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We Make a Difference

Exploratory Planning for Uncertain Times

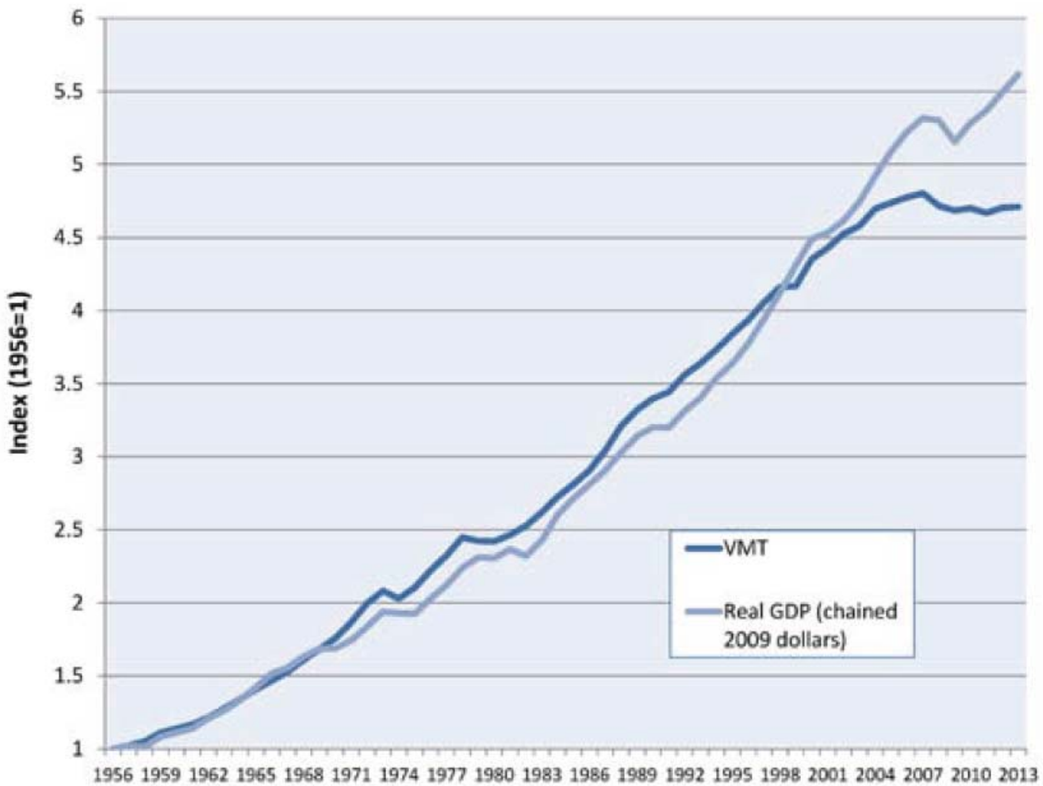
COMPASS March 20, 2018

Lorna Parkins AICP

30 Years of Planning

Explain the past → Predict the future

A funny thing happened around 2004…



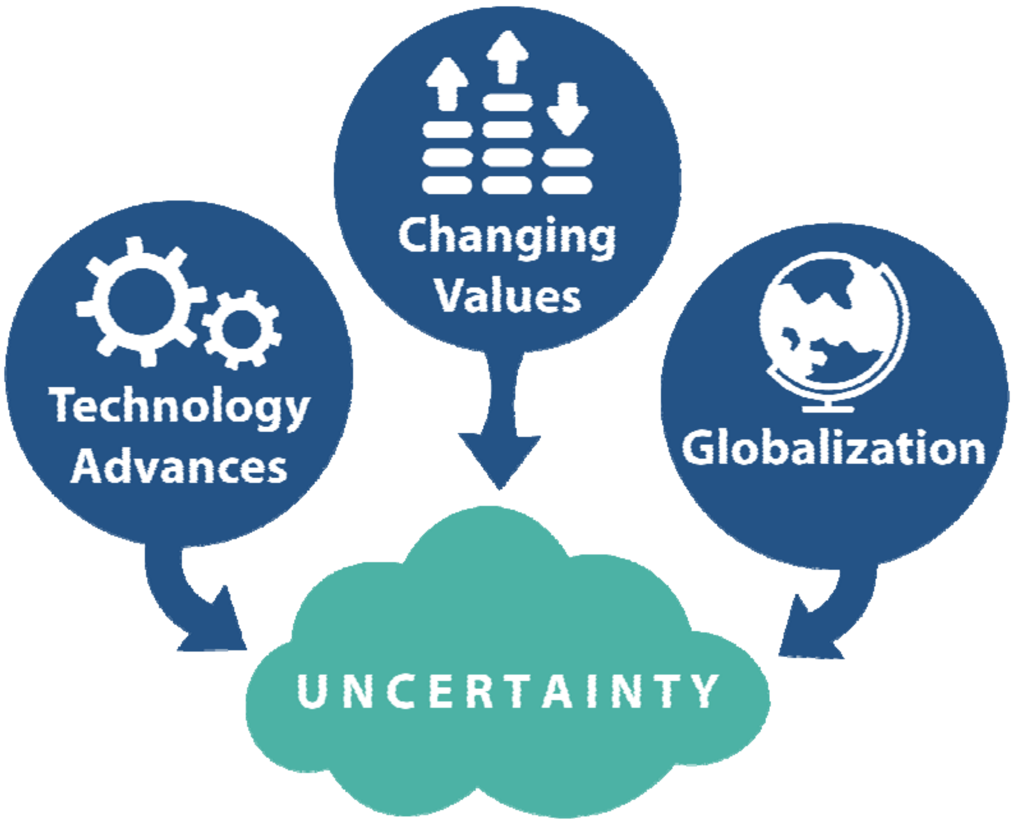
→ 2013 Real US GDP

→ 2013 US Vehicle Miles Traveled

Source: *Millennials in Motion*, US PIRG Education Fund & Frontier Group, 2014, p. 19.

Where do we go from here?

Disruptors cause uncertainty



Exploratory Planning for uncertain times

What is the range of outcomes?

What are the risks?

What are the opportunities?

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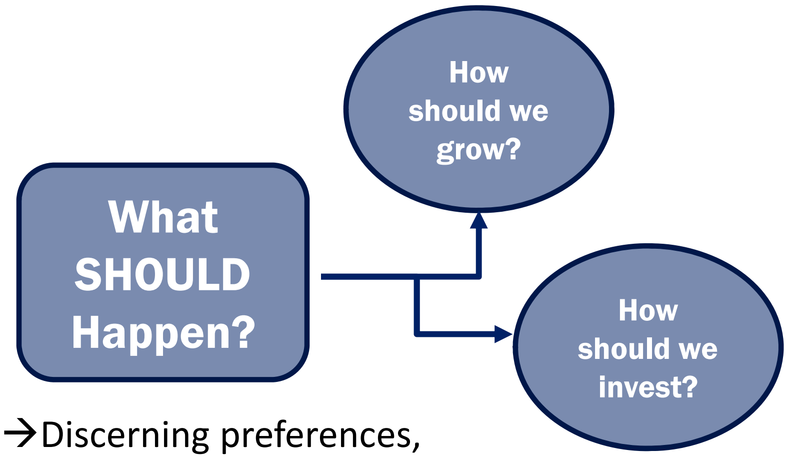
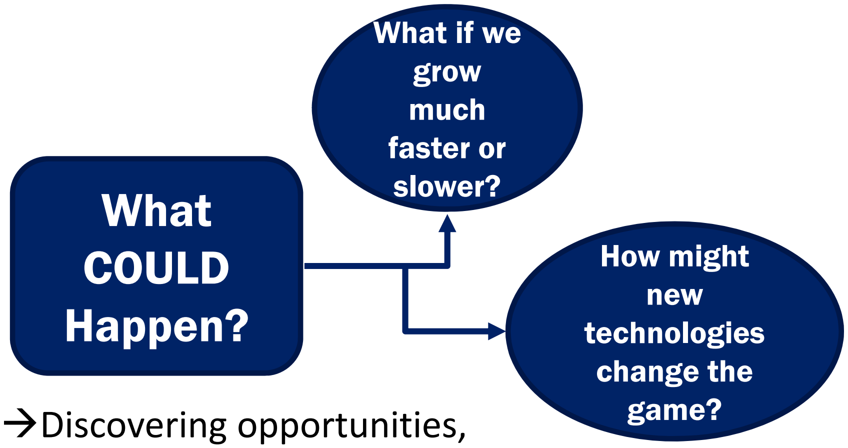
Normative vs Exploratory Planning

Normative scenarios envision what SHOULD happen?



→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

Preparing for Uncertainty: Exploratory Planning

OVERVIEW

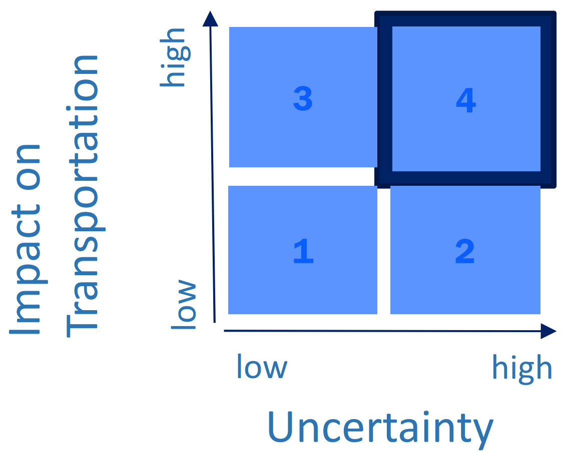
Start with drivers

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



Building Exploratory Scenarios

Drivers - exogenous forces that we can't fully control –

If external forces move in this direction .....

+

Levers - investments and policies that we can deploy --

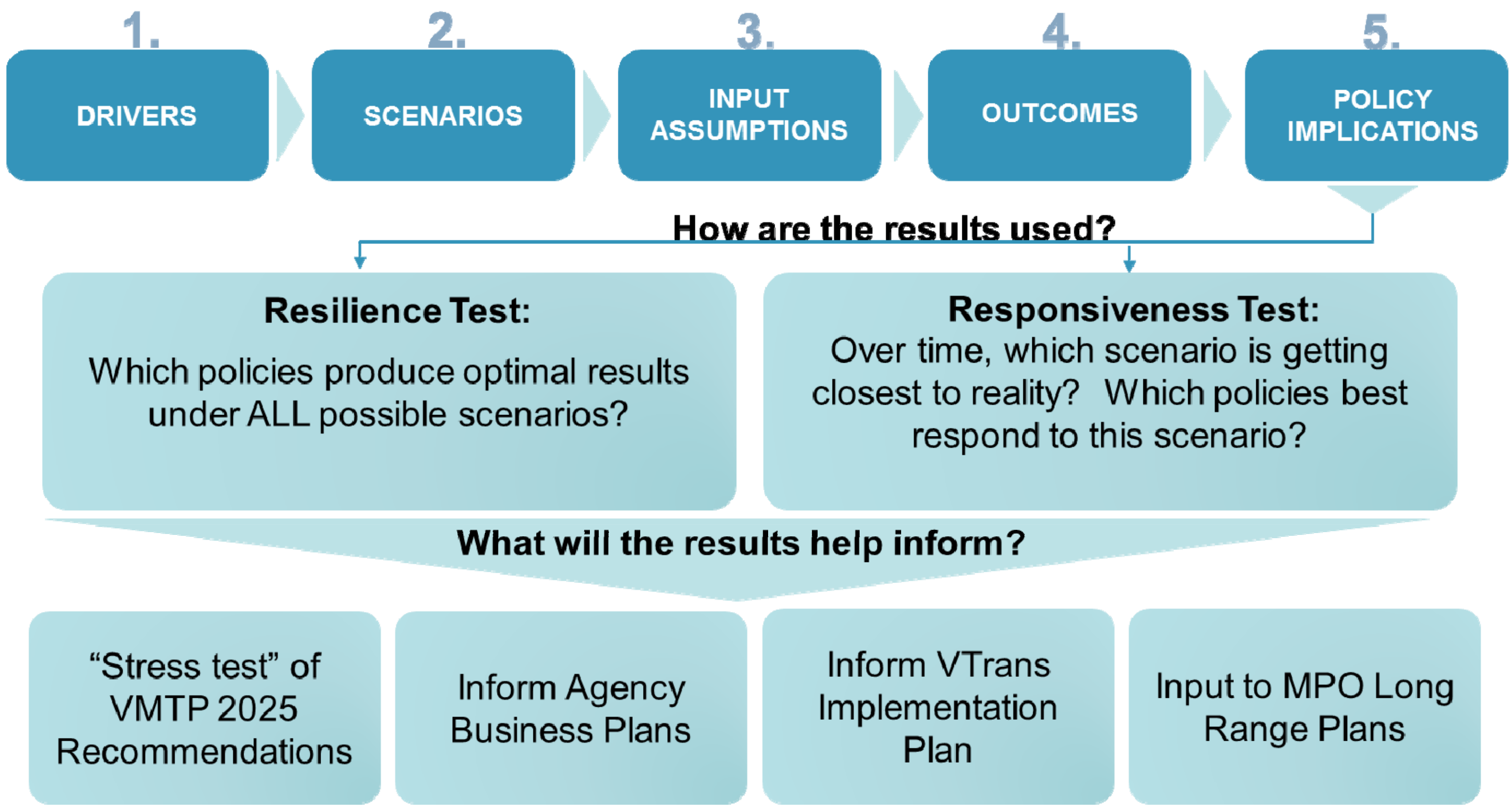
And if these types of public policies and investments are made ....

=

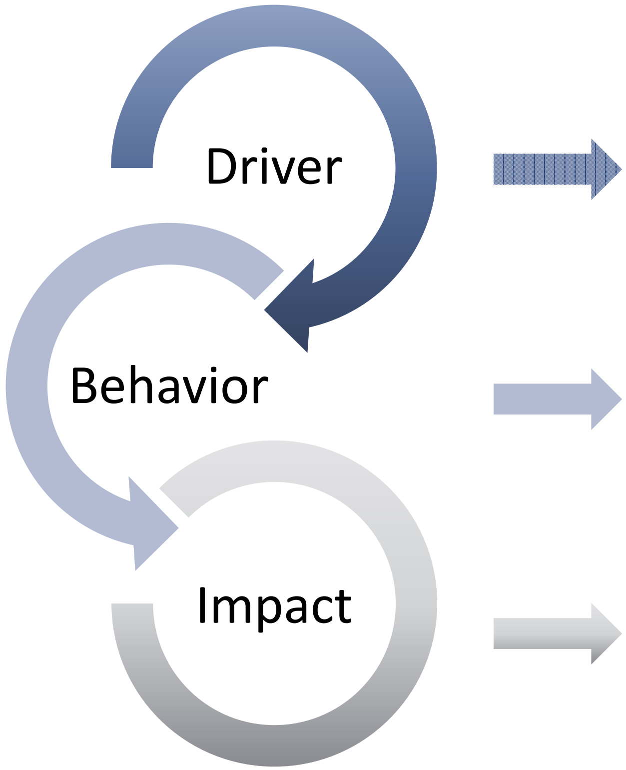
Outcomes - measurable results that matter to us --

Then these outcomes could occur.

Framework for VTrans exploratory planning



Chain of logic from inputs to outputs

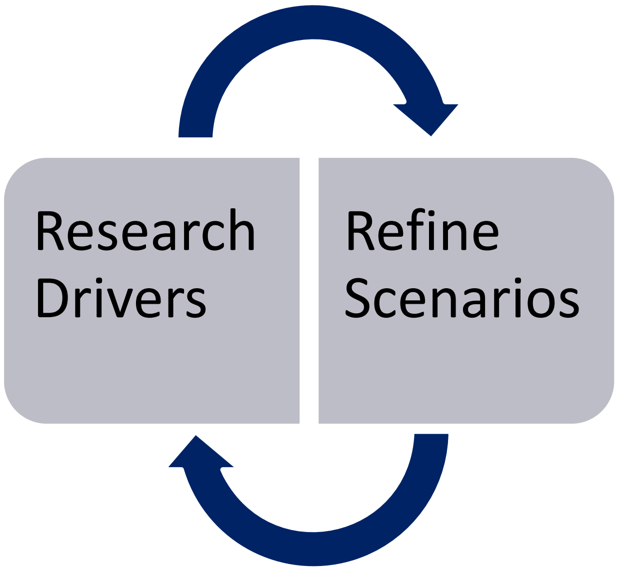


Research, data analysis, extract data from models

Research, expert input, public input

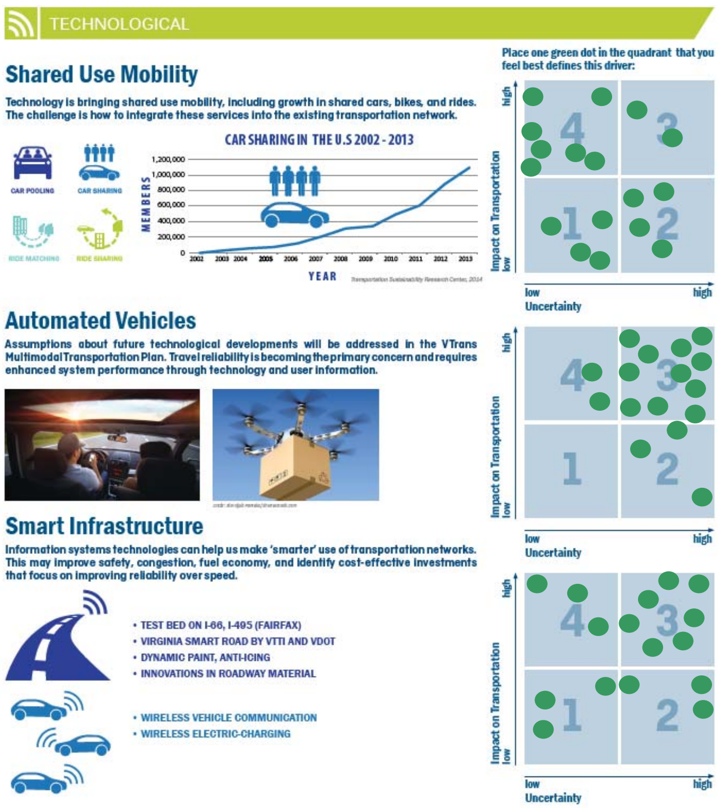
Research, data analysis, apply models

Iterative process to define scenarios



- Iterative Process
- Adapt to achieve:
  - Internal consistency
  - Range of outcomes

