VTrans2040: Sketch Planning for Exploratory Scenarios

AMPO CONFERENCE

OCTOBER 19, 2017
Scenario planning for uncertain times

TREND DRIVERS

Demographic

Economic

Environment/Energy

Technology/Mobility

Quantum Technology Advances

Shifting Values/Behaviors

Globalization

Trend Disrupters
Scenario Planning Approaches

NORMATIVE scenario planning is used to envision what SHOULD happen
PREDICTIVE scenario planning considers VARIATIONS ON A THEME

→ Discerning preferences, articulating values, shaping vision, strategizing preferred outcomes

What SHOULD Happen?

How should we grow?

How should we invest?

What COULD Happen?

What if we grow much faster or slower?

How might new technologies change the game?

→ Discovering opportunities, identifying risks, shaping tactics, optimizing chances of success
Stay tuned for new publications on “NextGen” Exploratory Scenario Planning...
VTrans 2040 Exploratory Scenarios

1. DRIVERS
2. SCENARIOS
3. INPUT ASSUMPTIONS
4. OUTCOMES
5. POLICY IMPLICATIONS

How are the results used?

**Resilience Test:**
Which policies produce optimal results under ALL possible scenarios?

**Responsiveness Test:**
Over time, which scenario is getting closest to reality? Which policies best respond to this scenario?

What will the results help inform?

- “Stress test” of VMTP 2025 Recommendations
- Inform Agency Business Plans
- Inform VTrans Implementation Plan
- Input to MPO Long Range Plans
Start with Drivers

Drivers (What drives change globally)

- Demographic
- Economic
- Technological
- Environmental

Transportation Outcomes (How global change can affect transportation)

- Demand/Behavior
- Supply/Delivery
- Operations/Performance
- System/User Costs

Impact on Transportation

Uncertainty

Impact Levels:
1. Low Low
2. Low High
3. High Low
4. High High
Sketch Planning Outputs

<table>
<thead>
<tr>
<th>Person Travel</th>
<th>Freight Movement</th>
<th>All Travel</th>
<th>Costs</th>
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</thead>
<tbody>
<tr>
<td>Person Miles</td>
<td>Freight Ton Miles</td>
<td>Vehicle Miles</td>
<td>User Costs</td>
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<tr>
<td>Person Trips</td>
<td>Freight Trips</td>
<td>Recurring Congestion</td>
<td>System Costs</td>
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<tr>
<td>Person Mode</td>
<td>Freight Mode</td>
<td>Non-recurring Congestion</td>
<td>Tradeoffs</td>
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</tbody>
</table>

- Quantitative
- Qualitative
- Directional/Relative
Scenario Planning Toolkit

DRIVERS
- Demographic
- Economic
- Environment/Energy
- Technology/Mobility

COMMUNITY TYPES
- V6 – Multimodal Urban
- V5 – High Density Suburban
- V4 – Multimodal Suburban
- V3 – Small Town/Suburban
- V2 – Low-Density Suburban
- V1 – Rural

GENERATIONS
- Baby Boomer
- Generation X
- Millennial
- Generation Z

INDUSTRY MIX
Placetypes

Two Key Criteria

1. People + Jobs Per Acre (Density)
2. Transit Accessibility

VTrans2040 Placetypes

V1 - Rural
V2 - Low Density Suburban
V3 - Small Town/Suburban
V4 - Multimodal Suburban
V5 - High Density Suburban
V6 - Multimodal Urban

PDC Boundaries

V1 – Rural
V2 – Low Density Suburban
V3 – Small Town/Suburban
V4 – Multimodal Suburban
V5 – High Density Suburban
V6 – Multimodal Urban

~90% of the state’s land area (2015)

Mechanicsville, Smithfield
Staunton, Danville
Sterling (Loudoun), Willow Lawn (Richmond)
Fan District (Richmond), Ghent (Norfolk)
Downtown Richmond, Clarendon (Arlington)

Downtown Richmond, Clarendon (Arlington)

Richmond, Clarendon (Arlington)

Fan District
Ghent (Norfolk)

Sterling (Loudoun), Willow Lawn (Richmond)

V1 – Rural
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PDC Boundaries
Placetypes

VTrans2040 Placetypes
- V1 - Rural
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- PDC Boundaries

