Exploratory Planning for Uncertain Times

COMPASS March 20, 2018

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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

Where do we go from here?
Disruptors cause uncertainty

- Technology Advances
- Changing Values
- Globalization

Uncertainty
Exploratory Planning for uncertain times

- What is the range of outcomes?
- What are the risks?
- What are the opportunities?
Normative vs Exploratory Planning

Normative scenarios envision what SHOULD happen?

EXPLORATORY scenarios ask what COULD happen?

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

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

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?
Preparing for Uncertainty: Exploratory Planning
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

We Make a Difference
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

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 VMTIP 2025 Recommendations
Inform Agency Business Plans
Inform VTrans Implementation Plan
Input to MPO Long Range Plans
Chain of logic from inputs to outputs

Driver
- Research, data analysis, extract data from models

Behavior
- Research, expert input, public input

Impact
- 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?

Shared Use Mobility
Technology is bringing a shared use mobility, including growth in shared cars, bikes, and rides. The challenge is in how to integrate these services into the existing transportation network.

Automated Vehicles
Assumptions about future technological developments will be addressed in the VTA's Mobility and Transportation Plan. Travel reliability is becoming the primary concern and requires advanced system performance through technology and user information.

Smart Infrastructure
Intelligent systems technologies can help us make 'smarter' use of transportation networks. This may improve safety, congestion, cost efficiency, and identify cost-effective investments that focus on improving reliability over space.

CAR SHARING IN THE U.S. 2000 - 2013

2040 COMMUNITY

Vehicle Technology and Ownership
How it is about you how you are, and do you walk, bus, bike or drive to get around? Is there an alternative choice to traditional transportation? For example, on-demand ridesharing services can provide more flexible and efficient travel options. Future advancements in autonomous vehicle technology may also be expected to affect the future of transportation.

2040 Vehicle Technology and Ownership

We Make a Difference
Potential exploratory planning outputs

**Person Travel**
- Person Trips
- Person Miles
- Mode Mix

**Freight Movement**
- Freight Trips
- Ton Miles
- Mode Mix

**All Travel**
- Recurring Congestion
- Vehicle Miles
- Non-Recurring Congestion

**Costs**
- User Costs
- System Costs
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**
Linking land use and transportation

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

**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
Example Exploratory Scenarios

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
Baseline Scenario Assumptions for 2040

Where is population growth occurring?
Across the state, but highest growth rates found in multimodal areas

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
Assumptions for Industrial Renaissance
(High Growth Industry)

<table>
<thead>
<tr>
<th>Where is population growth occurring?</th>
<th>What are the employment and industry trends?</th>
<th>How advanced is transportation technology?</th>
<th>What are the environmental considerations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar distribution to 2015</td>
<td>High tech manufacturing</td>
<td>High degree of AV and Mobility on Demand, varying by placetype (same as Baseline)</td>
<td>High end of predicted trends in high-heat days and severe storm days</td>
</tr>
<tr>
<td>Millennials ultimately move to suburbs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assumptions for Techtopia (High Growth Technology)

Where is population growth occurring?
- Strong growth in urban areas

What are the employment and industry trends?
- Micro production, knowledge-based economic growth

How advanced is transportation technology?
- AV and Mobility on Demand in “full effect”

What are the environmental considerations?
- 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?
- Preference for smaller, walkable communities

What are the employment and industry trends?
- Growth in small business, retail, and healthcare

How advanced is transportation technology?
- AV is high, but Mobility on Demand is low

What are the environmental considerations?
- Virginia develops away from vulnerable areas

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?
- Sluggish population growth
- Population decline in urban areas, fewer Millennials move to Virginia

What are the employment and industry trends?
- Reduced military spending, economic slowdown

How advanced is transportation technology?
- Delayed adoption of AV and Mobility on Demand relative to Baseline Scenario

What are the environmental considerations?
- Environment status quo, volatile global energy prices
Key trends by scenario

VTrans2040 Scenarios
- Industrial Renaissance
- Techtopia
- Silver Age
- General Slowdown

LOCATION (where are people moving to/leaving?)
- V6 – Multimodal Urban
- V5 – High Density Suburban
- V4 – Multimodal Suburban
- V3 – Small Town/Suburban
- V2 – Low-Density Suburban
- V1 – Rural

AUTONOMOUS VEHICLE TECHNOLOGY
- 100% Driverless

MOBILITY ON DEMAND (ex: Uber, Lyft, Taxi, Transit)
- 100% Mobility on Demand

People driving cars
People Owning & Operating their own cars

We Make a Difference
Scenario Components

- Mode Split
- AV and Mobility on Demand
- User Costs (Savings)
- System Costs (Savings)

- Demand-based VMT
- Technology and Efficiency
- Demand Balance

- Employment
- Population

- Environmental Considerations:
  - Sea-level Rise
  - Inland Flooding
  - High Heat Days
  - Energy

