Making Sense of Uncertainty: Framework for Megatrends

2022 National Planning Conference (Virtual)

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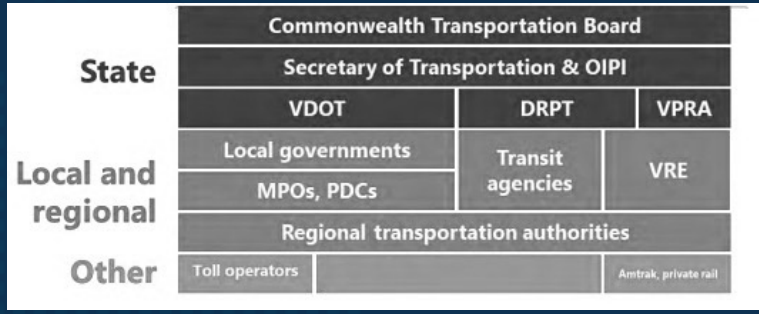
- **Virginia Office of Intermodal Planning and Investment (OIPI)**
  - An office within the Virginia Transportation Secretariat that supports and advises the Secretary as the chairperson of the Commonwealth Transportation Board (CTB).
  - OIPI's Statewide Transportation Planning (STP) section develops **VTrans - Virginia's Transportation Plan** for the CTB.
  - VTrans identifies long-term risks and opportunities for the CTB.



Source: Virginia Joint Legislative Audit and Review Commission (JLARC)

CONTEXT I FOCUS AREAS OF VTRANS – VIRGINIA'S TRANSPORTATION PLAN

Vision + Goals + Objectives

Needs + Priorities

Long-term
Risk & Opportunity
Register

Strategic Actions

FOCUS

SITUATIONS	CURRENT TRANSPORTATION PLANNING METHODS
Known knowns Awareness exists. Impacts are measurable.	Utilize sketch planning-level models or travel demand models
Known unknowns Awareness exists. Uncertainty around impacts.	Typically rely on a collection of statistics or ad-hoc subject-specific plans
Unknowns unknowns Awareness does not exist. Impacts are not measurable.	Outside the realm of traditional long-term planning

"If there's one thing that's certain in business, it's uncertainty."
- Stephen Covey

"Information is the resolution of uncertainty."
– Claude Shannon

"Planning is bringing the future into the present so that you can do something about it now."
- Alan Lakein

"The ability to simplify means to eliminate the unnecessary so that the necessary may speak."
- Hans Hofmann

Why

Why is there uncertainty?

What

What is driving the uncertainty?

When

When will the uncertainty start impacting?

How

How will the uncertainty impact?