Opportunities for outreach

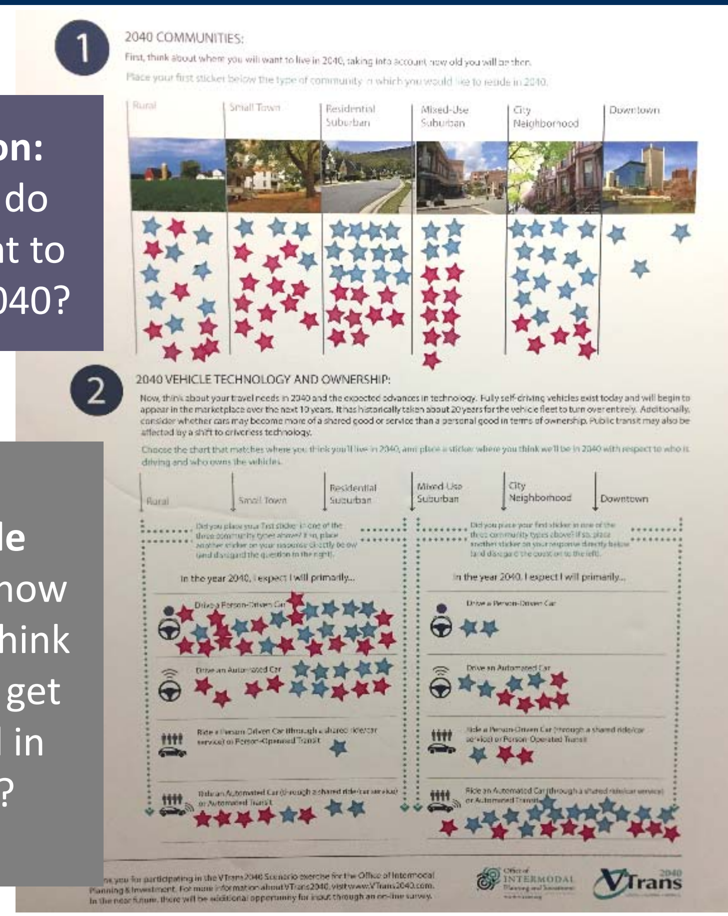


1

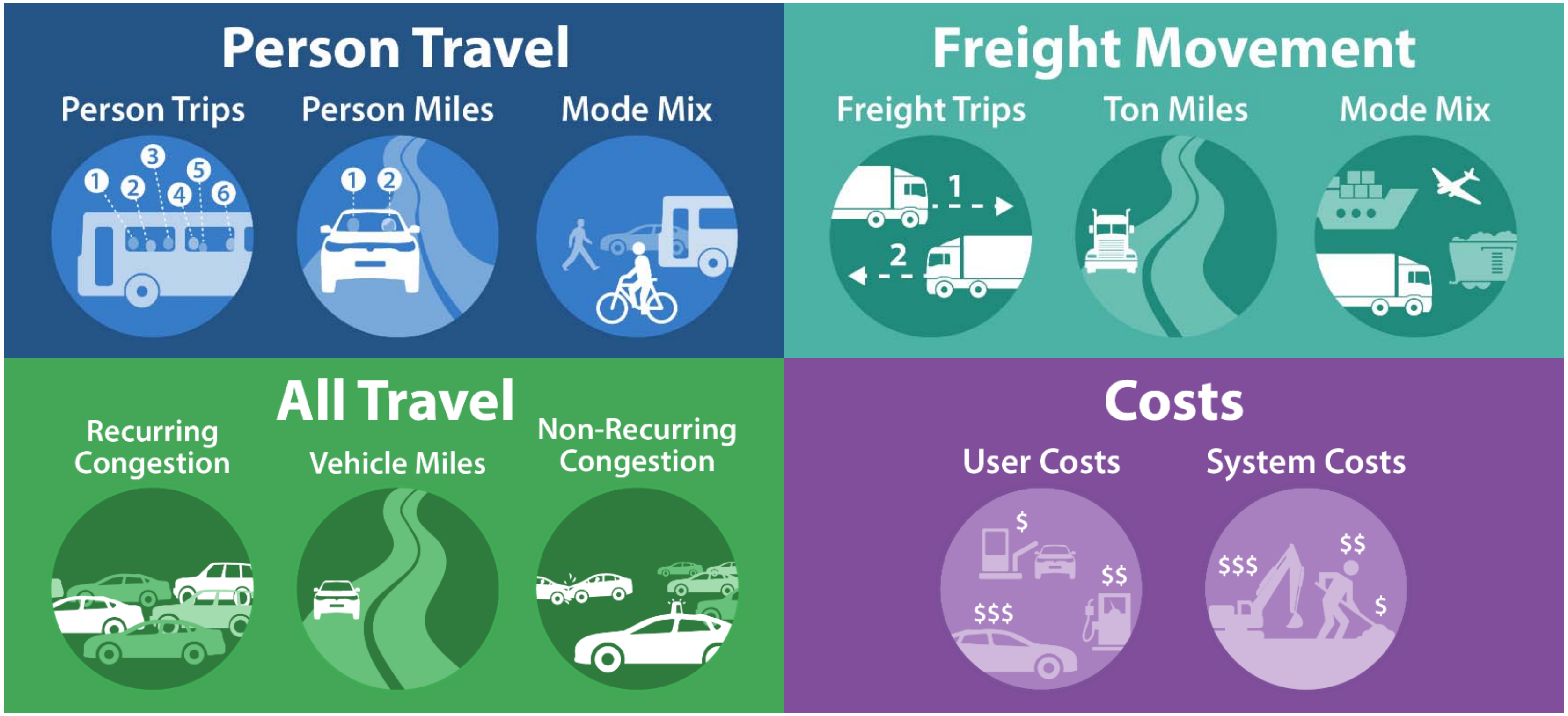
Location: Where do you want to live in 2040?

2

Vehicle Travel: how do you think you will get around in 2040?



Potential exploratory planning outputs



Exploratory 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

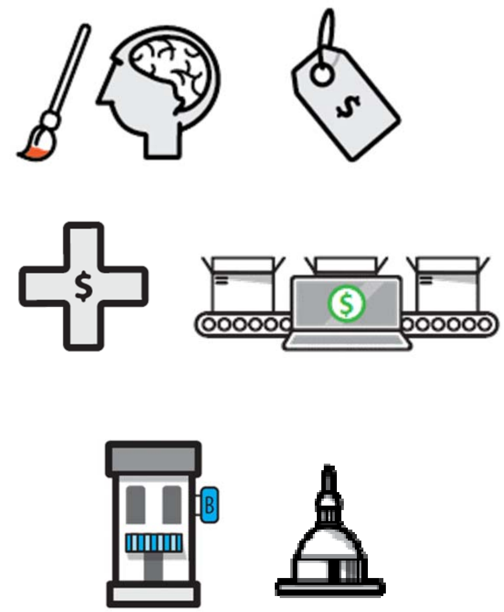
Baby Boomer

Generation X

Millennial

Generation Z

INDUSTRY MIX



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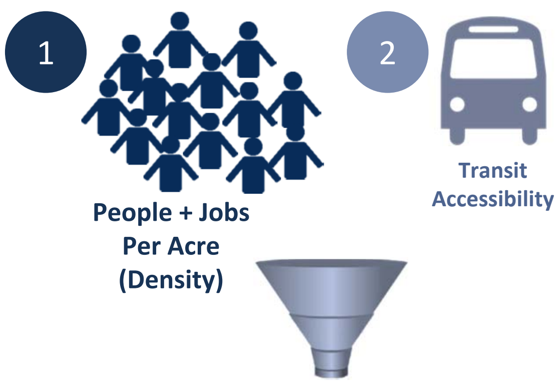
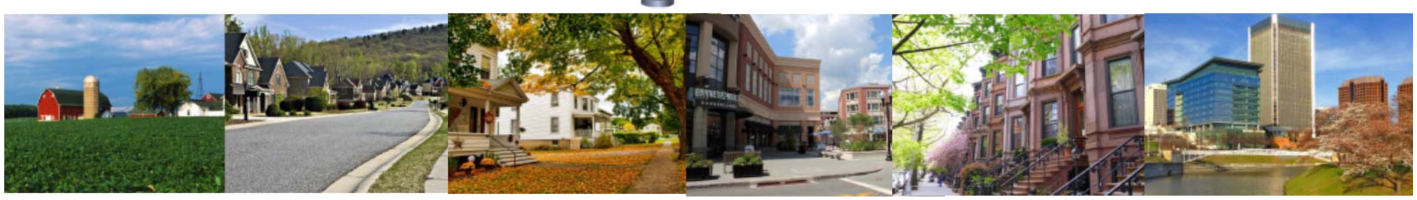
Linking land use and transportation

Two Key Criteria to Define Placetypes



The Placetypes reflect areas with noticeable differences in travel behavior as it relates to land use patterns.

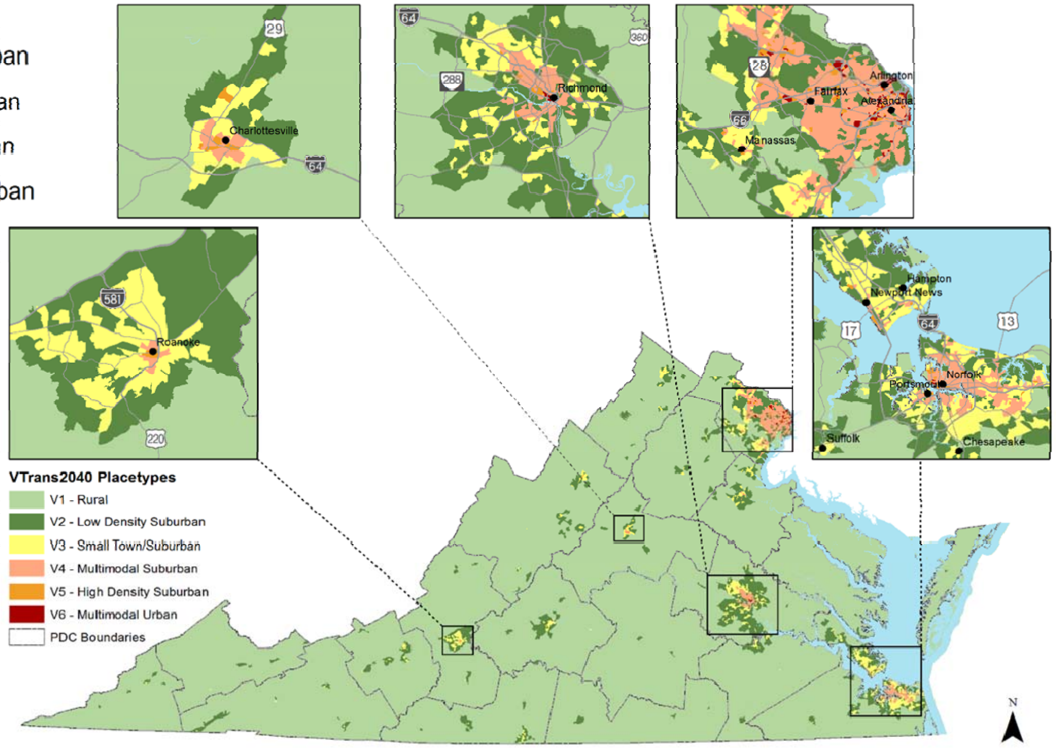


V1 – Rural	V2 – Low-Density Suburban	V3 – Small Town/ Suburban	V4 – Multimodal Suburban	V5 – High Density Suburban	V6 – Multimodal Urban

Linking land use and transportation

VTrans2040 Placetypes

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



Differentiate:

- Mode Split
- Demographics
- Trip Rates
- Technology Implementation

What are the critical distinctions in your community types and how might you measure them?

- Travel modes
- Walkability
- Trip generation
- Jobs/housing balance
- Commute length

Preparing for Uncertainty: VTrans Exploratory Scenarios

DEEP DIVE

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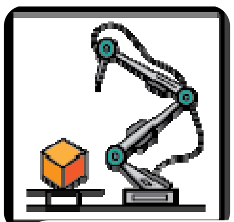
Example Exploratory Scenarios



High Growth Industrial
- Less Urban
- Higher VMT Assumptions

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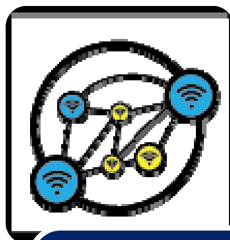
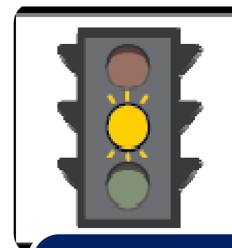


High Growth High Tech
- More Urban
- More Multimodal

Whfkwrsld

Moderate Growth
- Older Demographics
- Walkable Places

Vlyhu#Djh



Reduced Growth
- Federal Spending Reduced
- Slower adoption of technology

Jhqhudo# Vorz grzq

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

Assumptions for Industrial Renaissance (High Growth Industry)

Where is population growth occurring?

Similar distribution to 2015

Millennials ultimately move to suburbs

What are the employment and industry trends?

High tech manufacturing

How advanced is transportation technology?

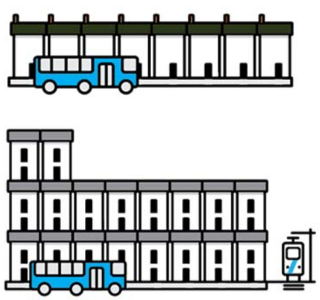
High degree of AV and Mobility on Demand, varying by placetype (same as Baseline)

What are the environmental considerations?

High end of predicted trends in high-heat days and severe storm days

Assumptions for Techtopia (High Growth Technology)

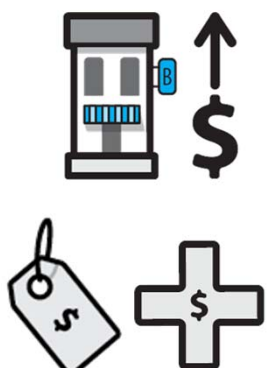
Where is population growth occurring?	What are the employment and industry trends?	How advanced is transportation technology?	What are the environmental considerations?
Strong growth in urban areas	Micro production, knowledge-based economic growth	AV and Mobility on Demand in "full effect"	Low end of predicted trends in high-heat days and severe storm days

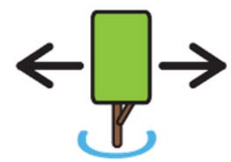


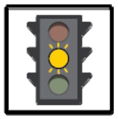
Surge in telecommuting

Assumptions for Silver Age (Moderate Growth)

Where is population growth occurring?	What are the employment and industry trends?	How advanced is transportation technology?	What are the environmental considerations?
Preference for smaller, walkable communities	Growth in small business, retail, and healthcare	AV is high, but Mobility on Demand is low	Virginia develops away from vulnerable areas

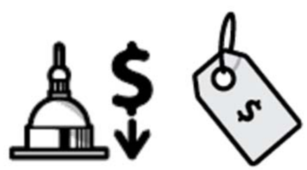




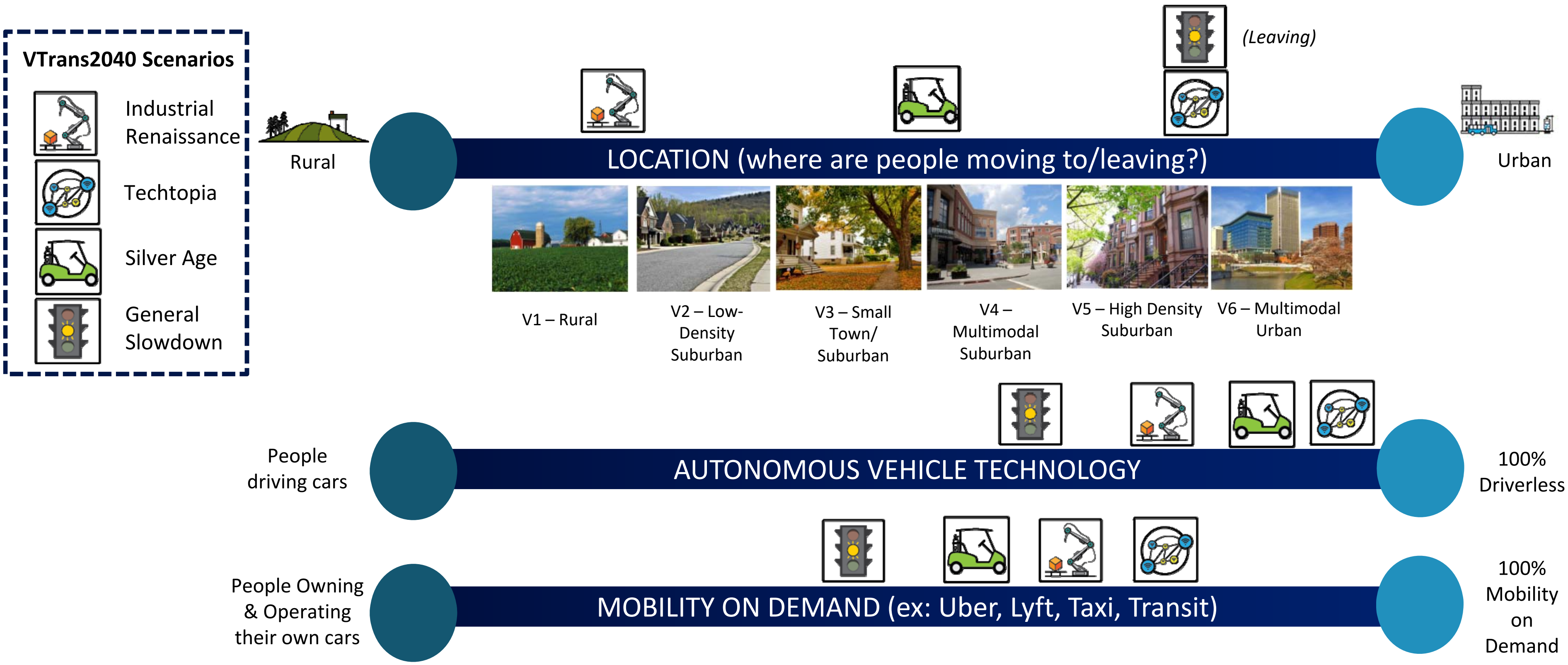


Assumptions for General Slowdown (Low Growth)