Differentiate:
- Mode Split
- Demographics
- Trip Rates
- Technology Implementation
Crafting Scenarios from Drivers

High Growth
Industrial
• Less Urban
• Higher VMT Assumptions

High Growth
High Tech
• More Urban
• More Multimodal

Moderate Growth
• Older Demographics
• Walkable Places

Reduced Growth
• Federal Spending Reduced
• Slower adoption of technology

Industrial Renaissance
Techtopia
Silver Age
General Slowdown
Crafting Scenarios from Drivers

- Iterative Process
- Adapt to achieve:
  - Internal consistency
  - Range of outcomes
Baseline Scenario Assumptions for 2040

**Where is population growth occurring?**
Across the state, but highest growth rates found in multimodal areas
Increases in transit, biking, and telecommuting modes

**What are the employment and industry trends?**
Shift to online retail, home delivery

**How advanced is transportation technology?**
High degree of AV and Mobility on Demand, varying by placetype

**What are the environmental considerations?**
Baseline of predictions for high-heat days and severe storm days

Increases in transit, biking, and telecommuting modes
Scenarios Overview

**Industrial Renaissance**
- High Pop. Growth
- Industrial
- Suburban/Rural
- Med. AV/MOD
- Climate Extremes

**Techtopia**
- High Pop. Growth
- High Tech.
- Urban
- High AV/MOD
- Climate Stability

**Silver Age**
- Comparable Pop. Growth
- Small business/Health Care
- Walkable Places
- Med.-High AV/Low MOD
- Develop. in less Vulnerable Places

**General Slowdown**
- Lower Pop. Growth
- Reduced Spending
- Less Urban
- Low AV/MOD
- Volatile Energy $
Employment

ECONOMIC DRIVERS AND EMPLOYMENT
Economic Drivers

**Industrial Renaissance**
- Expansion of Creative Class
- Advanced production
- Growth in international trade

**Techtopia**
- Microproduction
- Expansion of Creative Class
- Growth in international trade

**Silver Age**
- Small Business Growth
- Healthcare

**General Slowdown**
- Military Slowdown
- Retail Slowdown
Assumed Scenario Employment Adjustments

Projected Employment Change by Scenario (2015-2040)

- **2040 Baseline**: 23.2%
- **Industrial Renaissance**: 27.9%
- **Techtopia**: 27.7%
- **Silver Age**: 22.4%
- **General Slowdown**: 19.2%

Employment Growth by Scenario (Versus 2040 Baseline)

- **Industrial Renaissance**: +3.7%
- **Techtopia**: +3.6%
- **Silver Age**: -0.7%
- **General Slowdown**: -3.3%
Population

DISTRIBUTION AND ALLOCATION
Population Drivers

- **Industrial Renaissance**: Attract More Millennials, Attract More Boomers
- **Techtopia**: Attract More Gen X, Attract More Gen Z
- **Silver Age**: Attract More Gen X, Attract Fewer Gen Z
- **General Slowdown**: Attract Fewer Millennials
Assumed Scenario Population Adjustments

Projected Population Change by Scenario (2015-2040)

- Industrial Renaissance: 28.3%
- Techtopia: 32.3%
- Silver Age: 32.2%
- General Slowdown: 27.6%
- Scenario 1: 24.8%

Population Change by Scenario (Versus 2040 Baseline)

- Industrial Renaissance: 3.1%
- Techtopia: 3.0%
- Silver Age: -0.5%
- General Slowdown: -2.8%
## 2040 Population Allocation by Placetype Assumptions

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*V7 - New Placetype introduced for Scenario 2, reflecting densities comparable to those in San Francisco, CA and Washington, DC.

**Key:**
- Increase
- Decrease
- Baseline
## 2040 Population Allocation by Placetype Assumptions

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**Key:**
- Increase
- Baseline
- Decrease

N/A
Over 600,000 more people live in Virginia in Scenarios 1 & 2 than in Scenario 4.