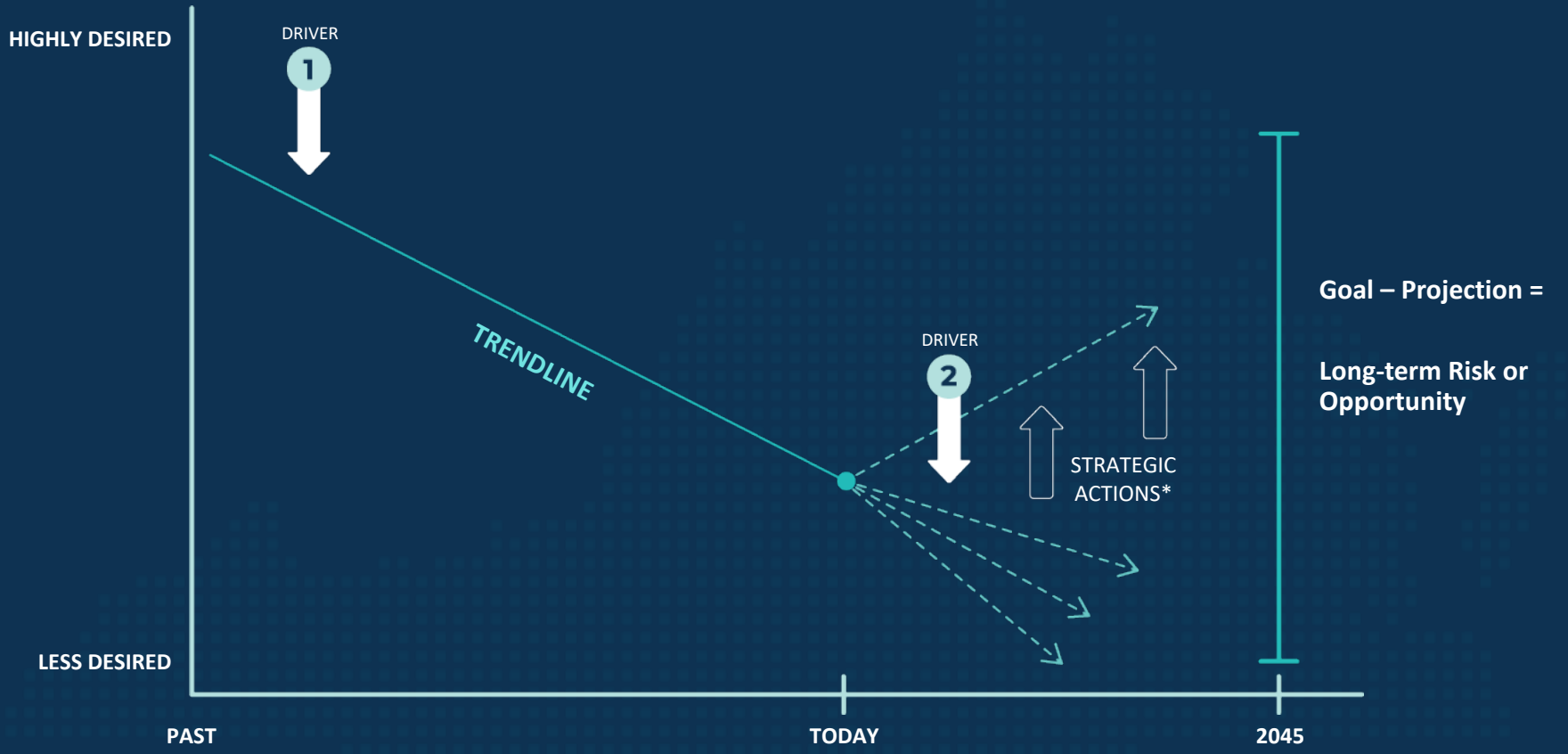
How can we plan for the uncertainty?

How Much

How much will the uncertainty impact?

Where

Where the uncertainty has the greatest impact?


HIGHLY DESIRED
DRIVER
1
TRENDLINE
DRIVER
2
STRATEGIC ACTIONS*
Goal – Projection =
Long-term Risk or Opportunity
LESS DESIRED
PAST
TODAY
2045

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 macrotrends 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, Technical Guide: Policy for Identification and Monitoring of VTrans Long-term Risk & Opportunity Register (Weblink)

POLICY FRAMEWORK

STEP 1 Identify Mega- & Macrotrends

STEP 2 Identify Metrices Associated With the Board's Goals

STEP 3 Estimate Impacts of Macrotrends Metrices

STEP 4 Develop VTrans Long-term Risk & Opportunity Register

STEP 5 Track Macrotrends For Annual Reporting

IDENTIFY MEGA- & MACROTRENDS

MEGATREND

CLIMATE

MACROTREND

Increase in Flooding Risk

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

IDENTIFY MEGA- & MACROTRENDS

MEGATREND **CLIMATE**

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

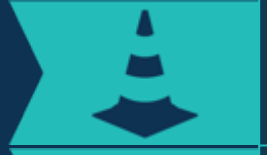
IDENTIFY MEGA- & MACROTRENDS

MEGATREND	CLIMATE	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

IDENTIFY MEGA- & MACROTRENDS

MEGATREND	CLIMATE	TECHNOLOGICAL ADVANCEMENTS	CHANGE IN CONSUMPTION PATTERNS	SOCIO-DEMOGRAPHIC / EMPLOYMENT CHANGES
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	Growth of Professional Service Industry Increase in Workplace Flexibility Growth of the 65+ Cohort Population and Employment Shift