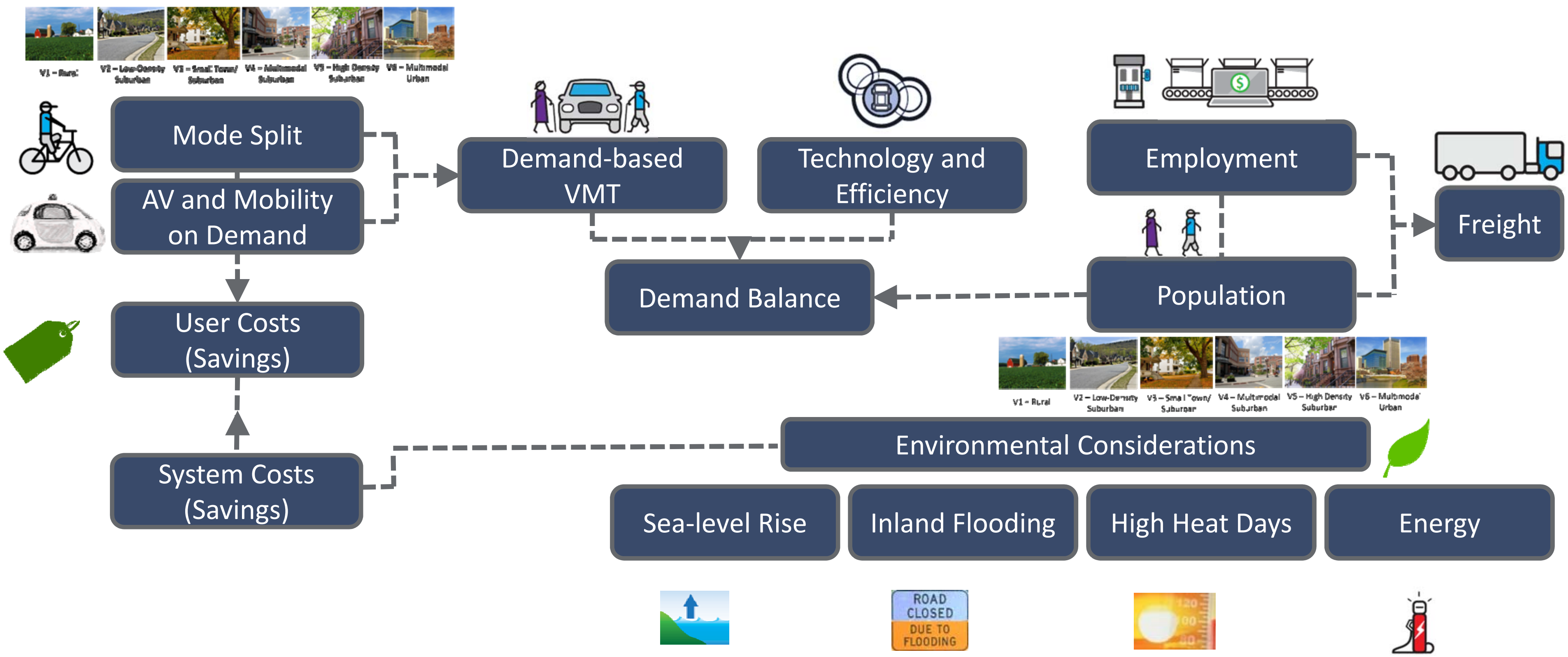
Where is population growth occurring?	What are the employment and industry trends?	How advanced is transportation technology?	What are the environmental considerations?
Sluggish population growth	Reduced military spending, economic slowdown	Delayed adoption of AV and Mobility on Demand relative to Baseline Scenario	Environment status quo, volatile global energy prices
Population decline in urban areas, fewer Millennials move to Virginia			



Key trends by scenario



Scenario Components



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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

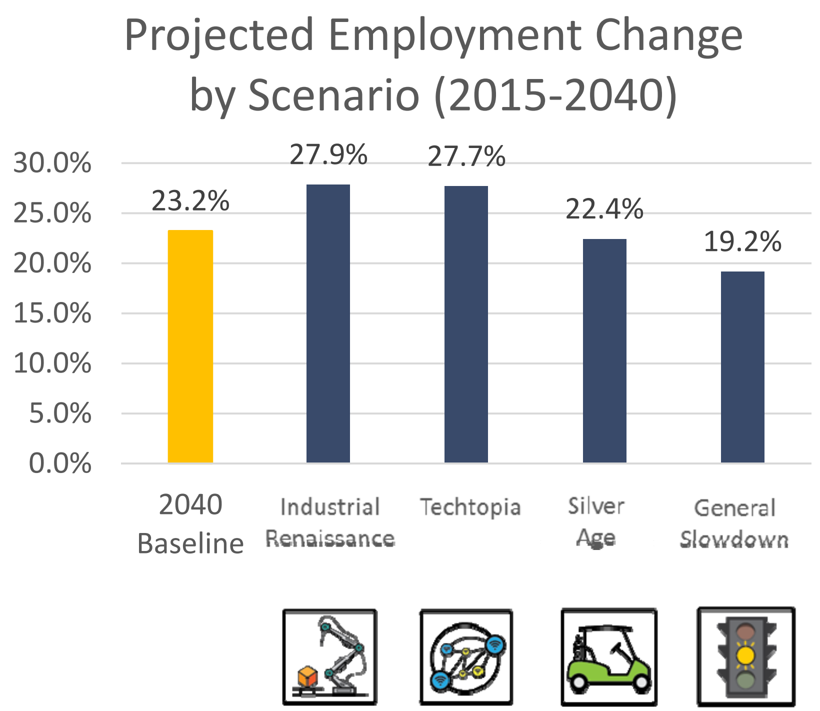
Healthcare

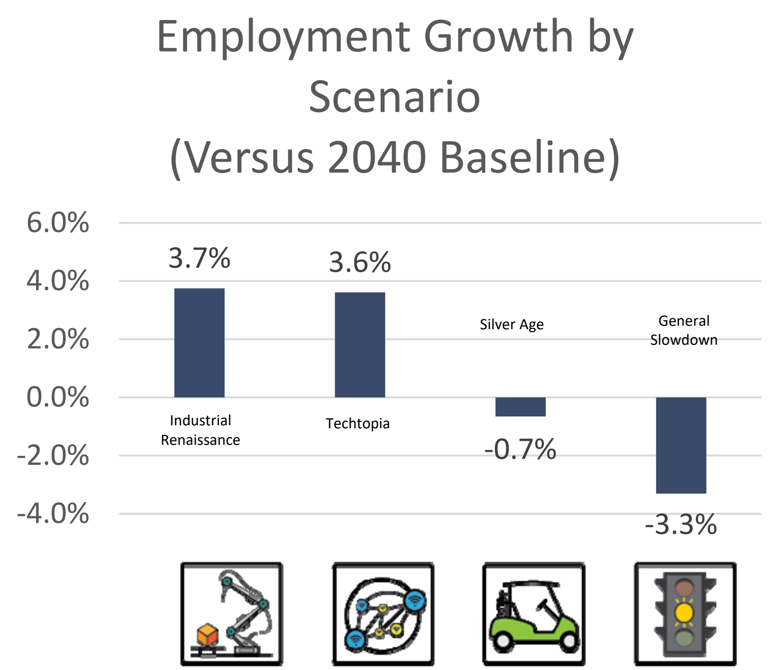
General Slowdown

Military Slowdown

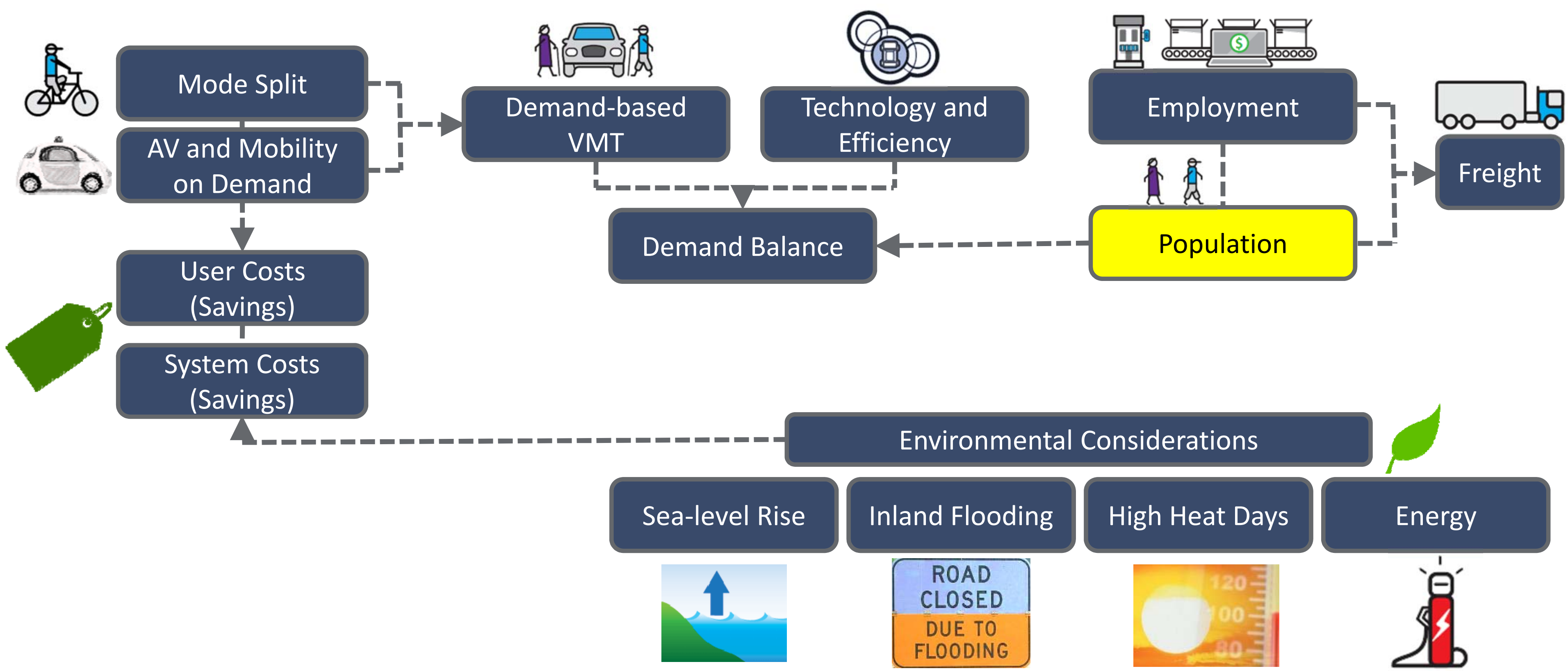
Retail Slowdown

Assumed scenario employment adjustments





Population


Mode Split
AV and Mobility on Demand
Demand-based VMT
Technology and Efficiency
Employment
Freight
Population
Demand Balance
User Costs (Savings)
System Costs (Savings)
Environmental Considerations
Sea-level Rise
Inland Flooding
High Heat Days
Energy
ROAD CLOSED DUE TO FLOODING

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Population drivers

Industrial Renaissanc e

Attract More Millennials

Attract More Boomers

Techtopia

Attract More Gen X

Attract More Gen Z

Silver Age

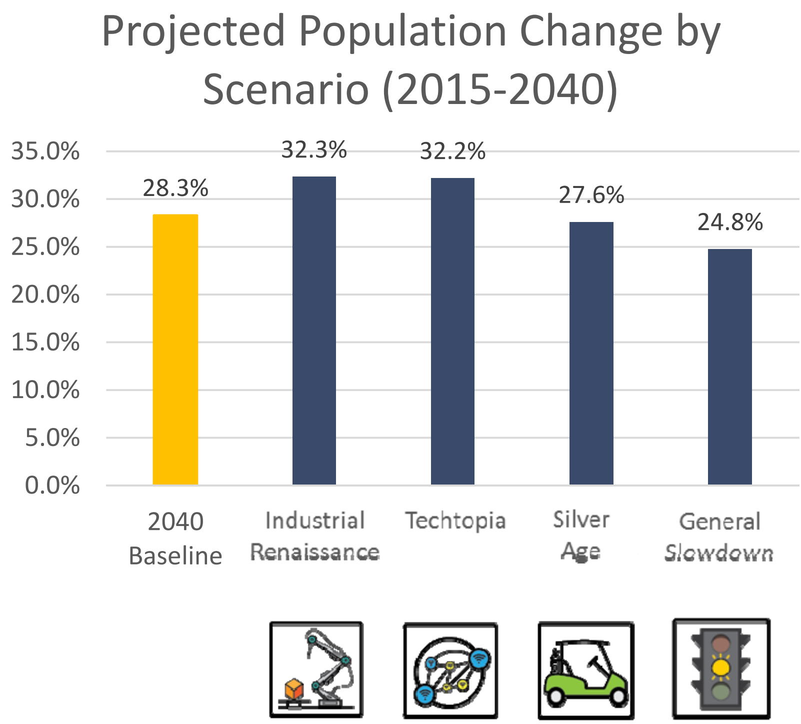
Attract More Gen X

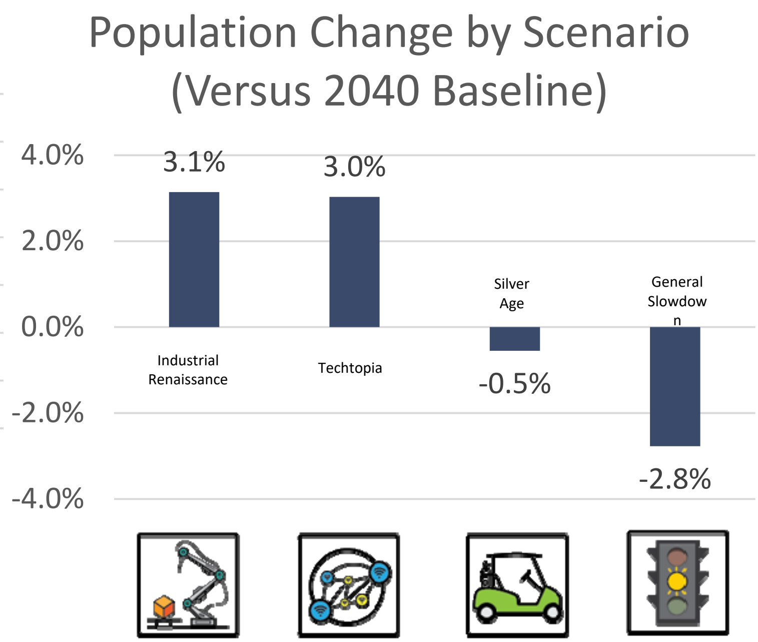
Attract Fewer Gen Z

General Slowdown

Attract Fewer Millenials

Assumed scenario population adjustments





2040 population allocation by placetype

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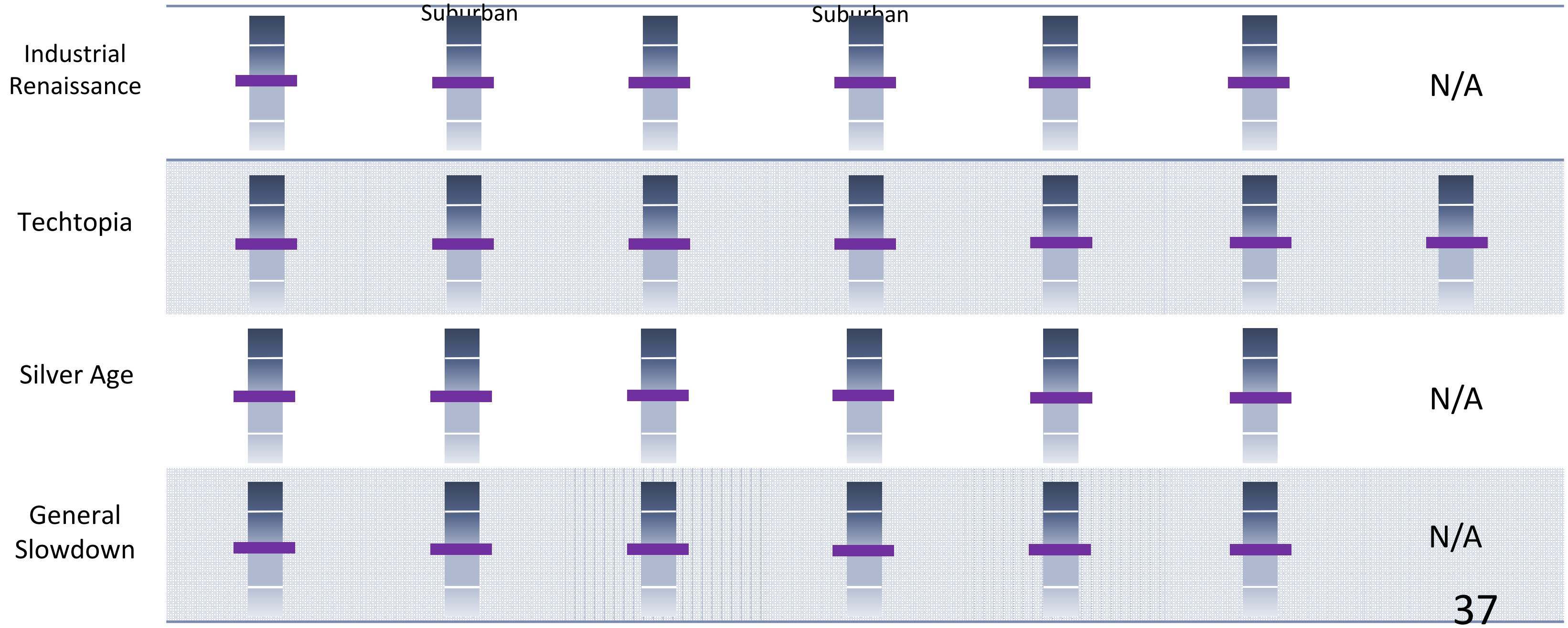
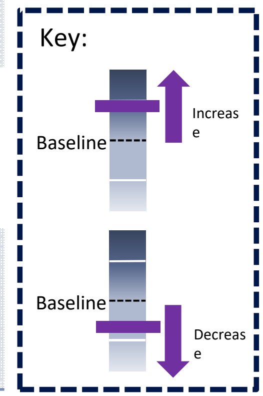
V1 – Rural | V2 – Low-Density Suburban | V3 – Small Town/Suburban | V4 – Multimodal Suburban | V5 – High Density Suburban | V6 – Multimodal Urban | V7 – High Density Urban*

