OREGON TRANSPORTATION PLAN

A resilient transportation future for all Oregonians

TRB TRANSPORTATION RESEARCH BOARD

Conference on

Innovations in Travel Analysis and Planning

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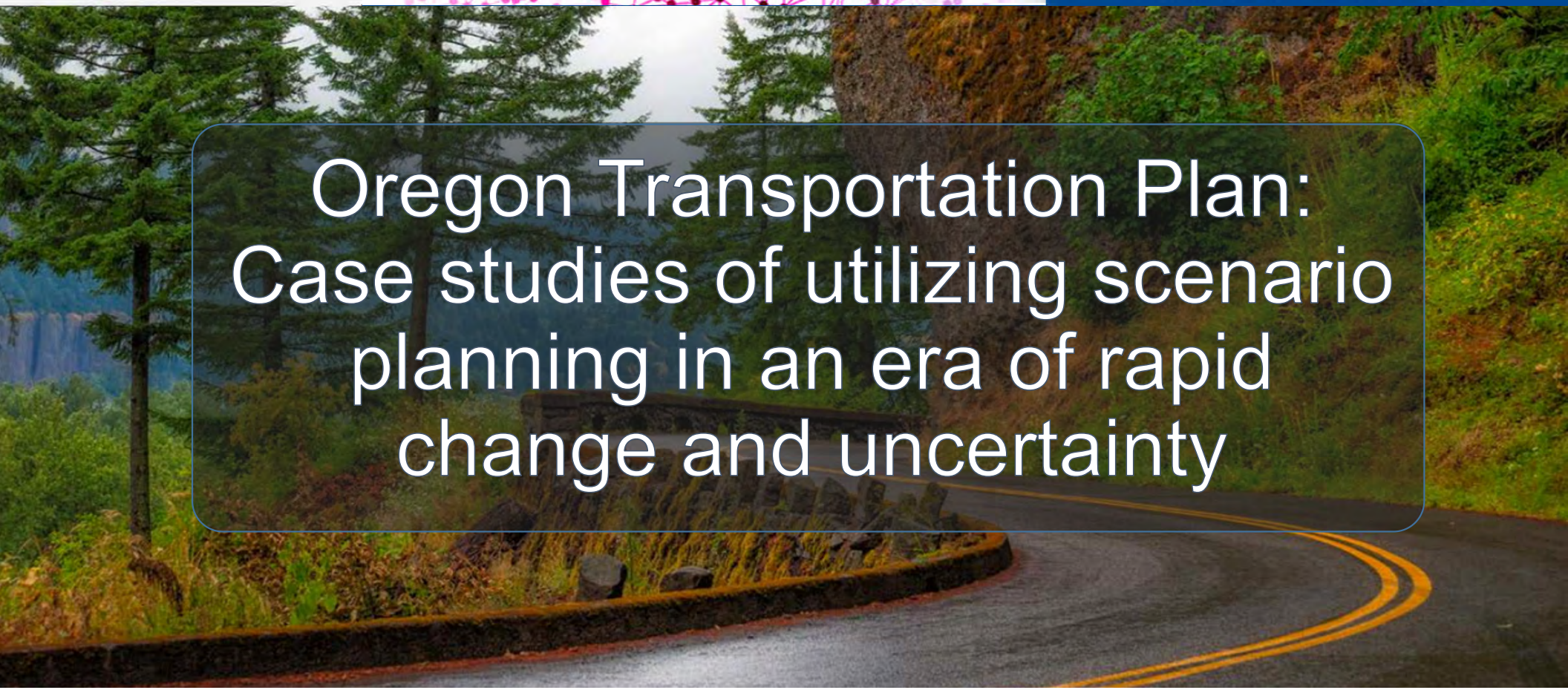

Oregon Transportation Plan: Case studies of utilizing scenario planning in an era of rapid change and uncertainty

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What is the OTP?

- A Plan for ODOT and Oregon
- Multimodal
- Vision out to 2050
- Policies and strategies for the entire transportation lifecycle
- Directs ODOT
- Influences other state agencies
- Locals must be consistent with it

OTP First Principles

Meta-epistemology: “thinking about how we think”

