Managing Transportation Unknowns with Performance-Based Planning, Models and Scenarios

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FHWA Office of Planning

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Performance-Based Planning: Definition

- Evaluate **measurable** outcomes
- Then do things to move toward the **target**

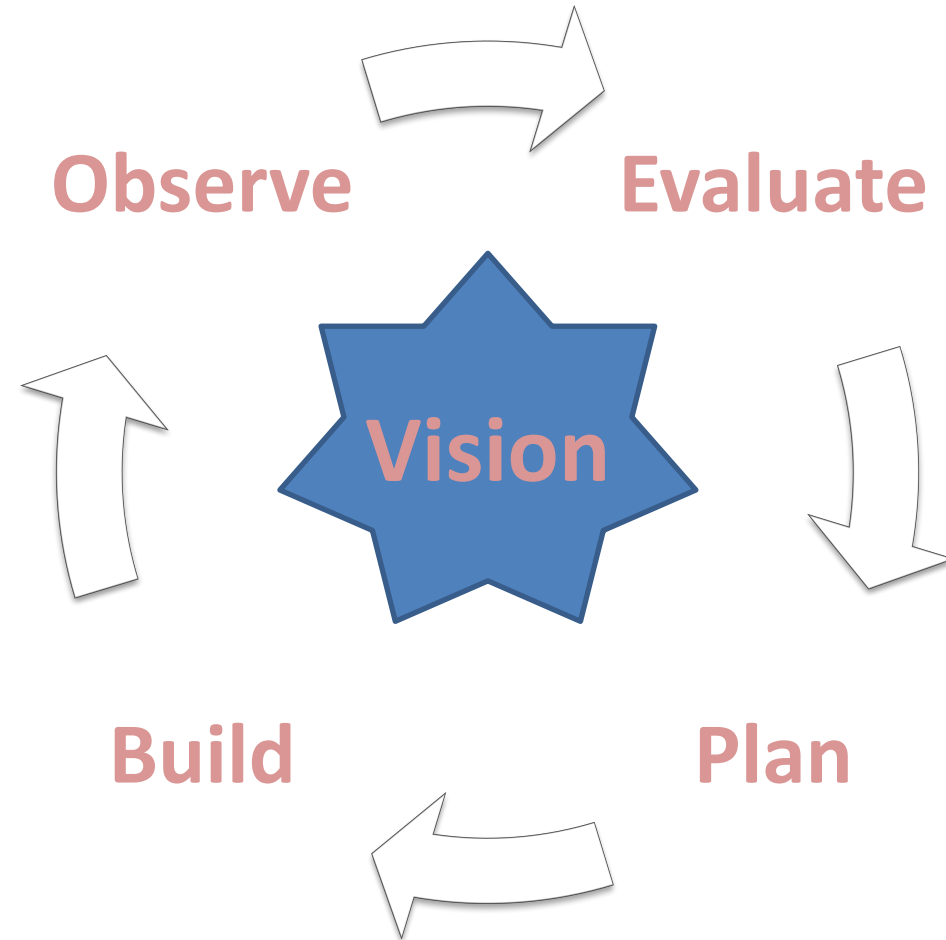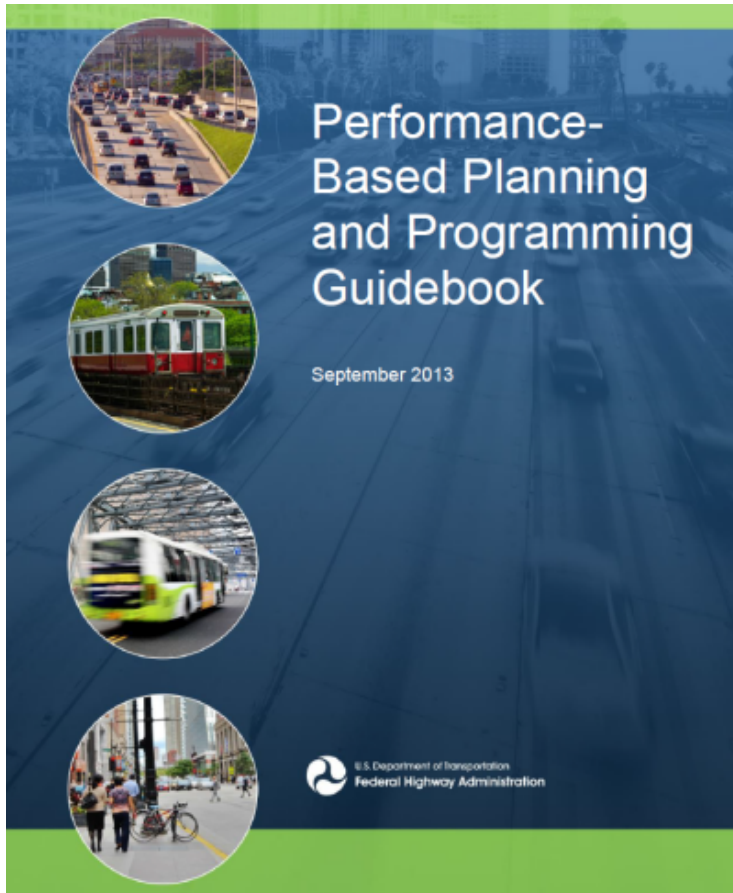- Measurable – "What is it?"
- Target – "What does it mean?"