IDENTIFY METRICES

	GOALS	METRICES FOR CTB GOALS
	Economic Competitiveness and Prosperity (focus on congestion and reliability)	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

- **Paul Saffo's[1] 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

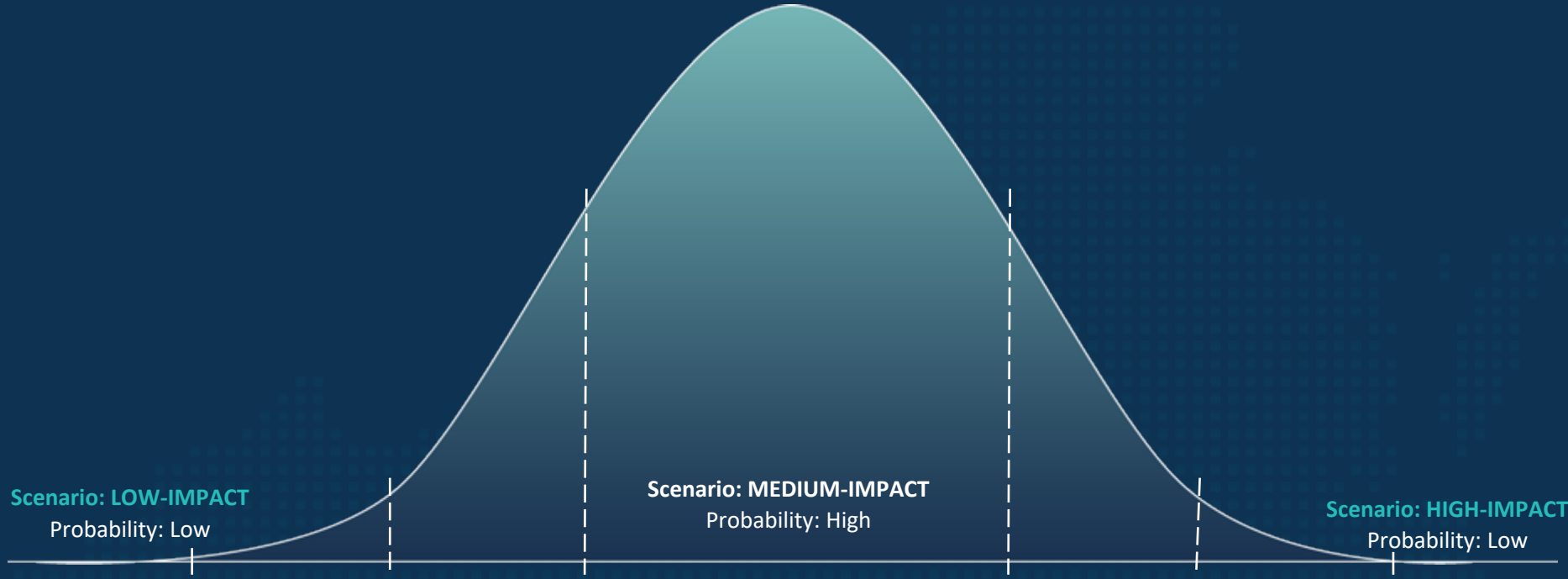
"The primary goal of forecasting is to identify the full range of possibilities, not a limited set of illusory certainties."

"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."

