



COMMONWEALTH of VIRGINIA  
*Office of the*  
SECRETARY of TRANSPORTATION

**VTrans Long-term Risk & Opportunity Register  
Webinar 3**

Jitender Ramchandani, Office of Intermodal Planning and Investment

September 20, 2021



## DISCUSSION ITEMS

- Today's Webinar
- Context and Overview
- Draft Policy Framework
- Resources

## TODAY'S WEBINAR: SUBJECT UNDER DISCUSSION

- ▶ The Office of Intermodal Planning and Investment (OIPI) has developed a draft policy for the Commonwealth Transportation Board's (CTB) consideration.
- ▶ The draft policy:
  - ▶ Identifies risks and opportunities based on a range of estimated impacts of external factors (Mega and Macrotrends) over the next two+ decades (2045)
  - ▶ Develops a process to systematically monitor and report on external factors (Mega and Macrotrends), and accordingly adjust risks and opportunities
  - ▶ Provides tools, methods, and techniques for local jurisdictions, MPOs, PDCs, and other stakeholders for awareness and to improve collective preparedness

# TODAY'S WEBINAR: SUBJECT UNDER DISCUSSION

## POLICY GUIDE (DRAFT Chapter 6)

A resource for policy makers.

### VTRANS POLICY GUIDE

- Values, Goals, Objectives and Guiding Principles
- VTrans Travel Markets
- Identification and Prioritization of the Mid-term Transportation Needs
- Development and Monitoring of the Long-term Risk and Opportunity Register

VTRANS | VIRGINIA'S  
TRANSPORTATION PLAN



PREPARED BY THE OFFICE OF INTERMODAL  
PLANNING AND INVESTMENT FOR THE  
COMMONWEALTH TRANSPORTATION BOARD

DRAFT SEPTEMBER 2021

[Weblink](#)

## TECHNICAL GUIDE

A resource for planners,  
engineers, and other  
professionals interested in the  
data sources, processes, and  
methods used to implement  
the CTB's policies.

### TECHNICAL GUIDE: DEVELOPMENT AND MONITORING OF VTRANS LONG-TERM RISK & OPPORTUNITY REGISTER

VTRANS | VIRGINIA'S  
TRANSPORTATION PLAN



PREPARED BY THE OFFICE OF INTERMODAL  
PLANNING AND INVESTMENT FOR THE  
COMMONWEALTH TRANSPORTATION BOARD

September 2021

[Weblink](#)

# TODAY'S WEBINAR: SUBJECT UNDER DISCUSSION



## InteractVTRANS Data Explorer

Please note that [InteractVTrans Data Explorer Module](#), an online interactive tool, is in BETA release. According to [Techterms.com](#), “Beta software refers to computer software that is undergoing testing and has not yet been official released.” The webtool map perform unexpectedly and/or display erroneous results. At this time, the BETA release is to allow users to test and provide feedback prior to official release.

- ▶ For Review and Feedback: **Draft Policy** and the **Draft VTrans Risk & Opportunity Register**
  - ▶ Convey refinements to approach shared previously to synthesize different trends
  - ▶ Convey how scenario planning is integrated in this approach
  - ▶ Share tools<sup>1</sup> and resources for stakeholders for informational purposes

<sup>1</sup>: InteractVTrans Data Explorer is in BETA version.

- ▶ This is the third and last webinar in a series of three.
  - ▶ Webinar 1: Economic and Technology Trends | Wednesday, April 14th ([Meeting materials](#))
  - ▶ Webinar 2: Vulnerability Assessment | Tuesday, June 15<sup>th</sup> ([Meeting materials](#))

# CONTEXT AND OVERVIEW: COMPONENTS OF VTRANS

1  
CTB's Vision, Guiding Principles, Goals and Objectives

2  
VTrans Mid-term Needs: Identification and Prioritization

3  
VTrans Long-term Risk & Opportunity Register

4  
Strategic Actions (Recommendations)



JAN 2020

JAN 2020  
MARCH 2021

BY THE END OF 2021



## ► Key Terms

### MEGATREND

“A large, social, economic, political, environmental or technological change that is slow to form. Once in place, megatrends influence a wide range of activities, processes and perceptions, both in government and in society, possibly for decades. They are the underlying forces that drive trends.” – European Foresight Forum

### MACROTREND

An emerging pattern of change likely to impact state government and require a response.

More than one macro trends can be associated with a megatrend.

### RISK & OPPORTUNITY REGISTER

It “identifies and records the risks facing different areas of business. Identifying risk is a critical step in managing it and the risk and opportunity register allow our organization to assess the risk in context with our overall strategy and help record the controls and treatments of those risks.” – ISO9001

Resource: Definitions section in Technical Guide: Draft Policy for Identification and Monitoring of VTrans Long-term Risk & Opportunity Register ([Weblink](#))

STEP 1 IDENTIFY MEGA- & MACROTRENDS

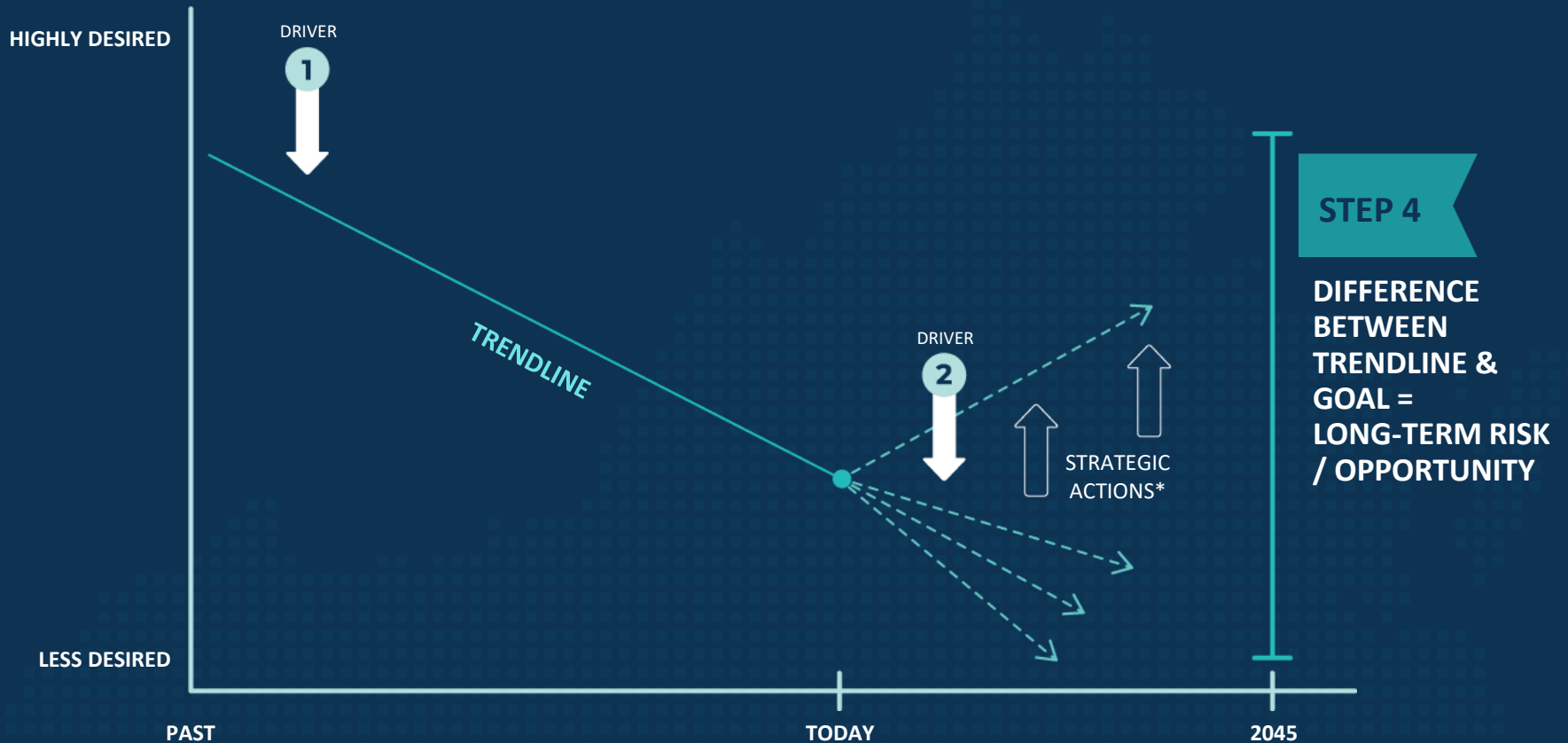
STEP 2 IDENTIFY SURROGATES FOR CTB GOALS

STEP 3 ESTIMATE IMPACTS OF MACROTRENDS ON SURROGATES

STEP 4 DEVELOP VTRANS LONG-TERM RISK  
& OPPORTUNITY REGISTER

STEP 5 TRACK MACROTRENDS FOR ANNUAL REPORTING

# DRAFT POLICY FRAMEWORK: APPROACH



- ▶ Why plan for the Year 2045?
- ▶ What is a Risk & Opportunity Register? Why include it in a planning document?
- ▶ How does the draft policy impact or benefit local jurisdictions, MPOs, and PDCs, and other entities?

