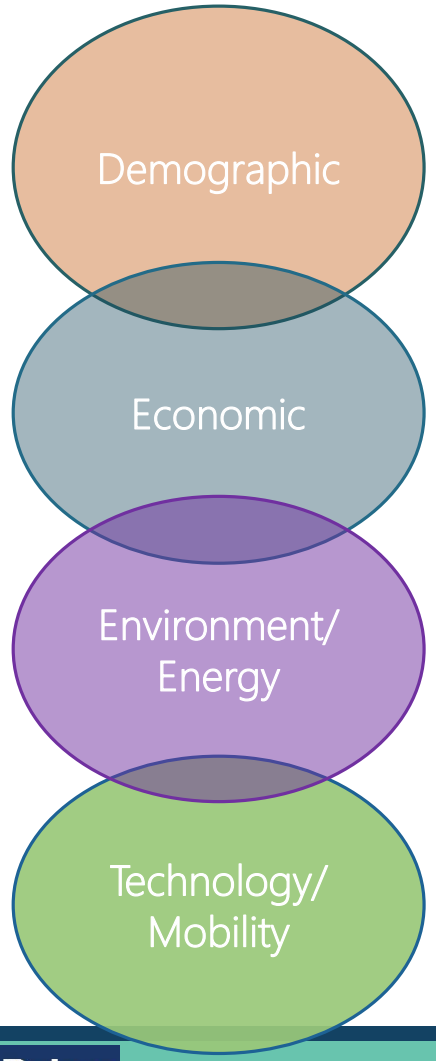
VTrans2040: Sketch Planning for Exploratory Scenarios

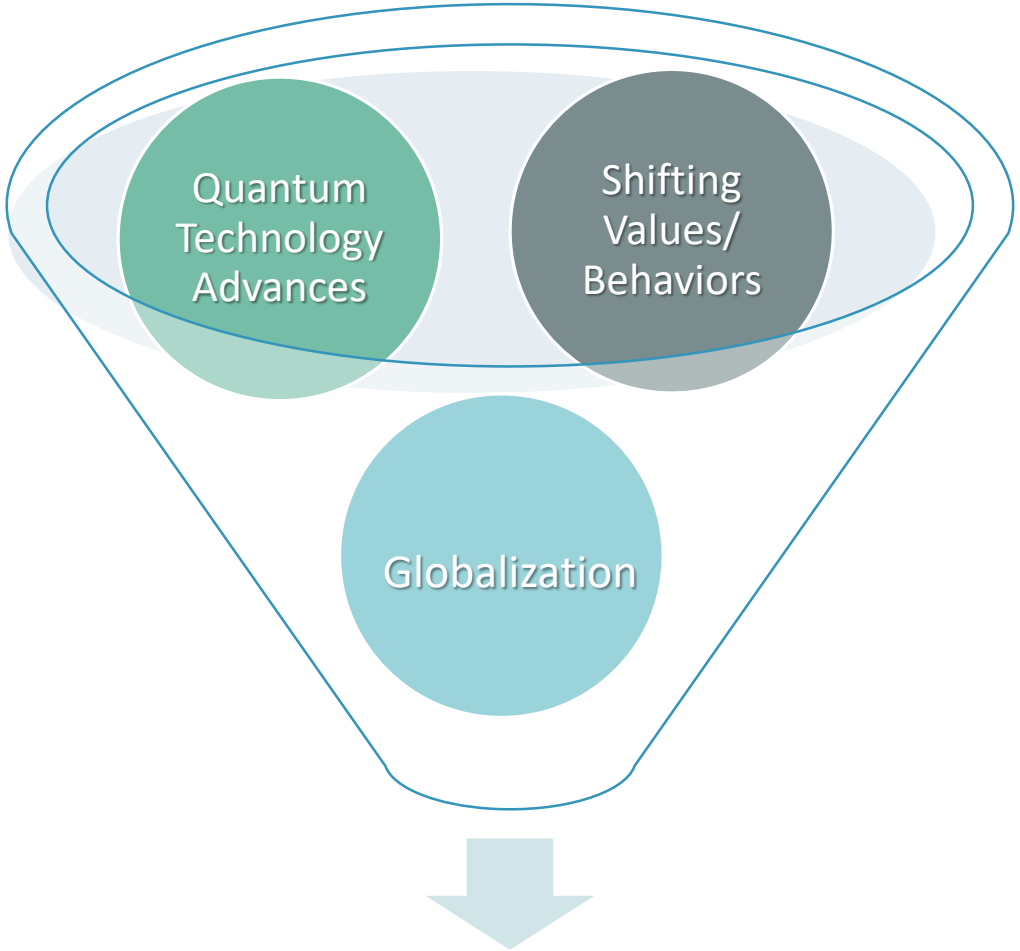
AMPO CONFERENCE

OCTOBER 19, 2017

Scenario planning for uncertain times

TREND DRIVERS

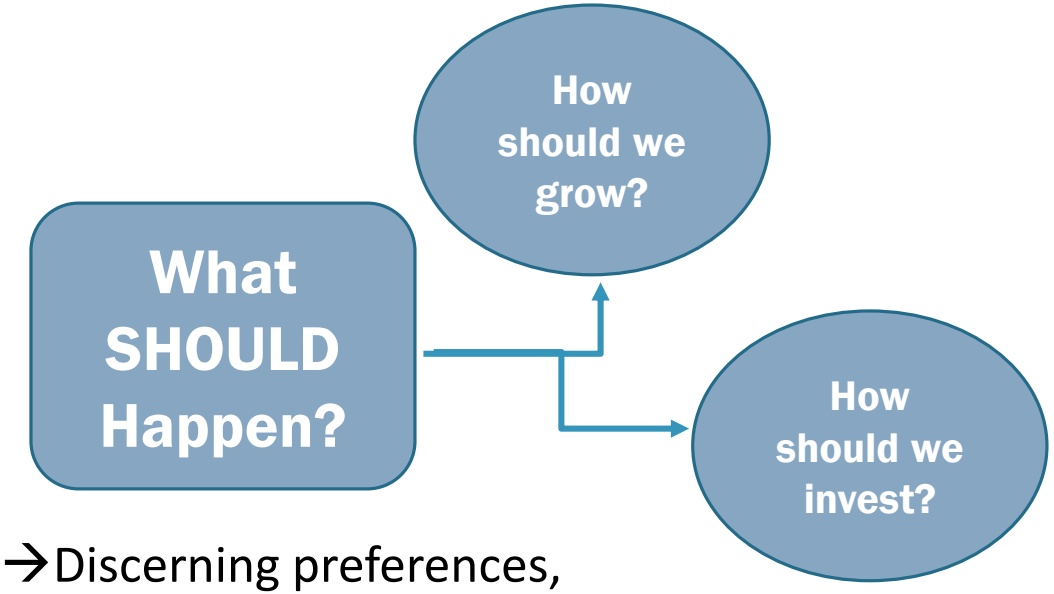




Trend Disrupters

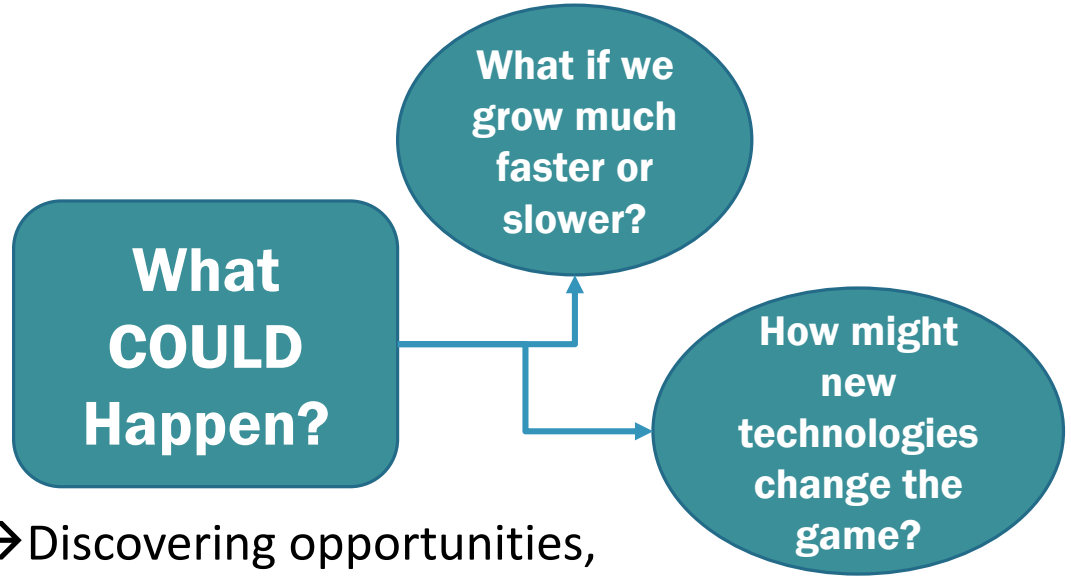
Scenario Planning Approaches

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



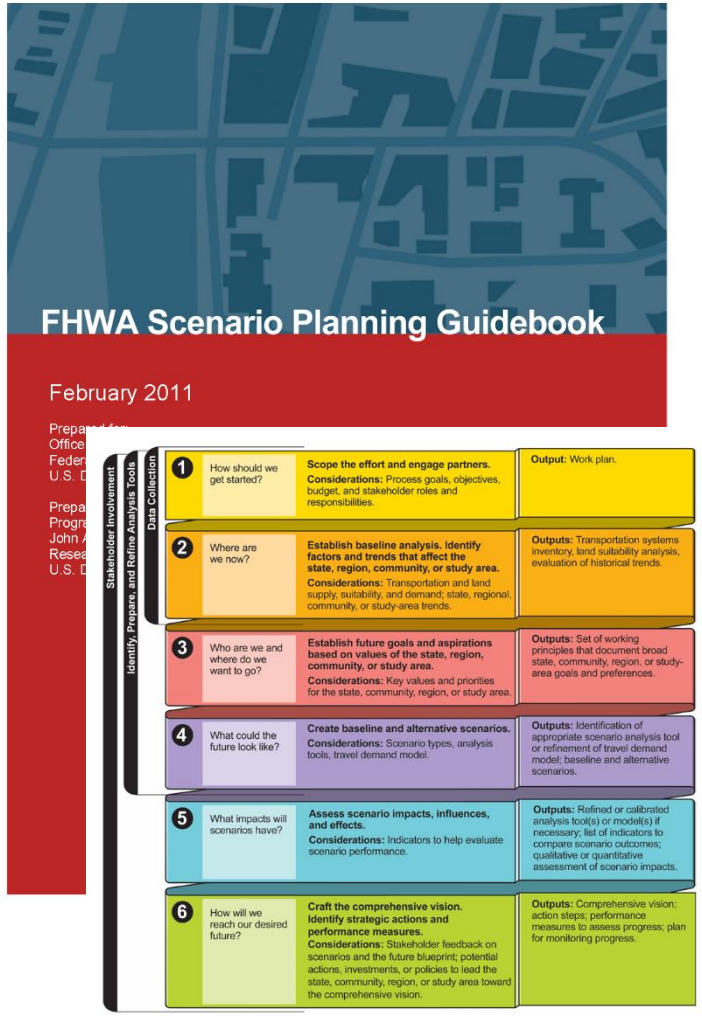
→Discerning preferences, articulating values, shaping vision, strategizing preferred outcomes