Approx. 900,000 more people live in high density areas (V5, V6, V7) in Scenario 2 than in Scenario 4.
Getting Around

MODE SPLIT, AUTONOMOUS VEHICLES, AND MOBILITY ON DEMAND
Transportation Mode Shift Assumptions by Scenario (Relative to Baseline) in 2040

- **Industrial Renaissance**: Same as Baseline
- **Techtopia**: An increase in alternative transportation could help reduce Vehicle Miles of Travel (VMT) and decrease overall transportation costs
- **Silver Age**: Same as Baseline
- **General Slowdown**: Same as Baseline
Mode Split Methodology

Computed mode splits and VMT by Placetype for each Scenario, accounting for:

1. Work/non-work travel
2. Anticipated changes in travel behavior
3. Mode-specific occupancy rates (yielding weighted ratio of person trips to vehicle trips)
4. VMT per capita relative to 2014
By 2040...it is likely that autonomous vehicles and Mobility on Demand (ex: Uber and Lyft) will play a significant role in passenger travel, especially in urban areas.

Automation and Mobility on Demand assumptions vary across placetypes and by scenario.

Information inspired by 2016 public input
Assumptions of Percent of Passenger Vehicle Travel Using Autonomous Vehicles and Mobility on Demand

Percent AV Travel by Scenario
Anticipated range: 70% (low) to 90% (high)

Its is likely that AV technology will be extremely advanced by 2040, but it is uncertain whether our policies, infrastructure, and preferences will accommodate and welcome this monumental technological shift.

Percent Mobility on Demand by Scenario
Anticipated range: 50% (low) to 80% (high)

Mobility on Demand services, like Uber and Lyft, are expected to continue changing the way we travel, especially for short trips in urban areas.
Travel Demand & Through-put

DEMAND, TECHNOLOGY, AND EFFICIENCY
Population and mode split changes are expected to result in roadway demand increases (VMT) of **22%-30%** (depending on Scenario)

VMT is expected to increase as more people take more trips.
Technology & Roadway Demand

Technology is expected to change travel behavior and increase roadway demand (VMT) by 25%-35% (depending on Scenario).
Technology and Efficiency

Safety
Information
Pricing
V2V & V2I
THROUGHPUT
Induced VMT Change Results

Technology’s most significant capacity/through-put benefits will likely occur on interstates and arterials.

VDOT’s interstate and arterial network was classified by VTrans Placetype to help capture the extent of technology benefits across the Commonwealth.

<table>
<thead>
<tr>
<th>Placetype</th>
<th>Interstates as % of total network</th>
<th>Arterials as % of total network</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1 Rural</td>
<td>4%</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>V2 Low Density Suburban</td>
<td>7%</td>
<td>24%</td>
<td>31%</td>
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<tr>
<td>V3 Small Town/Suburban</td>
<td>7%</td>
<td>30%</td>
<td>37%</td>
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<tr>
<td>V4 Multimodal Suburban</td>
<td>7%</td>
<td>31%</td>
<td>38%</td>
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<tr>
<td>V5 High Density Suburban</td>
<td>12%</td>
<td>35%</td>
<td>47%</td>
</tr>
<tr>
<td>V6 Multimodal Urban</td>
<td>10%</td>
<td>31%</td>
<td>42%</td>
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</tbody>
</table>
Technology and improved efficiency are expected to increase throughput by 9%-21% (depending on Scenario)

Although VMT is expected to increase, vehicle technology & infrastructure improvements will help increase travel efficiency and throughput (effectively increasing roadway capacity)
Comparing Scenarios (Statewide)

- **Industrial Renaissance**
  - DEMAND: Pop., VMT
  - CAPACITY: Thru-put

- **Techtopia**
  - DEMAND: Pop., VMT
  - CAPACITY: Thru-put

- **Silver Age**
  - DEMAND: Pop., VMT
  - CAPACITY: Thru-put

- **General Slowdown**
  - DEMAND: Pop., VMT
  - CAPACITY: Thru-put
Additional Components

- More detailed freight analysis
- Environmental driver analysis
- User cost analysis
- System cost analysis
- Survey on risks, opportunities & investments
How can we prepare for the future?

Anticipate increased demand

- Harness the safety and efficiency benefits of Connected and Automated Vehicle (CAV) technology to increase travel throughput
- Design corridors to be nimble, with phased adaptation to technological advances (e.g. Connected and Automated vehicles)
- Coordinate transportation and land use
- Maintain and enhance the physical and digital infrastructure
- Evaluate new models of transportation funding
- Pursue the opportunities offered by smarter transit and mobility on demand
- Prepare for growth in freight, powered by rapid innovation
Thank You!

Final Presentations and Materials
www.vtrans2040.com
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