Resource: VTrans Website. Webpage: Frequently Asked Questions ([Weblink](#))

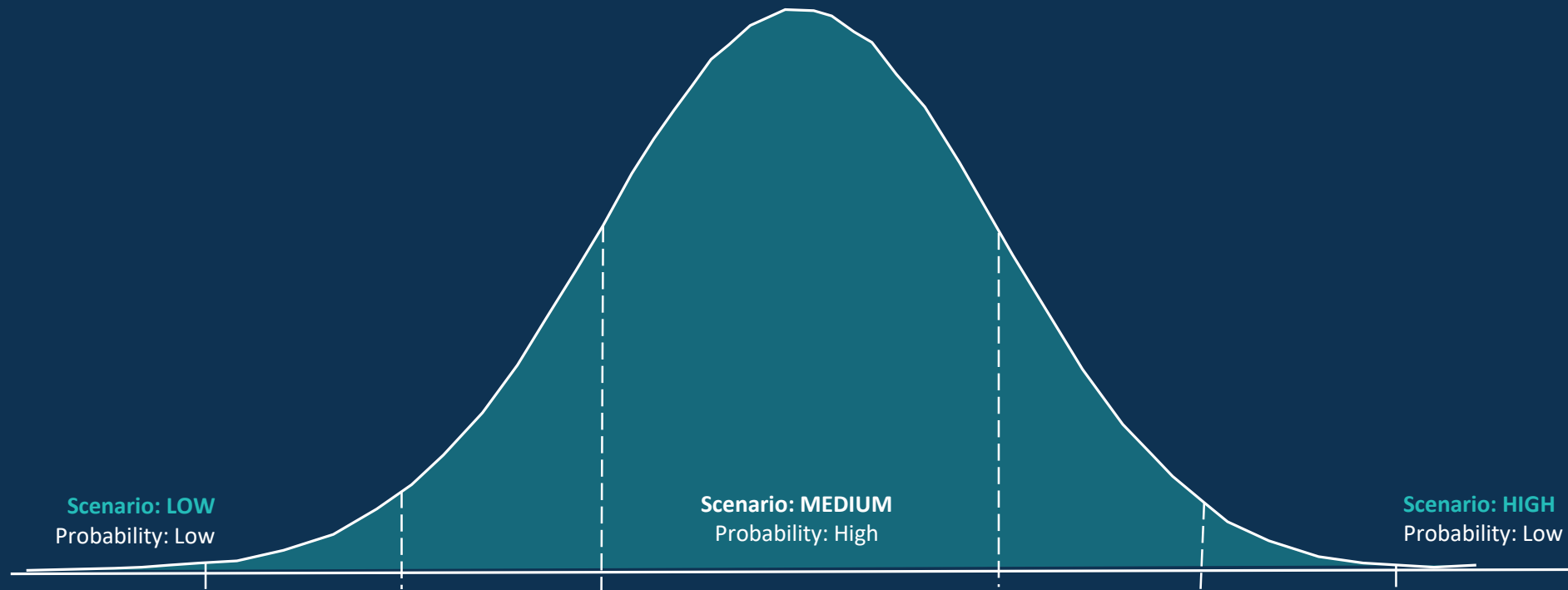
- ▶ Paul Saffo's<sup>1</sup> six rules of forecasting:
  - ▶ Rule # 1: Define a Cone of Uncertainty
  - ▶ Rule # 2: Look for the S Curve
  - ▶ Rule # 3: Embrace the Things That Don't Fit
  - ▶ Rule # 4: Hold Strong Opinions Weakly
  - ▶ Rule # 5: Look Back Twice as Far as You Look Forward
  - ▶ Rule # 6: Know When Not to Make a Forecast

## ► Paul Saffo's<sup>1</sup> characteristics of a good forecast:

- “The primary goal of forecasting is to identify the full range of possibilities, not a limited set of illusory certainties.”
- “Unlike a prediction, a forecast must have a logic to it.”
- “The consumer of the forecast must understand enough of the forecast process and logic to make an independent assessment of its quality—and to properly account for the opportunities and risks it presents.”

# DRAFT POLICY FRAMEWORK: FORECASTING AND SCENARIO PLANNING

## SCENARIOS: HOW ARE *LOW*, *MEDIUM*, AND *HIGH* DEFINED



- The following are four major categories of uncertainties for 2045 estimates:
  - Global Policy Uncertainty (Megatrends are global in nature)
  - Scientific Uncertainty
  - Forecast Uncertainty
  - Model Uncertainty
- The Technical Guide notes several uncertainties that are known at this time. We also realize that there are several others that are not known or evident to us. **Your feedback on such uncertainties will help.**
- The intent is to develop a process that can be replicated. Again, as Mr. Saffo says, “If you must forecast, then forecast often—and be the first one to prove yourself wrong.”



MEGATREND

**CLIMATE CHANGE**

MACROTREND



Increase in  
Flooding Risk

- Sea Level Rise
- Storm Surge
- Inland/Riverine Flooding



MEGATREND

## CLIMATE CHANGE

MACROTREND



Increase in Flooding Risk

- Sea Level Rise
- Storm Surge
- Inland/Riverine Flooding

## TECHNOLOGICAL ADVANCEMENTS



Adoption of Highly Autonomous Vehicles



Adoption of Electric Vehicles



Growth in Shared Mobility


MEGATREND

## CLIMATE CHANGE

## TECHNOLOGICAL ADVANCEMENTS


## CHANGE IN CONSUMPTION PATTERNS

MACROTREND




Increase in Flooding Risk


- Sea Level Rise
- Storm Surge
- Inland/Riverine Flooding




Adoption of Highly Autonomous Vehicles




Adoption of Electric Vehicles



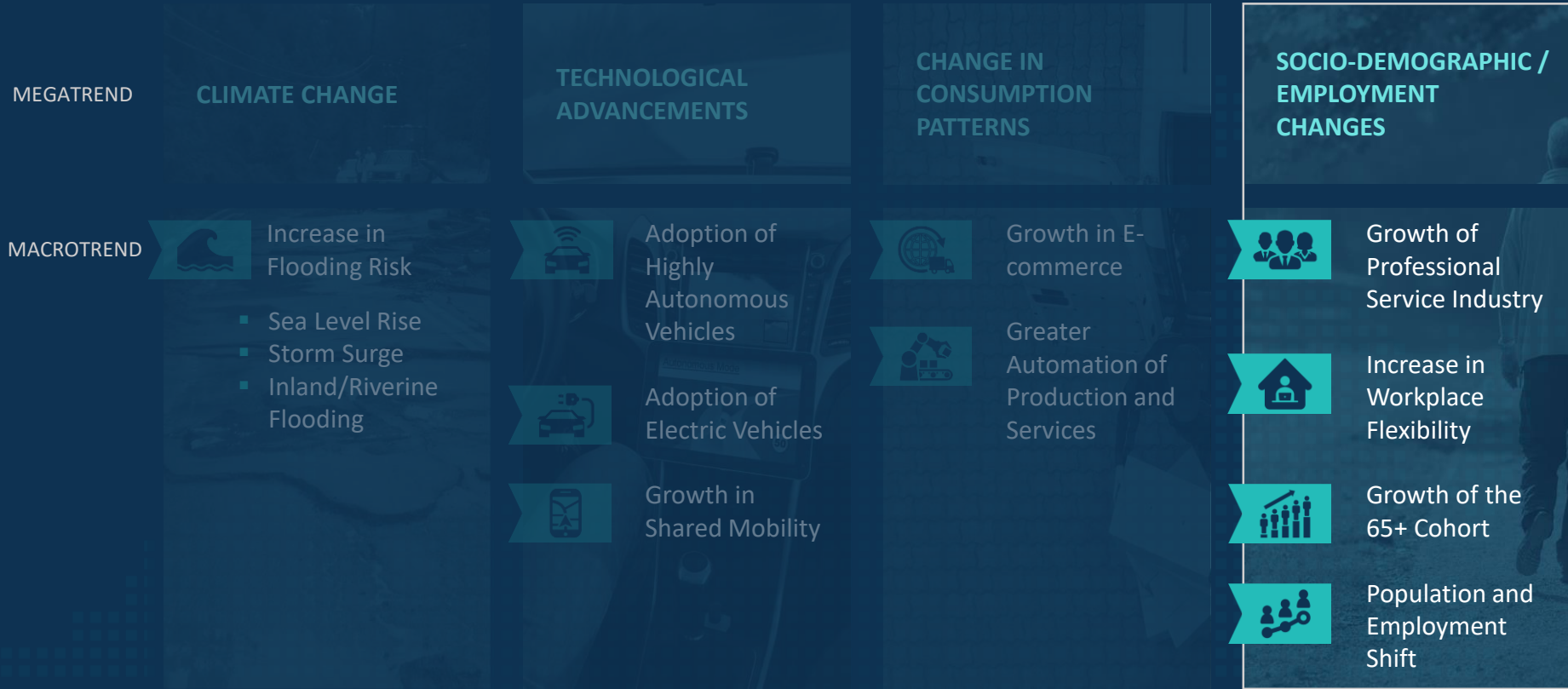
Growth in Shared Mobility



Growth in E-commerce



Greater Automation of Production and Services



- ▶ This macrotrend focuses on flooding risk due to sea level rise, storm surge, and inland/riverine flooding.
  - ▶ Please refer to [Webinar 2: Vulnerability Assessment](#)
  - ▶ [VTrans Vulnerability Assessment Webpage](#)