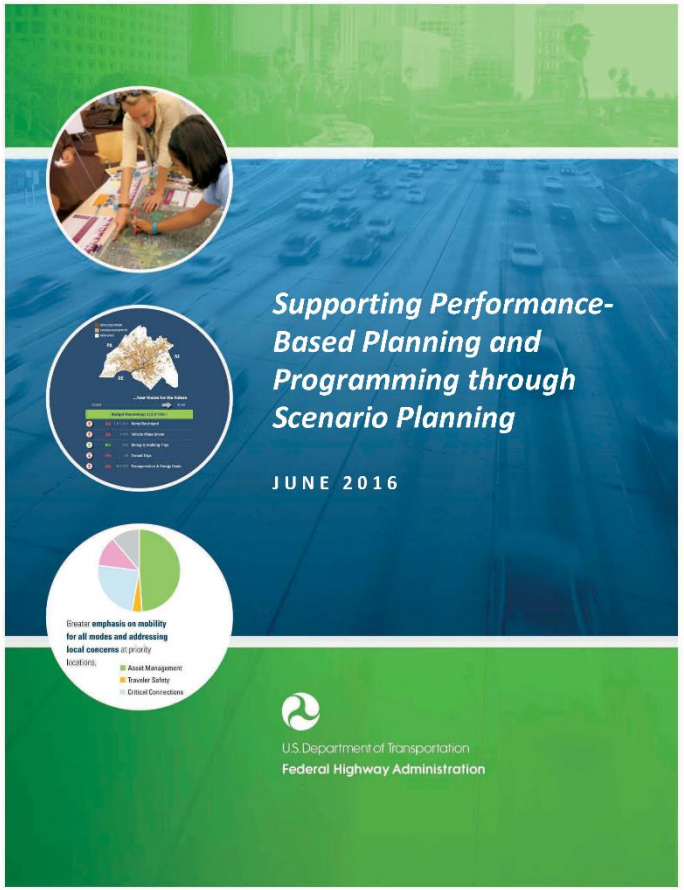
EXPLORATORY scenarios ask what COULD happen?

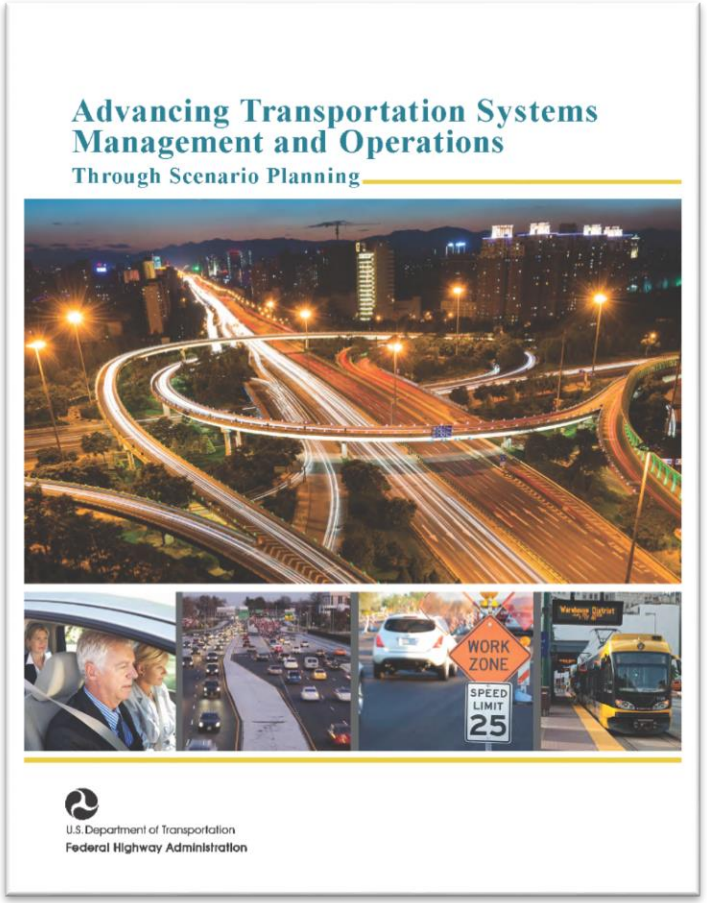


→Discovering opportunities, identifying risks, shaping tactics, optimizing chances of success

FHWA Scenario Planning Guidance







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?

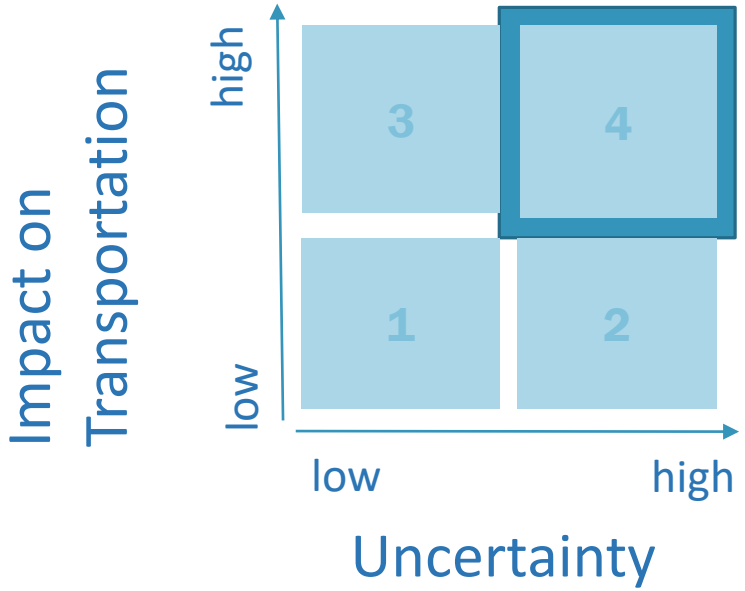
- "Stress test" of VMTP 2025 Recommendations
- Inform Agency Business Plans
- Inform VTrans Implementation Plan
- Input to MPO Long Range Plans

Start with Drivers

DRIVERS
(What drives change globally)

TRANSPORTATION OUTCOMES
(How global change can affect transportation)

- DEMOGRAPHIC → DEMAND/BEHAVIOR
- ECONOMIC → SUPPLY / DELIVERY
- TECHNOLOGICAL → OPERATIONS / PERFORMANCE
- ENVIRONMENTAL → SYSTEM /USER COSTS



Sketch Planning Outputs

Person Travel	Freight Movement	All Travel	Costs
Person Miles	Freight Ton Miles	Vehicle Miles	User Costs
Person Trips	Freight Trips	Recurring Congestion	System Costs
Person Mode	Freight Mode	Non-recurring Congestion	Tradeoffs

- 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

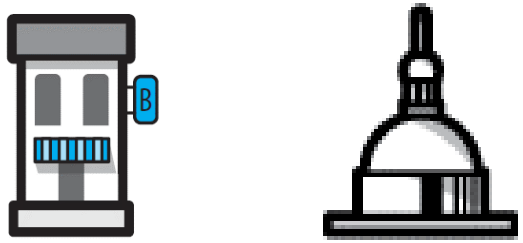
Baby Boomer

Generation X

Millennial

Generation Z

INDUSTRY MIX



Placetypes

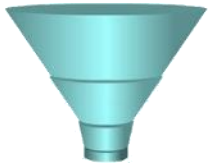
Two Key Criteria

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

~90% of the state's land area (2015)

V2 – Low-Density Suburban

Mechanicsville, Smithfield

V3 – Small Town/ Suburban

Staunton, Danville

V4 – Multimodal Suburban

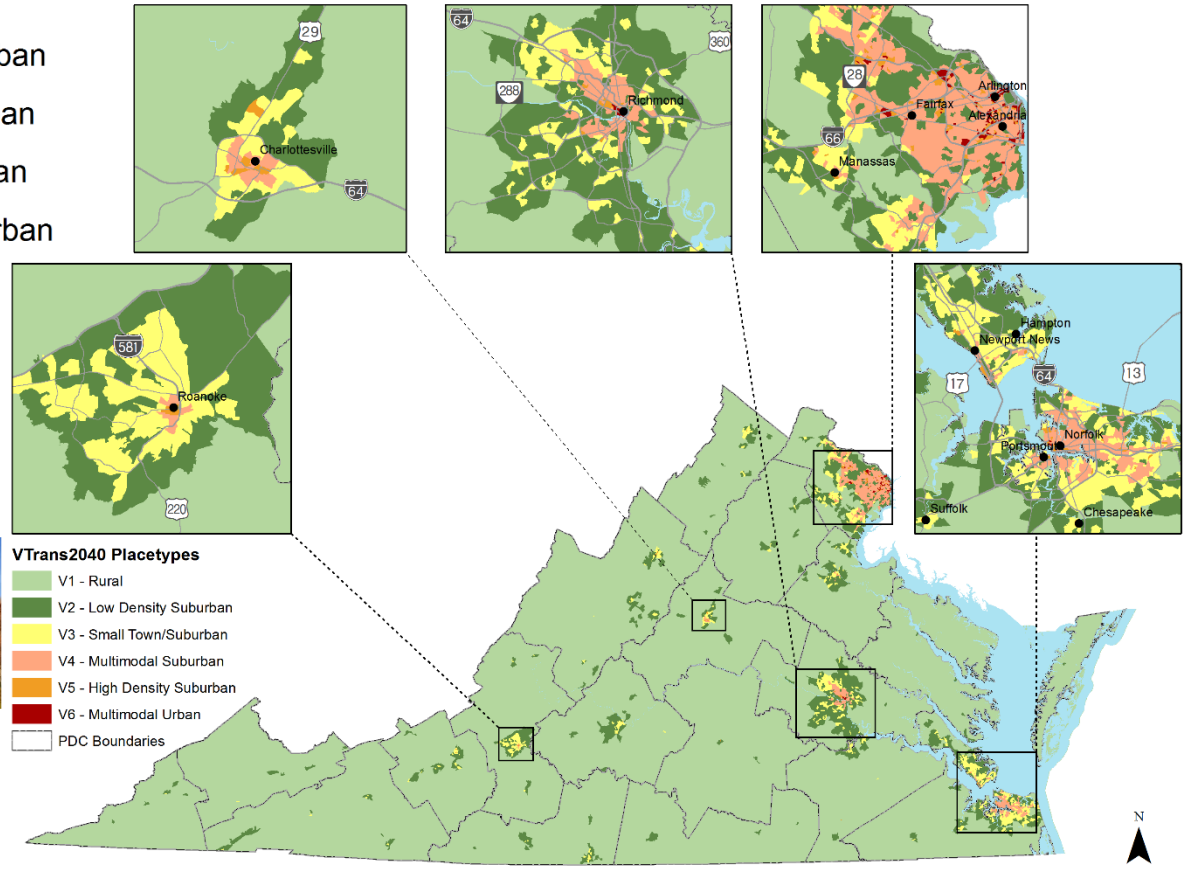
Sterling (Loudoun), Willow Lawn (Richmond)