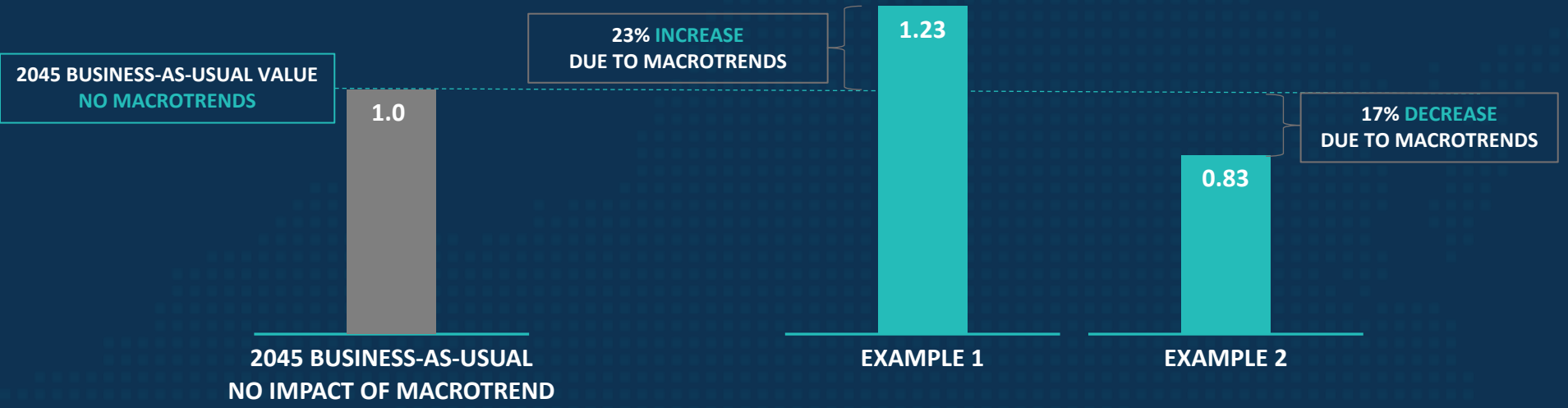
[1] Saffo, Paul. 2007, July-August. Six Rules for Effective Forecasting. Harvard Business Review. Accessed on September 19, 2021.

- **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

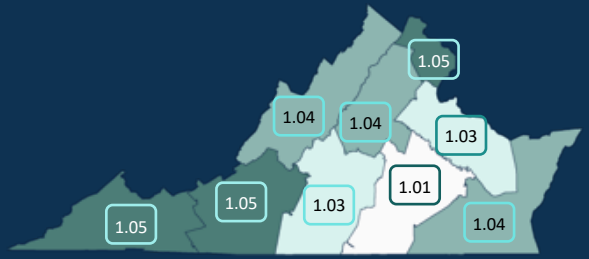
- **Probability based scenarios – low, medium, and high impact – to account for uncertainty**



- **Impacts on metrices are measured in relation to 1.0 - 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



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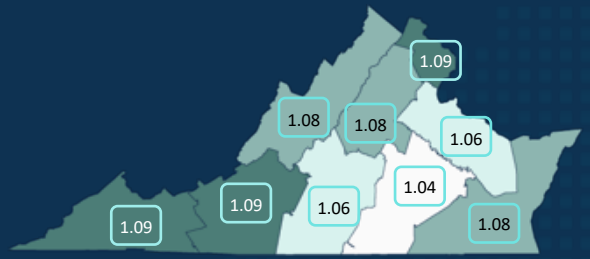
STATEWIDE: LOW IMPACT



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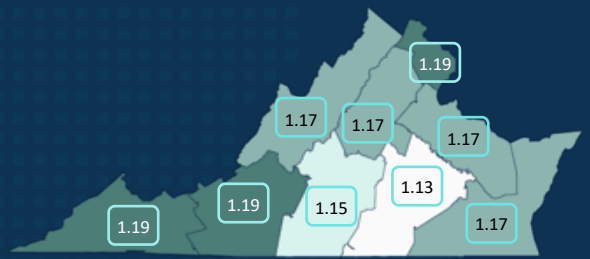
STATEWIDE: MEDIUM IMPACT