## KEY DRIVERS

### 1 | VEHICLE SENSING + INFO PROCESSING



CPU



GPS



LIDAR



Connectivity



Sensors



Smart



Active Safety



Video Camera



Communication

### 2 | COMPETITION FOR FIRST-MOVER ADVANTAGE



SAN FRANCISCO

VS

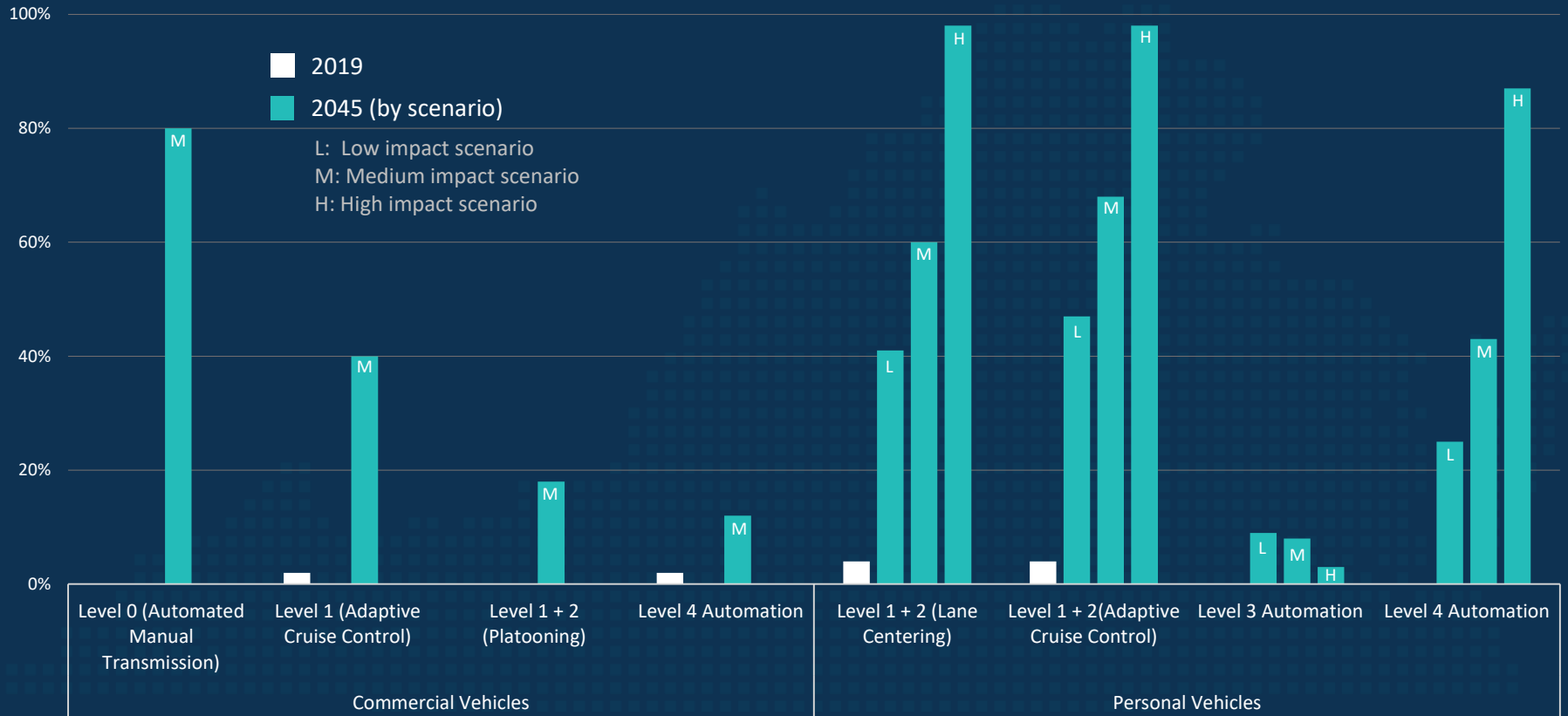


DETROIT

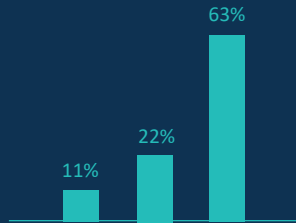
### 3 | CONSUMER PREFERENCE FOR SAFETY AND TECHNOLOGY



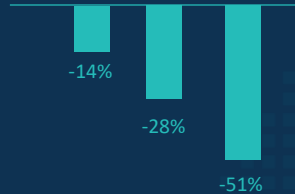
## EXISTING AND ESTIMATED MARKET PENETRATION BY VEHICLE TYPE AND LEVEL OF AUTOMATION



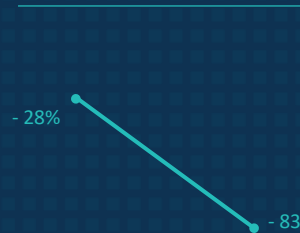
## WHAT IT MEANS FOR TRANSPORTATION (IN ISOLATION)



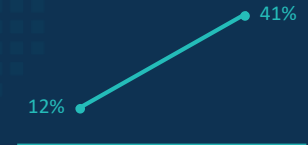
**ROADWAY CAPACITY**  
“Basic Freeway Segment”



**NUMBER OF CRASHES**  
Fatal Injury



**VEHICLE OPERATING COST**  
Varies based on vehicle and use



**VEHICLE MILES TRAVELED**



## KEY DRIVERS

1 | ADVANCEMENT OF  
EV BATTERY TECHNOLOGY



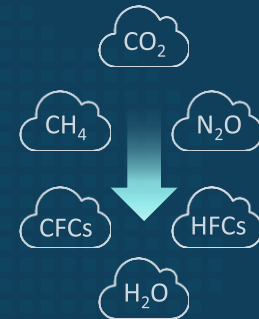
2 | DECREASING  
MANUFACTURING COST



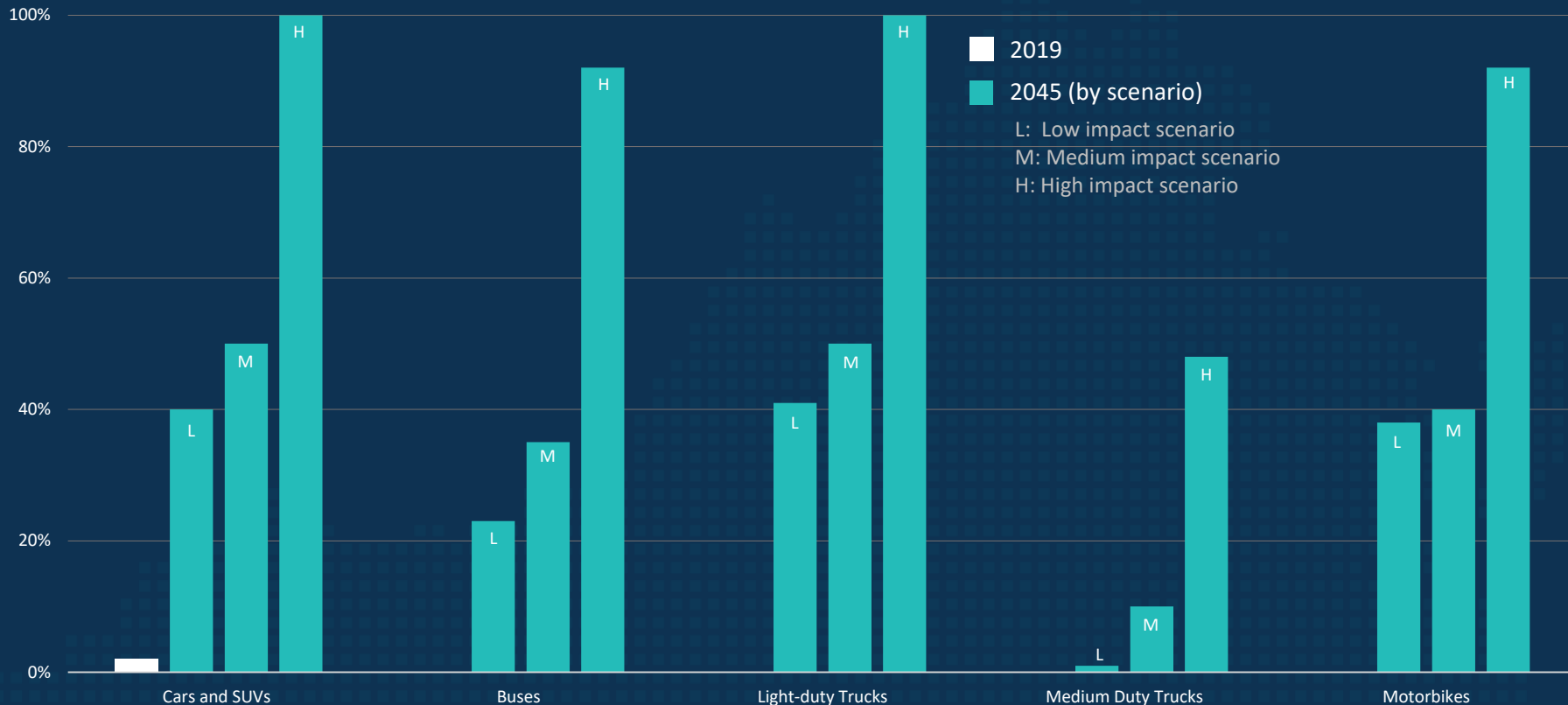
3 | GROWTH IN NATIONAL CHARGING INFRASTRUCTURE



4 | PUBLIC POLICY TO  
REDUCE GHG EMISSIONS



## EXISTING AND ESTIMATED MARKET PENETRATION BY VEHICLE TYPE



## NOTEWORTHY STATISTICS

**50-70**

NUMBER OF CURRENTLY  
AVAILABLE MODELS

**1.4M**

EVS SOLD (UNTIL 2020)

**18%**

% CHANGE IN PRIVATE VEHICLE  
VMT DUE TO LEVEL 4 AV + EV  
(2045)

**41%**

% CHANGE IN RIDESOURCE VMT  
DUE TO LEVEL 4 AV + EV (2045)