V5 – High Density Suburban

Fan District (Richmond). Ghent (Norfolk)

V6 – Multimodal Urban

Downtown Richmond, Clarendon (Arlington)



Placetypes

VTrans2040 Placetypes

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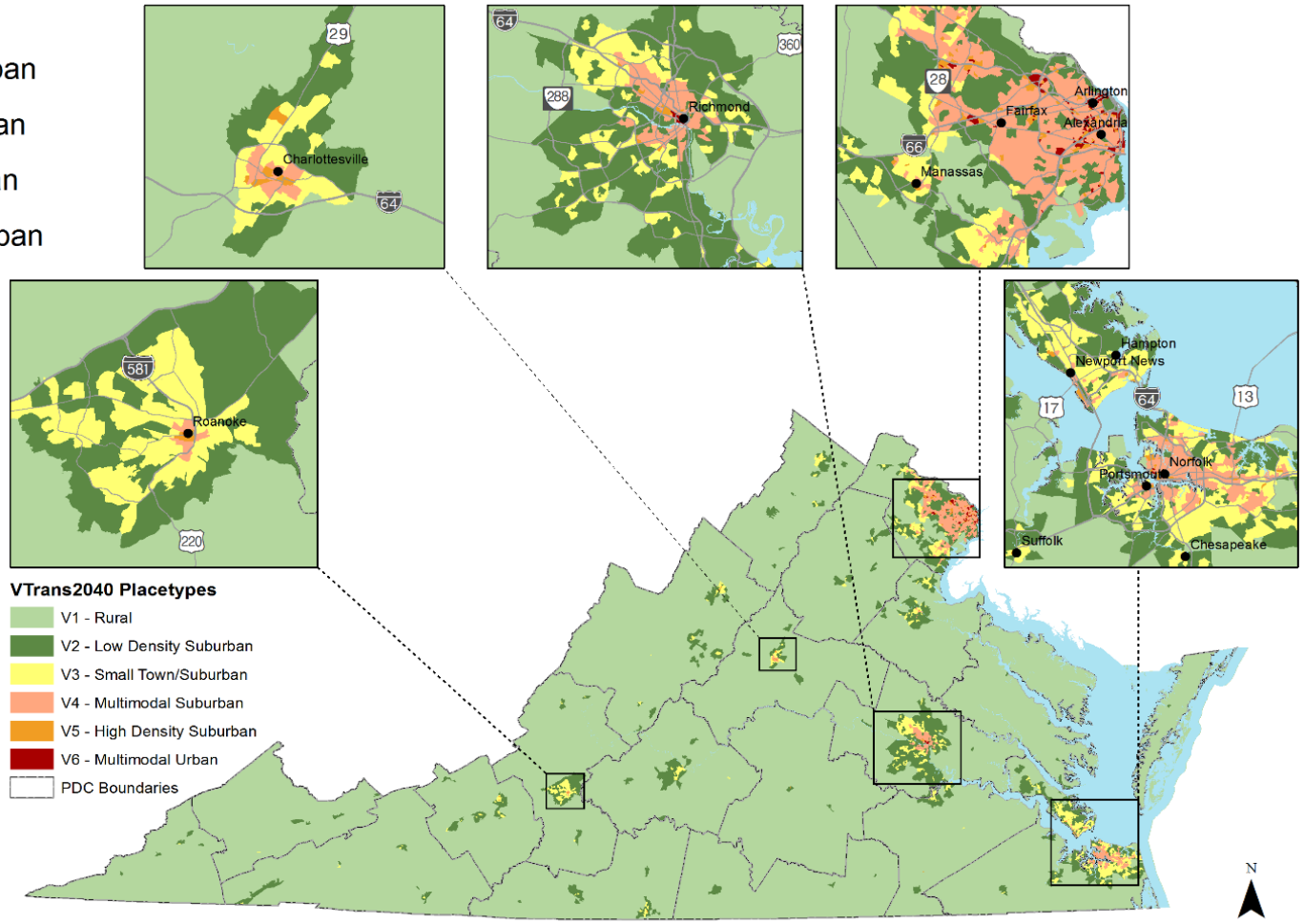
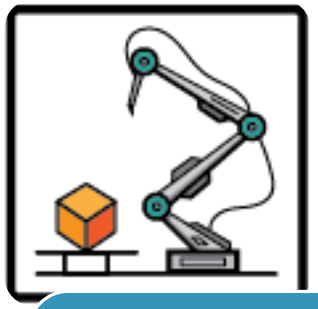


Differentiate:

- Mode Split
- Demographics
- Trip Rates
- Technology Implementation

Crafting Scenarios from Drivers



High Growth Industrial

- Less Urban
- Higher VMT Assumptions

Industrial Renaissance

High Growth High Tech

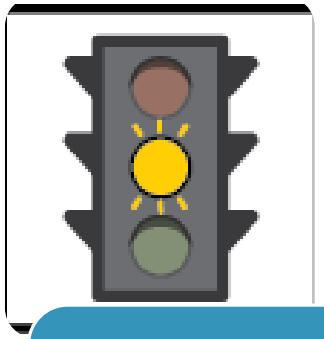
- More Urban
- More Multimodal

Techtopia

Moderate Growth

- Older Demographics
- Walkable Places

Silver Age

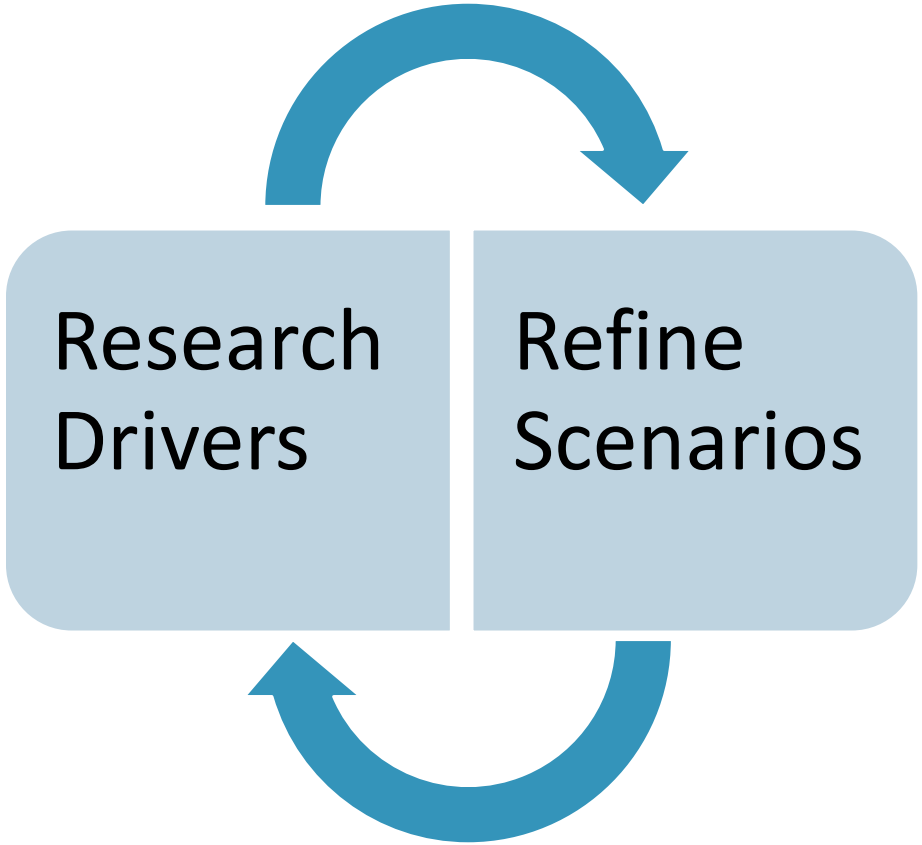


Reduced Growth

- Federal Spending Reduced
- Slower adoption of technology

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

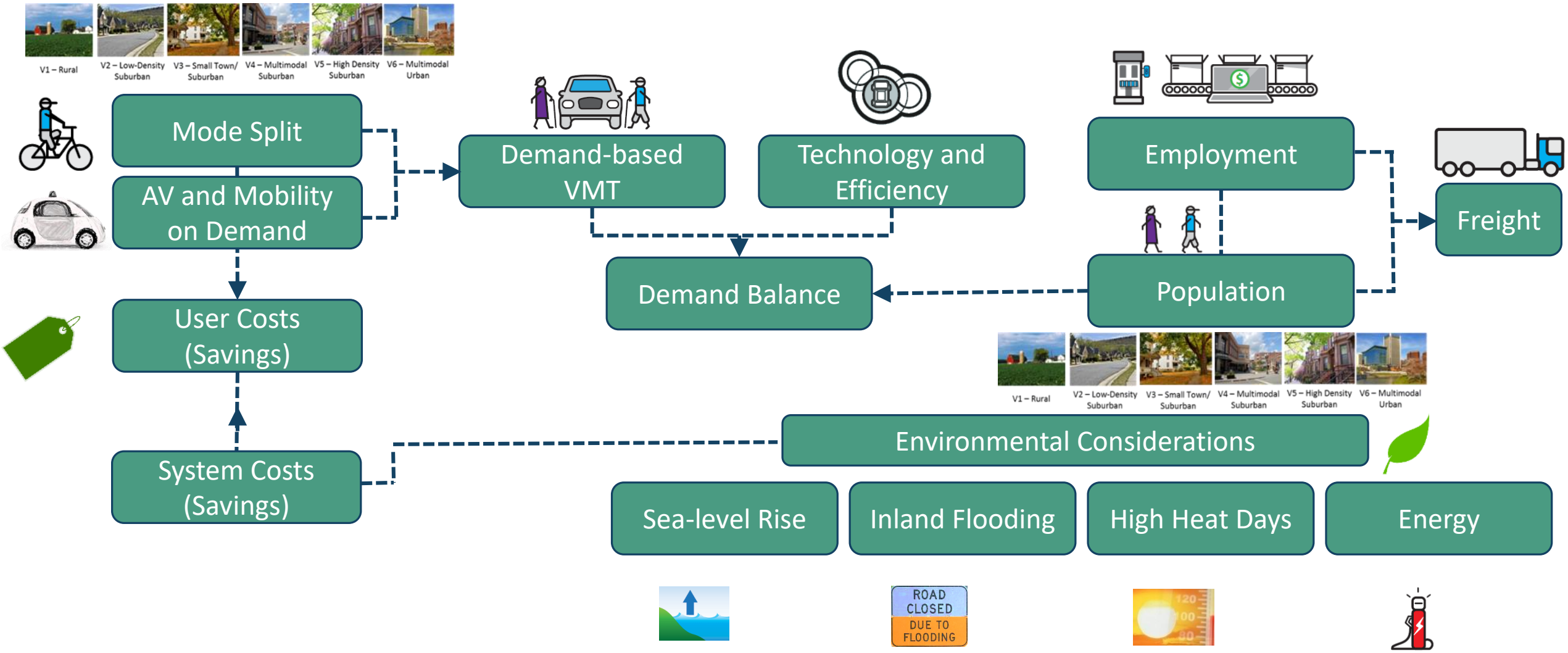
What are the environmental considerations?

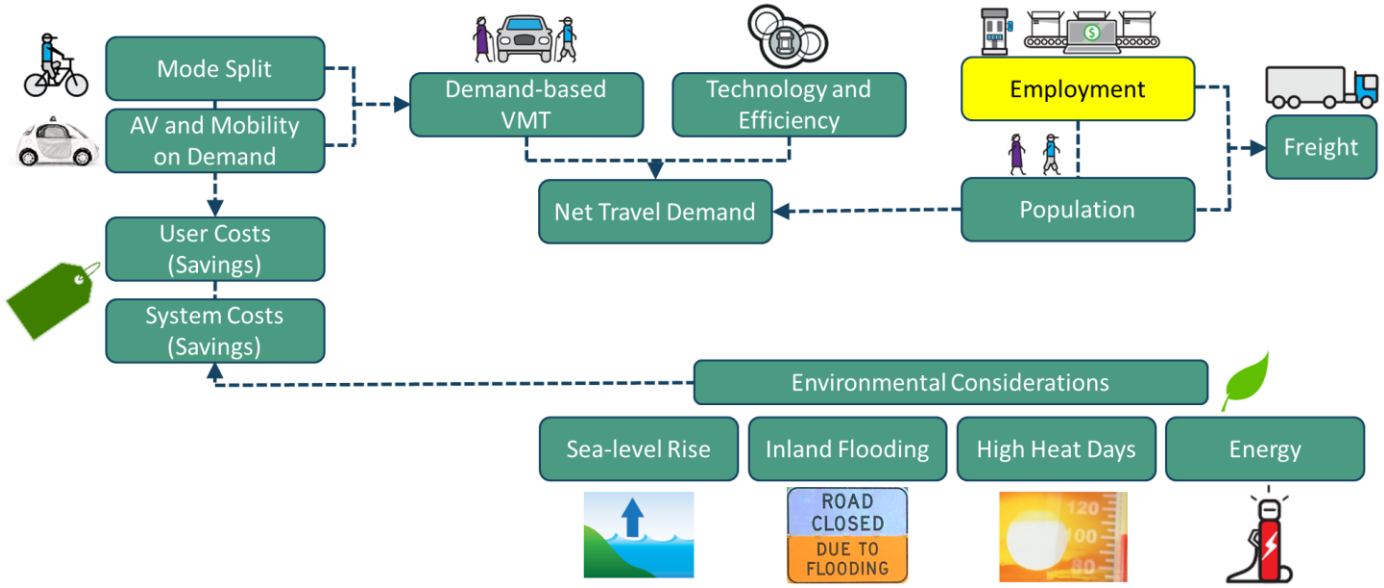
Baseline of predictions for high-heat days and severe storm days