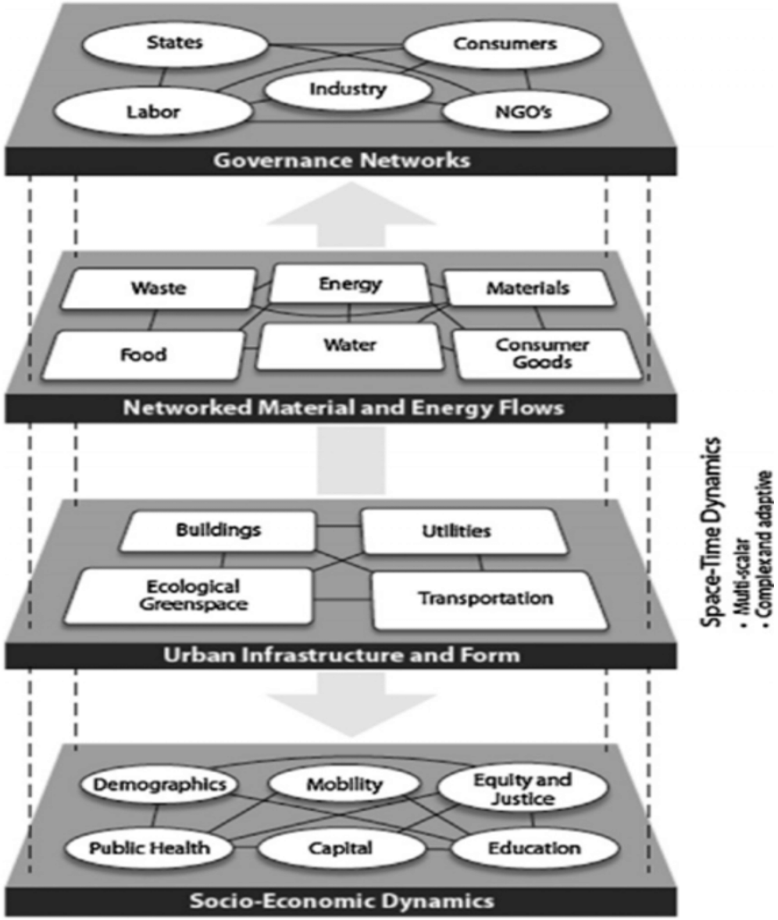
Consider the *Who Why What How*

Play to the strengths of the process using the tools, applying the “prescriptive” and “descriptive” accordingly

Make complexity of the system relatable

Complex System Thinking

…consider the complexity of the system in a relatable way



Meerow, Newell, and Stults (2016, 45)

System is about relationships

- People and communities (socio-economics)
- People and institutions (government, industry)
- People and infrastructure
- People and the natural environment
- Networks and flows (goods, resources)

Planning Process

Positioning the “prescriptive” and the “descriptive”

Prescriptive: “What information do we need?” “How will we make informed choices and come to agreement?”

Tools: PMP, PI/O/C, charters, media releases, background reports

↓

Descriptive: “What is happening in transportation?” “How Is the system working/not working for you?”

Tools: Virtual (sometimes in-person) engagement (virtual open house, Focus Groups, transportation personas)

↓

Prescriptive: “Given what we know about x, what could happen if y?” “What should we do?”

Tools: Scenario Planning, virtual open house 2 (informed choices)

Key Drivers of Change

1. Social Equity

2. Climate Change

3. Population and Labor Force Changes

4. Industry Composition Trends

5. Emerging Transportation Technology Trends

6. Resiliency and Disaster Planning

OTP Development Process

Primary "ingredients" for achieving an outcome-driven Oregon Transportation Plan:

- Understand the users and uses of the system and needs today and in the future
- Conduct research and identify best practices
- Seek the council of subject matter and other experts
- Balance diverse perspectives and needs
- Be visionary but actionable
- Establish a decision-making framework, considering tradeoffs

Vision and Values Statement:

"Oregon's transportation system supports all Oregonians by **connecting people and goods to places in the most climate-friendly, equitable, and safe way**."

Advancing these Goals:

- Mobility
- Safety
- Sustainability and Climate Action
- Economic Vitality and Livability
- Stewardship of Public Resources
- Social Equity

Goals to Measurable Processes

Goal	Policy Objective	Model Output Measure
Mobility	Mobility 1: Multimodal Travel	Transit Trips Per Capita
		Bike Trips Per Capita
		Walk Trips Per Capita
	Mobility 2: Reduce daily VMT	Household Daily VMT Per Person
		Total Daily VMT Per Capita
	Mobility 4: Improve Travel Time Reliability	Travel Time Index under Extreme Congestion
GHG & Equity	Sustain 1: Reduce GHG Emissions	Total CO2e GHG emissions
		Household CO2e Per Person
	Sustain 2: Efficiency of Vehicle Fleet	CO2e per mile of Transit service
		CO2e per mile of Heavy Trucks
	Equity 1: Reduce transportation cost burden	Share of income spent on transportation for households with annual income less than 25k
Safety	Reduce Crashes and improve safety	Number of Urban Car deaths
		Number of Urban car Injuries
		Number of Rural Car deaths
State of Good Repair & Reliability	Minimize disbenefits of maintenance and probably of failures	Funding for Preservation and Adaptation

Goals → Objectives

Objectives → Measurable outputs from the analytical tools.

This crosswalk enabled a transparent process how a specific outcome in the evaluation of possible futures supports (or not) policy objectives and goals of the OTP.

The OTP is an Outcome Driven Plan

Input Driven Planning

- Evaluate A Baseline Future
- Determine Measures of Effectiveness
- Design Normative Scenarios
- Test Scenarios Against Goals