- Freight
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

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

We Make a Difference
Population drivers

Industrial Renaissance
- Attract More Boomers
- Attract More Millennials

Techtopia
- Attract More Gen Z
- Attract More Gen X

Silver Age
- Attract More Gen X
- Attract Fewer Gen Z

General Slowdown
- Attract Fewer Millennials
Projected Population Change by Scenario (2015-2040)

- 2040 Baseline: 28.3%
- Industrial Renaissance: 32.3%
- Techtopia: 32.2%
- Silver Age: 27.6%
- General Slowdown: 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

<table>
<thead>
<tr>
<th>V1 – Rural</th>
<th>V2 – Low-Density</th>
<th>V3 – Small Town/Suburban</th>
<th>V4 – Multimodal</th>
<th>V5 – High Density Suburban</th>
<th>V6 – Multimodal Urban</th>
<th>V7 – High Density Urban*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Renaissance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Techtopia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Silver Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>General Slowdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>

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

*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

#### 2040 Population by Placetype by Scenario (in Millions)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>V1 – Rural</th>
<th>V2 – Low-Density Suburban</th>
<th>V3 – Small Town/Suburban</th>
<th>V4 – Multimodal Suburban</th>
<th>V5 – High Density Suburban</th>
<th>V6 – Multimodal Urban</th>
<th>V7 – High Density Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.28 m</td>
<td>2.34 m</td>
<td>2.04 m</td>
<td>2.04 m</td>
<td>2.63 m</td>
<td>0.34 m</td>
<td>0.33 m</td>
</tr>
<tr>
<td>Industrial Renaissance</td>
<td>0.29 m</td>
<td>2.60 m</td>
<td>2.04 m</td>
<td>2.04 m</td>
<td>2.63 m</td>
<td>0.35 m</td>
<td>0.34 m</td>
</tr>
<tr>
<td>Techoopia</td>
<td>0.32 m</td>
<td>2.41 m</td>
<td>2.15 m</td>
<td>2.15 m</td>
<td>2.63 m</td>
<td>0.36 m</td>
<td>0.35 m</td>
</tr>
<tr>
<td>Silver Age</td>
<td>0.32 m</td>
<td>2.41 m</td>
<td>2.15 m</td>
<td>2.15 m</td>
<td>2.63 m</td>
<td>0.36 m</td>
<td>0.35 m</td>
</tr>
<tr>
<td>General Slowdown</td>
<td>0.33 m</td>
<td>2.41 m</td>
<td>2.15 m</td>
<td>2.15 m</td>
<td>2.63 m</td>
<td>0.36 m</td>
<td>0.35 m</td>
</tr>
</tbody>
</table>

#### Observations:
- **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

- Mode Split
  - AV and Mobility on Demand
    - User Costs (Savings)
    - System Costs (Savings)

- Demand-based VMT
- Technology and Efficiency
- Employment (report available)
- Population
- Freight

Environmental Considerations
- Sea-level Rise
- Inland Flooding
- High Heat Days
- Energy
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
Assumed percent of passenger vehicle travel
using autonomous vehicles in 2040

Percent AV Travel by Scenario

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

Baseline
Industrial Renaissance
Techtopia
Silver Age
General Slowdown

Med.
Med.
High
Med.-
Low

We Make a Difference

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.
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)

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

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 technology assumptions by placetype

% Automation [1]  % Mobility on Demand [2]

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

50%  65%  70%  75%  85%  90%

75%  77%  80%  83%  86%  90%

[1] [2] Information above was inspired by public input
Technology and Efficiency

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

We Make a Difference
Technology and travel behavior

Induced Mobility

ZOV Trips

Longer Commutes

Induced Mobility

Short Trips

Parking

We Make a Difference
Transit in 2040

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

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

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

Source: CBS Washington

Source: vegasexperience.com

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
Although VMT is expected to increase, vehicle technology & infrastructure improvements will help increase travel efficiency and throughput (effectively increasing roadway capacity).
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>
</tr>
<tr>
<td>V3 Small Town/Suburban</td>
<td>7%</td>
<td>30%</td>
<td>37%</td>
</tr>
<tr>
<td>V4 Multimodal Suburban</td>
<td>7%</td>
<td>31%</td>
<td>38%</td>
</tr>
<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>
</tr>
</tbody>
</table>
Technology and improved efficiency are expected to increase throughput by **9%-21%** *(depending on Scenario)*
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.
Potential roadway demand by placetype in 2040

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

- **V1 RURAL**: 25% Higher Demand
- **V3 SMALL TOWN/SUBURBAN**: 18% Higher Demand
- **V5 HIGH DENSITY SUBURBAN**: 3% Lower Demand