## KEY DRIVERS

1 | HIGH PREVALENCE + CAPABILITIES OF MOBILE COMMUNICATION DEVICES



2 | DESIRE FOR WORK HOUR FLEXIBILITY / WILLINGNESS TO WORK IN GIG ECONOMY



## NOTEWORTHY STATISTICS: RIDESOURCING (A.K.A. Transportation Network Company or TNC)

8%

HOUSEHOLDS HAD A FAMILY MEMBER USE IN LAST 30 DAYS

9%

SHARE OF TOTAL TRIPS IN SAN FRANCISCO

2 to 12%

SHARE OF TOTAL WEEKDAY VMT IN SIX MAJOR CITIES

1%

CURRENT SHARE OF THE TOTAL ADDRESSABLE MARKET

## NOTEWORTHY STATISTICS: MICROMOBILITY (BIKE + SCOOTER SHARING)

**96%**

Y-O-Y GROWTH RATE

**38%**

SCOOTERS: SHARE OF OF ALL  
MICROMOBILITY IN SIX CITIES

## WHAT IT MEANS FOR TRANSPORTATION (IN ISOLATION)

**9.4M**

NUMBER OF URBAN AREA SOV  
TRIPS SWITCHABLE TO  
RIDESOURCE (2045)

**252K**

NUMBER OF URBAN AREA SOV  
TRIPS SWITCHABLE TO  
MICROMOBILITY (2045)

Up to **18%**

NUMBER OF URBAN AREA SOV  
VMT SWITCHABLE TO  
RIDESOURCE (2045)

**0.01%**

NUMBER OF URBAN AREA SOV  
VMT SWITCHABLE TO  
MICROMOBILITY (2045)

## KEY DRIVERS

1 | CUSTOMER CONVENIENCE AND EXPECTATIONS



2 | CONSUMER WILLINGNESS TO PAY FOR DELIVERY SHIPPING SERVICES



3 | PRODUCTIVITY GAINS DUE TO AUTOMATION OF WAREHOUSING





## NOTEWORTHY STATISTICS

82k

VA JOBS IN B2B AND B2C E-COMMERCE (2019)

259K

VA JOBS IN B2B AND B2C E-COMMERCE (2045)

8%

SHARE OF B2C E-COMMERCE SALES OF THE TOTAL B2C SALES (2019)

14 to 31%

SHARE OF B2C E-COMMERCE SALES OF THE TOTAL B2C SALES (2045)

## KEY DRIVERS

### 1 | GROWTH OF E-COMMERCE

### 2 | EXPANDED USE OF JUST-IN-TIME + LEAN PRODUCTION

### 3 | INCREASED USE OF MACHINE LEARNING + ARTIFICIAL INTELLIGENCE

### 4 | DIGITIZATION OF PRODUCTION + DISTRIBUTION



## NOTEWORTHY STATISTICS

~300

VA 3D PRINTING JOBS (2019)

30,000

VA 3D PRINTING JOBS (2045)

0%

SHORT-RANGE DRONE SHARE OF  
THE E-COMMERCE SALES (2019)

25%

SHORT-RANGE DRONE SHARE OF  
THE E-COMMERCE SALES (2045  
HIGH ESTIMATE)