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 $

Scenario Components





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

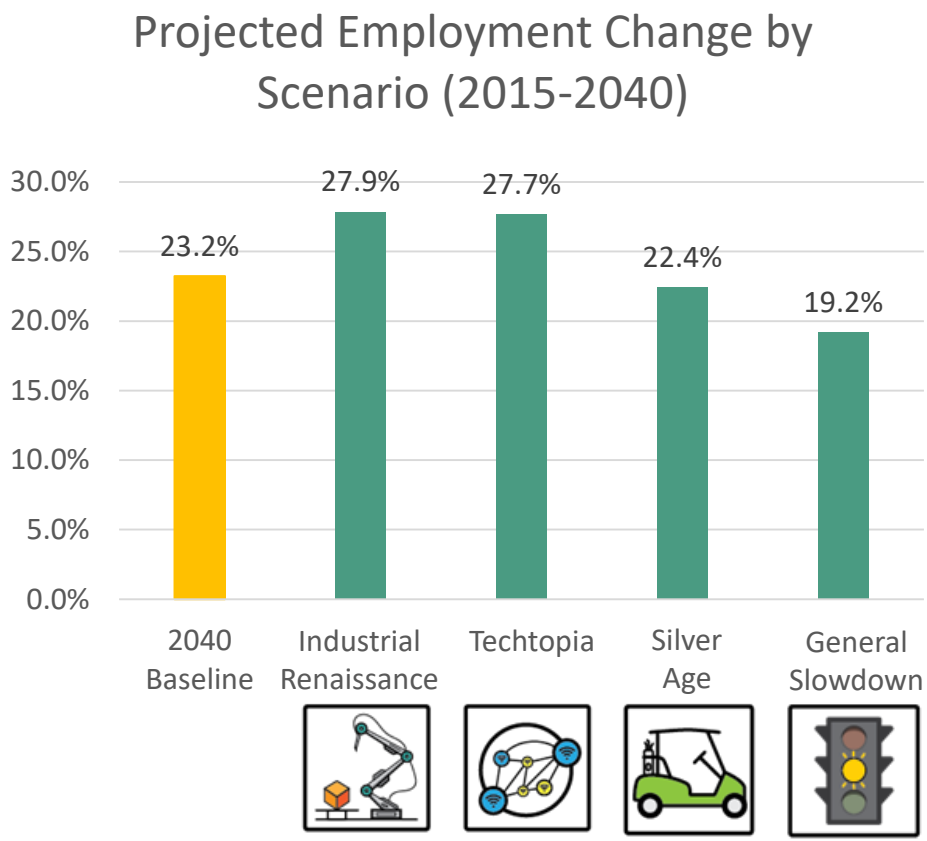
Healthcare

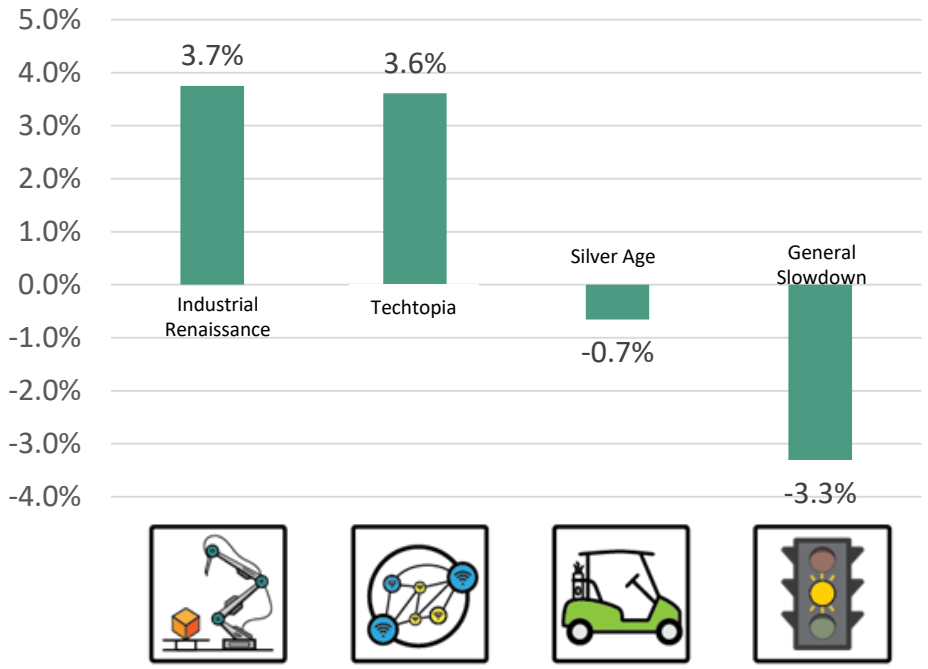
General Slowdown

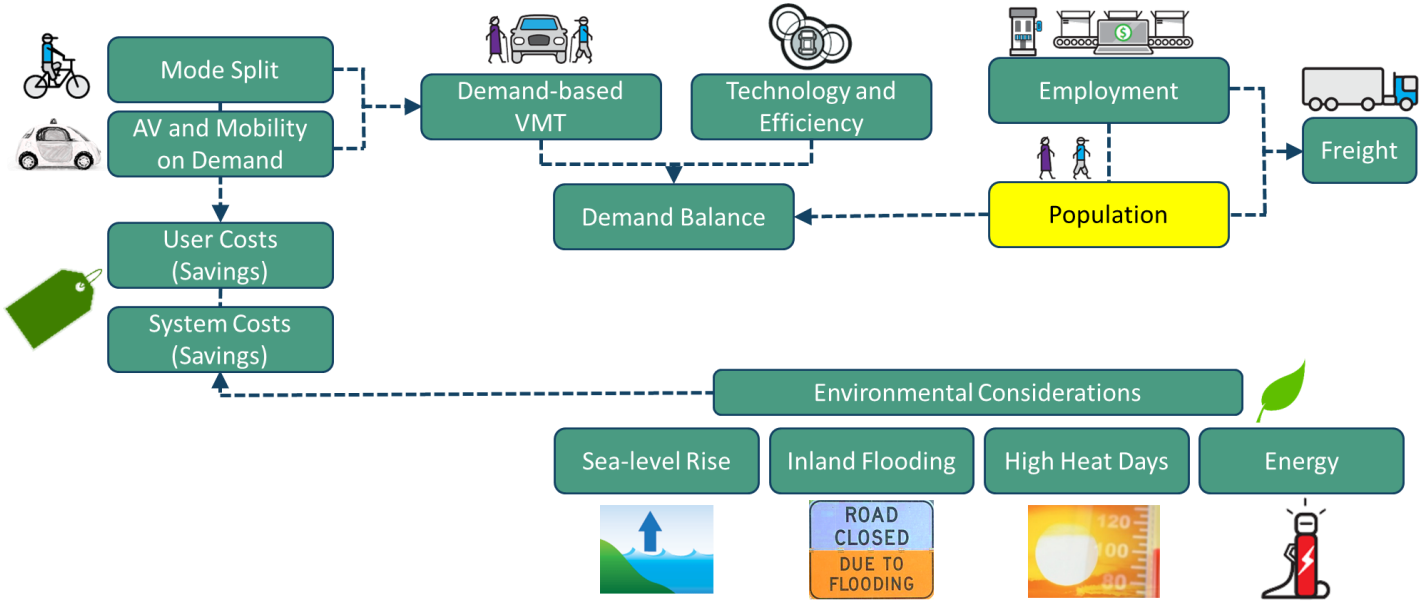
Military Slowdown

Retail Slowdown

Assumed Scenario Employment Adjustments







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

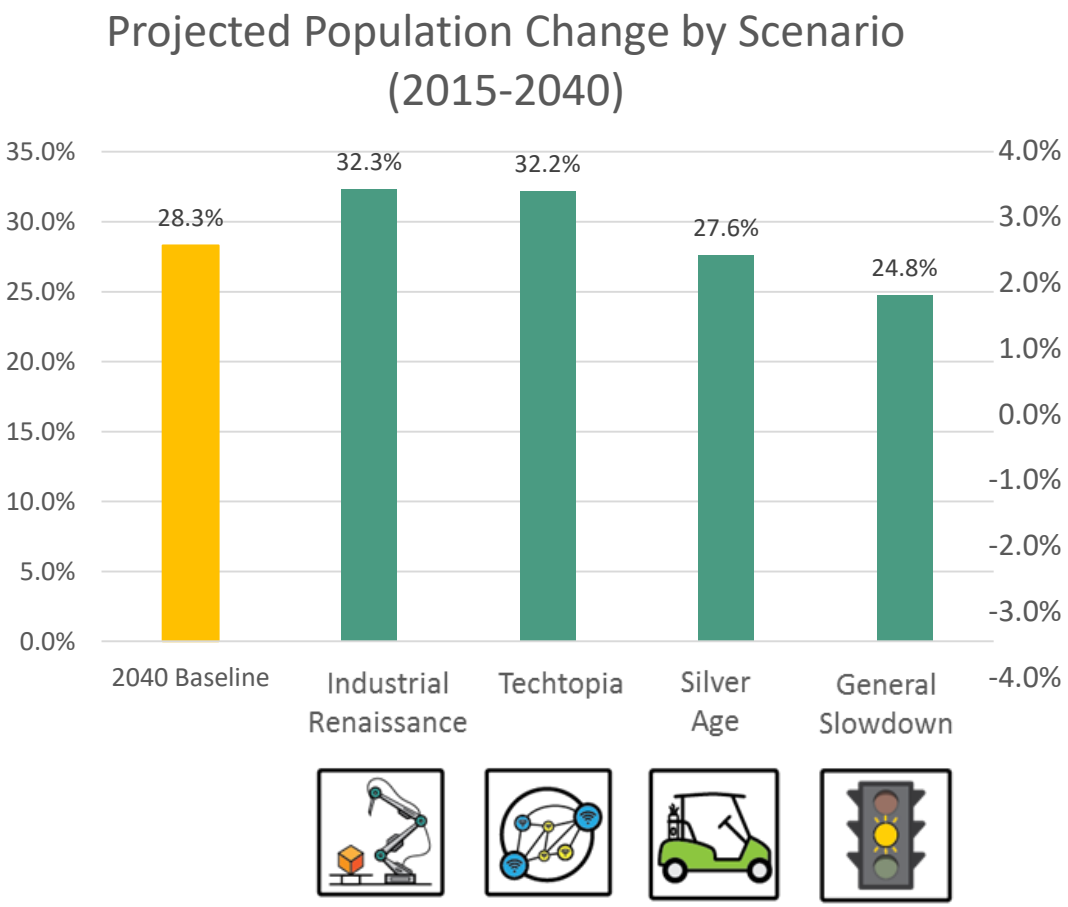
Attract More Gen X

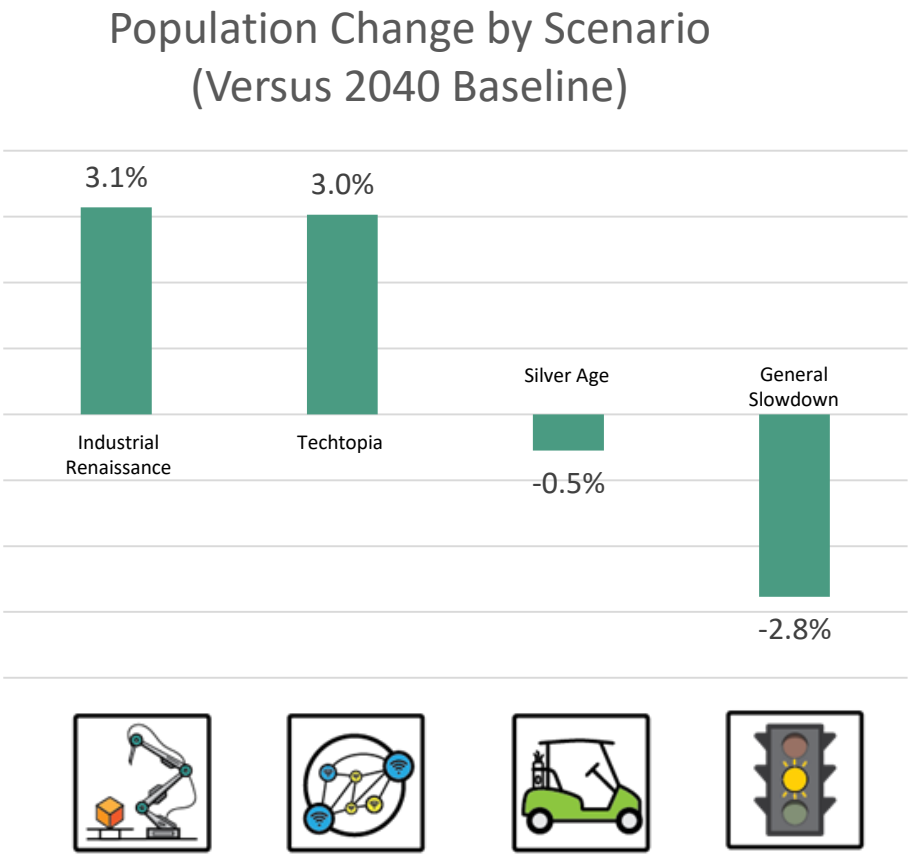
Attract Fewer Gen Z

General Slowdown

Attract Fewer Millenials

Assumed Scenario Population Adjustments





2040 Population Allocation by Placetype Assumptions


V1 – Rural


V2 – Low-Density Suburban


V3 – Small Town/Suburban


V4 – Multimodal Suburban


V5 – High Density Suburban

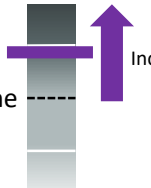

V6 – Multimodal Urban

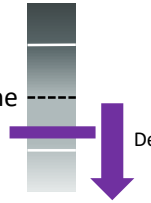

V7 – High Density Urban*

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

	V1 – Rural	V2 – Low-Density Suburban	V3 – Small Town/Suburban	V4 – Multimodal Suburban	V5 – High Density Suburban	V6 – Multimodal Urban	V7 – High Density Urban*
Industrial Renaissance							N/A
Techtopia							
Silver Age							N/A
General Slowdown							N/A

Key:

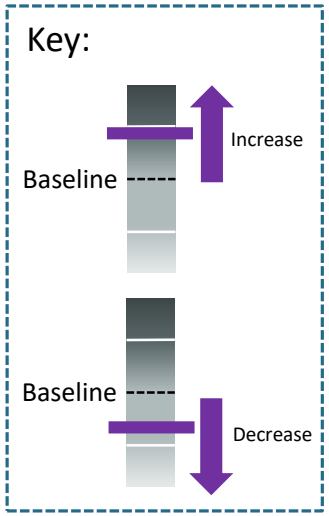




2040 Population Allocation by Placetype Assumptions

	V1 – Rural	V2 – Low-Density Suburban	V3 – Small Town/Suburban	V4 – Multimodal Suburban	V5 – High Density Suburban	V6 – Multimodal Urban	V7 – High Density Urban*
Industrial Renaissance							N/A
Techtopia							
Silver Age							N/A
General Slowdown							N/A