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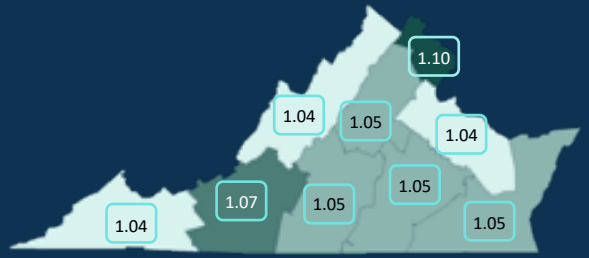
STATEWIDE: HIGH IMPACT

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



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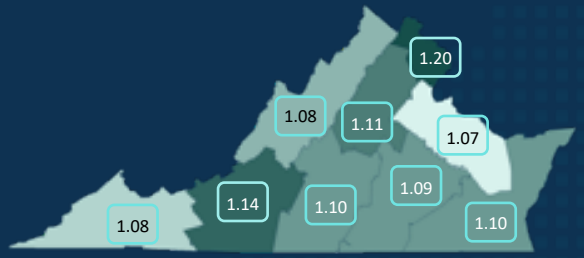
STATEWIDE: LOW IMPACT



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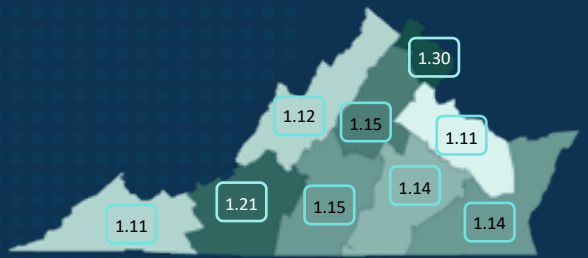
STATEWIDE: MEDIUM IMPACT



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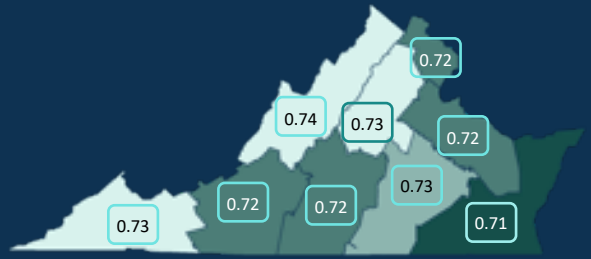
STATEWIDE: HIGH IMPACT

NUMBER OF AT-RISK MILES FROM FLOODING

	STATEWIDE: LOW IMPACT	STATEWIDE: MEDIUM IMPACT	STATEWIDE: HIGH IMPACT
SEA LEVEL RISE*	900	1,100	1,400
STORM SURGE*	7,700	13,100	17,100
INLAND/ RIVERINE FLOODING *	17,500	17,900	18,200

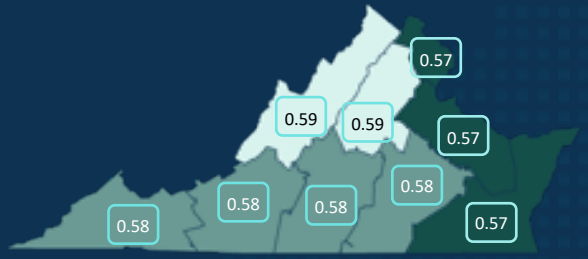
*Numbers rounded to the nearest 100. Resource: Webpage

