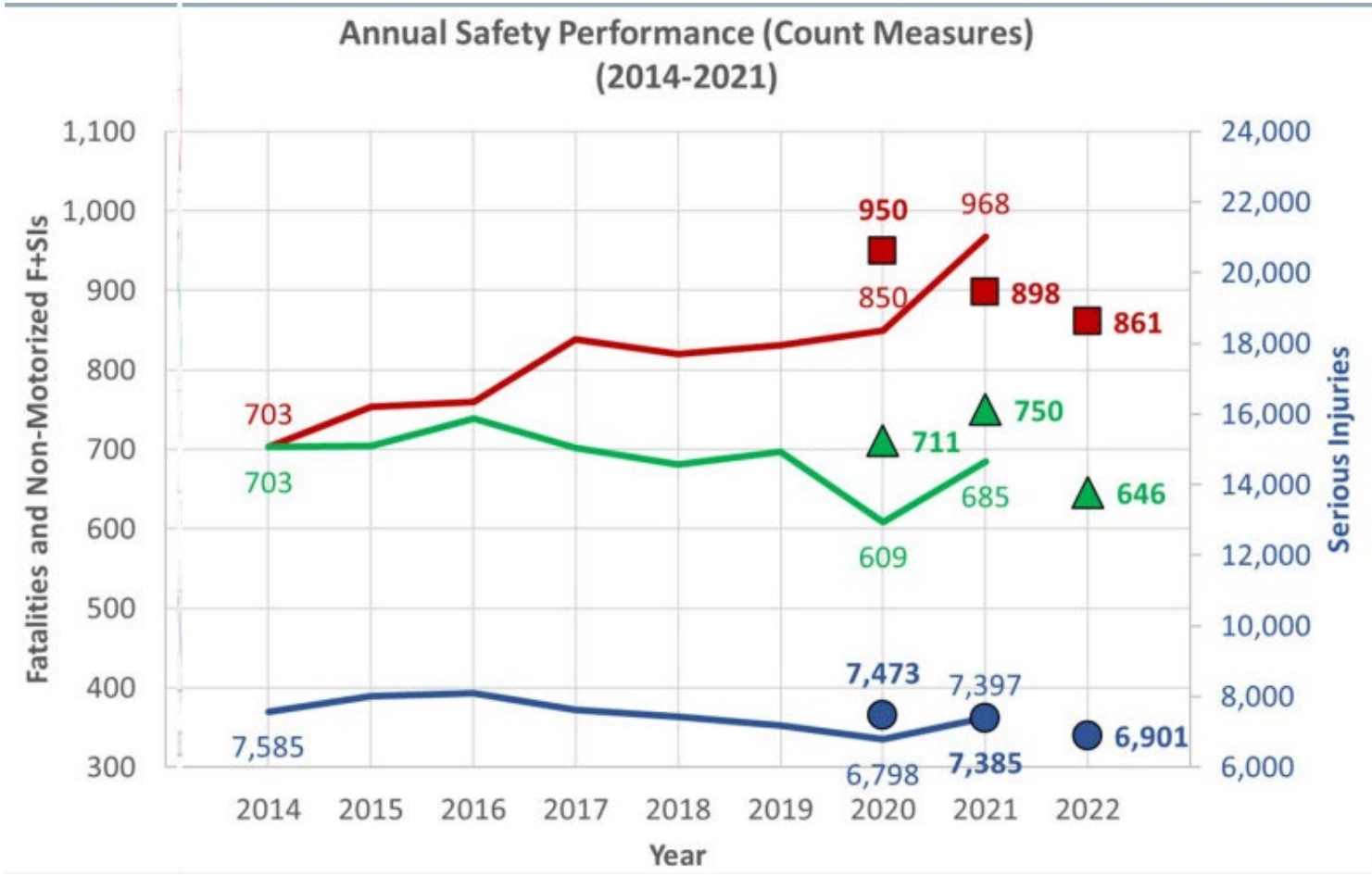
DRIVE SMART VIRGINIA

Distracted Driving Summit: Emerging Technology for Safer Roadways

VDOT Chief Deputy Commissioner Cathy McGhee, P.E.

August 19, 2022

Safety Performance Measures in Virginia



Board adopted targets beginning in 2019 using a model-based approach

- Actual Annual Fatalities (FARS)
- Fatalities Target
- Actual Annual Non-Motorized F+SI
- Non-Motorized F+SI Target
- Actual Annual Serious Injuries
- Serious Injuries Target

Emerging Technology for Safer Roadways

- **What we are using:**
  - Variable Speed Limit (VSL) System

- **What we are considering:**
  - Regional Multi-Modal Mobility Program (RM3P)
  - Automated Speed Enforcement (ASE)
  - Safety Data Analytics Project (SDAP)

Using

Variable Speed Limit System

Variable Speed Limit (VSL) System

- **Background**
  - **I-95 Corridor Improvement Plan (CIP)**
    - I-95 near Fredericksburg experiences heavy recurring weekday and weekend congestion
    - High incident and personal vehicle delay increases approaching Fredericksburg (and further north)
    - Unreliable travel time due to stop-and-go conditions throughout the corridor
    - Other projects north of Fredericksburg will not mitigate congestion south of these projects
  - **Why we are using VSL**
    - Speed Harmonization
    - End-of-Queue Warning
    - Weather and Visibility Advisories