Performance-Based Planning:
By The Numbers

Source: http://dashboard.virginiadot.org

- **Measure** something
- Is it **Good** or **Bad**?
- Set **targets**
- Change for the better
- **Measure** again
- Repeat until happy

Performance-Based Planning and Programming Guidebook

September 2013

U.S. Department of Transportation
Federal Highway Administration

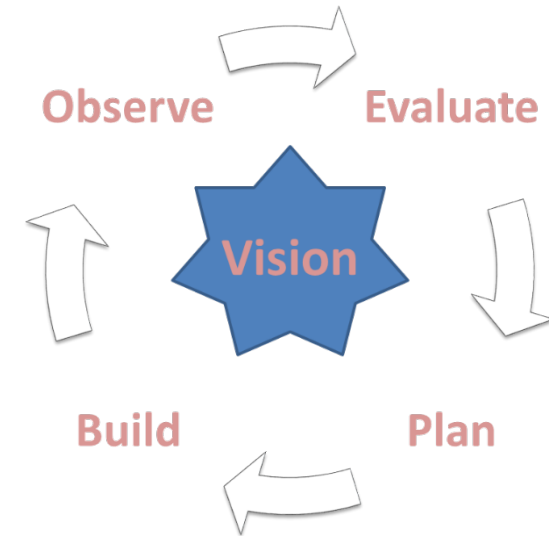**Observe** → **Evaluate** → **Plan** → **Build** → (cycle around) **Vision**

https://www.fhwa.dot.gov/planning/performance_based_planning/pbpp_guidebook/

Performance-Based Planning in Detail

How to Handle Uncertainty

- Take small steps
- Do experiments and pilot projects
- Reassess regularly
- Practice the Performance-Based cycle in small bites

Observe
Evaluate
Vision
Build
Plan

Summary of Scenarios for Performance-Based Planning

- Pick useful metrics
  - Detect key scenario events
  - Quantify success

- Use targets comprehensively
  - How are we doing?
  - Are we going where we expected?
  - How fast is the future coming at us?

- Develop contingency responses and projects
  - What would we do if… ?
  - Test projects against challenging scenarios

- Rethink scenarios based on what is happening

Scenarios are Stories, Not End States

- How we might get there is critical
- Examine
  - Drivers (external forces)
  - Levers (things we might control)
  - Tipping Points (new replaces old)
  - Significant Potential Risks
- Aim for resiliency in plans
  - Which set of projects gives us the most flexibility in the face of everything that might happen?

