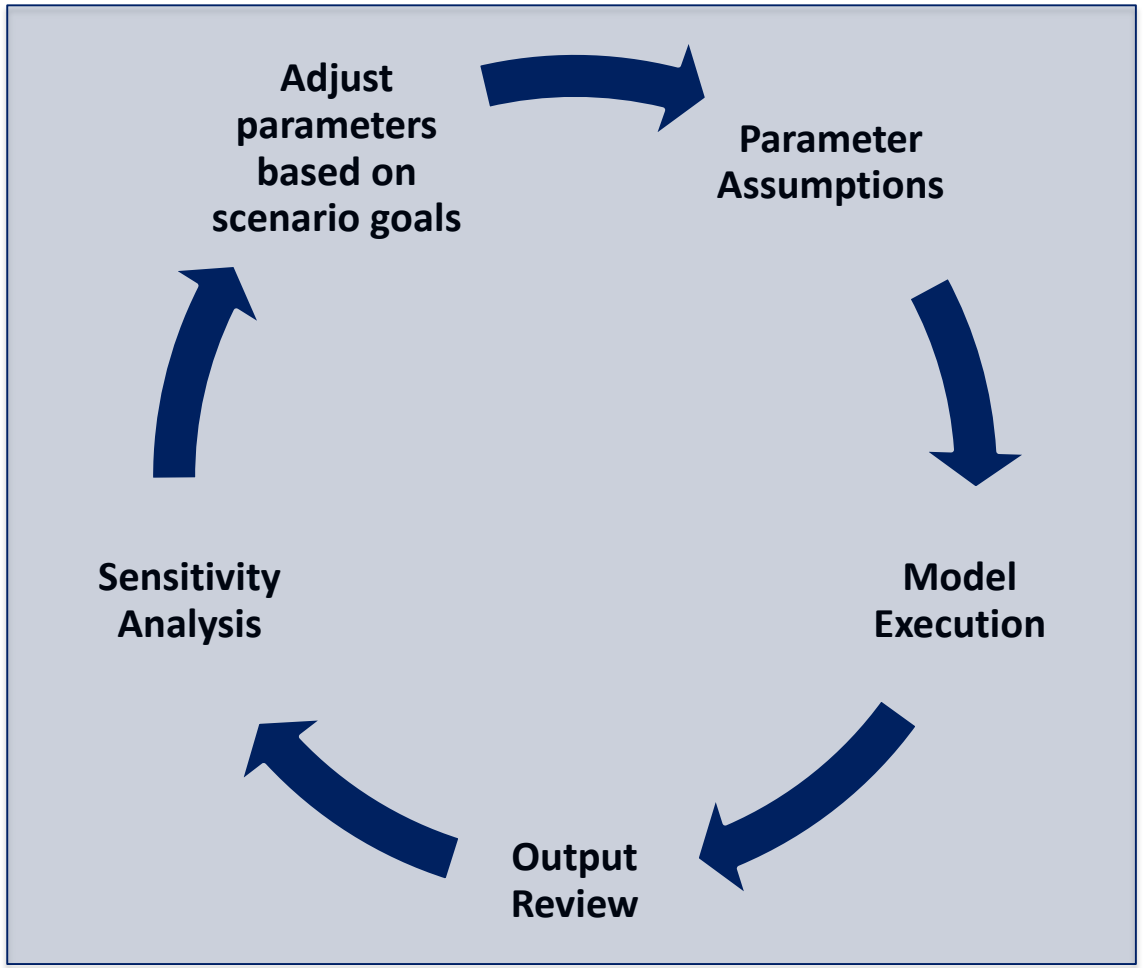
Quantifying Behavioral Parameters

PCE factors for CAVs in mixed flow?

Vehicle occupancies (CAV and MaaS)?

MaaS mode shares?

ZOV trip type mix and depot capacities?



Induced demand by trip purpose?

CAV/conventional split for trucks and external trips?

Change in VOT (peak, off-peak)?

Share of CAVs in household vehicles?

Hampton Roads Study Activities

In Process

- Development of detailed technology-oriented scenario narratives.
- Review and testing of updated HRTPO travel model.
- Quantify behavioral parameters by scenario.

Future

- Execute travel model and tabulate results in dashboard by scenario.

Selected References

- Autonomous Vehicle Implementation Prediction – Implications for Transportation Planning, Litman, September 2019.
- Ways to Consider Driverless Vehicles in Virginia Long-Range Travel Demand Models, John S. Miller, Ph.D., P.E., and Di Kang, March 2019.
- National Framework for Regional Vehicle Connectivity and Automation Planning, AMPO, January 2019.
- NCHRP Research Report 896: Updating Regional Transportation Planning and Modeling Tools to Address Impacts of Connected and Automated Vehicles, Volumes 1 & 2, 2018.

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