Iterate to find optimal solution

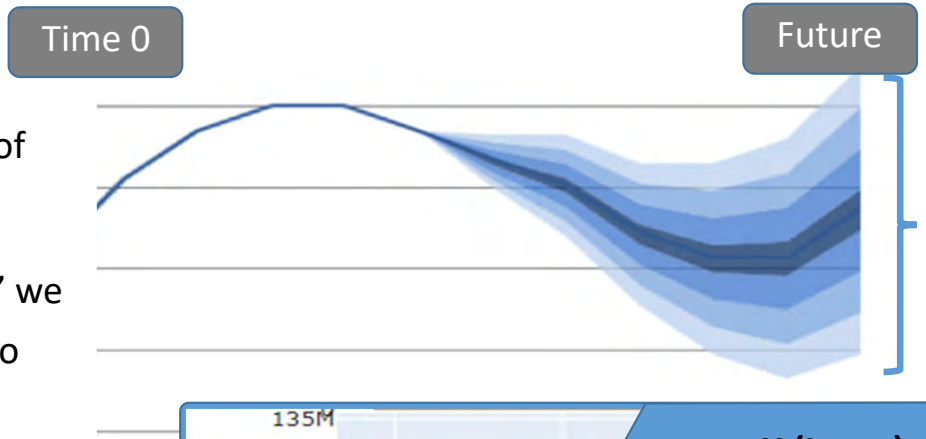
Outcome Driven Planning

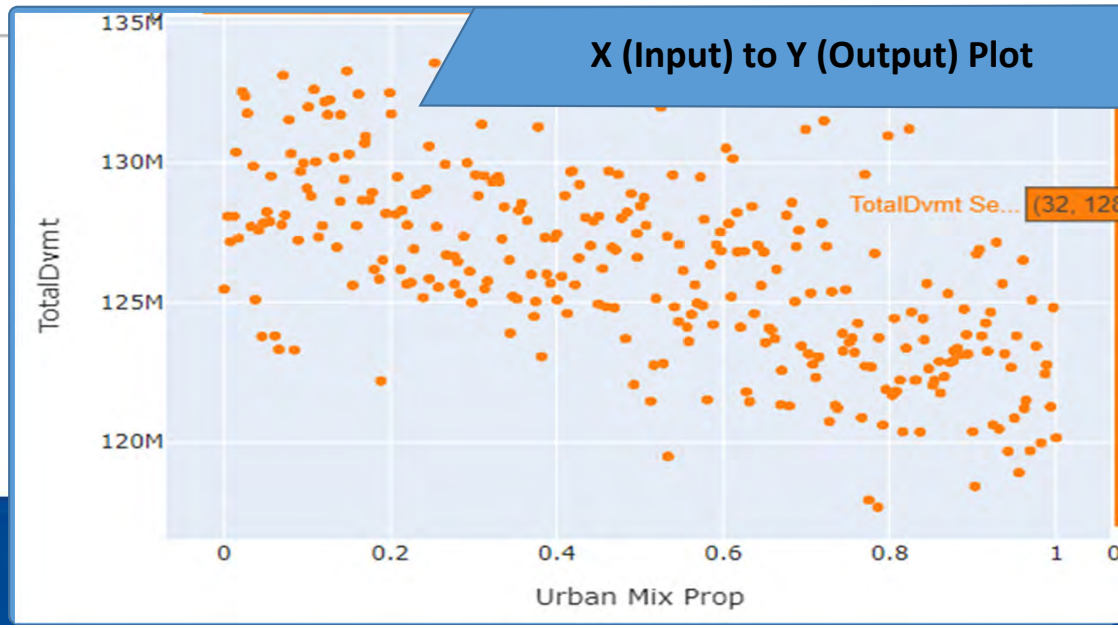
- Evaluate A Baseline Future
- Determine Measures of Effectiveness
- Determine Range of Feasible Inputs in Future Years
- Evaluate an Extensive Domain of Possible Future Scenarios
- Identify which Scenarios best Achieves Goals

New Tools Lead to New Opportunities

Outcome Driven Planning

- Enabled by new tools to allow for a robust set of quantitative analysis
- Rather than normative 'input driven outcomes' we can focus on a quantitative exploratory scenario planning (XSP) approach
- 'Goal Seek' to find Scenarios (and therefore which inputs) produce desirable outcomes
- **Many** unique results based on combinations of inputs. Beyond stochastic – it is based on design of model to explore scales, interpolations, etc.



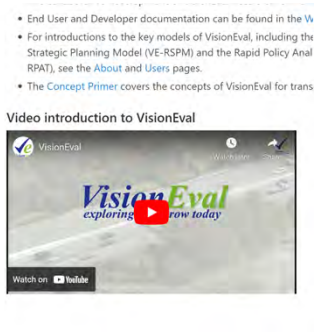


What is it? : VisionEval Strategic Model

- VisionEval is the most robust, quantitative strategic model that can be used for scenario planning.
- Estimated on readily available data including National data such as the National Household Travel Survey (NHTS) then calibrated to local conditions (PUMS, HPMS, travel surveys, travel models).
- Econometric framework for monetized costs (time & out of pocket) via a household travel budget. (e.g., congestion charges, fuel taxes, electrification effects)
- Sensitive to land use, operational tactics, and policy tactics (e.g., TDM, induced travel, signal coordination, teleworking).
- Runs quickly (run hundreds of scenarios in a short timeframe) because it lacks a specific network to assign trips. It is a daily travel model rather than a trip model.
- Results can be viewed in an interactive visualizer and are available in output files (CSVs, SQL, Excel, etc.)

VisionEval is supported through a Pooled Fund managed by FHWA.

