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

Jeremy Raw, P.E.
FHWA Office of Planning
May 8, 2019
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

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

Source: http://dashboard.virginiadot.org
https://www.fhwa.dot.gov/planning/performance_based_planning/pbpp_guidebook/
Performance-Based Planning in Detail

PLANNING
Strategic Direction
Where do we want to go?
- Goals and Objectives
- Performance Measures

Analysis
How are we going to get there?
- Identify Trends and Targets
- Identify Strategies and Analyze Alternatives
- Develop Investment Priorities

DATA
PUBLIC INVOLVEMENT

Investment Plan
- Resource Allocation
- Program of Projects

Implementation and Evaluation
How did we do?
- Monitoring
- Evaluation
- Reporting

Programming
What will it take?
How to Handle Uncertainty

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

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

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

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)
VisionEval
Strategic Modeling Framework

• Overview, Documentation and Downloads
  – http://visioneval.org

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

• Pooled Fund Contact:
  Jeremy Raw
  Jeremy.Raw@DOT.gov
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


• 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
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
Transportation Systems Management and Operations (TSMO) 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

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

Jeremy Raw, P.E.
FHWA Office of Planning
May 8, 2019