## KEY DRIVERS

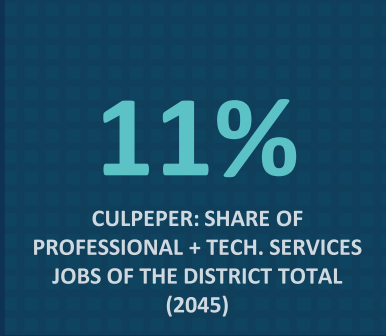
### 1 | DIGITIZATION OF ECONOMY



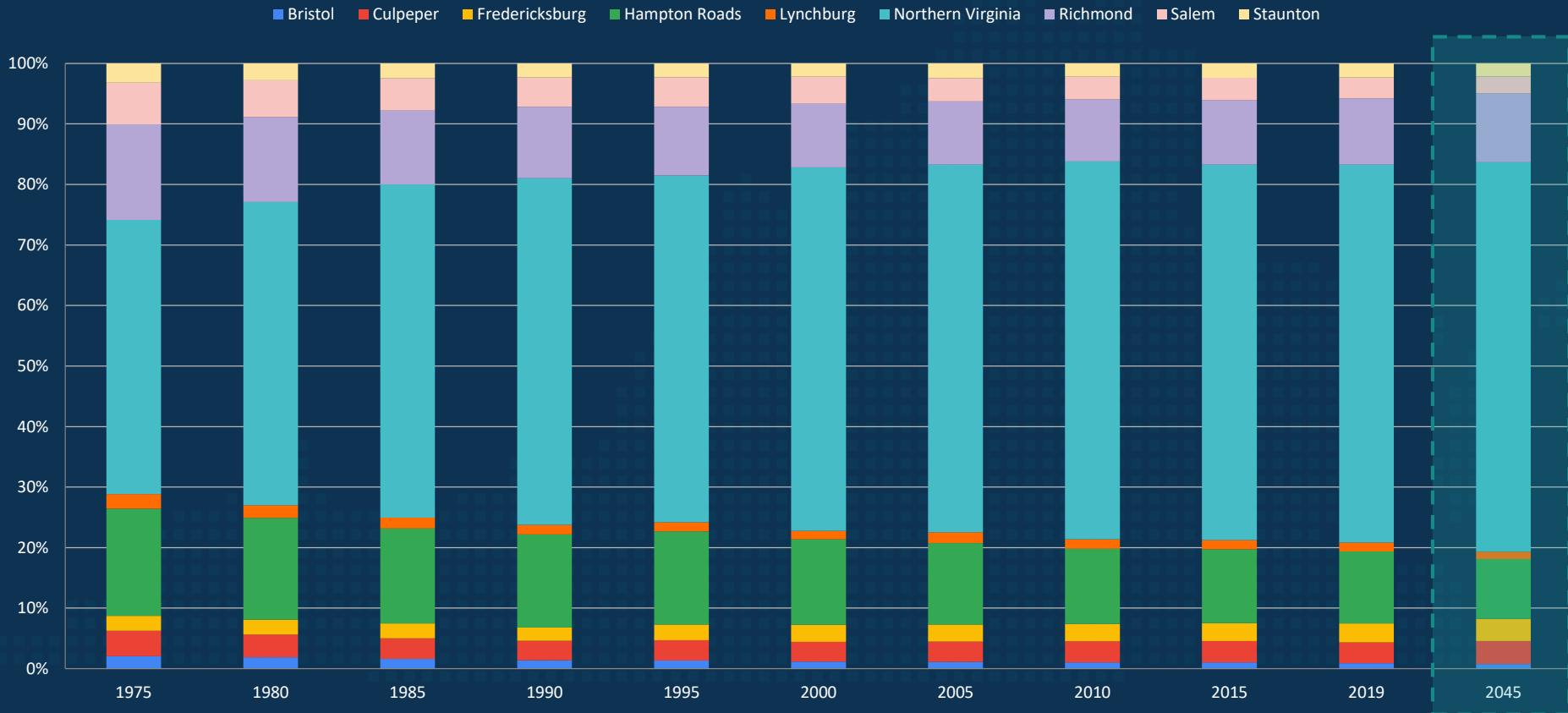
### 2 | TRANSFORMATION INTO A SERVICE ECONOMY



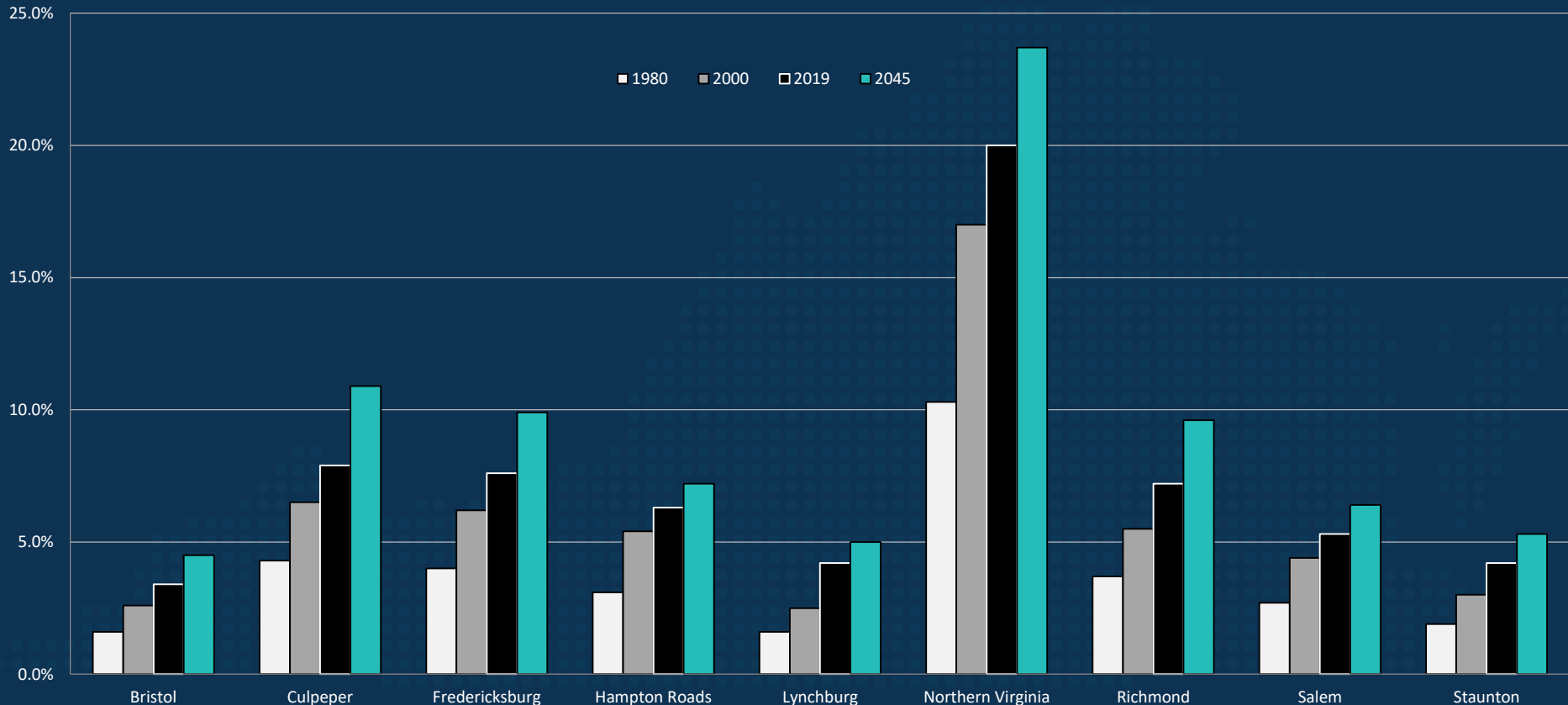
## NOTEWORTHY STATISTICS



## PROFESSIONAL AND TECHNICAL SERVICES JOBS: DISTRICT SHARE OF THE STATEWIDE TOTAL



## PROFESSIONAL AND TECHNICAL SERVICES JOBS: SHARE WITHIN CONSTRUCTION DISTRICT

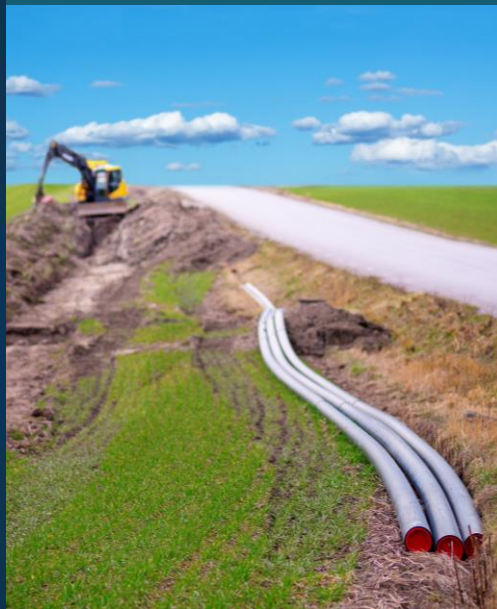


## KEY DRIVERS

### 1 | ADVANCEMENT OF COMMUNICATION TECHNOLOGY



### 2 | AVAILABILITY, RELIABILITY, AND SPEED OF BROADBAND SERVICES



### 3 | GROWTH IN KNOWLEDGE WORKER JOBS





## NOTEWORTHY STATISTICS

41%

TELEWORK CAPABLE JOBS IN 2019

9.5%

WORKERS THAT UTILIZED  
TELEWORK CAPABLE JOBS PRE-  
COVID-19

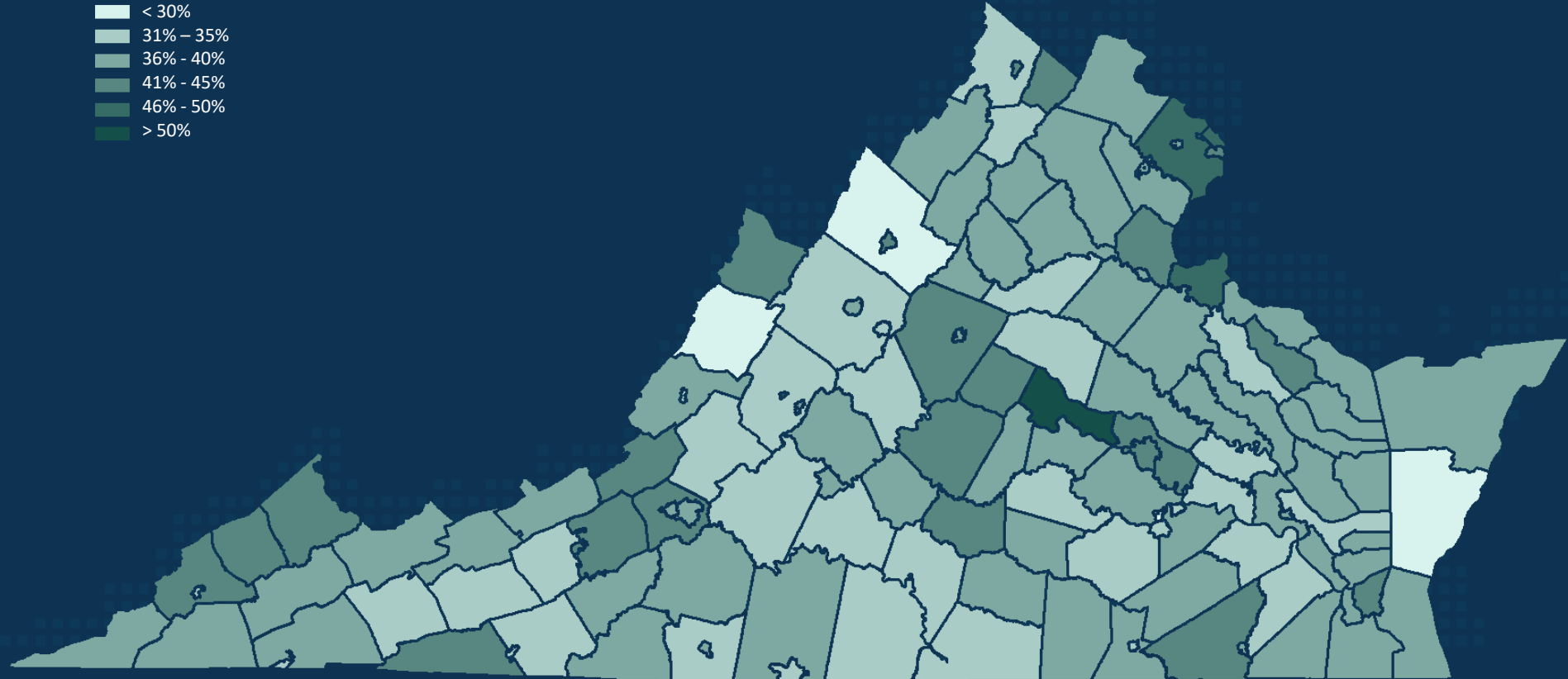
38 to  
40%

VA HH WITH SOME OR ALL OF THEIR  
IN-PERSON WORK CONDUCTED  
REMOTELY IN COVID-19,  
SUMMER 2020

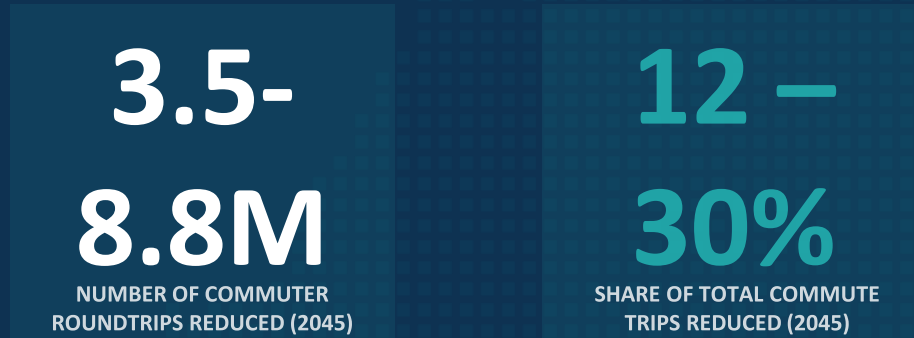
# MACROTREND # 8: INCREASE IN WORKPLACE FLEXIBILITY

## SHARE OF TELEWORK CAPABLE JOBS BY COUNTY (2045)

- < 30%
- 31% – 35%
- 36% - 40%
- 41% - 45%
- 46% - 50%
- > 50%



## WHAT IT MEANS FOR TRANSPORTATION (IN ISOLATION)



## KEY DRIVERS

1 | MIGRATION PATTERNS

2 | LOCATION PREFERENCES



3 | MEDICAL ADVANCEMENTS



4 | OVERALL POPULATION GROWTH

**NATURAL INCREASE**  
(RATIO OF BIRTHS TO DEATHS)

**HISTORICAL BIRTHS**  
(BABY BOOMER COHORT)

## NOTEWORTHY STATISTICS

**20%**

SHARE OF AGE 65 + OF THE  
STATE'S TOTAL POPULATION  
(2045)

**11%**

SHARE OF AGE 75 + OF THE  
STATE'S TOTAL POPULATION  
(2045)

**92 -**

**132%**

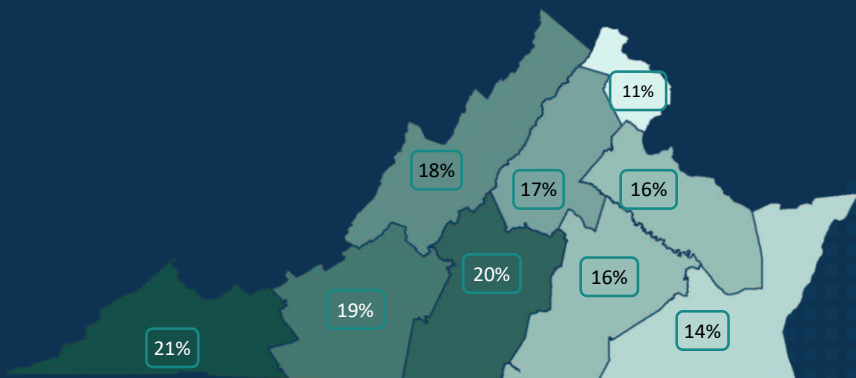
NOVA: PROJECTED INCREASE IN  
65+ POP. (2017 - 2045)