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





2040 population assumptions by placetype and scenario

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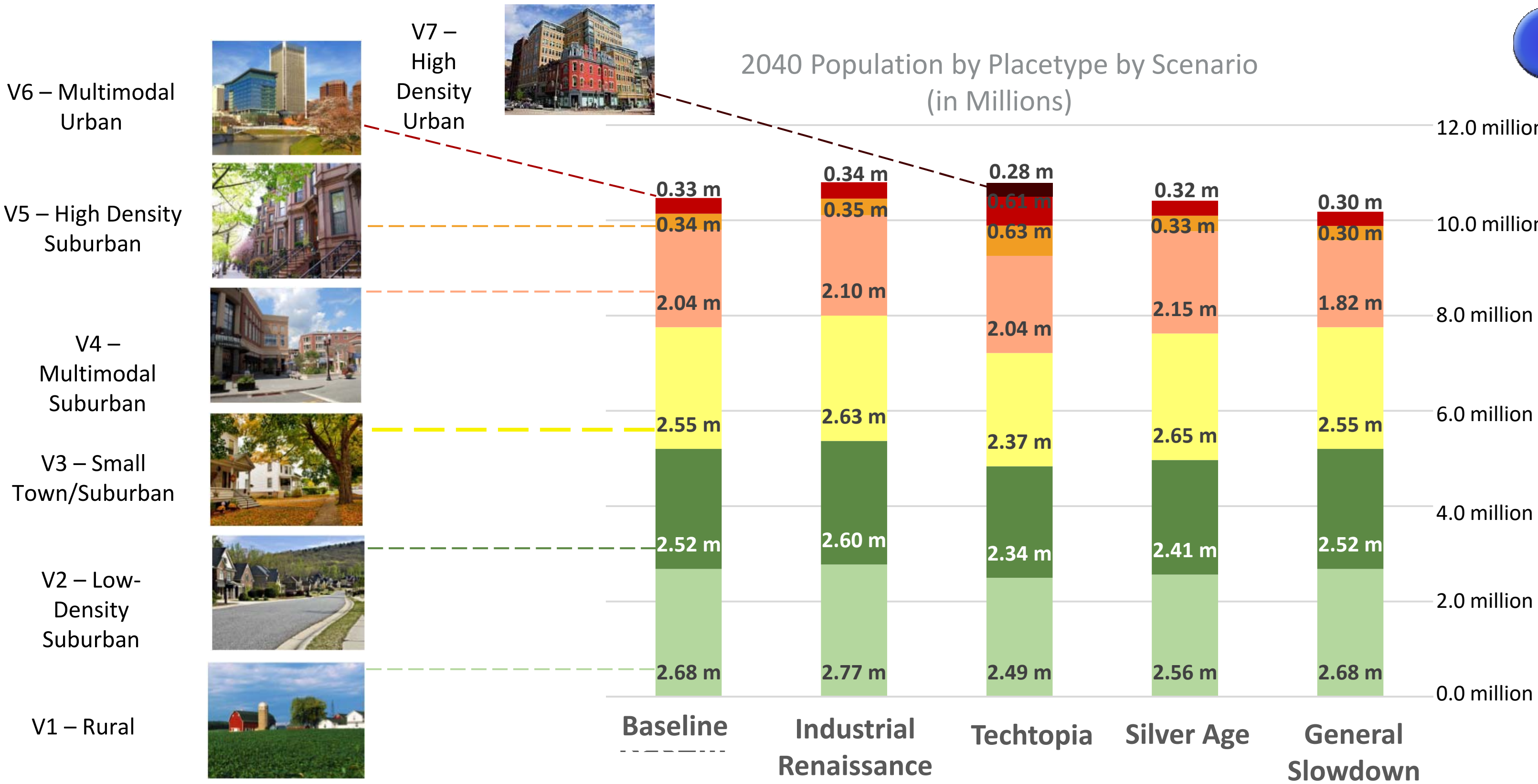
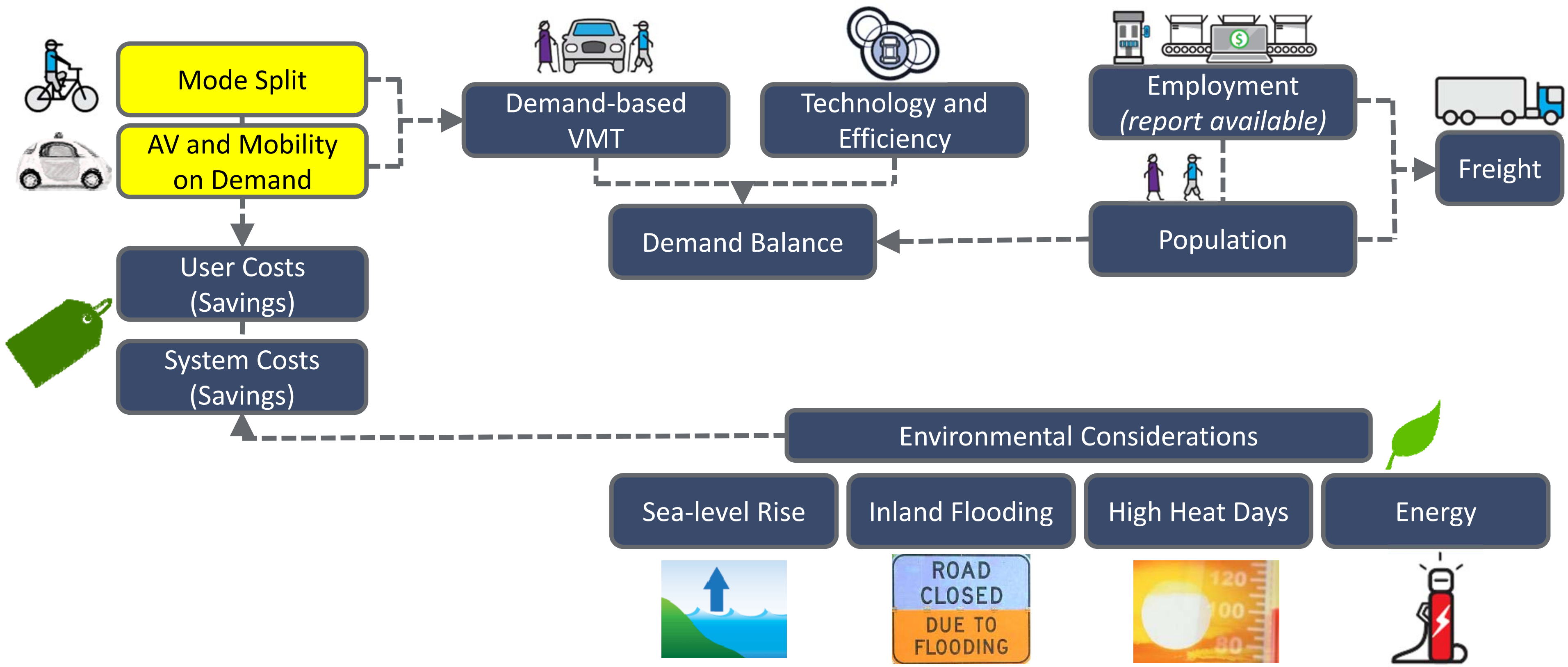


Over 600,000 more people live in Virginia in Scenarios 1 & 2 than in Scenario 4

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

Mode split and technology



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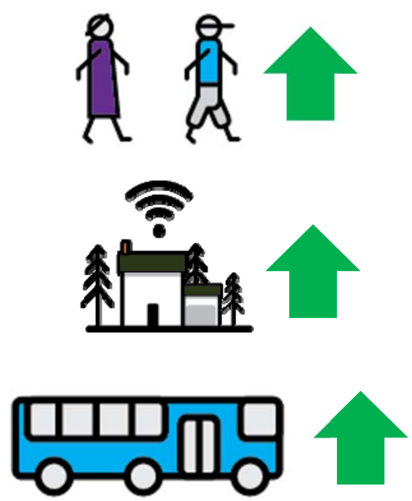
Transportation mode shift assumptions by scenario (relative to Baseline) in 2040

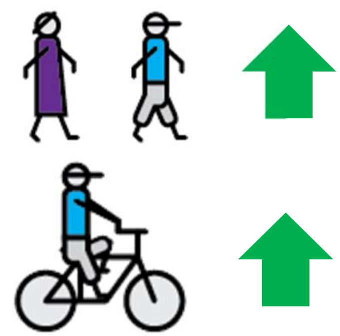
Industrial Renaissance

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

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Assumed percent of passenger vehicle travel using autonomous vehicles in 2040

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.

Baseline	Industrial Renaissance	Techtopia	Silver Age	General Slowdown

Baseline	Industrial Renaissance	Techtopia	Silver Age	General Slowdown
Med.	**Med.**	**High**	**Med.-High**	**Low**

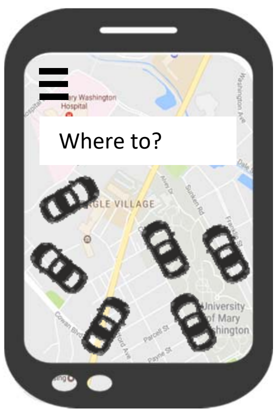
Assumed percent of passenger vehicle travel using mobility on demand in 2040

Percent Mobility on Demand by Scenario

Anticipated range: 50% (low) to 80% (high)

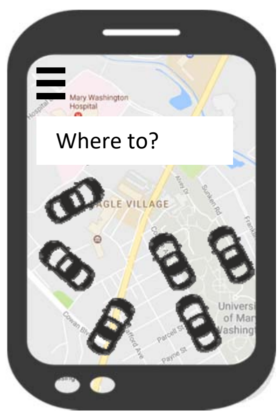
Mobility on Demand services, like Uber and Lyft, are expected to continue changing the way we travel, especially for short trips in urban areas.

Baseline



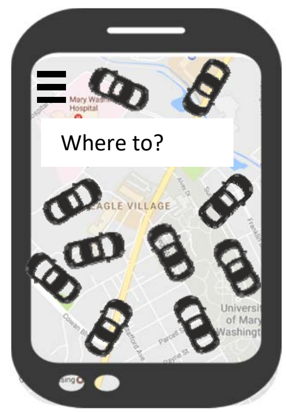
Med.

Industrial Renaissance



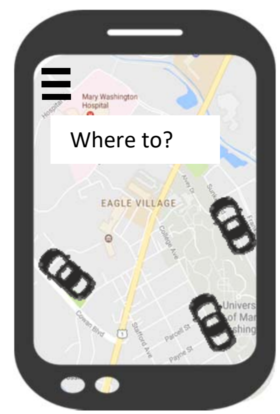
Med.

Techtopia



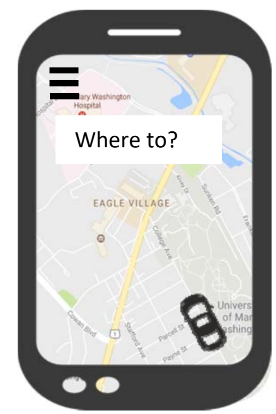
High

Silver Age



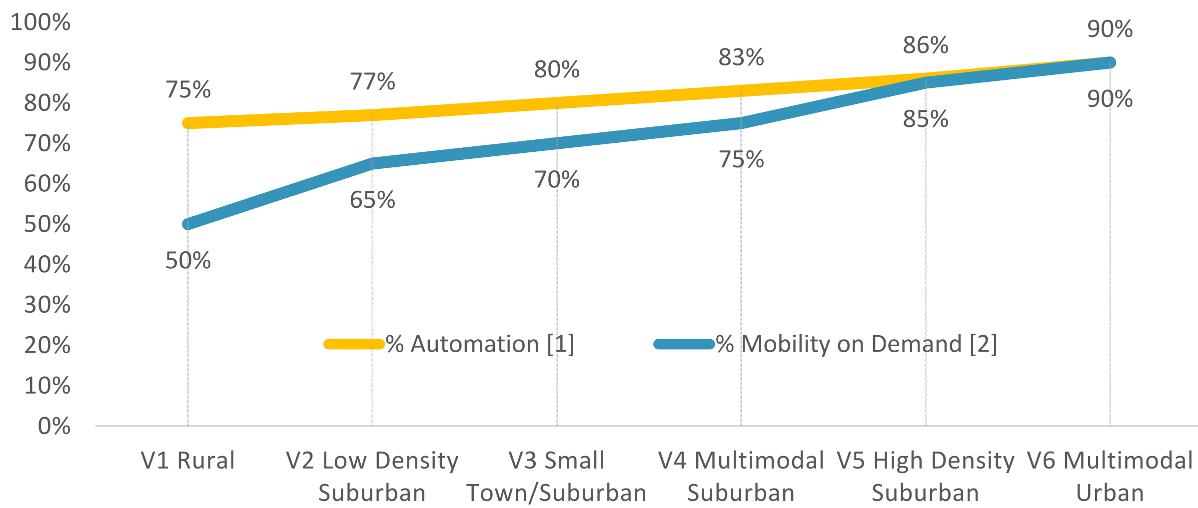
Low-Med.

General Slowdown



Low

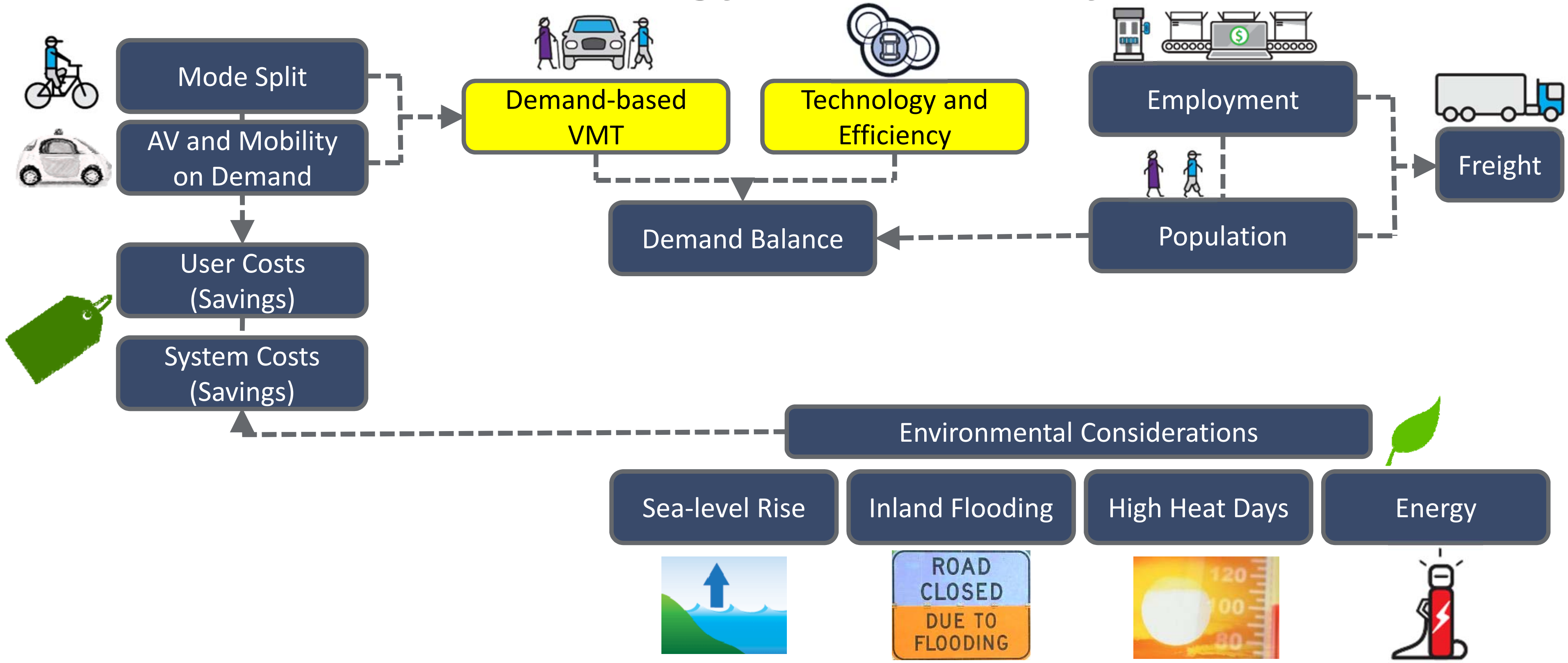
Baseline technology assumptions by placetype



[1] [2] Information above was inspired by public input

V2V connectivity. I-95 Corridor Coalition

Technology and Efficiency

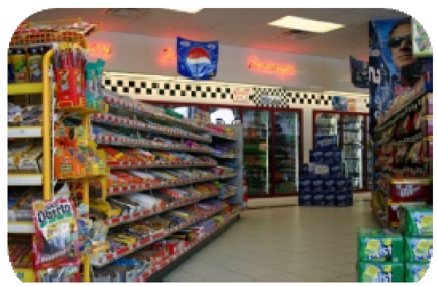


Technology and travel behavior

Induced Mobility ↑

ZOV Trips ↑

Longer Commutes ↑



Induced Mobility ↑

Short Trips ↑

Parking ↓

Transit in 2040

Transit could become more affordable, available and conventional as a result of:

- AV/CV technology
- Electric charging
- More streamlined/efficient network

Sion, Switzerland
Source: Swisspost

Autonomous transit is already being tested around the world

National Harbor, Maryland
Source: CBS Washington

Las Vegas, Nevada
Source: vegasexperience.com

Helsinki, Finland
Source: New York Times

Transit in 2040

Anticipate a Spectrum of Services…

Rail → BRT → Fixed-Route Bus → Custom Route Bus → Circulator Shuttles → Personal Transit

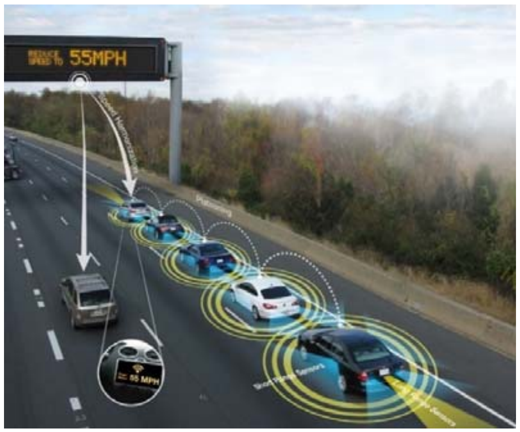
Fixed Route
High Capacity

↔

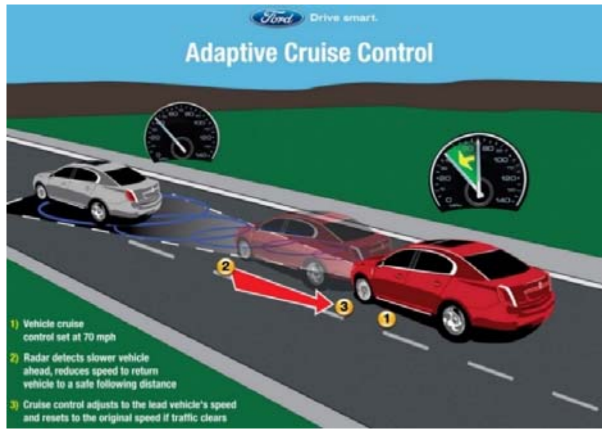
Demand-Responsive
Lower Capacity

Technology and roadway capacity

CAV Capacity Benefits



Vehicle Platooning. Source: USDOT



V2V connectivity. I-95 Corridor Coalition

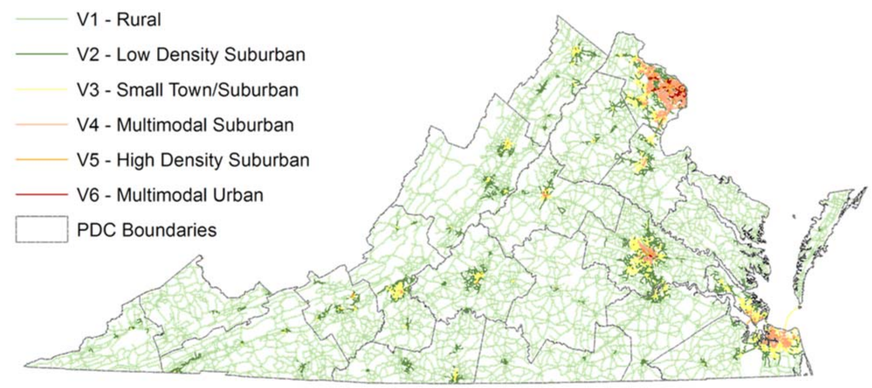
Although VMT is expected to increase, vehicle technology & infrastructure improvements will help increase travel efficiency and throughput (effectively increasing roadway capacity)

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)

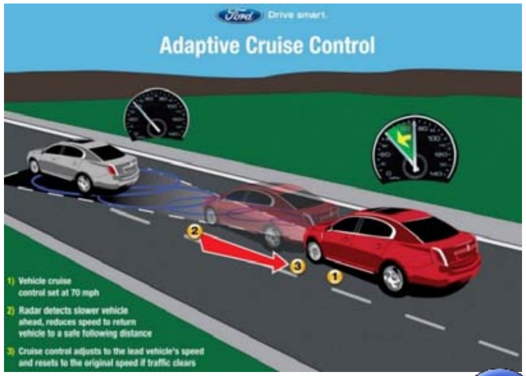
Placetype	Interstates as % of total network	Arterials as % of total network	**Total**
V1 Rural	4%	16%	**20%**
V2 Low Density Suburban	7%	24%	**31%**
V3 Small Town/Suburban	7%	30%	**37%**
V4 Multimodal Suburban	7%	31%	**38%**
V5 High Density Suburban	12%	35%	**47%**
V6 Multimodal Urban	10%	31%	**42%**

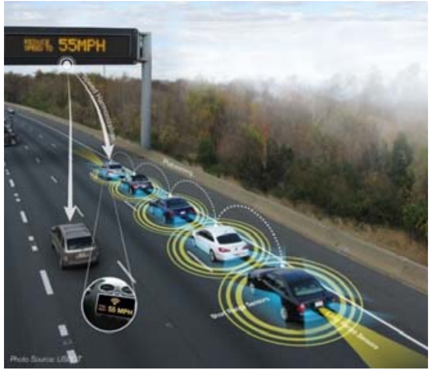
Technology, efficiency and throughput

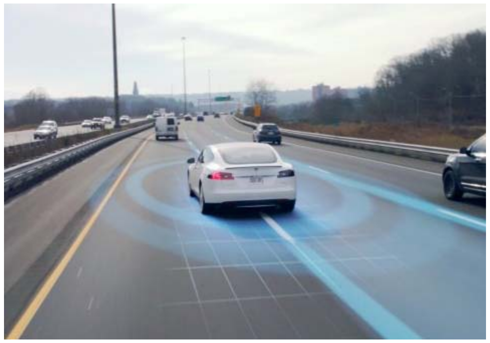
Technology and improved efficiency are expected to increase throughput by

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*)

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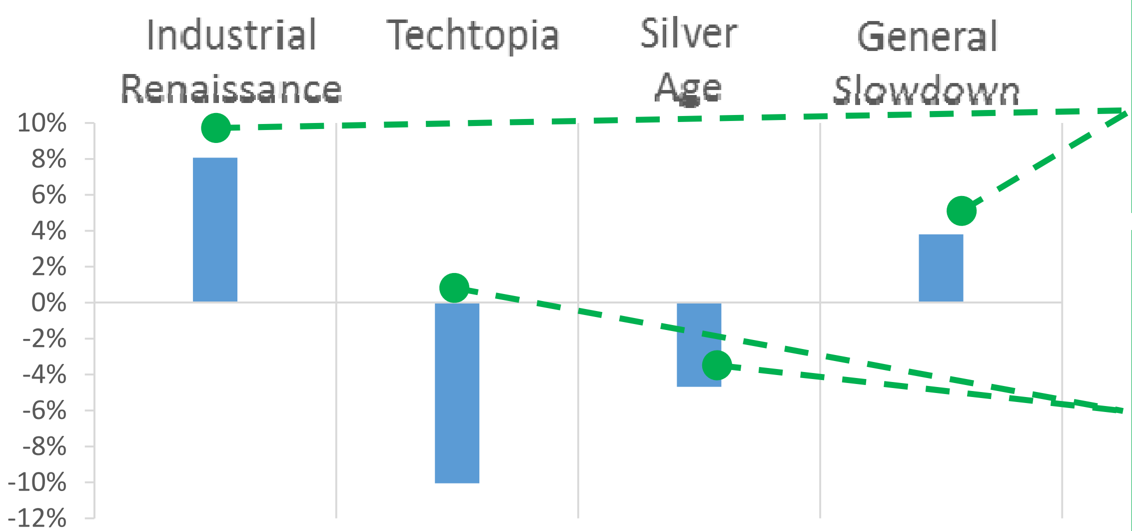
Net Change in Roadway Demand

How can Technology and Travel Behavior Influence Demand in 2040:

EXAMPLE NET CHANGE IN ROADWAY DEMAND BY SCENARIO

(VS. 2040 BASELINE)



Net roadway demand is expected to increase in **Scenarios 1 and 4** as VMT outpaces the capacity and efficiency benefits provided by technology and alternative transportation.

Net roadway demand is expected to decrease in **Scenarios 2 and 3** as travel behavior and efficiency increase the "effective capacity" of the roadway network

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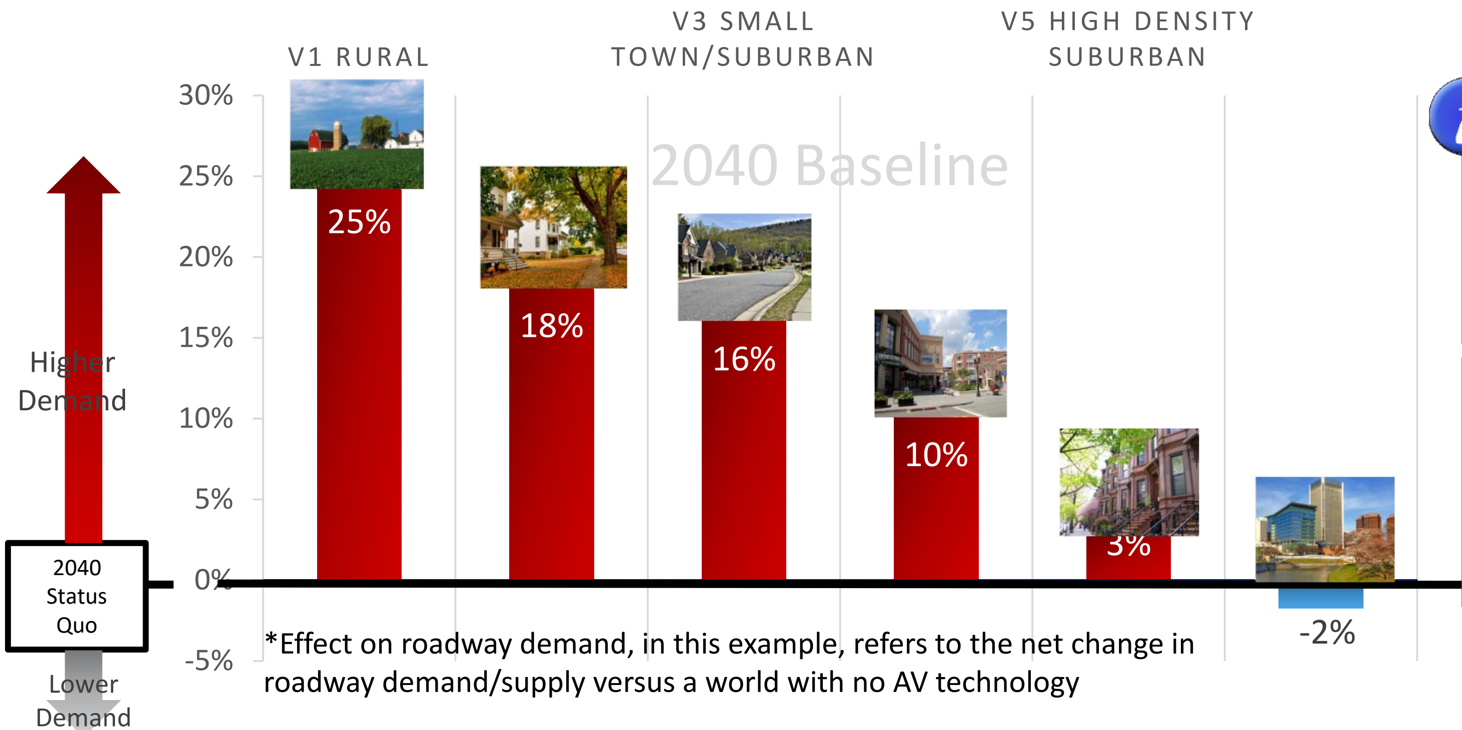
Potential roadway demand by placetype in 2040

2040 BASELINE VS. 2040 “Status Quo” (NO AV INFLUENCE)



*Effect on roadway demand, in this example, refers to the net change in roadway demand/supply versus a world with no AV technology

VMT is expected to increase in the 2040 Baseline as AVs and Mobility on Demand take shape.

The majority of increased auto travel is expected to occur in Virginia’s rural and suburban areas.

Comparing scenarios – high level insights

	 Industrial Renaissance	 Techtopia	 Silver Age	 General Slowdown
DEMAND	**Pop.** ↑↑ **VMT** ↑↑↑↑	**Pop.** ↑↑ **VMT** ↑↑↑	**Pop.** ↑ **VMT** ↑↑↑	**Pop.** ↑ **VMT** ↑↑↑
SYSTEM CAPACITY	**PTP** ↑↑	**PTP** ↑↑↑	**PTP** ↑↑	**PTP** ↑

PTP: Person Through-put

Takeaways by Placetype

V1 – Rural

V2 – Low-Density Suburban

V3 – Small Town/Suburban

V4 – Multimodal Suburban

V5 – High Density Suburban

V6 – Multimodal Urban

V7 – High Density Urban*

- Recurring congestion on two-lane rural roads
- More VMT on local streets and collectors
- More trips in high density suburban/urban areas

Operational Improvements
Innovative intersection design, dedicated CAV lanes on highways

Demand Management
*ITS, carpools, vanpools park & ride, transit, and peak travel restrictions

Complete Streets
w/ flexible route transit

Complete Streets
w/ integrated, full-spectrum transit

*V7- New Placetype introduced for Scenario 2, reflecting densities comparable to major US cities

Key Findings: *How can we prepare for the future?*

Anticipate Increased Demand

- Automated and on-demand vehicles will unleash growth in travel demand
- Foreseeable changes in travel behavior with connected and automated vehicles (CAV) will increase travel demand
- Tech. innovations in the economy as well as transportation will spur growth in freight traffic

Technology Will Enhance System Performance

- Safety improvements will reduce congestion from incidents
- Information will improve efficient use of the whole system
- Vehicles will become safer, smaller, and able to travel closer together

Timing is Key – Balancing these two sides of the technology future is critical

Design is also Key – Walkable and multimodal places have the most balanced outcomes

Risks ⚠

- Rising transportation demand could cause additional congestion (and pollution)
- Vehicle electrification and fleet management could threaten traditional transportation revenues
- Local streets and rural roads may have challenges accommodating higher demand
- Mobility-on-demand could threaten transit viability
- Resistance to vehicle autonomy could delay safety benefits from technology
- Climate volatility creates more reliability challenges and puts critical systems at risk

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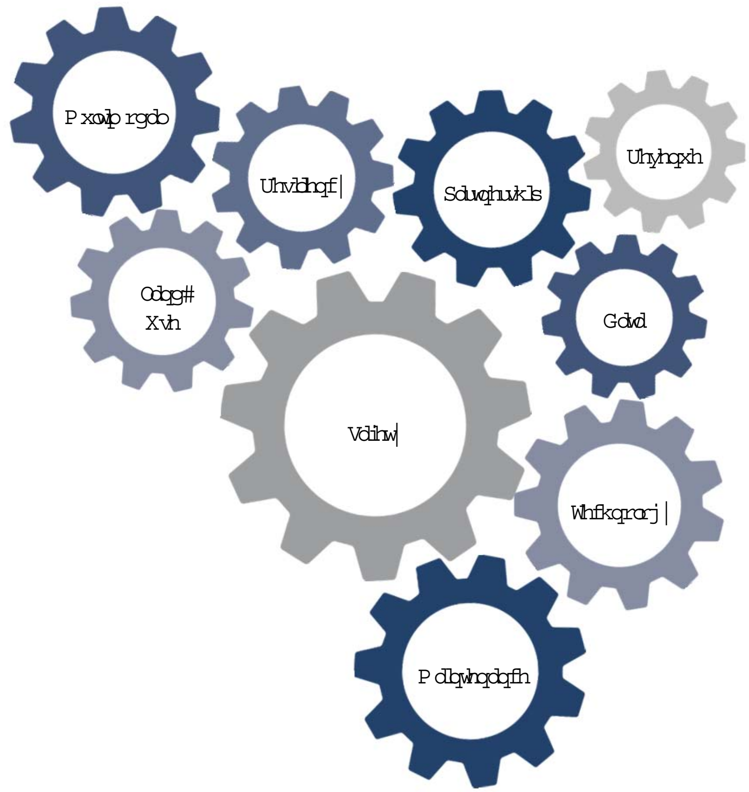
Opportunities



- **Timing is Key –** balance demand and throughput
- **Safety Benefits are Win-Win-Win**
- **Expect Revenue Impacts, but Seize Opportunities with Data**
- **Community Design is Key –** manage urban space and curb space
- **Be Nimble** – intermodal and multimodal corridors maximize flexibility (connecting airports, rail, ports, transit)
- **Be Resilient** – apply risk management approaches to data and assets