*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

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Demand</th>
<th>System Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Renaissance</td>
<td>Pop. VMT</td>
<td>PTP</td>
</tr>
<tr>
<td>Techtopia</td>
<td>Pop. VMT</td>
<td>PTP</td>
</tr>
<tr>
<td>Silver Age</td>
<td>Pop. VMT</td>
<td>PTP</td>
</tr>
<tr>
<td>General Slowdown</td>
<td>Pop. VMT</td>
<td>PTP</td>
</tr>
</tbody>
</table>

PTP: Person Through-put
**Takeaways by Placetype**

- **V1 – Rural**
  - Recurring congestion on two-lane rural roads

- **V2 – Low-Density Suburban**
  - More VMT on local streets and collectors

- **V3 – Small Town/Suburban**
  - More trips in high density suburban/urban areas

- **V4 – Multimodal Suburban**
  - Complete Streets w/ flexible route transit

- **V5 – High Density Suburban**
  - Complete Streets w/ integrated, full-spectrum transit

- **V6 – Multimodal Urban**
  - Operational Improvements
    - Innovative intersection design, dedicated CAV lanes on highways

- **V7 – High Density Urban***
  - Demand Management
    - *ITS, carpools, vanpools park & ride, transit, and peak travel restrictions

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*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
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
We start with drivers
Generational changes
Different values govern life choices
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
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.
Autonomous Shuttles/Transit

Dozens of international cities are conducting autonomous shuttle pilot/deployment programs.
Mobility as a Service
Information Systems

Potential 5G architecture. Source: Intel
Hype Cycle for Emerging Technologies

Source: Gartner 2017

We Make a Difference
Levels of Vehicle Automation

- **Full Automation**
- **High Automation**
- **Conditional Automation**
- **Partial Automation**
- **Driver Assistance**
- **No Automation**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Active Assistance System</td>
</tr>
<tr>
<td>1</td>
<td>Longitudinal or Transverse Guide</td>
</tr>
<tr>
<td>2</td>
<td>Traffic Control</td>
</tr>
<tr>
<td>3</td>
<td>No Take Over Request</td>
</tr>
<tr>
<td>4</td>
<td>No Driver Intervention</td>
</tr>
<tr>
<td>5</td>
<td>No Driver</td>
</tr>
</tbody>
</table>

Source: Siemens

Source: SAE and Michael Baker International
Connected vehicles

Vehicle-to-Network  
e.g. traffic 5 miles ahead  

Vehicle-to-Pedestrian  
e.g. pedestrian in walkway ahead  

Vehicle-to-Infrastructure  
e.g. traffic signal ahead turning red  

Vehicle-to-Vehicle  
e.g. emergency vehicle approaching
Highly automated vehicles

HOW WAYMO'S SELF-DRIVING CAR WORKS

One of Waymo's three lidar systems that shoots lasers so the car can see its surroundings. Waymo says this lidar can detect a helmet two-football fields away.

A forward facing camera works with 8 others stationed around the car to provide 360 degrees of vision.

Radar sensors can detect objects in rain, fog, or snow.

Waymo's self-driving sensors are tightly integrated into the hybrid minivan created by Fiat Chrysler.

SOURCE: Waymo
Vehicles will be connected and automated

Connected Automation for Greatest Benefits

Autonomous Vehicle
Operates in isolation from other vehicles using internal sensors

Connected Vehicle
Communicates with nearby vehicles and infrastructure

Connected Automated Vehicle
Leverages autonomous and connected vehicle capabilities
Red Light Violation Warning

Vehicle approaching intersection too fast, signal is turning red

Approaching vehicle receives SPaT message, identifies threat

Driver Vehicle Interface (DVI) alerts driver to brake

Smart signal broadcasting Signal Phase and Timing (SPaT)
Technology drivers in Treasure Valley

UBER

lyft
Environmental Drivers

- Electric vehicle deployment
- Heavy storms
- High heat
Drivers Exercise
Start the Conversation!
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%

Survey Respondent Age
- 70 or older: 2%
- 19 or younger: 2%
- 20 to 34 years: 25%
- 50 to 69 years: 37%
- 35 to 49 years: 34%
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

Perceived Concerns Regarding Emerging Transportation Technologies
Investment Priorities

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

- Parallel U.S. Highway, designated for CAV & conventional vehicles and cyclists/pedestrians (via shared-use path). Includes a managed lane (middle) for trucks.

- CAV-only interstate that maximizes efficiency for passenger vehicles, trucks, and transit vehicles (via full-depth shoulder during peak period). Interstate is equipped with sensors that communicate with vehicles. Managed lanes (middle) provide flexibility, serving as reversible HOT lanes with mobile charging.

- Parallel rail corridor, offering enhanced passenger service and freight capacity.

Corridor of Statewide Significance
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

- Risks
- Opportunities
  - Safety
  - Mobility
  - Funding
  - Data
Develop policies to be prepared
Monitor trends, impacts and investments
Resources

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