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



2040 Population Assumptions by Placetype and by Scenario

V7 – High Density Urban

V6 – Multimodal Urban

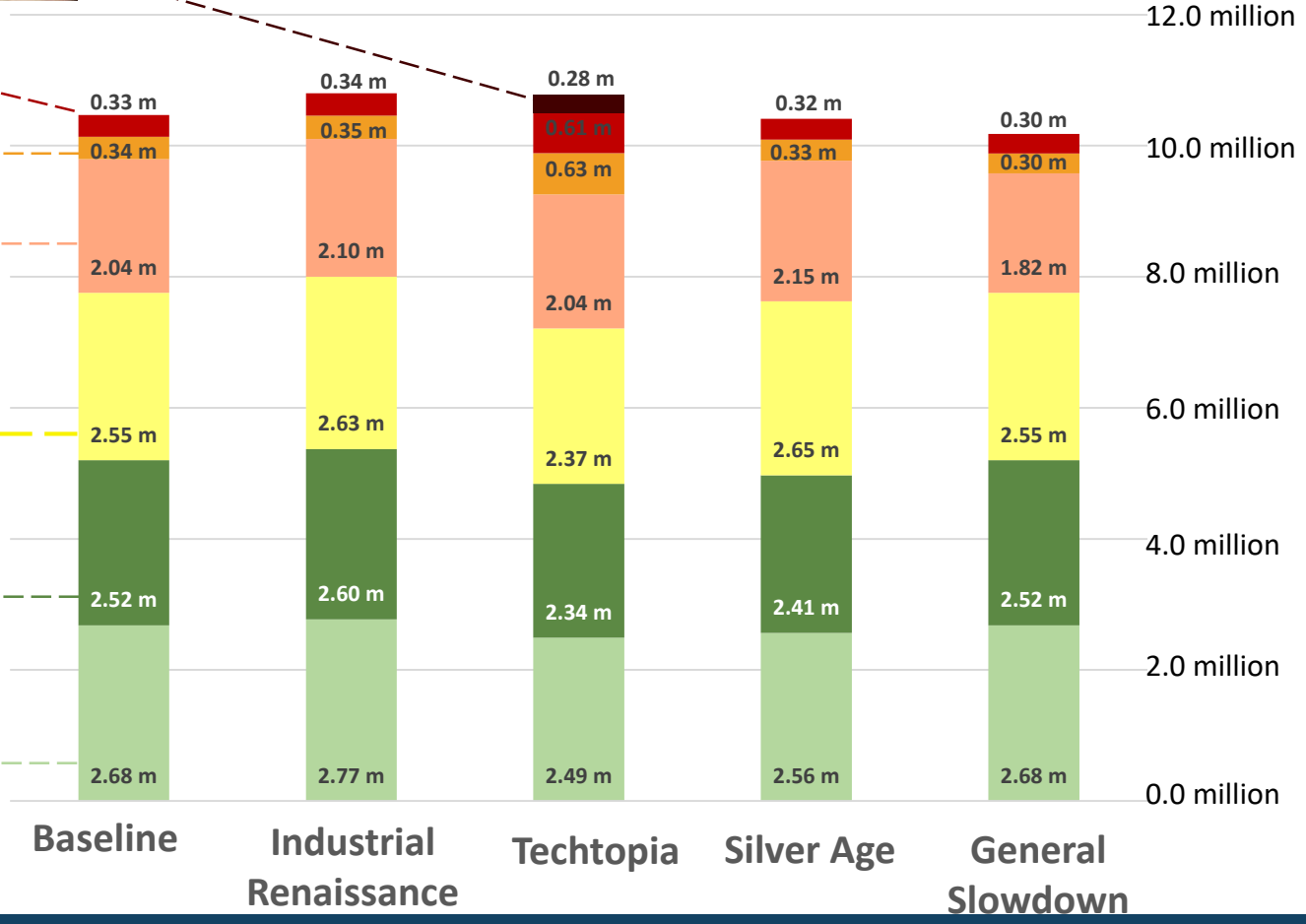
V5 – High Density Suburban

V4 – Multimodal Suburban

V3 – Small Town/Suburban

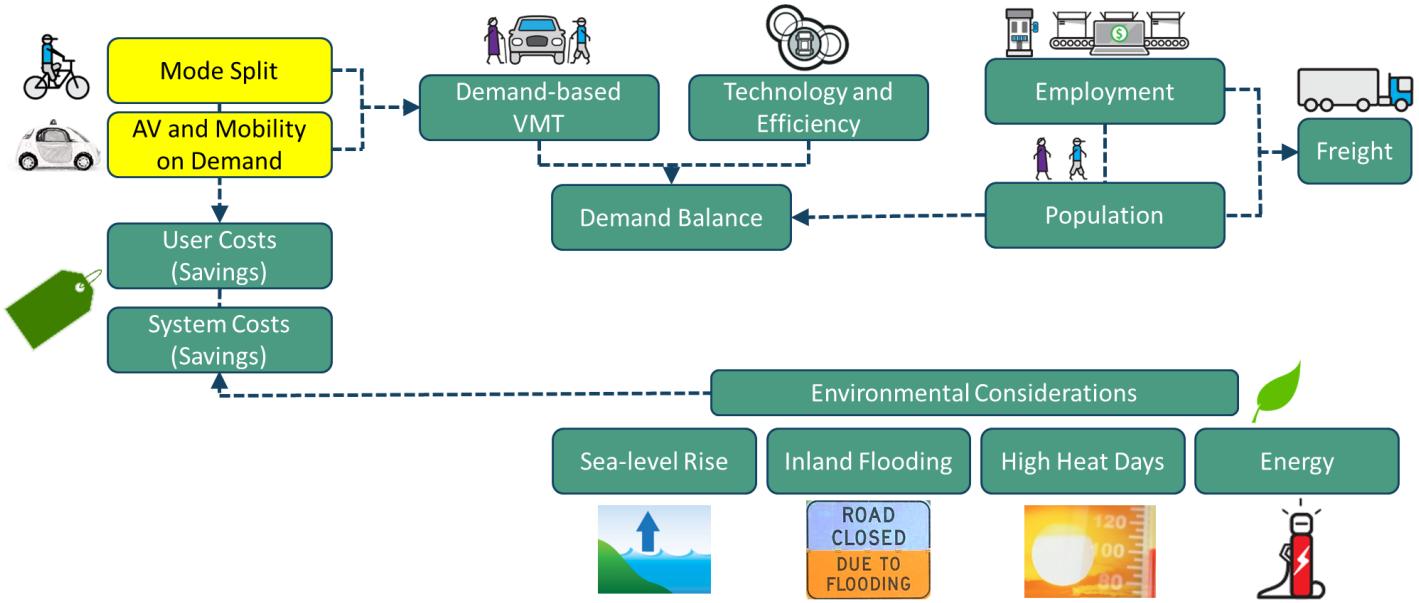
V2 – Low-Density Suburban

V1 – Rural



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

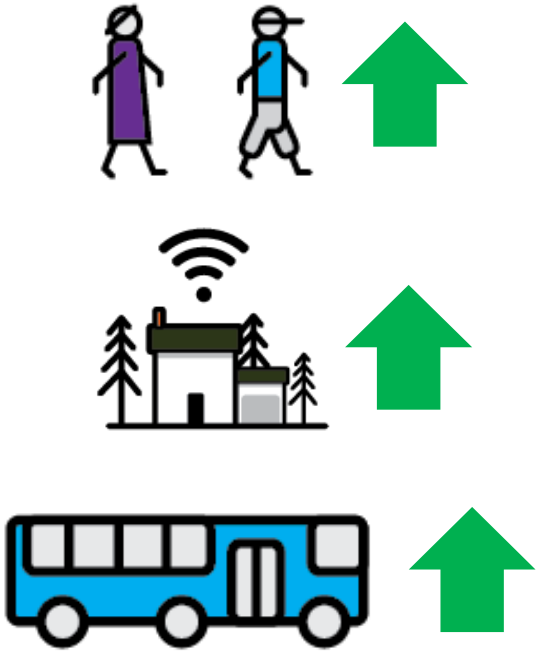
MODE SPLIT, AUTONOMOUS VEHICLES, AND MOBILITY ON DEMAND

Transportation Mode Shift Assumptions by Scenario (Relative to Baseline) in 2040

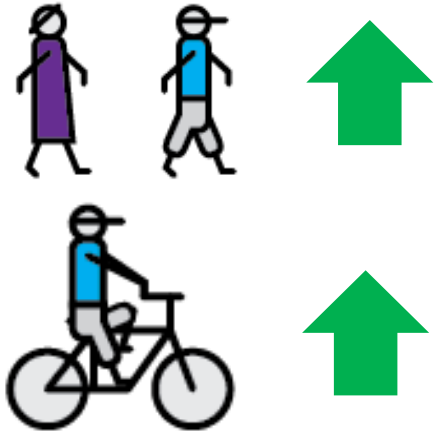
Industrial Renaissance

Same as Baseline

Techtopia



Silver Age



General Slowdown

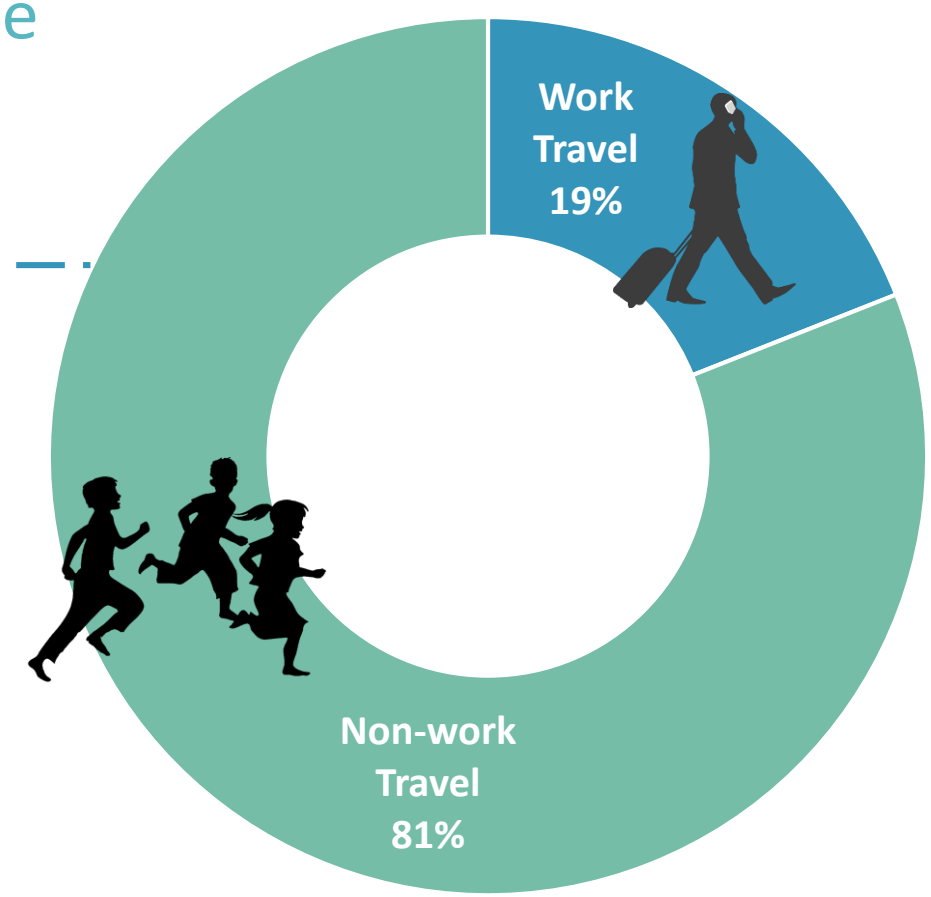
Same as Baseline

An increase in alternative transportation could help reduce Vehicle Miles of Travel (VMT) and decrease overall transportation costs