Exploratory Planning Workshop

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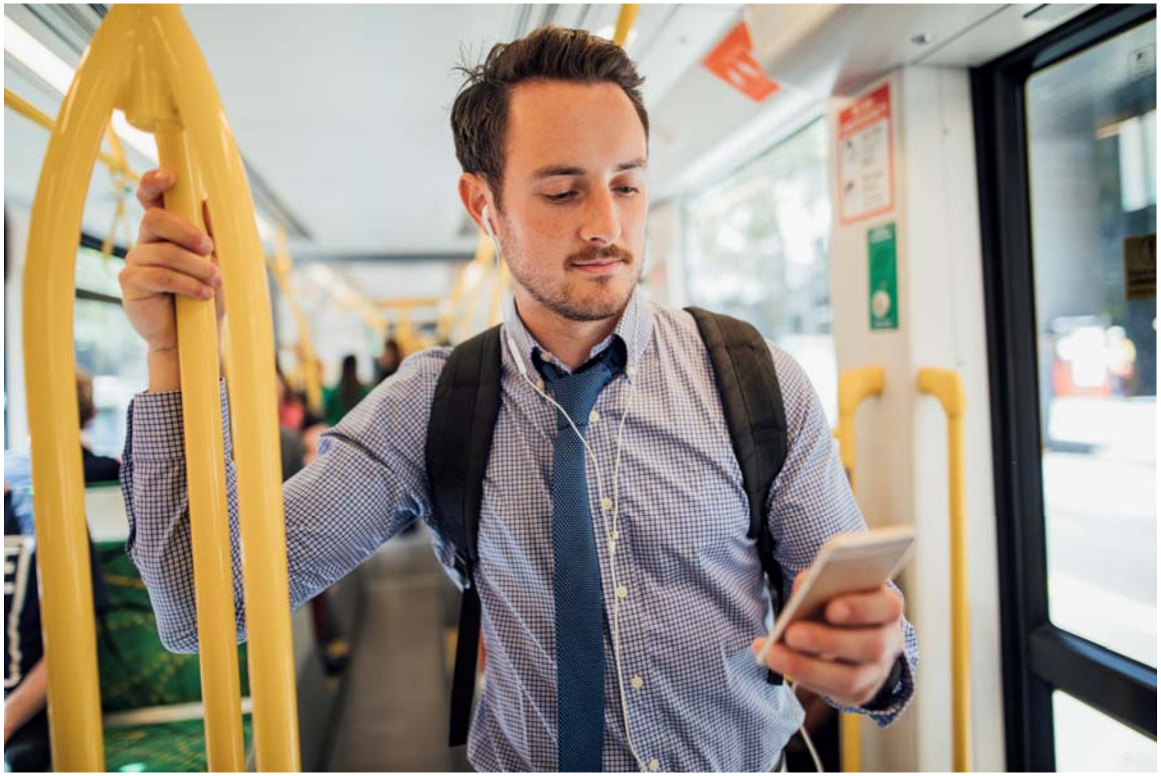
We start with drivers

Generational changes

Different values govern life choices



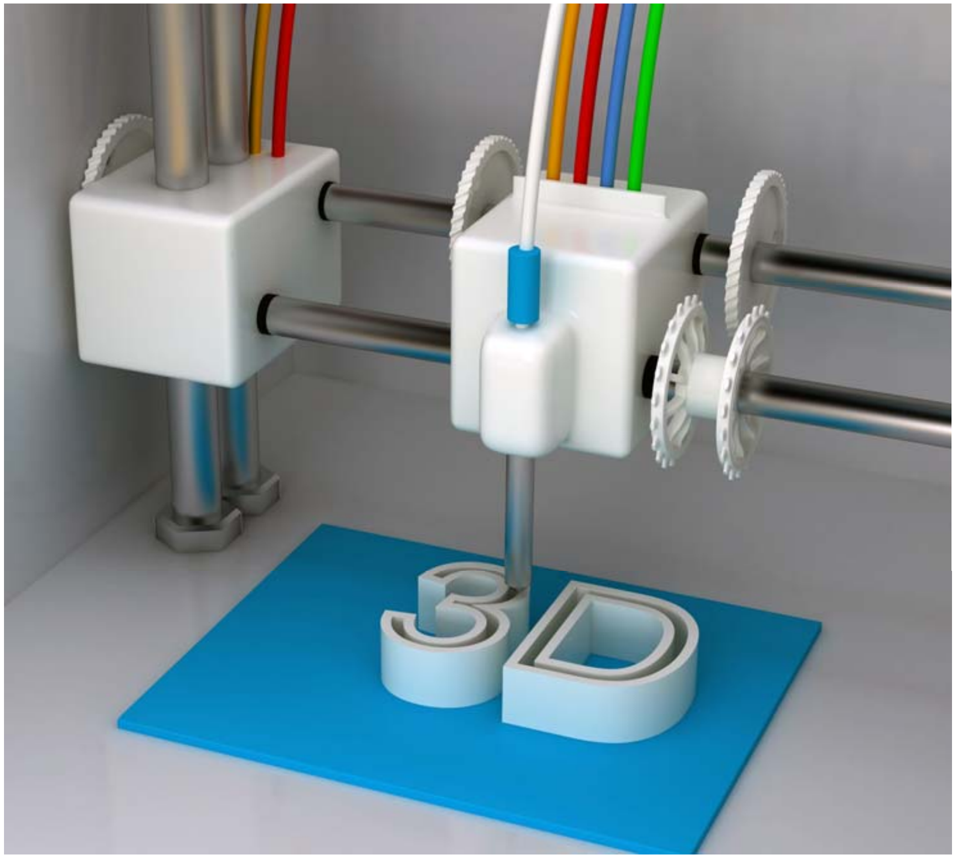
airbnb

UBER

lyft

Other demographic-land use trends?

Economic Disruptors



Economic Disruptors

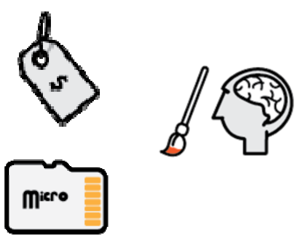
Tell me about economic…

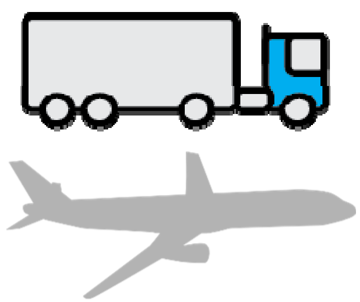
OPPORTUNITIES

- Technology
- Workforce
- Training
- Transportation

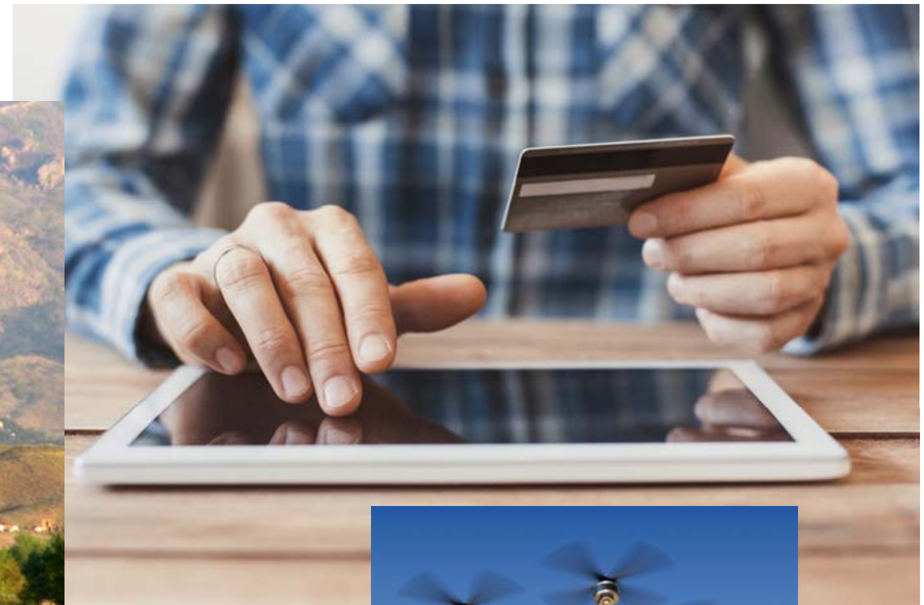
THREATS

- Technology
- Workforce
- Training
- Transportation





Economic drivers for Treasure Valley?



Technology Disruptors

- Connected vehicles
- Autonomous vehicles
- Mobility as a service
- Information systems

Connected and Automated Vehicles (CAV)

55 international cities are hosting CAV tests or have committed to doing so in the near future

29 international cities are undertaking long-range surveys of the regulatory, planning, and governance issues raised by CAVs, but have not yet started piloting

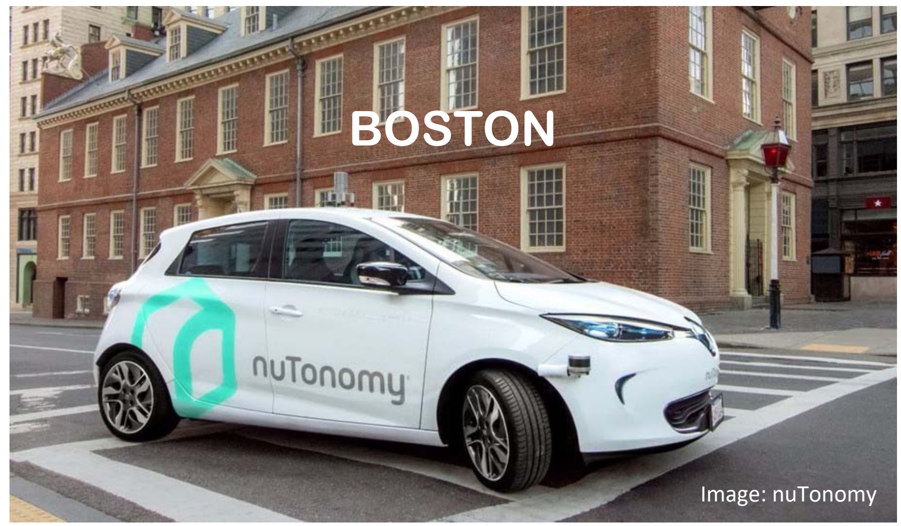


Image: nuTonomy

Autonomous Shuttles/Transit

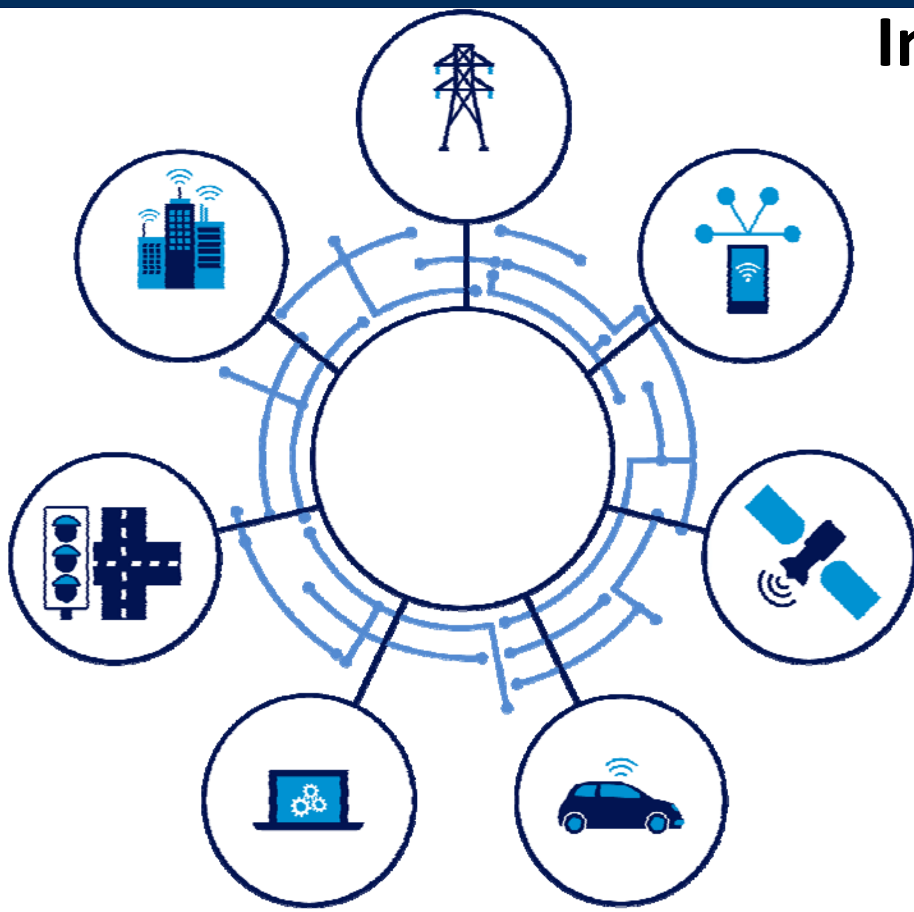
Dozens of international cities are conducting autonomous shuttle pilot/deployment programs

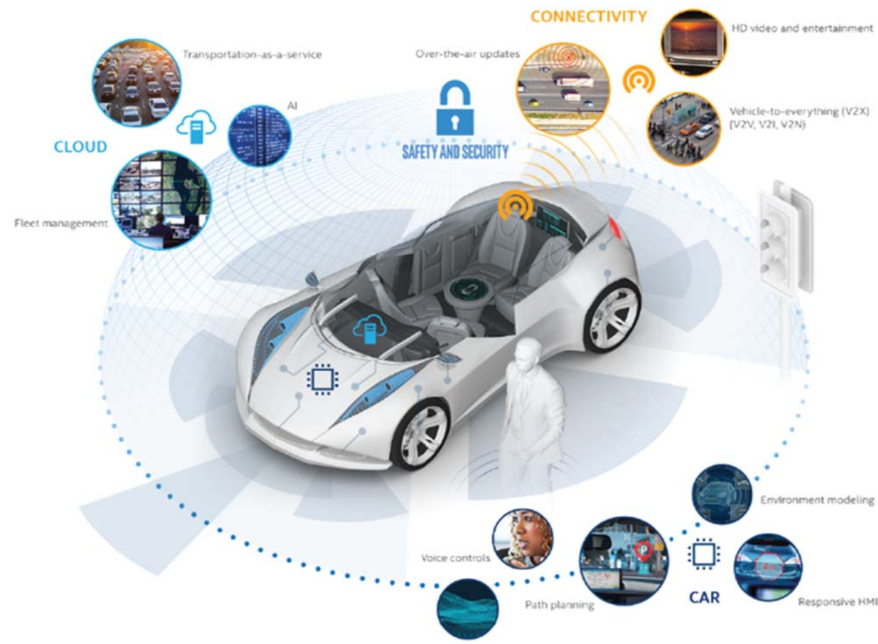
Mobility as a Service

UBER

lyft

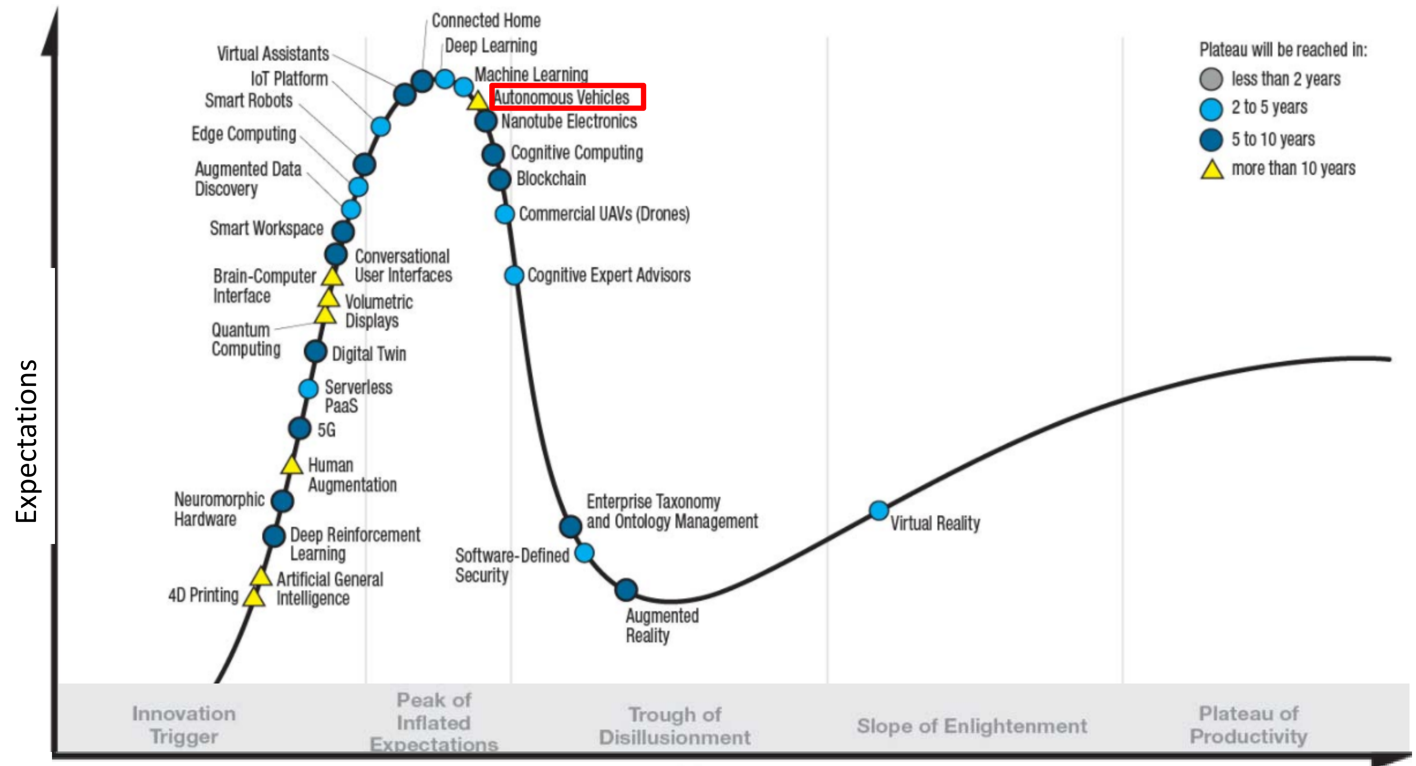
Information Systems





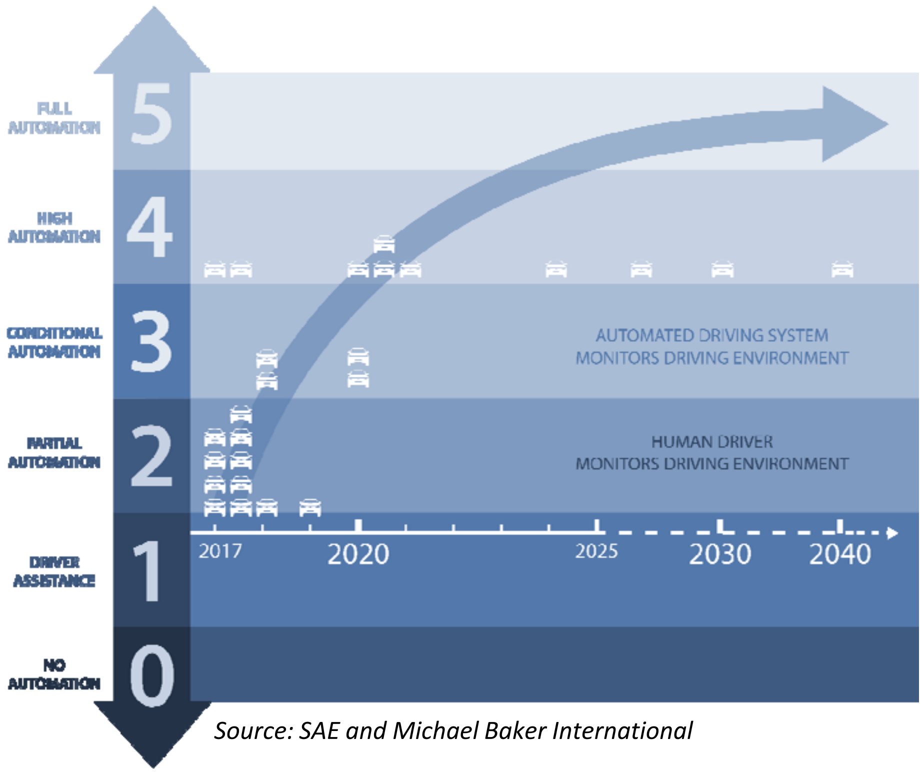
Potential 5G architecture. Source: Intel