**1 IN 5**

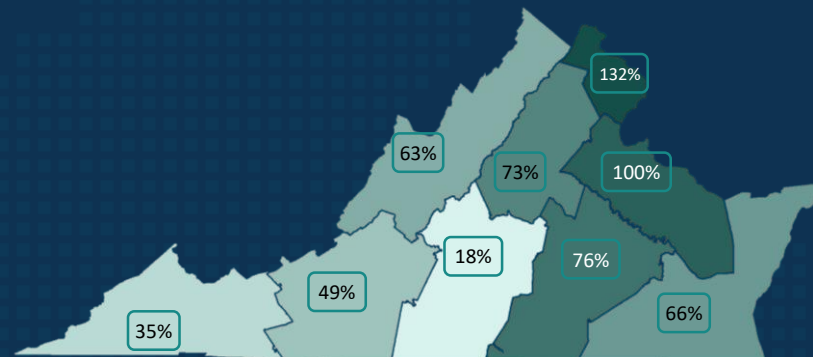
LYNCHBURG, SALEM, BRISTOL:  
PROPORTION OF RESIDENTS AGE  
65+ (2017)

# MACROTREND # 9: GROWTH OF 65+ COHORT

## POPULATION AGE 65+: SHARE OF THE REGIONAL TOTAL



2017: SHARE OF THE REGIONAL TOTAL



2017 - 2045: CHANGE IN AGE 65 + POPULATION

## KEY DRIVERS

### 1 | NATURAL HAZARDS



### 2 | LOCATIONAL PREFERENCES OF BUSINESSES + HOUSEHOLDS

## NOTEWORTHY STATISTICS

18-  
44%

STATEWIDE: EMPLOYMENT  
GROWTH (2017-45)

36 -  
54%

FREDRICKSBURG DISTRICT: POP  
GROWTH (2017-45)

2.7M  
36%

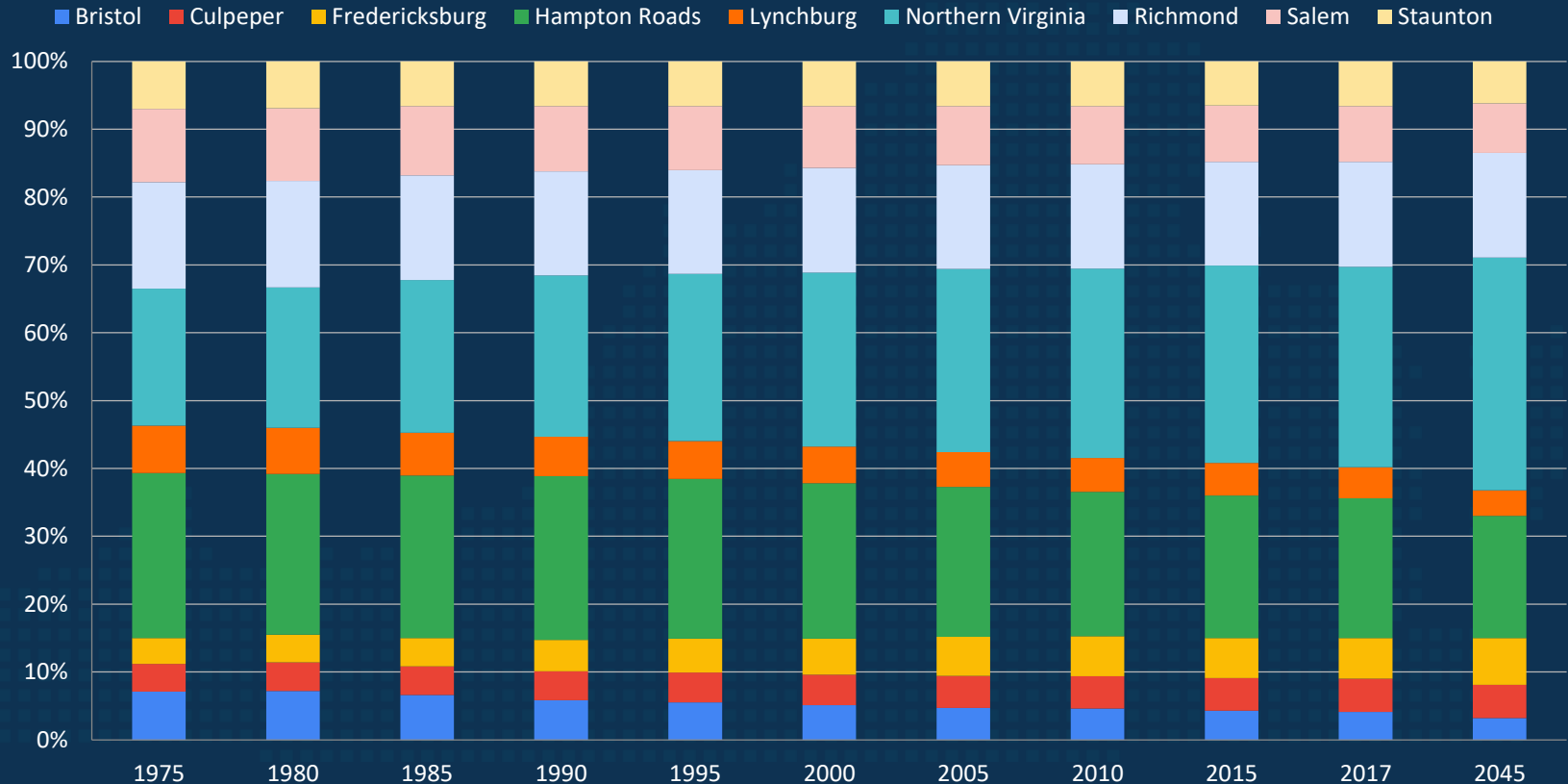
NOVA DISTRICT : EMPLOYMENT &  
SHARE OF STATE EMP. (2045)

2 OUT OF 3

VA RESIDENTS LIVES IN NOVA, HR,  
RICHMOND (2045)

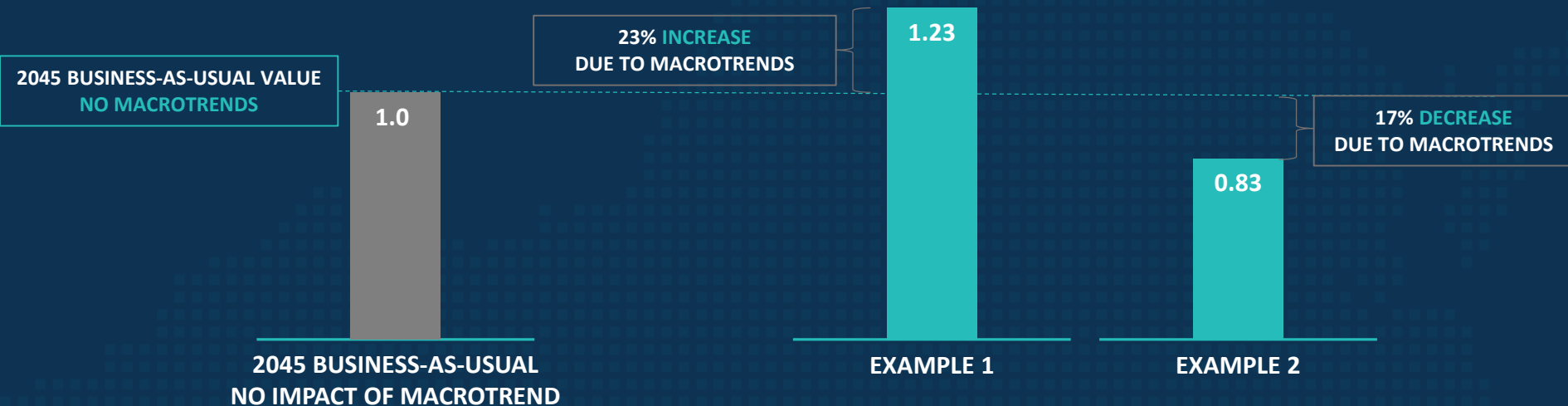


## POPULATION: DISTRICT SHARE OF THE STATEWIDE TOTAL

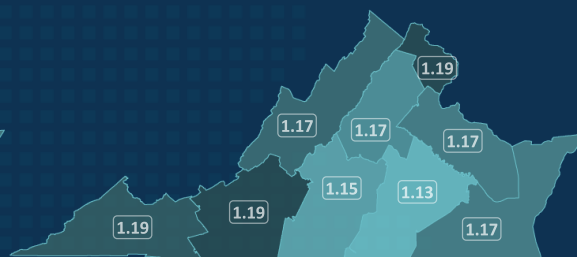
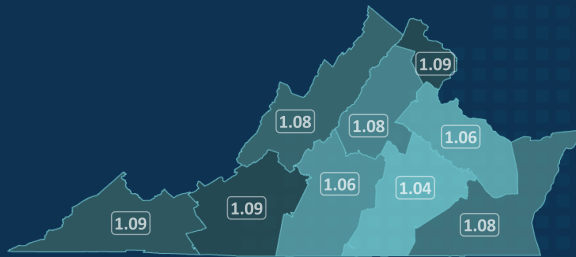
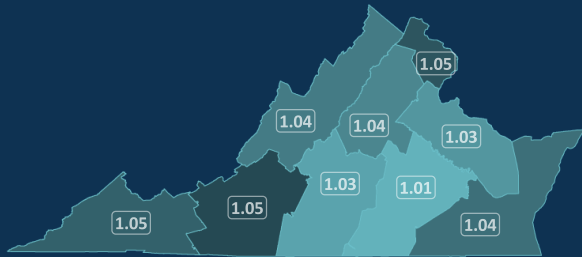


	GOALS	SURROGATES FOR CTB GOALS
	Economic Competitiveness and Prosperity	Vehicle Miles Traveled (VMT) Index
	Accessible and Connected Places	Shared Mobility Index
	Safety for All Users	Safety Index
	Proactive System Management	Roadways At Risk from Flooding
	Healthy Communities & Sustainable Transportation Communities	Tailpipe Emissions Index

- All except Goal D Surrogates are measured in relation to 1.0 which is 2045-Business-As-Usual Scenario with no impact from Macrotrends.