Mode Split Methodology

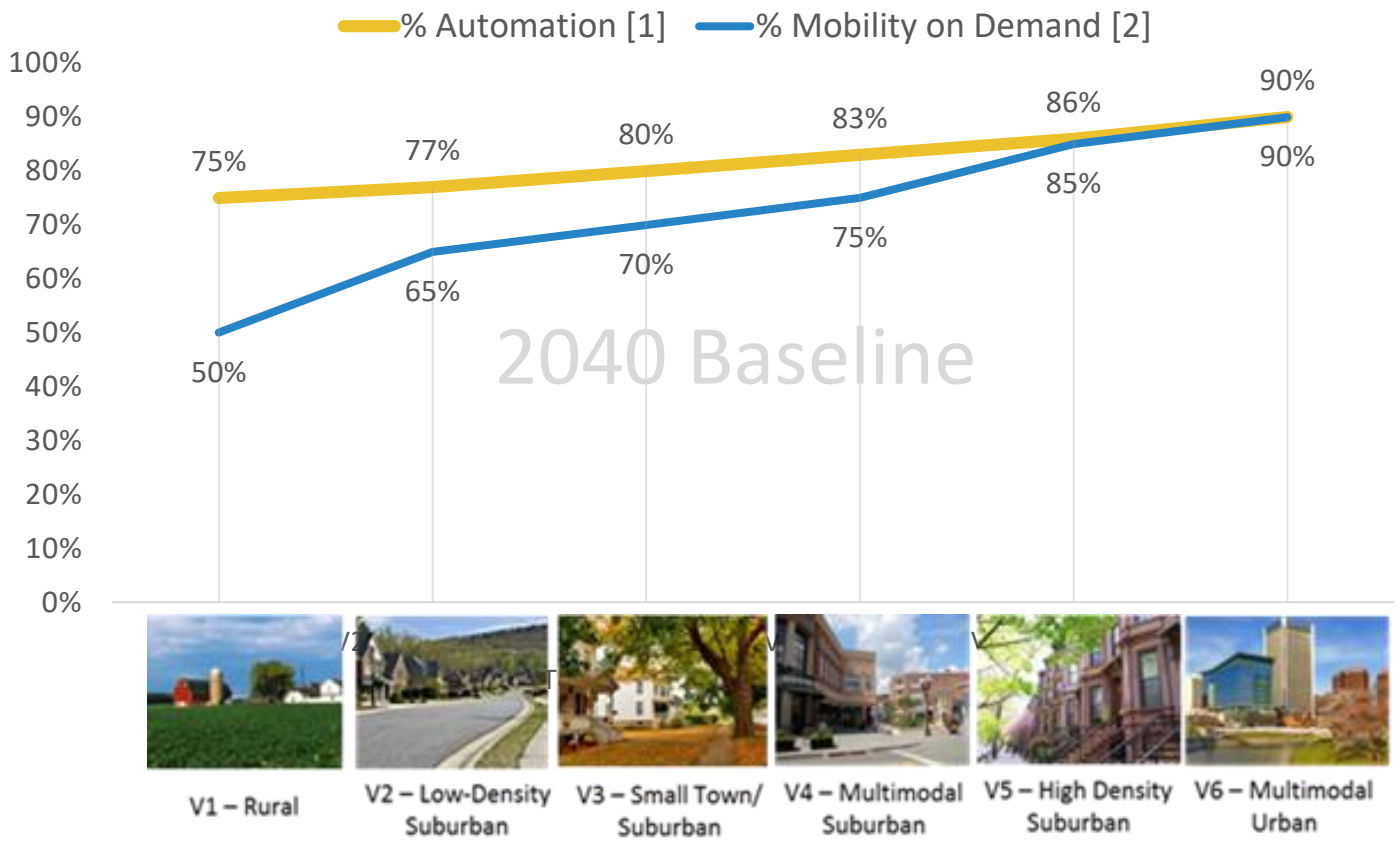
Computed mode splits and VMT by Placetype for each Scenario, accounting for:

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



Baseline Technology Assumptions

Percent passenger travel by autonomous vehicles and Mobility on Demand *in the 2040 Baseline*



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

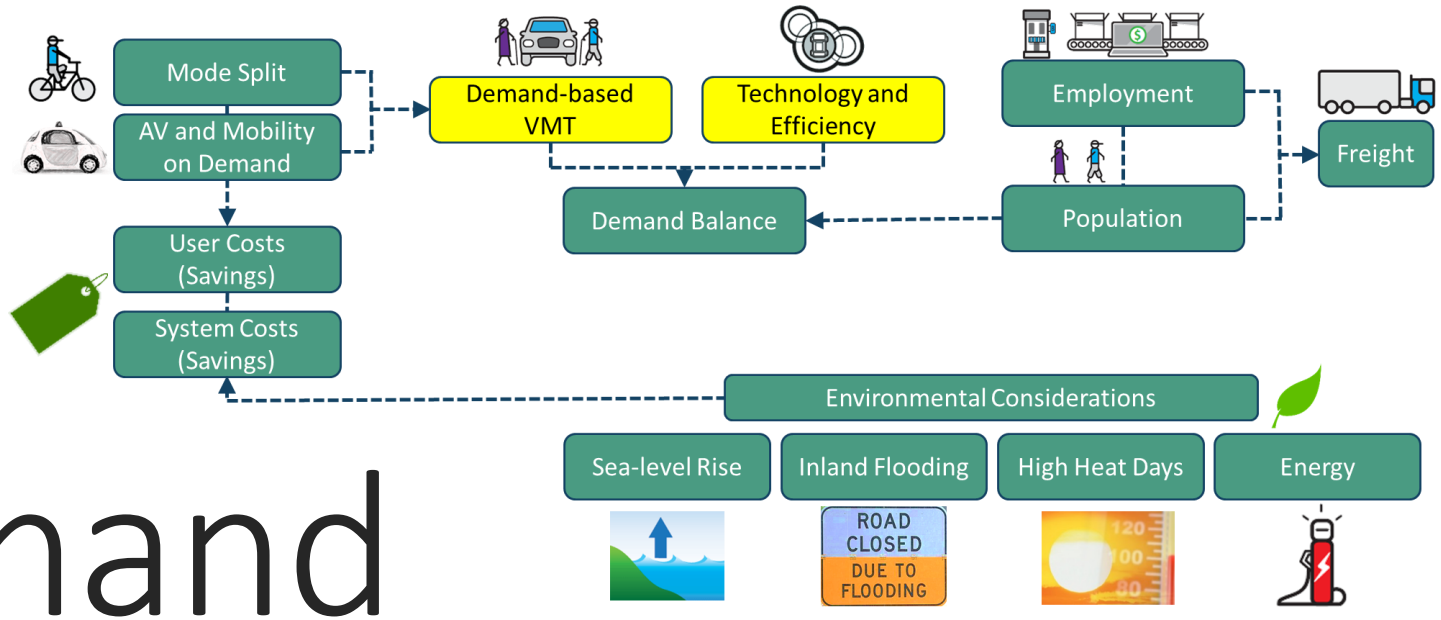
Anticipated range: 70% (low) to 90% (high)