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



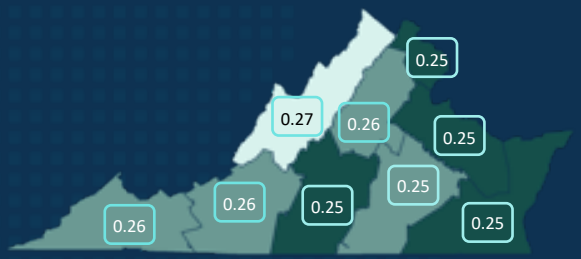
-26%

STATEWIDE: LOW IMPACT



-38%

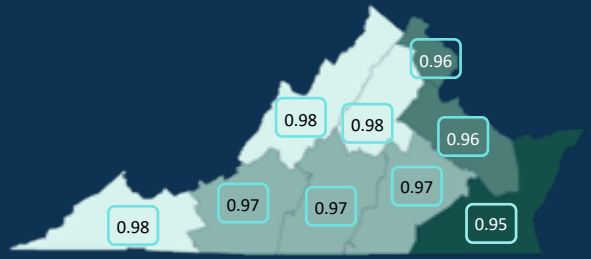
STATEWIDE: MEDIUM IMPACT



-67%

STATEWIDE: HIGH IMPACT

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



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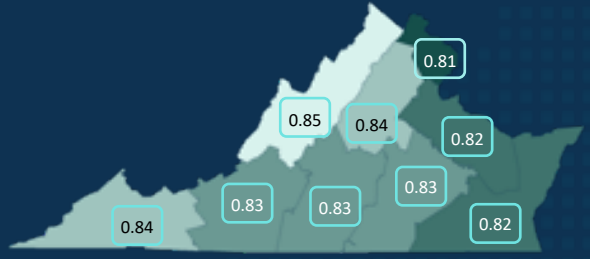
STATEWIDE: LOW IMPACT



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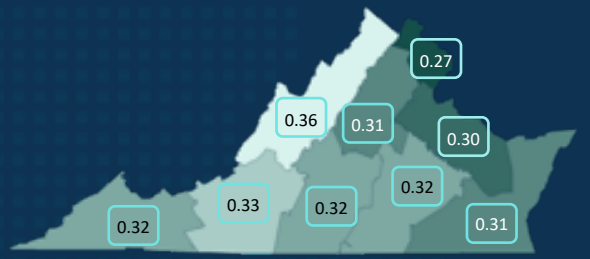
STATEWIDE: MEDIUM IMPACT



-69%

STATEWIDE: HIGH IMPACT

- 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

DEVELOP VTRANS LONG-TERM RISK & OPPORTUNITY REGISTER | RISKS[1]

- ⚠ Large number of roadways at-risk from flooding
- ⚠ Presence of unknown and unquantified flooding risks
- ⚠ Disproportionate flooding impacts on certain areas and populations
- ⚠ Higher rate of wear-and-tear on the transportation system
- ⚠ Increased curb access conflicts in urbanized areas
- ⚠ Insignificant (transportation system) benefits from shared mobility
- ⚠ Inequitable distribution of shared mobility benefits
- ⚠ Inability to meet mobility needs of Virginians age 65 and older

[1] ⚠ Uncertainty with **negative impacts** on CTB Goals in Step 3.

DEVELOP VTRANS LONG-TERM RISK & OPPORTUNITY REGISTER I OPPORTUNITIES[1]

STEP FOUR

- Eliminate or mitigate identified flooding risks
- Increase state's preparedness to address other climate-related macrotrends
- Improve ability to manage high number of highly autonomous vehicles
- Maximize safety benefits offered by highly autonomous vehicles
- Significantly reduce tailpipe emissions
- Utilize shared mobility services to improve accessibility
- Improve ability to manage shared mobility vehicles and services
- Proactively mitigate transportation impacts of automation and large warehouse/distribution centers
- Maximize utilization of workplace flexibility for telework capable jobs

[1] Uncertainty with **positive impacts** on CTB Goals in Step 3.

- Annual updates to the Board because :

> “If you must forecast, then forecast often — and be the first one to prove yourself wrong.”
>
> – Paul Saffo[1]

[1] Saffo, Paul. 2007, July-August. Six Rules for Effective Forecasting. Harvard Business Review. Accessed on September 19, 2021.