Models versus Scenarios

- "Modeling a Phenomenon" <> "Evaluating Scenarios"

- "Model phenomena"
  - Physical models
  - Microsimulations (sometimes)
  - Context narrowly and specifically defined

- "Evaluate scenarios"
  - Regional planning models
  - Sketch models
  - Context cannot be fully specified

What's in a "Model"?

- **Object of Study:** a specific phenomenon
- **Outcome:** what specific "natural" metrics define the phenomenon?
- **Data:** what data do we have (or expect to have)
- **Influences:** what factors influence the metrics, and what do we know about them (data, other models, etc.).
  - This should be the shortest possible list (parsimony)
- **Assumptions:** what we need to assume in order to relate influences to outcomes

Challenges for Modeling New Tech

- We haven't yet seen the phenomenon
- We don't have the data (even if we have seen the phenomenon)
- We're not clear on what we should assume
- We're often not even aware that we're making assumptions
- We don't understand the process behind the phenomenon
- The phenomenon itself may change the process in unknowable ways

What's a "Scenario"?

- Old definition:
  - Estimates of future conditions that serve as inputs to forecasting models

- New definition:
  - Everything in the old definition
  - **PLUS:** all the models and auxiliary assumptions we use to evaluate metrics relevant to the scenario

What's in a "Scenario"?

- **Object of Study:** Evaluate conditions relative to policy metrics
- **Outcome:** Values of policy metrics
- **Data:** The "old style" scenario – the conditions we need to evaluate
- **Components:** phenomena (models) that influence the outcome?
  - Defined by policy or decision context
  - Not deducible from data
- **Assumptions:** Models are driven by "what?" and "how?". Scenarios are driven by "Why?" or "Why do we need to know?"

Challenges for New Tech Scenarios

- "Forecasting models" are, in this sense, "scenarios"
- Scenarios are imposed on the phenomenon
  - Contingent on the policy context
- Scenarios cannot tell us what *will* happen
  - Scenario evaluations are about "what will matter", not "what will be"
  - There is an infinite number of scenarios
- The "right" scenarios cannot be deduced from data

Strategic Visioning and Planning
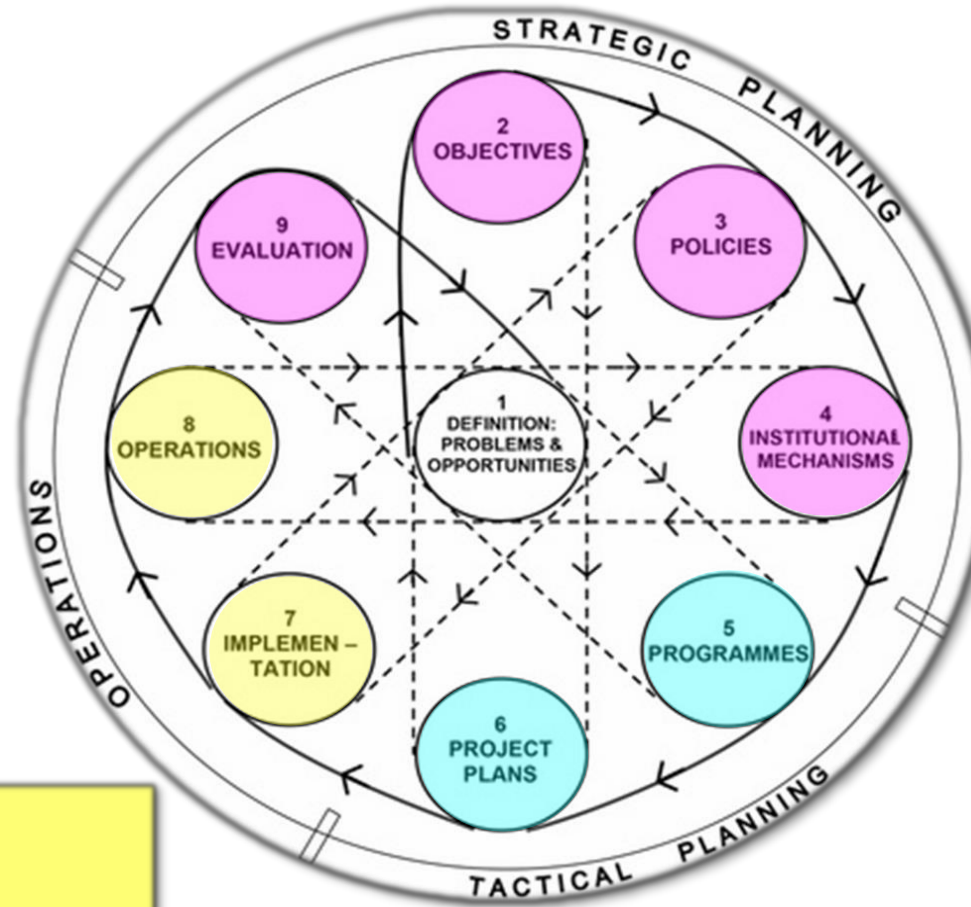
Strategic Planning Models
- Broad scope
- Limited detail (e.g. system level)
- Many scenarios
- **e.g. VisionEval**