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 & Roadway Demand

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

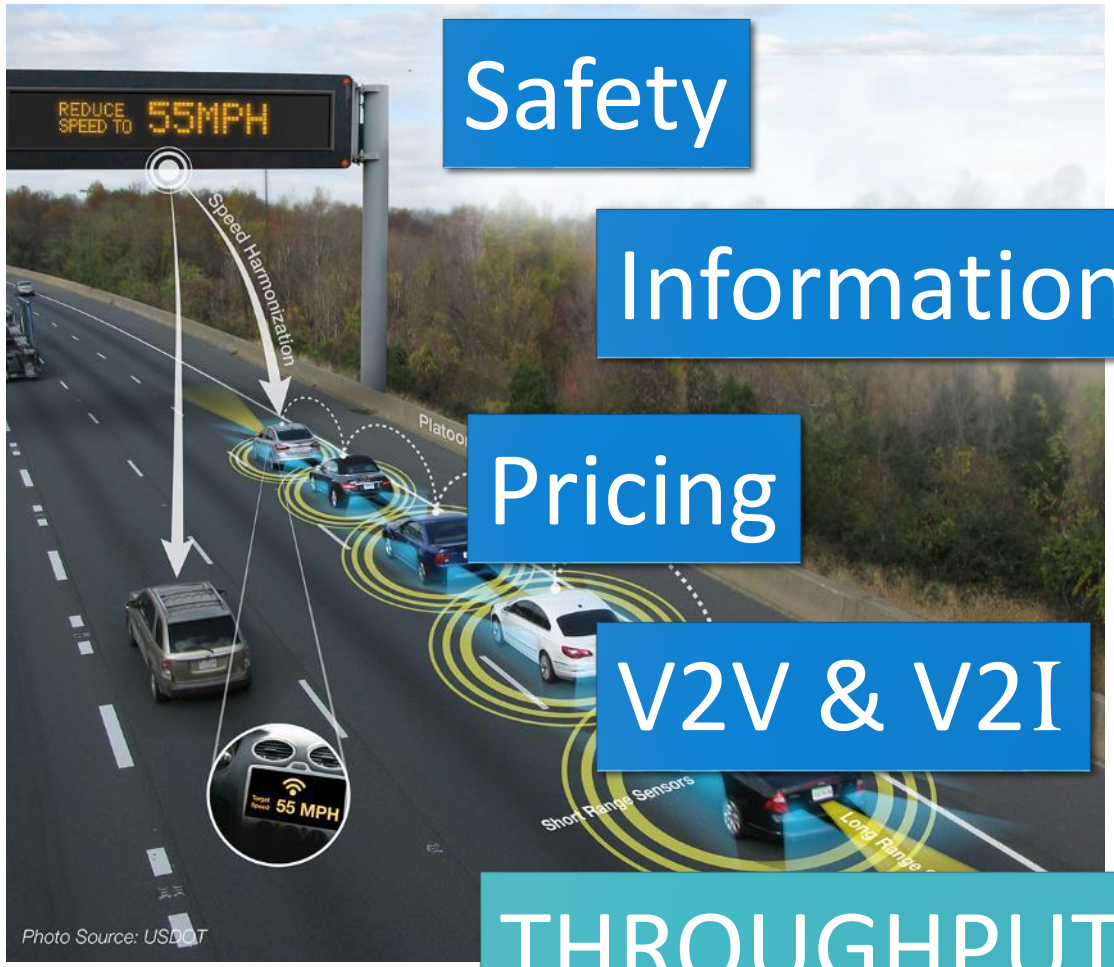
Technology & Roadway Demand

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

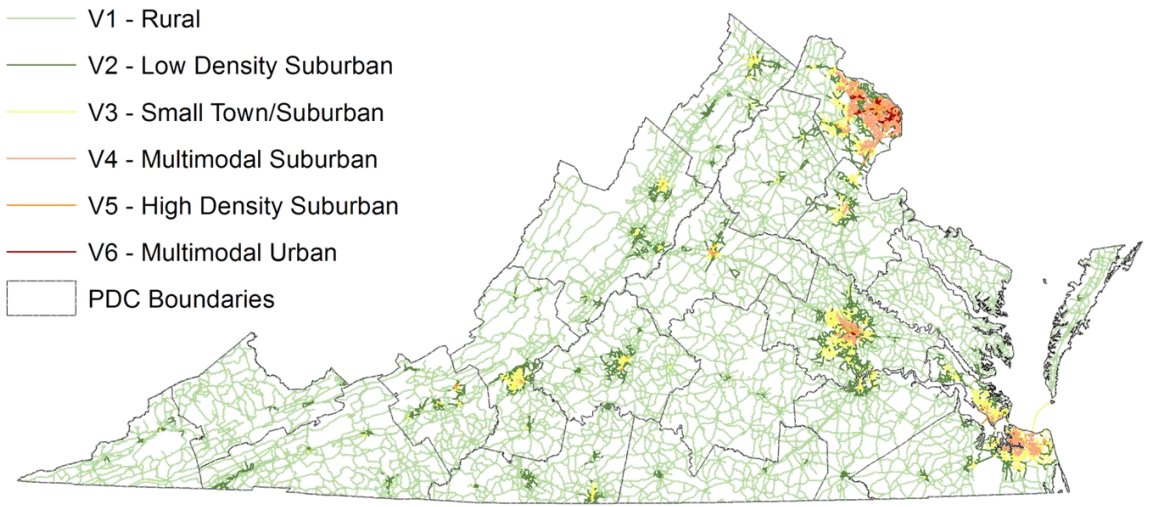
THROUGHPUT

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

Roadway Network Classified by Placetype



Interstates and Arterials by Placetype (2014)

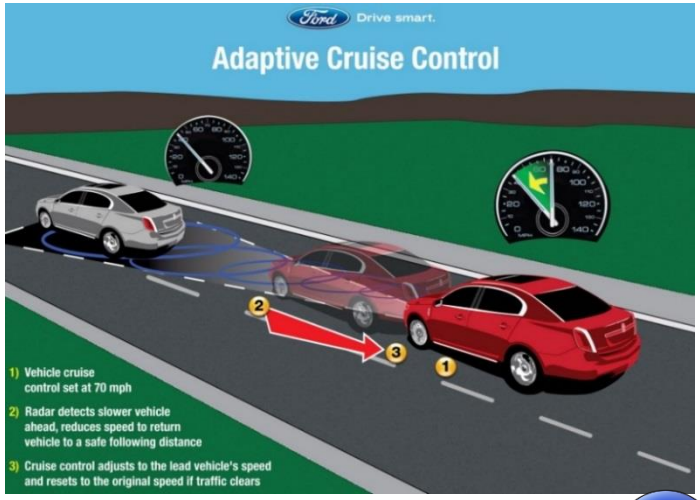
Placetype	Interstates as % of total network	Arterials as % of total network	**Total**
V1 Rural	4%	16%	**20%**
V2 Low Density Suburban	7%	24%	**31%**
V3 Small Town/Suburban	7%	30%	**37%**
V4 Multimodal Suburban	7%	31%	**38%**
V5 High Density Suburban	12%	35%	**47%**
V6 Multimodal Urban	10%	31%	**42%**

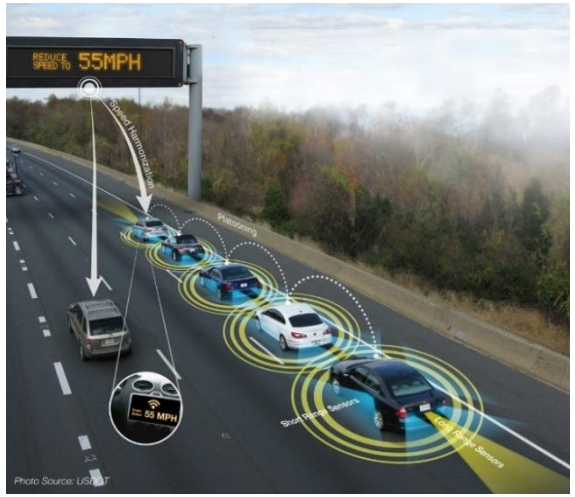
Technology, Efficiency & Throughput

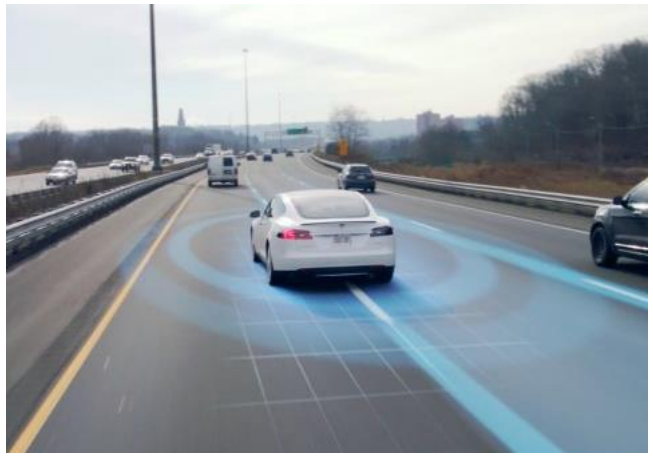
Technology and improved efficiency are expected to increase throughput by

9%-21%

(depending on Scenario)







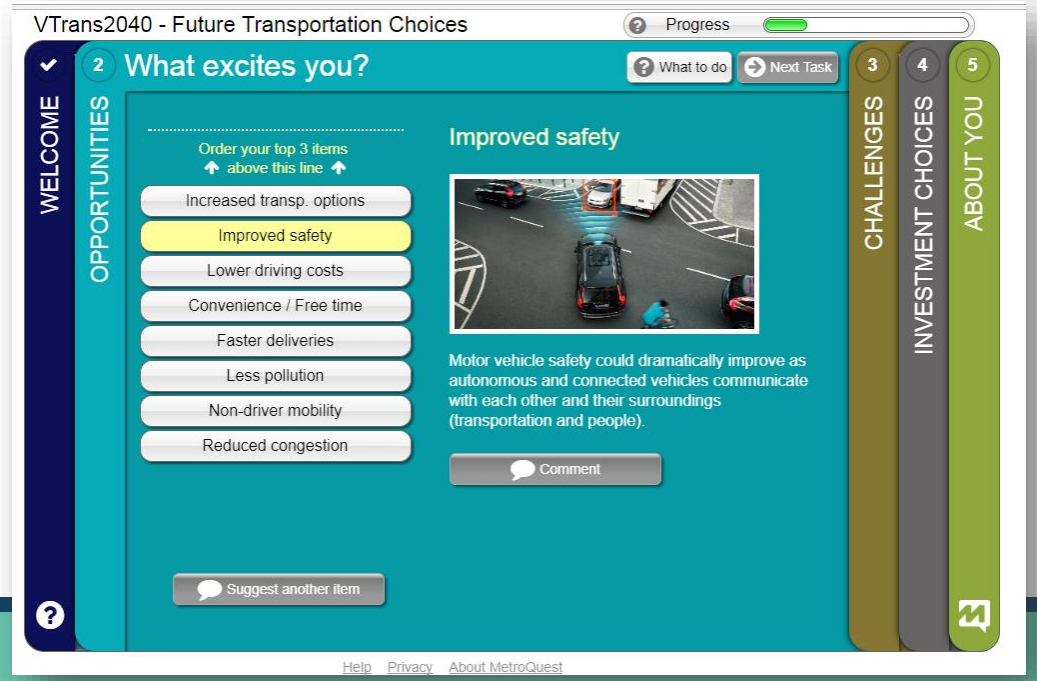
Although VMT is expected to increase, vehicle technology & infrastructure improvements will help increase travel efficiency and throughput (*effectively increasing roadway capacity*)

Comparing Scenarios (Statewide)

	Industrial Renaissance	Techtopia	Silver Age	General Slowdown
DEMAND	Pop. ↑↑ VMT ↑↑↑↑	Pop. ↑↑ VMT ↑↑↑	Pop. ↑ VMT ↑↑↑	Pop. ↑ VMT ↑↑↑
CAPACITY	Thru-put ↑	Thru-put ↑↑	Thru-put ↑	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

Coordinate transportation and land use

Pursue the opportunities offered by smarter transit and mobility on demand

Design corridors to be nimble, with phased adaptation to technological advances (e.g. Connected and Automated vehicles)

Maintain and enhance the physical *and* digital infrastructure

Prepare for growth in freight, powered by rapid innovation

Evaluate new models of transportation funding

Thank You!

Final Presentations and Materials

www.vtrans2040.com

www.ctb.virginia.org

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