TRACK MACROTRENDS

MACROTREND	TREND TRACKERS
	▪ Number of directional miles at risk from sea level rise ▪ Number of directional miles at risk from storm surge ▪ Number of directional miles at risk from inland/riverine flooding ▪ Annual cost of transportation repair due to flooding events
	▪ Market Penetration of Highly Autonomous Vehicles* ▪ Attitude and Preferences for Adoption of Highly Autonomous Vehicles*
	▪ Market Penetration of Electric Vehicles* ▪ Attitude and Preferences for Adoption of Electric Vehicles* ▪ Transportation Revenue by Revenue Source ▪ Greenhouse Gas (GHG) Emissions
	▪ Access to Shared Mobility Services* ▪ Utilization of Shared Mobility Services by Type*
	▪ Number of Warehouse and Distribution Centers ▪ Square Footage of Warehouse and Distribution Centers ▪ Share of E-commerce Sales (business-to-business, business-to-customers)

*Based on the VTrans State of Transportation Biennial Survey

TRACK MACROTRENDS

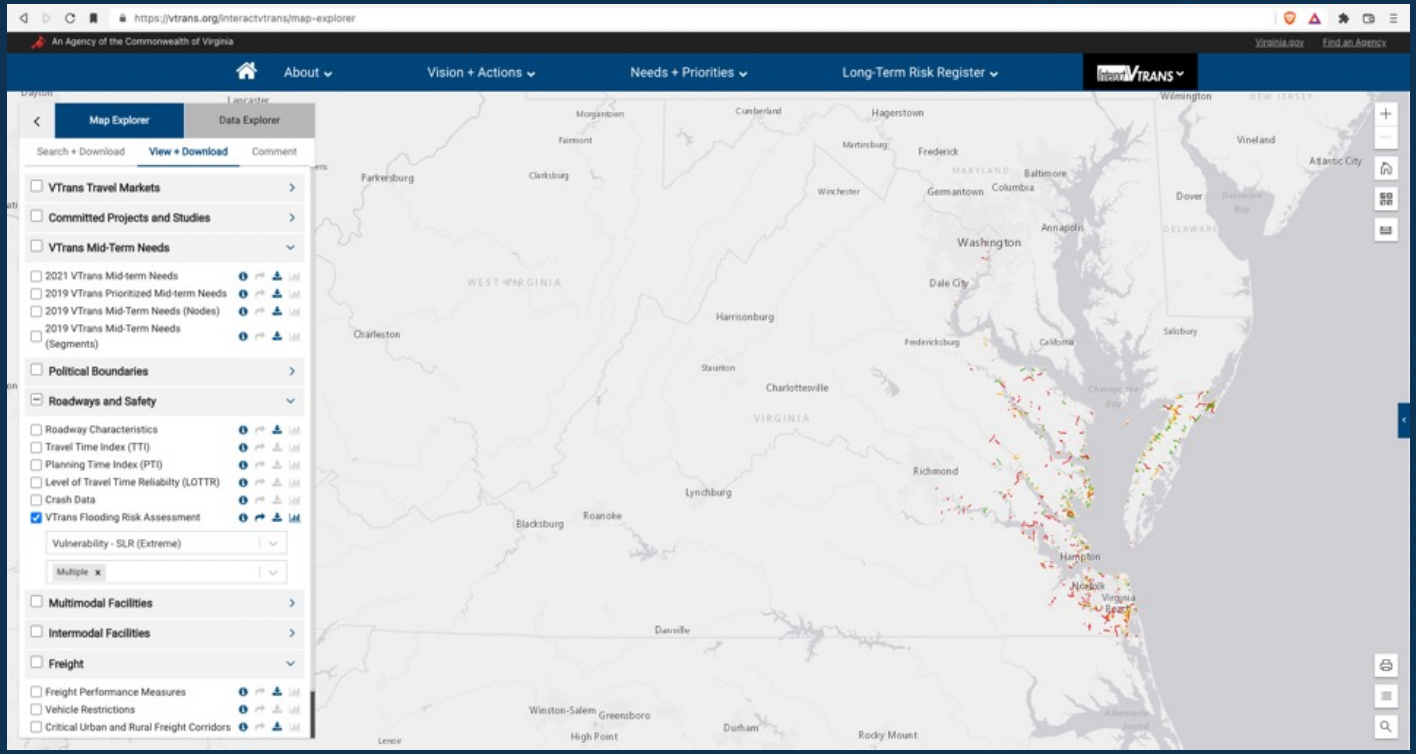
MACROTREND	TREND TRACKERS
	▪ Number of short-range and long-range drone deliveries ▪ Number of last-mile robotic deliveries ▪ Value output of 3D Printing
	▪ Number of Workers with Workplace Flexibility* ▪ Utilization of Workplace Flexibility*
	▪ Job Share of Professional + Technical Services Industry
	▪ Number of Virginians Age 65 or older ▪ Share of Age 65+ Cohort
	▪ VTrans Land Use Vitality (LUV) Index ▪ Population ▪ Employment ▪ Income