Hype Cycle for Emerging Technologies

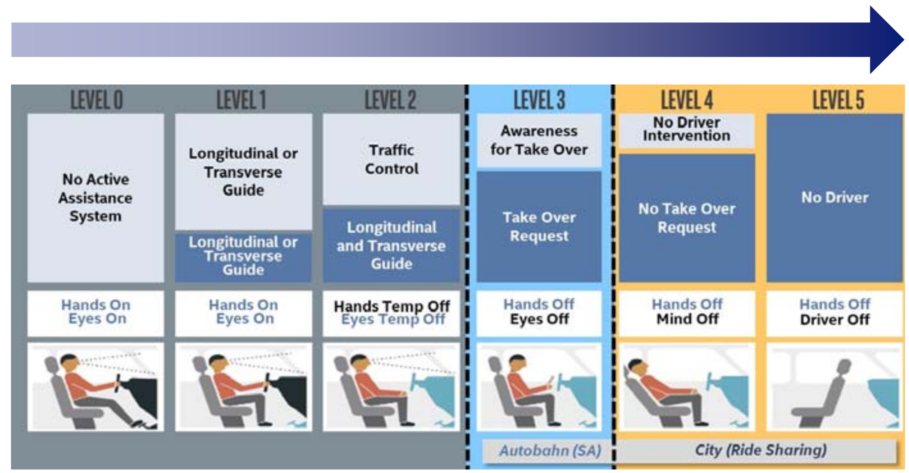


Source: Gartner 2017

Levels of Vehicle Automation

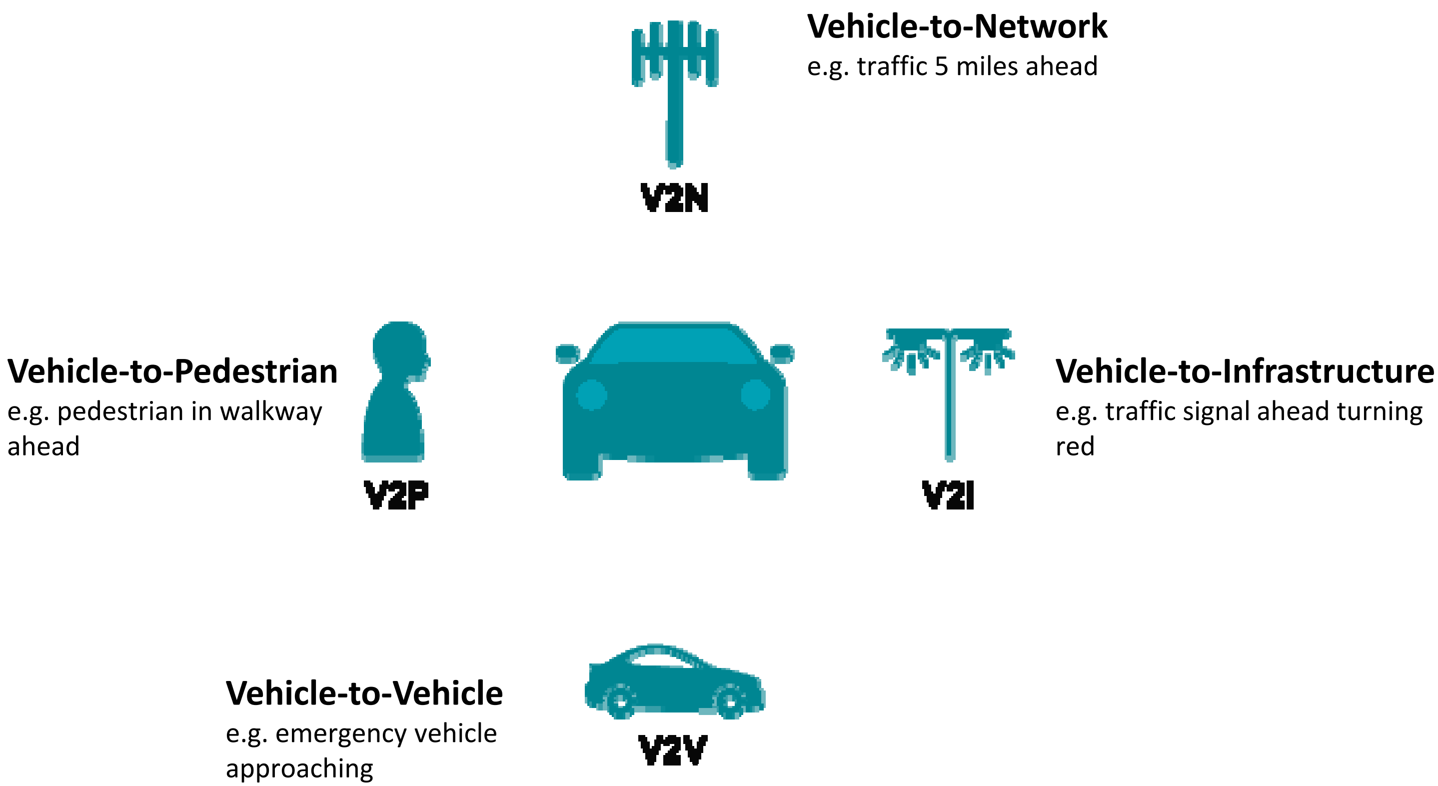


Source: *SAE and Michael Baker International*

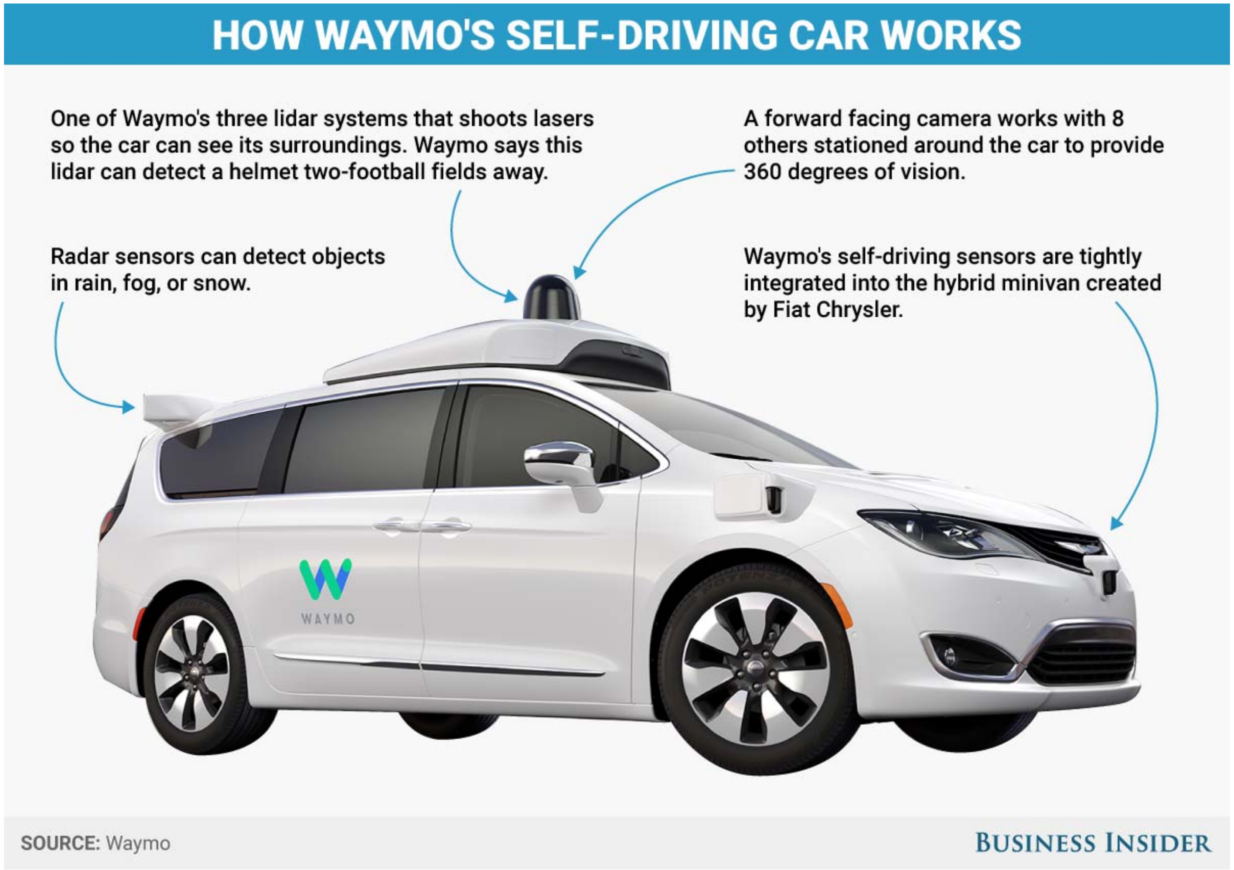


Source: Siemens

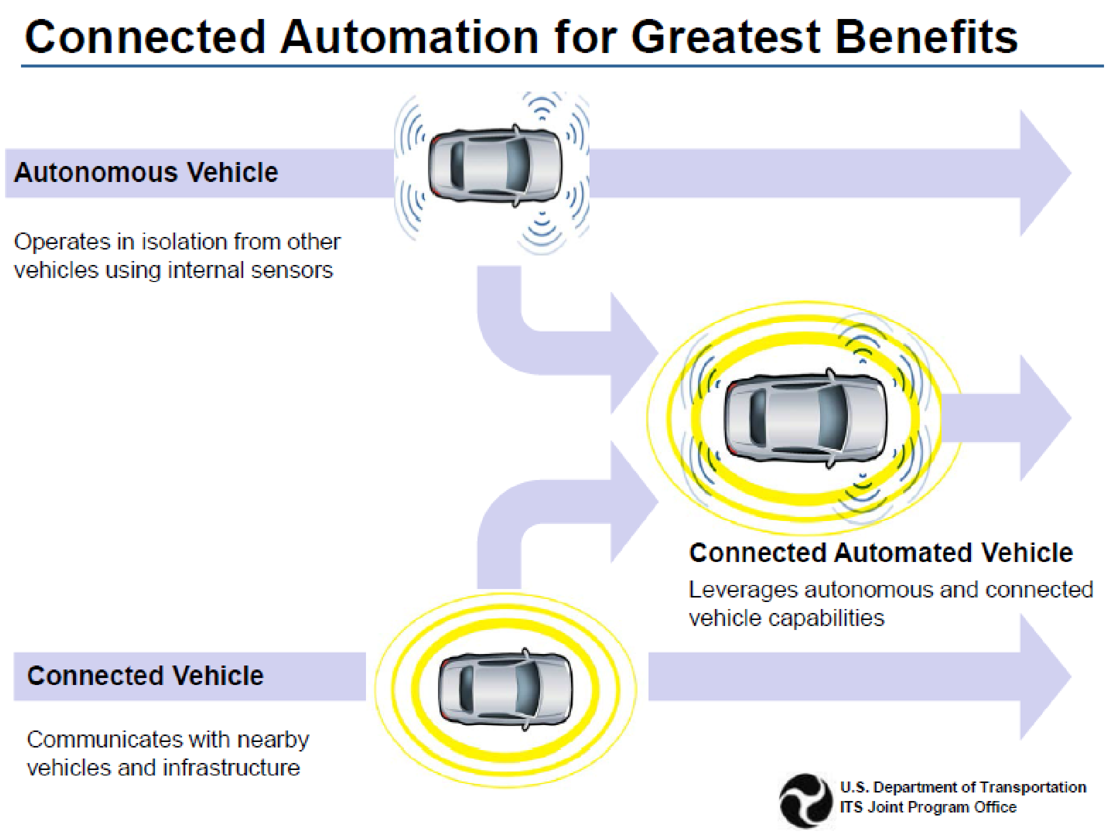
Connected vehicles



Highly automated vehicles

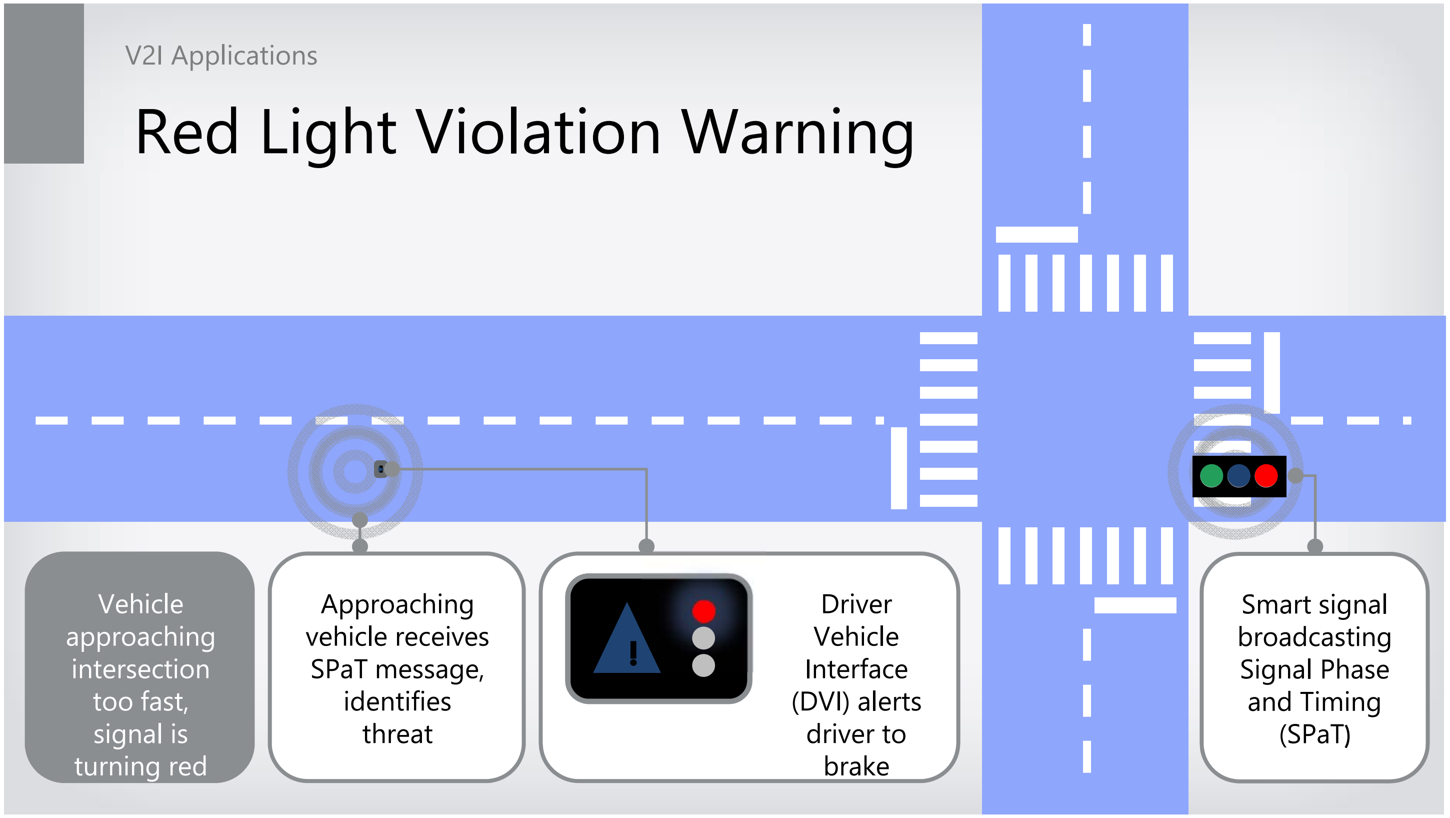


Vehicles will be connected and automated



V2I Applications

Red Light Violation Warning



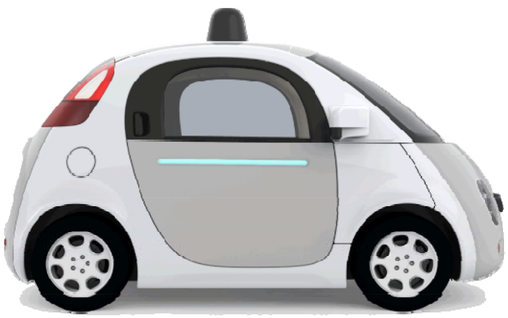
Technology drivers in Treasure Valley

UBER

lyft

Environmental Drivers

- Electric vehicle deployment
- Heavy storms
- High heat



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We Make a Difference

Drivers Exercise

Start the Conversation!