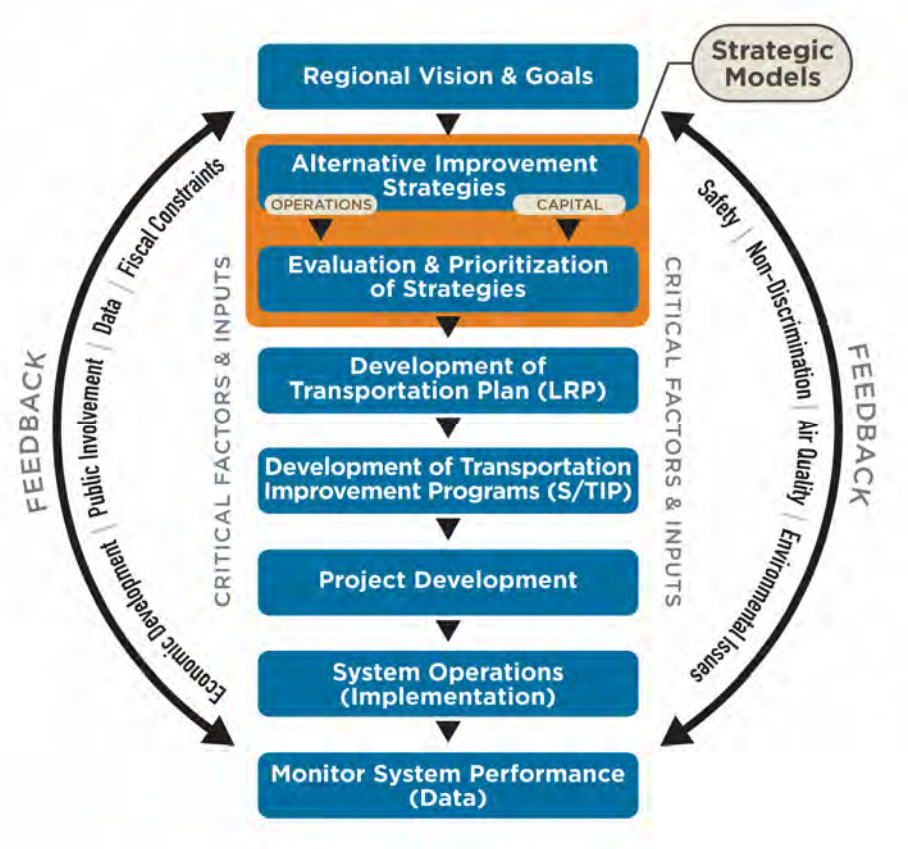
For more information
www.VisionEval.org



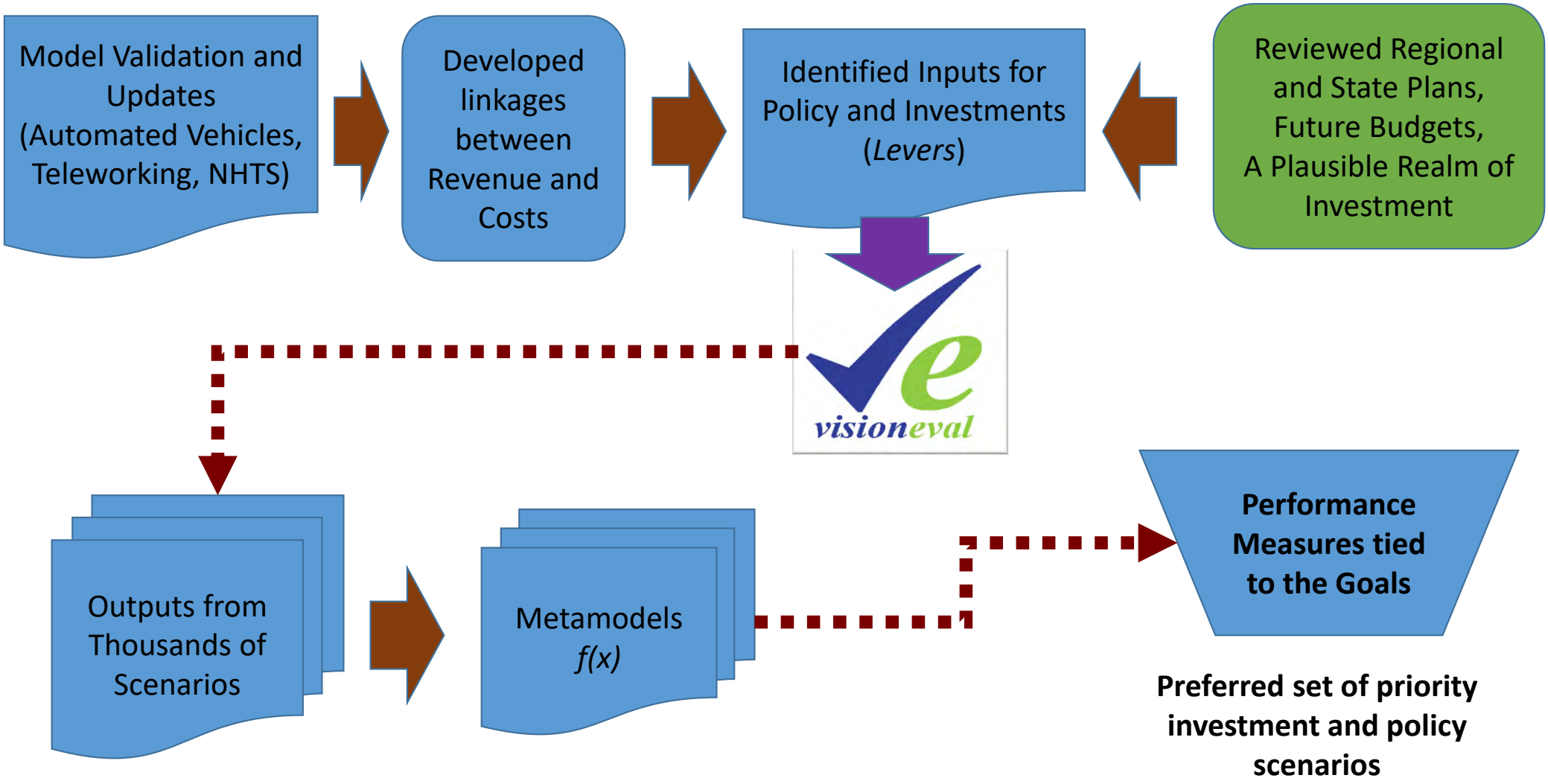
Covers more tactics more quickly than full travel models.

This makes them particularly compelling – they compliment existing models well.