## VEHICLE MILES TRAVELED (VMT) INDEX: ESTIMATED CHANGE IN VMT DUE TO VTRANS MACROTRENDS COMPARED TO THE 2045 BUSINESS-AS-USUAL SCENARIO



**+4%**

STATEWIDE: LOW IMPACT

**+8%**

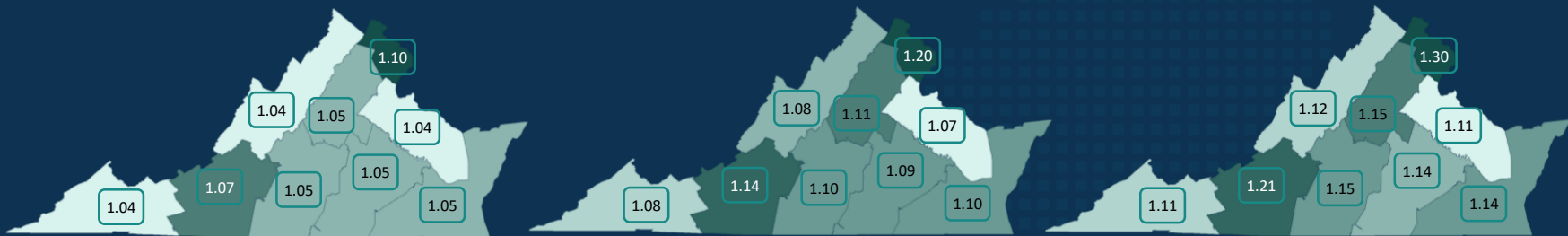
STATEWIDE: MEDIUM IMPACT

**+17%**

STATEWIDE: HIGH IMPACT



SHARED MOBILITY INDEX: ESTIMATED SWITCHABLE URBAN AUTO SOV VMT TO MICROMOBILITY + RIDESHARING DUE TO VTRANS MACROTRENDS COMPARED TO THE 2045 BUSINESS-AS-USUAL SCENARIO



**+9%**

STATEWIDE: LOW IMPACT

**+18%**

STATEWIDE: MEDIUM IMPACT

**+27%**

STATEWIDE: HIGH IMPACT



**SAFETY INDEX: ESTIMATED CHANGE IN NUMBER OF CRASHES INVOLVING FATALITIES + SERIOUS INJURIES DUE TO VTRANS MACROTRENDS COMPARED TO THE 2045 BUSINESS-AS-USUAL SCENARIO**

**-26%**

STATEWIDE: LOW IMPACT

**-38%**

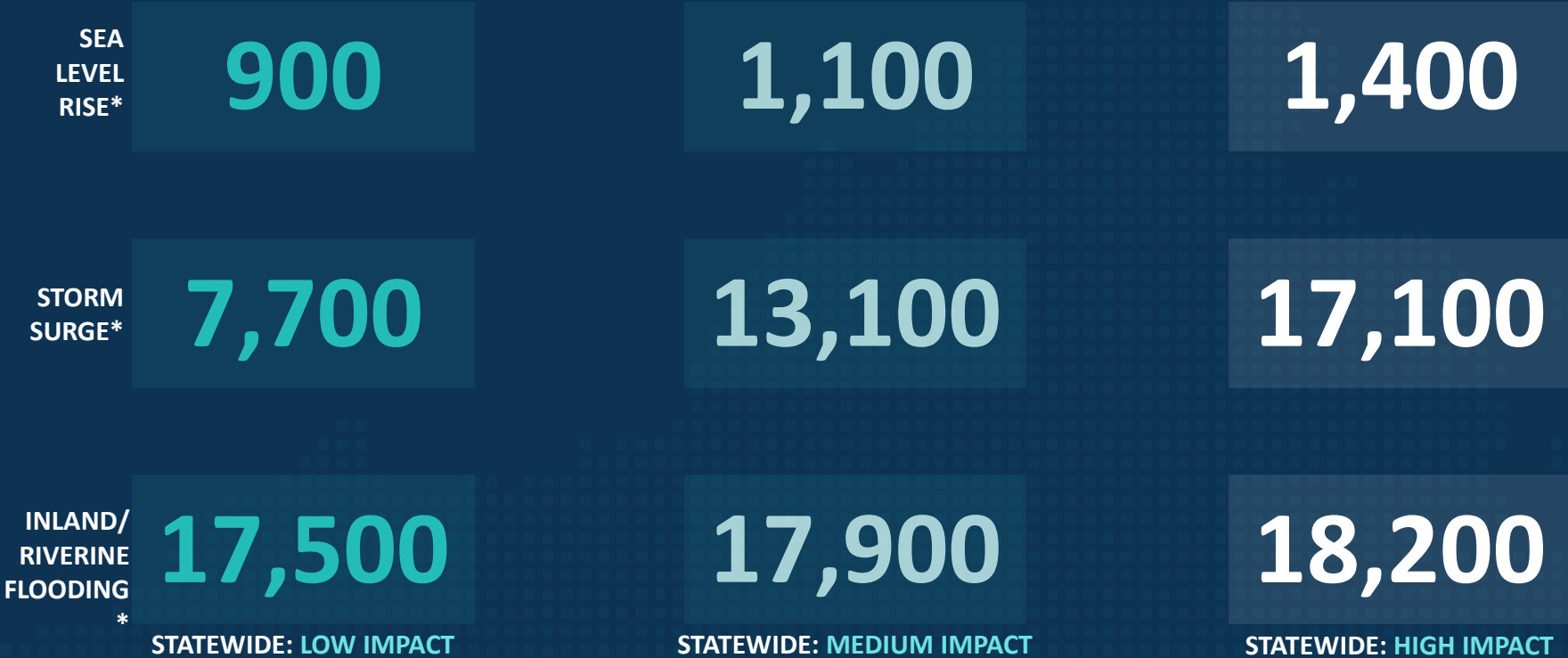
STATEWIDE: MEDIUM IMPACT

**-67%**

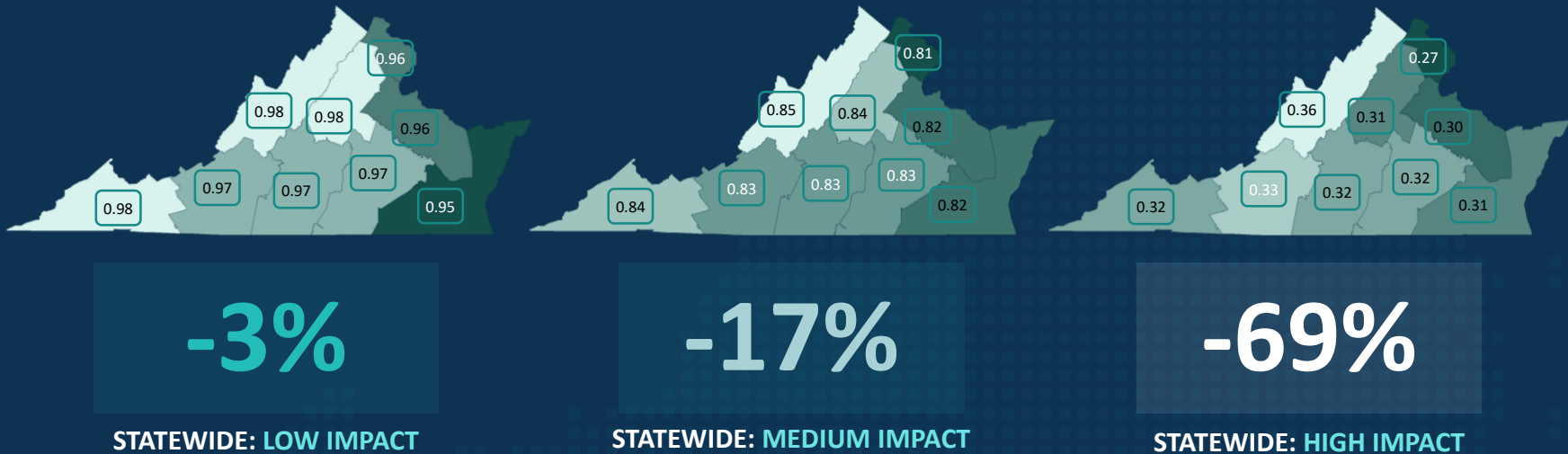
STATEWIDE: HIGH IMPACT



## NUMBER OF AT-RISK MILES FROM FLOODING



## TAILPIPE EMISSIONS INDEX: ESTIMATED CHANGE IN TAILPIPE EMISSIONS DUE TO VTRANS MACROTRENDS COMPARED TO THE 2045 BUSINESS-AS-USUAL SCENARIOS





- ▶ Risks and opportunities are identified utilizing the following criteria and based on estimated impacts (Step 3) of Macrotrends on CTB Goals.
  - ▶ Strategic in nature
  - ▶ Manageable in number
  - ▶ Level of detail suitable for policy-makers and executives
  - ▶ Most importantly based on [Step 3](#) evidence that is measurable, replicable, and with an ability to monitor

#	Macro-trend	Nature <sup>1</sup>	Description of Risk/Opportunity	CTB Goal Addressed					Proximity <sup>2</sup>	Priority
				Goal A	Goal B	Goal C	Goal D	Goal E		
1	Flooding Risk	Risk	A large number of state's roadways are at risk from flooding				x		Mid-term	
2	Flooding Risk	Opportunity	Proactively eliminate or mitigate identified flooding risks				x		Mid-term	
3	Flooding Risk	Risk	Several unknown and unquantified flooding risks are present				x		Long-term	
4	Flooding Risk	Risk	Impacts of increased flooding risk are disproportionately higher for certain geographic areas and populations		x		x		Long-term	
5	Flooding Risk	Opportunity	Increase state's preparedness to address <u>other macro-trends</u> associated with climate change megatrend				x		Mid-term	

<sup>1</sup> Risk: Uncertainty with negative impacts on CTB Goals in Step 3. Opportunity: Uncertainty with a positive impact on CTB Goals in Step 3.