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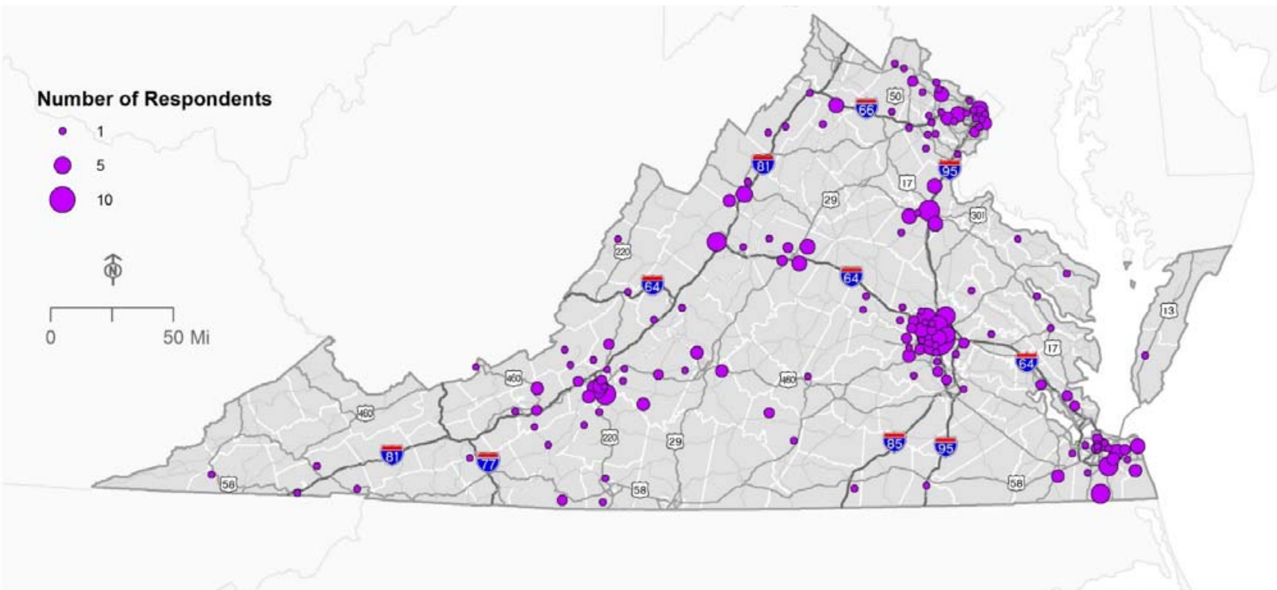
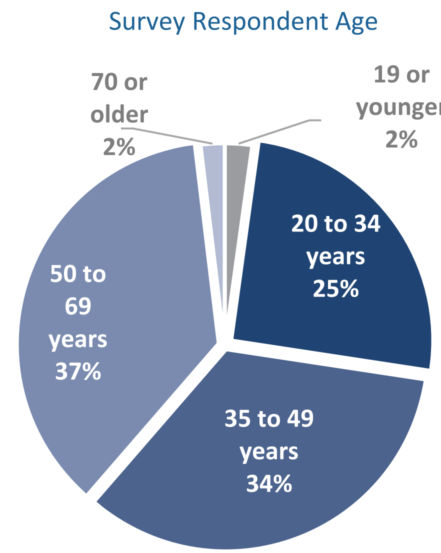
Survey Respondents





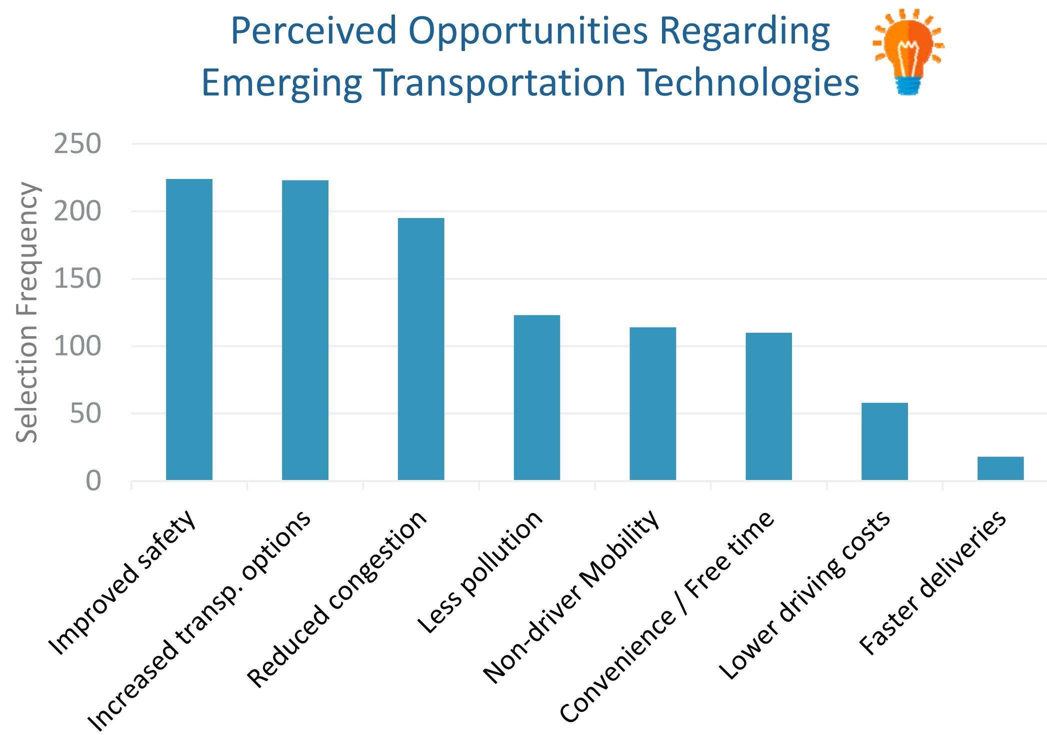
Virginia Population by Age Group (ACS, 2016)

- 19 or younger: 25%
- 20-34 years: 21%
- 35-49 years: 20%
- 50-69: 25%
- 70 or older: 10%

Technology Opportunities

- 1,065 Rankings for eight categories
- 57 Comments

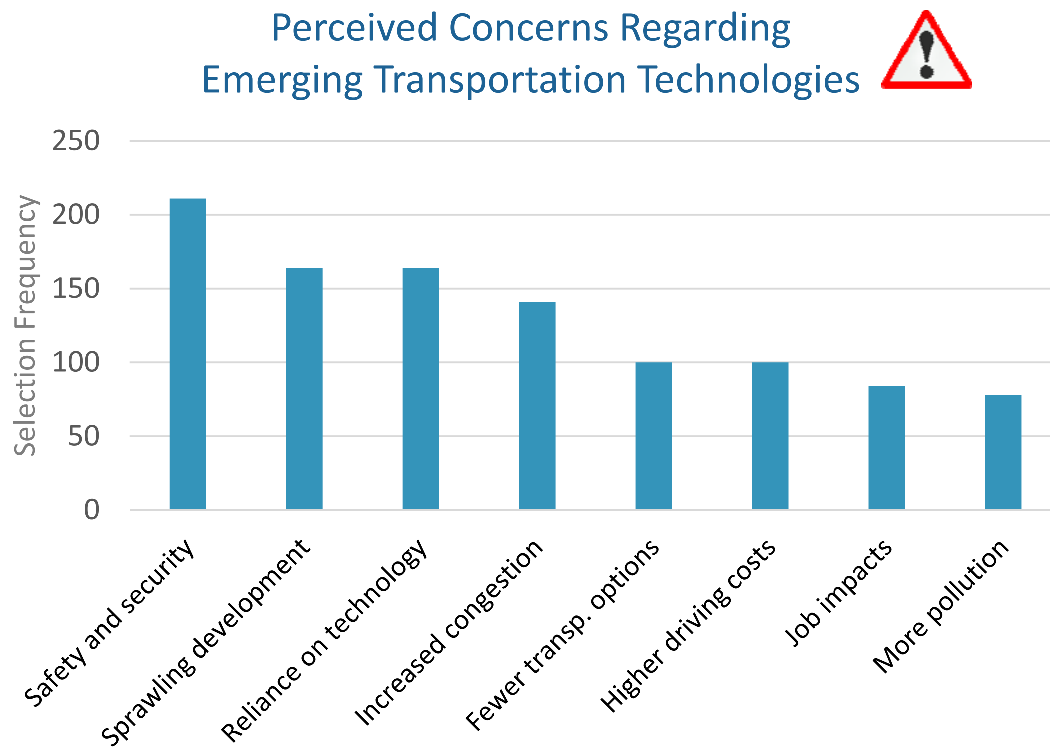
Respondents could select 3 items



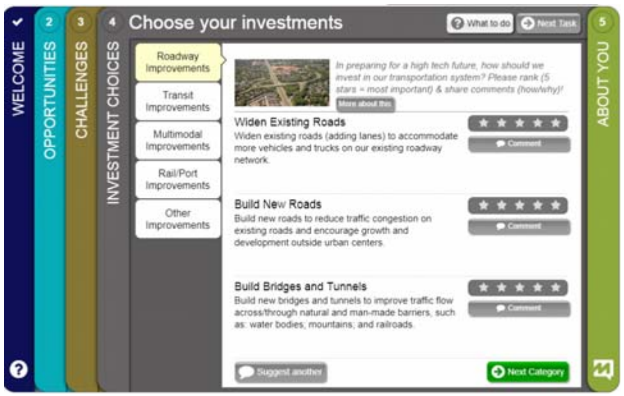
Technology Concerns

- 1,042 Rankings for eight categories
- 33 Comments

Respondents could select 3 items

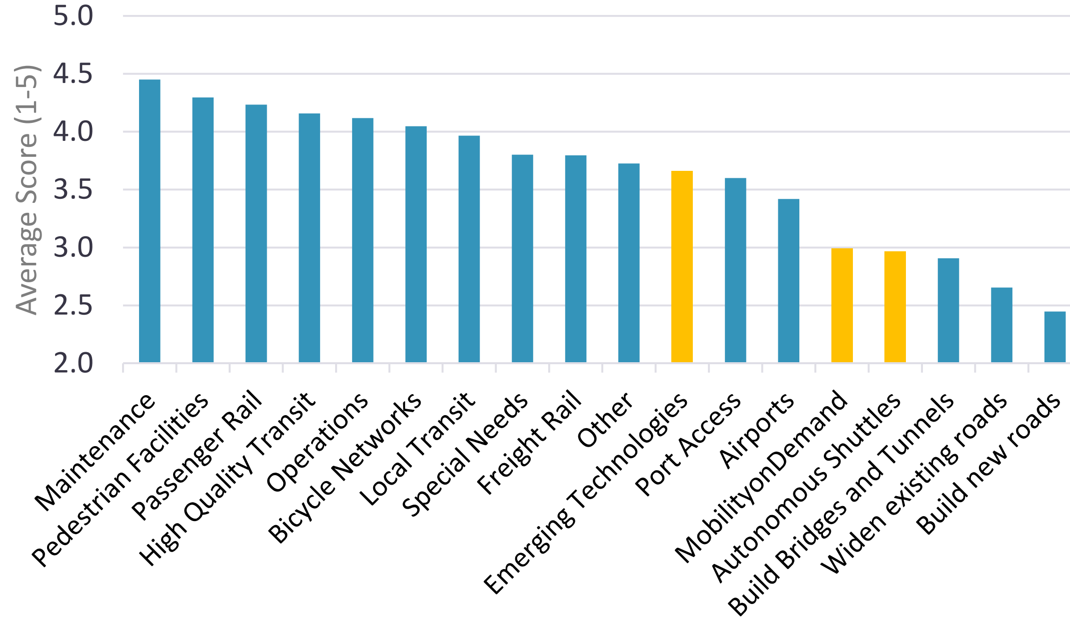


Investment Priorities

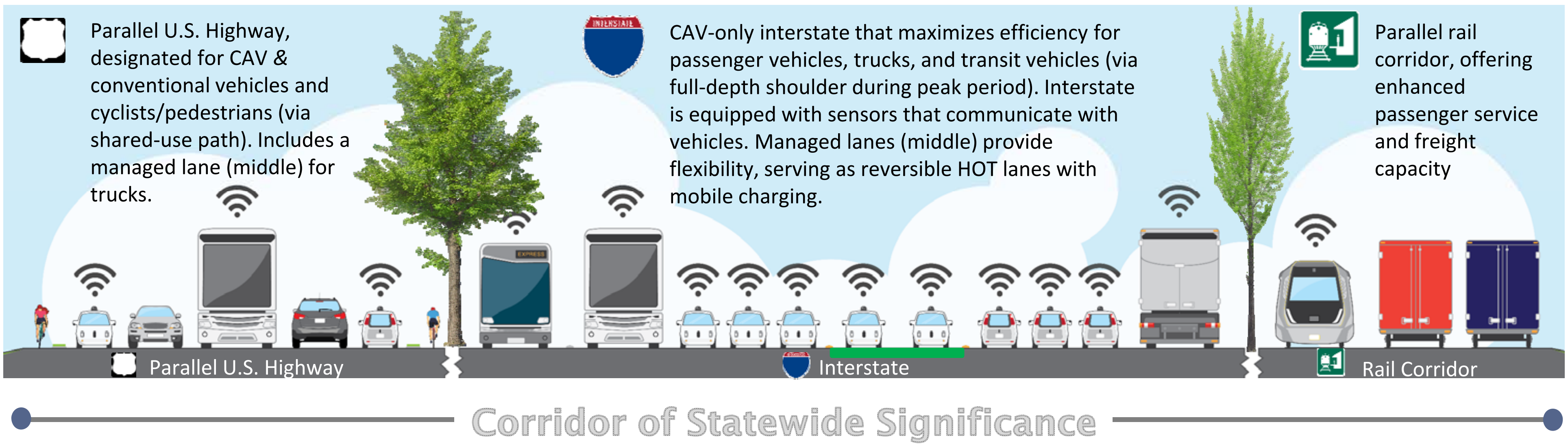


- 6,102 Total Rankings
- 573 Comments
- Emerging technologies, mobility on demand, and autonomous shuttles all ranked outside the top 10

Investment Priorities: Average Scores
(5 = highest possible score)



Inter-City Corridors



Urban Networks

Envisioning the Future…

1. Separated bike lanes and walkways
2. High quality rapid transit systems with dedicated lanes or tracks
3. Autonomous transit shuttles to connect to high volume transit corridors
4. Inductive charging strips in pavement offers charging boost for electric vehicles
5. Mobility-on-demand services, like bikeshare
6. "Smart intersections", equipped with sensors that seamlessly relay traffic and safety information to motorists
7. Smaller freight vehicles (trucks, vans) and drone delivery

Small Towns

Envisioning the Future…

1. Smaller vehicle, flexible-route transit service
2. Mobility-on-demand services, like bikeshare and carshare
3. Pedestrian/bike-friendly intersections that alert vehicles/motorists of pedestrian and cycling activity
4. Designated pick-up and drop-off areas for autonomous vehicles
5. "Smart intersections", equipped with sensors that seamlessly relay traffic and safety information to motorists

Focus on risks and opportunities

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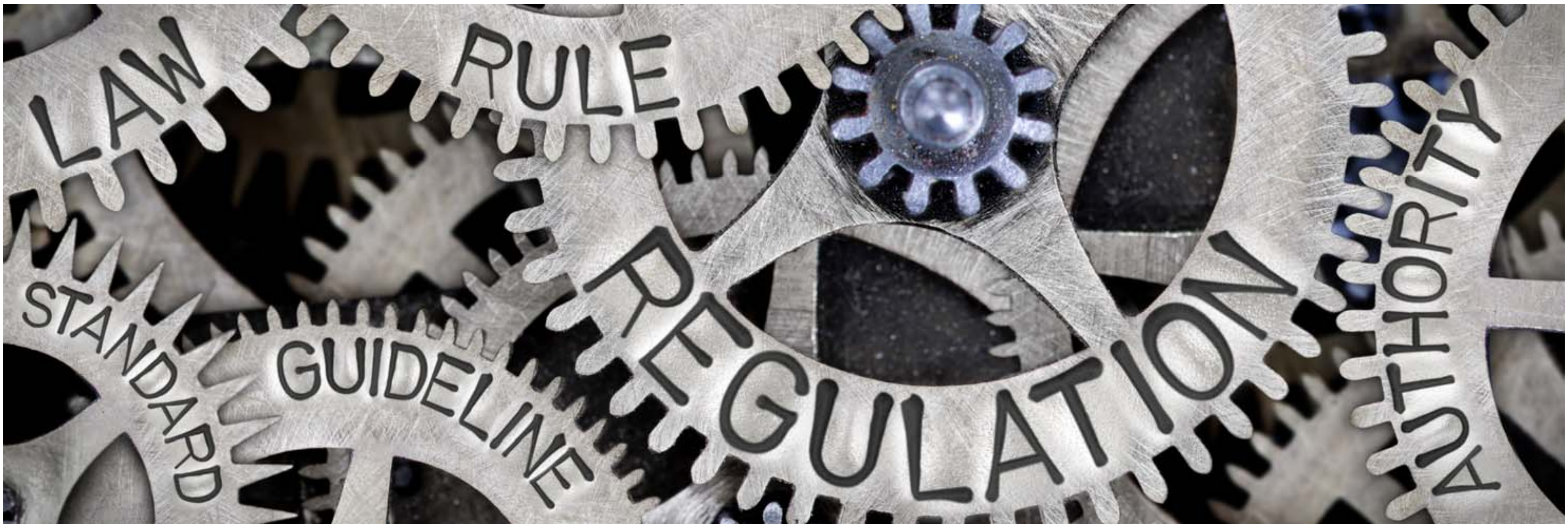
Develop policies to be prepared



Monitor trends, impacts and investments

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Resources

- FHWA “Next Gen” Scenario Planning Guidebook - forthcoming 2018
- State of Maryland/University of Maryland
- State of Oregon/University of Oregon

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Questions and Discussion