Strategic Modeling in the Planning Process



- **Scenarios and future visions can be informed and tested**
- **Assess validity of different approaches**
- **Key metrics of VMT, GHG, Energy**
- **Identify likely policies and investments with high ROI early in the process. Justify and direct further detailed work.**
- **Used for LRTPs at both the MPO and DOT level**
- **Can be used to support CRPs and other GHG and emission work.**


Model Validation and Updates (Automated Vehicles, Teleworking, NHTS)
Developed linkages between Revenue and Costs
Identified Inputs for Policy and Investments (*Levers*)
Reviewed Regional and State Plans, Future Budgets, A Plausible Realm of Investment
visioneval
Outputs from Thousands of Scenarios
Metamodels *f(x)*
Performance Measures tied to the Goals
Preferred set of priority investment and policy scenarios

Range of Inputs

Phase 1: Levers

Phase 1 Tested a wide range of values among 13 different dimensions within Oregon's sphere of influence are tested. These largely include items such as:

Land Use Density
Btwn: Existing and 40% Mixed Use

Roadway Capacity
Btwn: 1.7% to 3.9% increase

Active Travel
Btwn: 2.5x and 4.5x increase in funding

Transit
Btwn: 25% and 85% increase in revenue miles

Electrification
Up to 30% BEV cars and buses

Demand Management
Btwn: 9% and 21% of Employees participating

Phase 2: Uncertainties

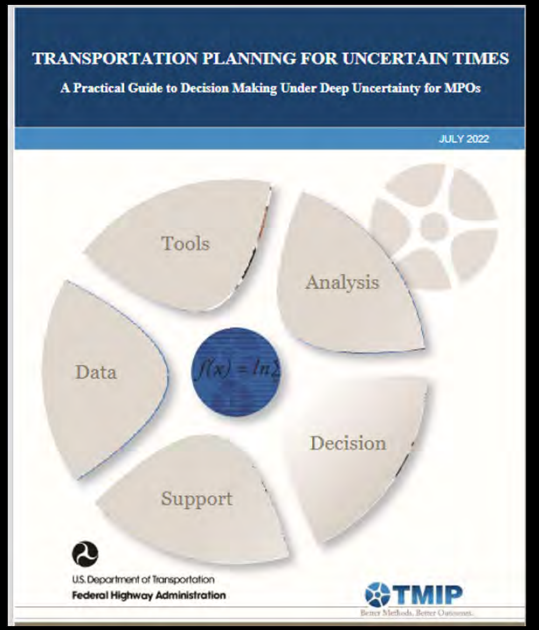
Phase 2 tested a range of largely uncertain inputs including:

- L3 and L5 Driverless vehicles (market penetration, capacity, delay)
- Teleworking rates (pre-Pandemic to 2021 peaks)
- Fuel & energy prices, and other ownership costs
- Shared rides and ride-hailing prices

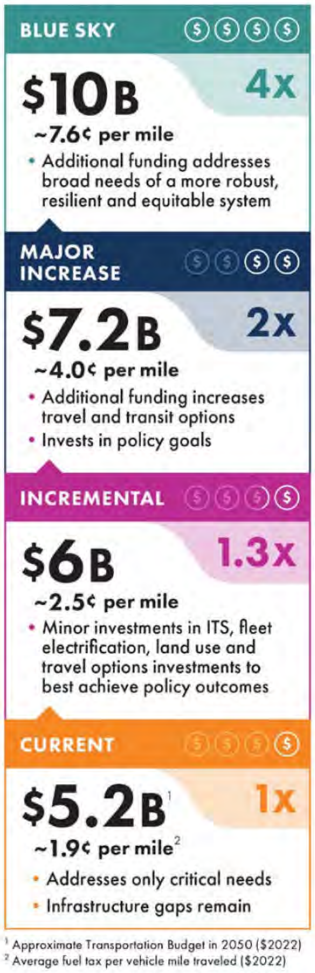
Phase 2:
Stress Test the Preferred Outcomes to Uncertainties

What was Novel

- Constrained environment between total budget reflects revenue and the amount of funding available for investments or maintenance.
  - Revenue to fund Transportation = Registrations + Fuel Taxes (gas+electricity) + VMT tax
  - Costs = full operational costs of Investing and Maintaining the system (a "loaded" cost to account for 'over head' as well as cash outlays, debt, etc.)
  - Feedbacks = if Preservation and Adaptation were below certain values, disbenefits then accrue back into the system
- Application of the Exploratory Framework TMIP-EMAT in a Statewide VisionEval Model.
  - Tool built on the Exploratory Modeling Workbench design supported by FHWA through several projects.
  - Expansive scenario design within a budget constrained environment
- Developed query mechanisms to evaluate Metamodels produced and develop insights on what inputs are associated with desired outcomes and the inverse; what inputs challenge those goals.



Recent research highlights the strengths of the VisionEval tool for planning applications and decision making under deep uncertainty