Operations Models
- Limited scope
- Very detailed (e.g. intersection level)
- Few scenarios
- e.g. traffic simulation, transit operations

Tactical Models
- Moderate scope
- Moderate detail (e.g. link level)
- Few scenarios
- e.g. urban travel demand model

Modified from planning diagram by: Edward Leman (www.chreod.ca)

Performance-Based Planning, Models and Scenarios

VisionEval
Strategic Modeling Framework

- Overview, Documentation and Downloads
  - http://visioneval.org

- Open Source Code and Technical Information
  - https://github.com/VisionEval

- Pooled Fund Contact:

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Serenity Prayer for Modelers

Grant me the **serenity** to accept scenarios in place of certainty,

The **courage** (and the data) to model the things I can,

And the **wisdom** to know the difference.

New Publications

- NCHRP Report 896:
  "Updating Regional Transportation Planning and Modeling Tools to Address Impacts of Connected and Automated Vehicles" (November 2018)
  https://www.trb.org/Main/Blurbs/178392.aspx

- AMPO Automation Planning Framework (April 2019) http://www.ampo.org

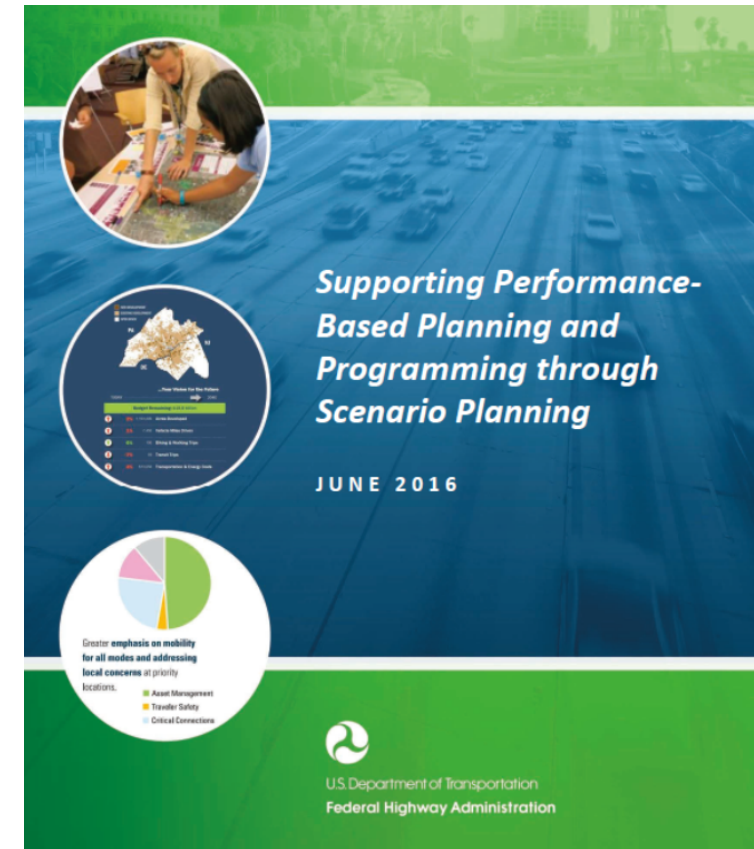- Scenario Planning for Vehicular Automation (FHWA Office of Policy; Forthcoming)