*Based on the VTrans State of Transportation Biennial Survey

- **The policy relies on over 150 variables based on over 100 data sources for over 250 geographies.**

- **A custom application allows viewing and downloading of data at different geographies – local jurisdictions, planning district (similar to council of governments), DOT construction district, etc.**

COMMUNICATION I InteractVTrans MapExplorer



This map shows the High Impact Scenario for Macrotrend # 1: Flooding Risk from Sea Level Rise.

COMMUNICATION I InteractVTrans DataExplorer

This infographic shows the medium-impact scenario for the VMT Index at the local jurisdiction level.

Resource: https://vtrans.org/interactvtrans/data-explorer

KEY TAKEAWAYS

- **Piece-meal or ad-hoc approach to planning for emerging trends has severe limitations.** Multi-disciplinary approaches that consider interactions between different trends have greater value.

- **Planning profession can greatly benefit from higher reliance on academic literature for day-to-day decisions.** There is an abundance of "shiny objects"[1] – academic literature helps reduce those shiny objectives.

- **An ability to reimagine utilization of available data and tools by developing new methods and processes is a greater and more pressing need.** Arguably, there is an abundance of planning data but there is a severe shortage of ability to conceive methods and processes to maximize benefits.

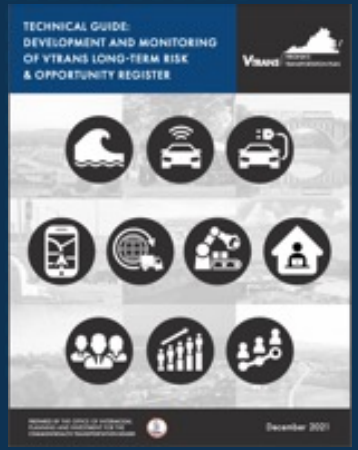
- **There is greater value in making transportation planning process-oriented than product-oriented.** To borrow the phrase from Michael Neuman, "Does planning need a plan"[2].

[1] Wozniak, T. (2020, November 16). *Council post: Three tips for avoiding 'shiny object syndrome' in marketing*. Forbes. Retrieved April 19, 2022, from https://www.forbes.com/sites/forbescommunicationscouncil/2020/11/17/three-tips-for-avoiding-shiny-object-syndrome-in-marketing/?sh=7d71900512c1

2 Neuman, M. (1998). Does planning need the plan? Journal of the American Planning Association, 64(2), 208–220. https://doi.org/10.1080/01944369808975976

RESOURCES

- Risk & Opportunity Register: Webpage
- Megatrend 1: Climate: Webpage: Webpage
- Megatrend 2: Technological Advances: Webpage I Slides I Video
- Megatrend 3: Consumption Patterns: Webpage I Slides I Video
- Megatrend 4: Socio-demographic Changes: Webpage I Slides I Video
- Policy Guide (for policymakers): Document
- Technical Guide (for practitioners): Document



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