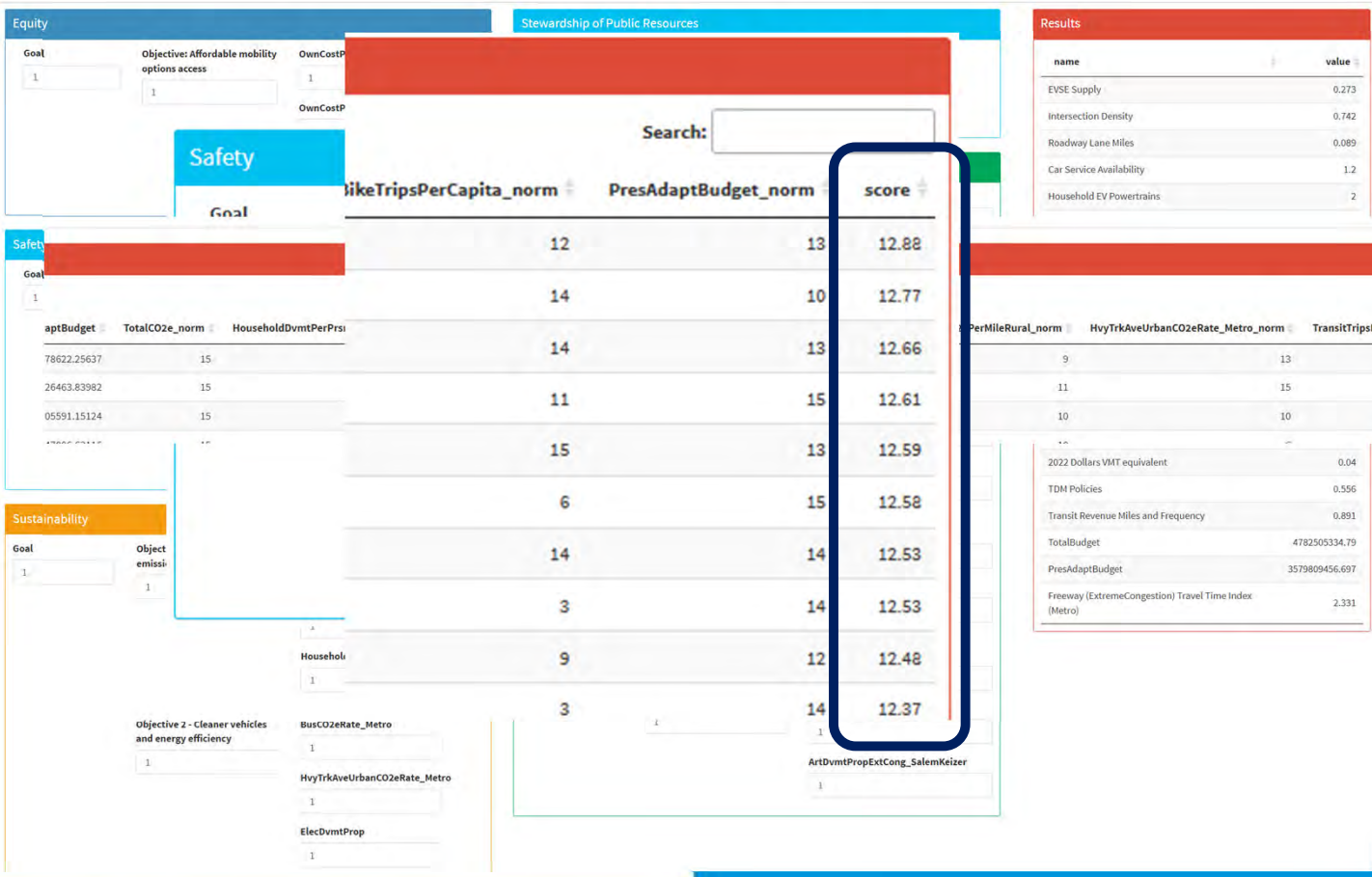
How we used it

- 4 Funding Levels created the constrained environment (costs balanced to revenue)
- VE processed runs based on permutations of the inputs
- 16,000 scenarios (metamodel results) analyzed at each funding level.
- Developed RShiny tool to interactively weight each output from the VE model to develop a 'score' for each scenario.
- Higher Scores are associated with meeting the intended goal Areas.
- The Balanced Outcome of all goals being equally weighted was preferred, with different scenario designs at each funding level

Uploaded all Results from the EMAT Metamodal

A weight for each output, objective, and goal

Each output was put into 15 bins and each bin was given points for how well it attained the goal



Each Scenario is Scored based on how many points each output had

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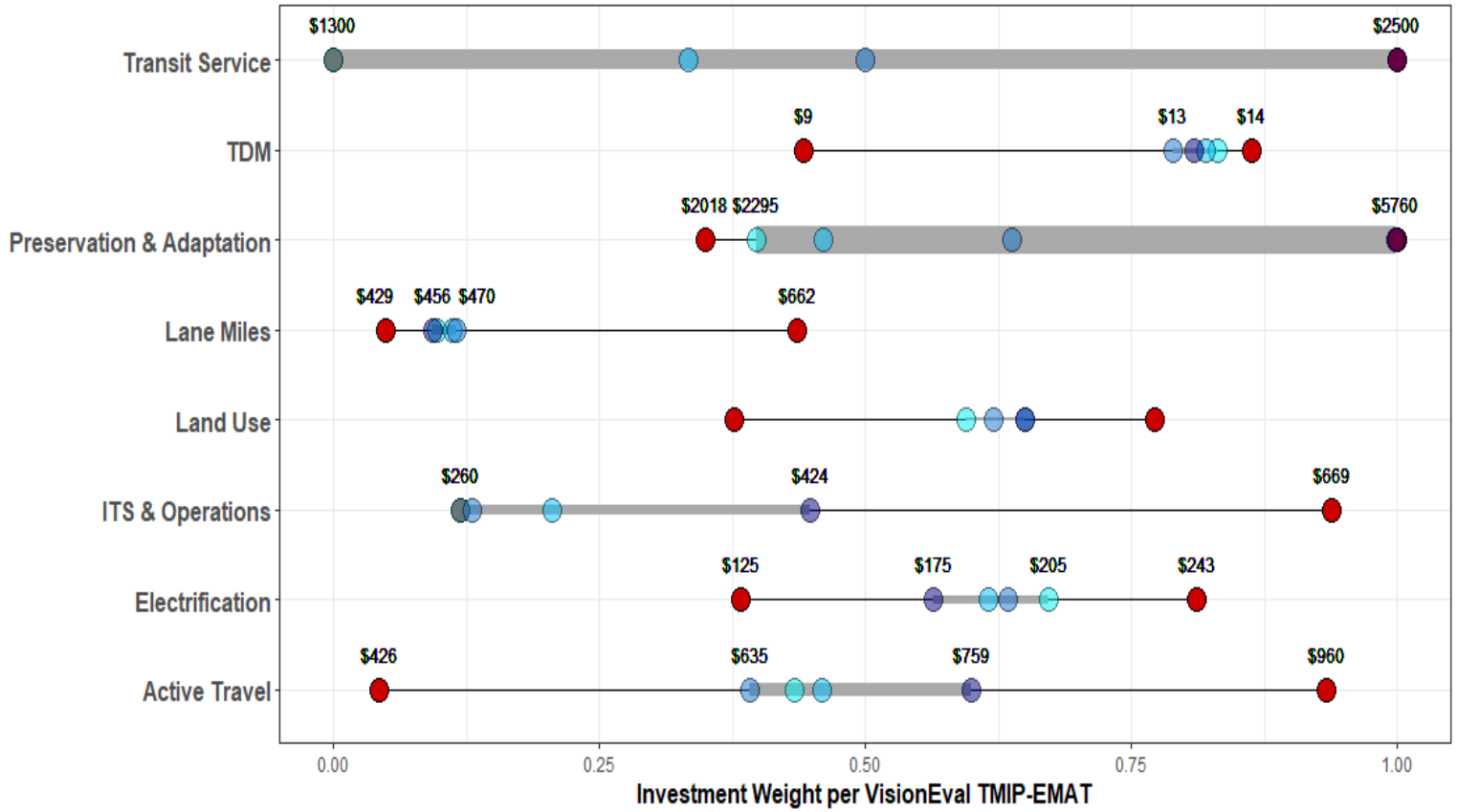
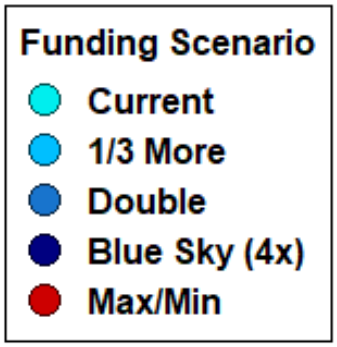
Investment Ranges For the OTP: Balanced Outcome