FHWA Scenario Planning Guidebook
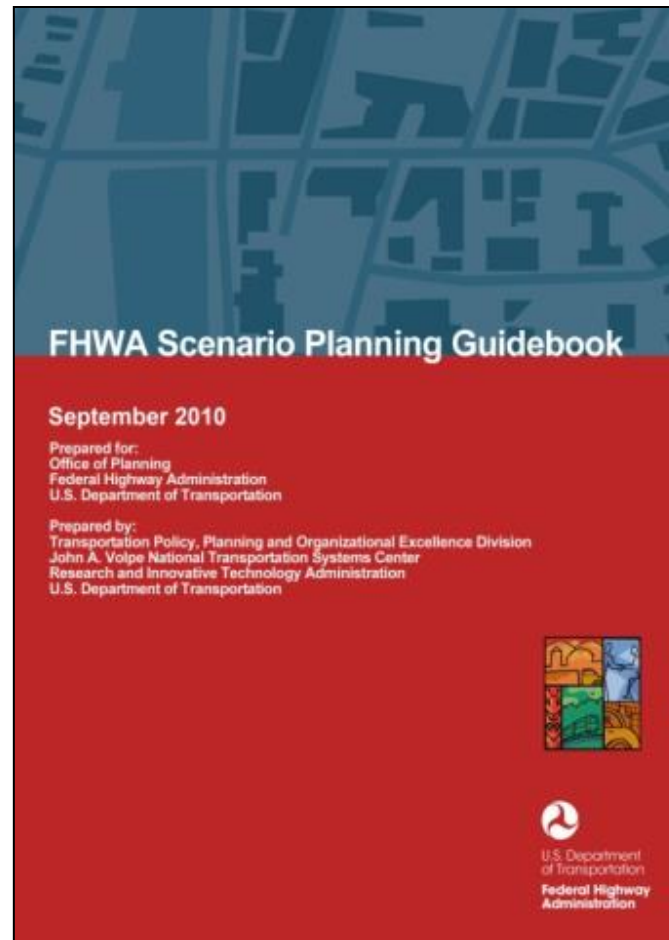
https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/scenario_planning_guidebook_2011

Performance-Based Planning, Models and Scenarios

Scenario Planning Supports Performance-Based Planning and Programming

- Apply performance management concepts in transportation planning and programming processes

- Based on strategic direction to shape decisions about policies and investments

- Ensure that transportation investment decisions (*long-range* and *short-range)* are based on their ability to meet established goals

Supporting Performance-Based Planning and Programming through Scenario Planning

JUNE 2016

U.S. Department of Transportation
Federal Highway Administration

NEXT GENERATION SCENARIO PLANNING:
A TRANSPORTATION PRACTITIONER'S GUIDE

U.S. Department of Transportation
Federal Highway Administration

https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/publications/next_gen/index.cfm

Transportation Systems Management and Operations (TSMO) through Scenario Planning

Advancing Transportation Systems Management and Operations
Through Scenario Planning

➢ Consider uncertainties that impact TSMO

➢ Adapt to shifting behavior or community goals

➢ Examine tradeoffs among strategies

➢ Build consensus on competing goals

➢ Translate goals to specific TSMO strategies

https://ops.fhwa.dot.gov/publications/fhwahop16016/index.htm

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