<sup>2</sup> Near-term: 0–6 years. Mid-term: 6–10 years. Long-term: 10+ years

#	Macro-trend	Nature <sup>1</sup>	Description of Risk/Opportunity	CTB Goal Addressed					Proximity <sup>2</sup>	Priority
				Goal A	Goal B	Goal C	Goal D	Goal E		
6	AVs	Opportunity	Improve state's ability to manage a transportation system with high number of highly autonomous vehicles	x					Long-term	
7	AVs	Opportunity	Maximize safety benefits offered by highly autonomous vehicles, especially those with Automated Driving System			x			Long-term	
8	AVs	Risk	Greater wear-and-tear of transportation system due to increased VMT induced by AVs				x		Long-term	
9	EVs	Risk	Greater wear-and-tear on transportation system due to growth of electric vehicles combined with higher than average vehicle weight, especially in a high growth scenario				x		Mid-term	
10	EVs	Opportunity	Improve air quality and minimize environmental impacts of transportation system					x	Mid-term	

<sup>1</sup> Risk: Uncertainty with negative impacts on CTB Goals in Step 3. Opportunity: Uncertainty with a positive impact on CTB Goals in Step 3.

<sup>2</sup> Near-term: 0– 6 years. Mid-term: 6 – 10 years. Long-term: 10 + years

#	Macro-trend	Nature <sup>1</sup>	Description of Risk/Opportunity	CTB Goal Addressed					Proximity <sup>2</sup>	Priority
				Goal A	Goal B	Goal C	Goal D	Goal E		
11	Shared Mobility	Opportunity	Utilization of shared mobility services to improve accessibility		x					Mid-term
12	Shared Mobility	Risk	Increased curb access conflicts in urbanized areas due to shared mobility vehicles and services in urbanized areas		x					Near-term
13	Shared Mobility	Risk	Projected growth in non-Single Occupancy Vehicle (SOV) mode share does not provide measurable benefits in terms of transportation system management due to SOV trips converting to Ridesourcing services in urbanized areas		x					Mid-term
14	Shared Mobility	Opportunity	Improve state's ability to manage a transportation system with high number of shared mobility vehicles		x					Long-term
15	Shared Mobility	Risk	Benefits of growth in shared mobility are not equally accessible by all areas and population segments		x					Mid-term

<sup>1</sup> Risk: Uncertainty with negative impacts on CTB Goals in Step 3. Opportunity: Uncertainty with a positive impact on CTB Goals in Step 3.






<sup>2</sup> Near-term: 0–6 years. Mid-term: 6 – 10 years. Long-term: 10+ years

#	Macro-trend	Nature <sup>1</sup>	Description of Risk/Opportunity	CTB Goal Addressed					Proximity <sup>2</sup>	Priority
				Goal A	Goal B	Goal C	Goal D	Goal E		
16	E-Comm.	Risk	Greater wear-and-tear of transportation system due to e-commerce heavy vehicles				x		Long-term	
17	E-Comm.	Risk	Increased curb access conflicts in urbanized areas due to e-commerce deliveries		x				Mid-term	
18	Auto-mation	Opportunity	Improve state's ability to proactively manage transportation impacts associated with greater automation of production and services		x				Long-term	
19	WP Flex.	Opportunity	Maximize utilization of workplace flexibility for telework capable jobs	x			x		Long-term	
20	Age 65+	Risk	Transportation system and services are unable to meet mobility needs of 65+ cohort		x				Long-term	






<sup>1</sup> Risk: Uncertainty with negative impacts on CTB Goals in Step 3. Opportunity: Uncertainty with a positive impact on CTB Goals in Step 3.

<sup>2</sup> Near-term: 0–6 years. Mid-term: 6–10 years. Long-term: 10+ years

OPI will provide annual updates to the Board utilizing the following **VTrans Trend Trackers**.

MACROTREND	VTRANS TREND TRACKERS
	<ul style="list-style-type: none"> <li>▪ Number of directional miles at risk from sea level rise</li> <li>▪ Number of directional miles at risk from storm surge</li> <li>▪ Number of directional miles at risk from inland/riverine flooding</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Market Penetration of Highly Autonomous Vehicles*</li> <li>▪ Attitude and Preferences for Adoption of Highly Autonomous Vehicles*</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Market Penetration of Electric Vehicles*</li> <li>▪ Attitude and Preferences for Adoption of Electric Vehicles*</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Access to Shared Mobility Services*</li> <li>▪ Utilization of Shared Mobility Services by Type*</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Number of Warehouse and Distribution Centers</li> <li>▪ Square Footage of Warehouse and Distribution Centers</li> <li>▪ Share of E-commerce Sales (Business-to-business, business-to-customers)</li> </ul>

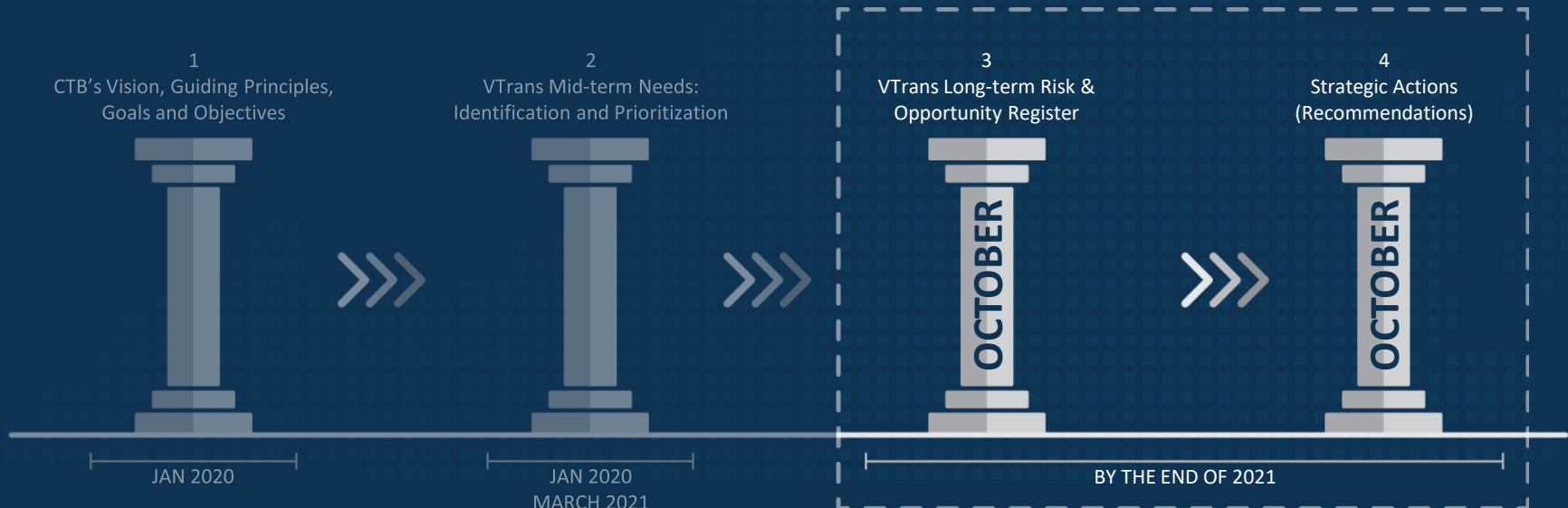
OIPI will provide annual updates to the Board utilizing the following **VTrans Trend Trackers**.

MACROTREND	VTRANS TREND TRACKERS
	<ul style="list-style-type: none"> <li>Value output of 3D Printing</li> <li>Number of short-range and long-range drone deliveries</li> <li>Number of last-mile robotic deliveries</li> </ul>
	<ul style="list-style-type: none"> <li>Number of Workers with Workplace Flexibility*</li> <li>Utilization of Workplace Flexibility*</li> </ul>
	<ul style="list-style-type: none"> <li>Share of Professional Service Industry</li> </ul>
	<ul style="list-style-type: none"> <li>Number of Virginias Age 65 or higher</li> <li>Share of Age 65+ Cohort</li> </ul>
	<ul style="list-style-type: none"> <li>VTrans Land Use Vitality Index</li> <li>Population</li> <li>Employment</li> <li>Income</li> </ul>

\*Based on the VTrans State of Transportation Biennial Survey

## NEXT STEPS

- Gather feedback from CTB members on risks and opportunities.
- Present the following at the October CTB Workshop.





## NEXT STEPS

- ▶ Please provide feedback on the Draft Policy and the Risk & Opportunity Register by **October 4**.
- ▶ Please email comments to [comment@vtrans.org](mailto:comment@vtrans.org)

## PARTING THOUGHTS

- The purpose of this exercise is to *prepare, not predict*
- There are a number of uncertainties. The process allows for modifications based on continuous improvement
- *Feedback on Risk & Opportunity Register*, especially from local and regional perspective will be extremely helpful

“All predictions are wrong, that's one of the few certainties granted to mankind.”

— Milan Kundera, *Ignorance*