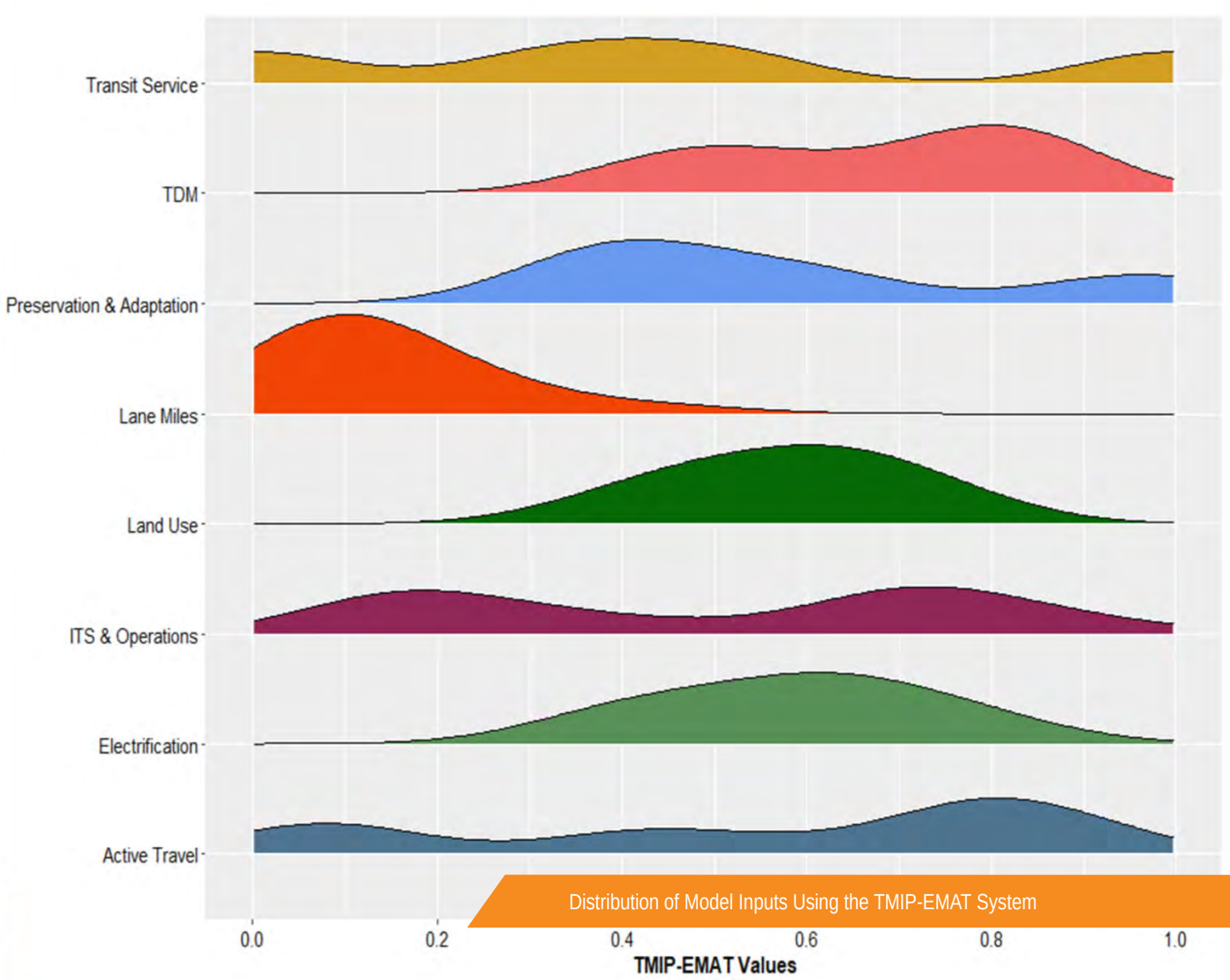


Balanced Funding in the center – with the ends representing the range of other investment levels for other Goal areas emphasized (GHG, Mobility & Preservation, Multimodal travel)

The OTP Balanced Outcome Scenario (optimize achieving all goals) was shown to have some consistency as to the inputs underpinning that scenario.

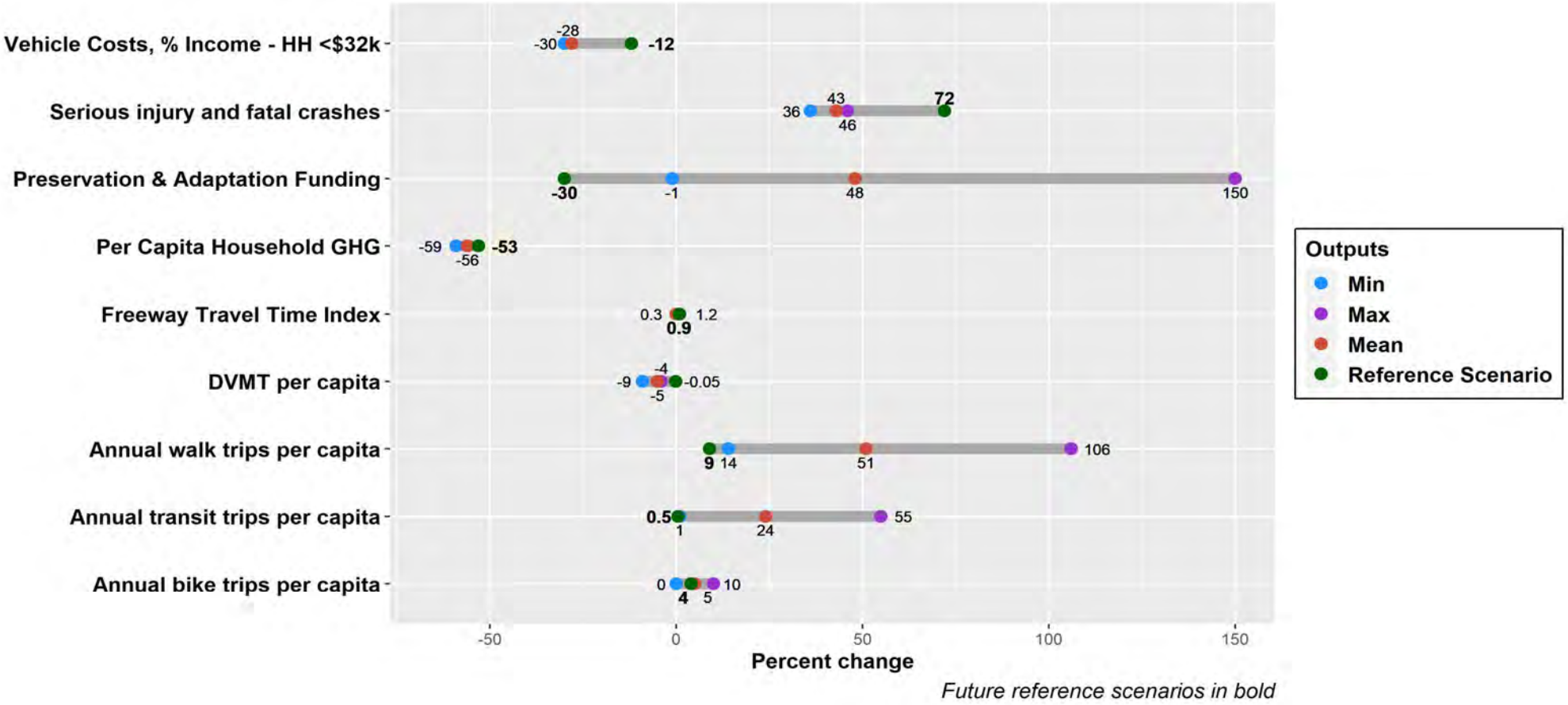
The 'waves' here show the Input distribution across the funding levels that achieve the Balanced Outcome.

- **Lane Miles vs Active Travel & TDM**
- **Electrification & Land Use**
- **ITS & Operations**



Distribution of Model Inputs Using the TMIP-EMAT System

Outcomes Across the OTP Scenario with Changes in Funding



Future reference scenarios in bold

How We Told The Story

Technical Process

Identify “drivers of change”

Develop and refine scenarios

Define tools and assumptions

Evaluate and report out findings

Gathering Input

Stakeholders consider “what if” questions

Engage public through online open houses

Findings inform understanding of trade-offs

OTC considers feedback

What We Heard Back and Learned

Balanced Outcome Scenario – Optimization across the 6 OTP Goals– supported by ODOT executive leadership and recommended by the Policy Coordinating Committee (chief advisory body for the OTP update process)

Recognize that some outcomes could have been strengthened, but that is the impact of balancing across the 6 OTP Goals

Public comment period recently concluded – most comments on the OTP Scenarios were supportive of Blue Sky (4X) in order to prioritize certain OTP Goals over others

Observed Tensions:

- Reduced VMT per capita contrasting with Travel Time Reliability and mobility
- Biking trips and Transit
- VMT and Electrification

Thank You

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Oregon Department of Transportation