VSL System – Control Algorithm

Inputs

Outputs

Step 1

Field Traffic Data

Derive **Traffic Conditions** and determine if they are getting **WORSE**, **BETTER**, or **STAYING CONSISTENT**

Traffic Conditions

Step 2

Traffic Conditions

Derive **Recommended Speeds** based on prevailing traffic conditions at each sign location

Recommended Speeds

Step 3

Recommended Speeds

Adjust and Smooth Recommended Speeds to derive **Posted Speed Limits** at each sign location

Posted Speed Limits

VSL System – Corridor Evaluation & Expansion Strategy

- **Evaluate Project Performance**
  - Reduce Recurring and Non-Recurring Congestion
  - Reduce Incidents
  - Improve Travel Time Reliability
  - Increase Throughput
- **Define characteristics for future deployments**
  - Crash rates
  - Congestion hot spots, severity and duration
  - Weather or visibility impacts
  - Available capacity for increased throughput
- **Identify and prioritize candidate VSL corridors throughout state for future deployments**

Considering

Regional Multi-Modal Mobility Program

History of Regional Multi-Modal Mobility Program (RM3P)

- Integrated Corridor Management (ICM) Plans
- Northern Virginia Transportation Authority (NVTA) identifies ICM as important to meeting the vision of its long-range regional plan, TransAction
- NVTA and Commonwealth develop a plan for RM3P and include it in the Innovative Technology Transportation (ITTF) program
- Federal Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD) grant allows expansion of geographic scope into Fredericksburg

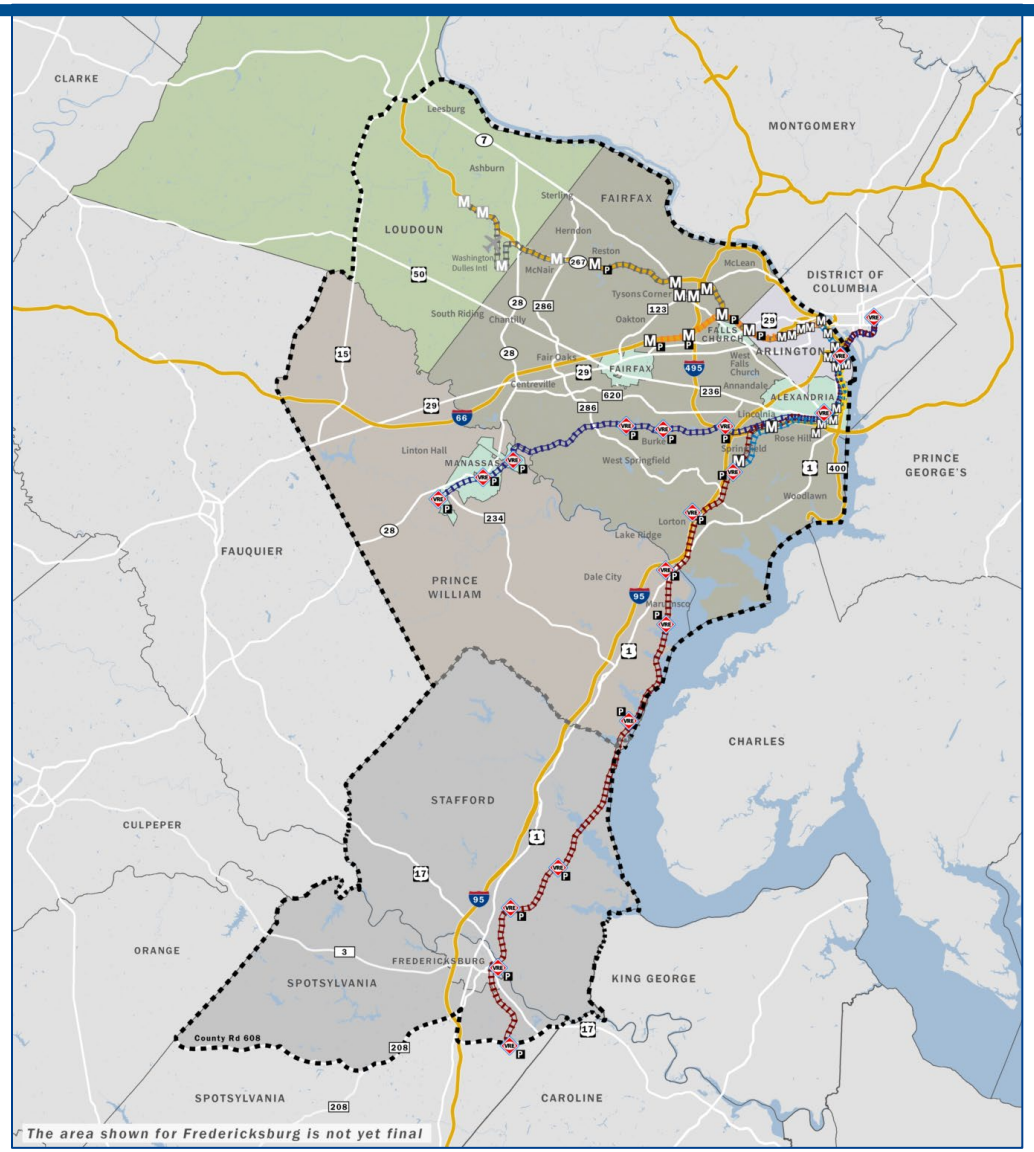
The RM3P Mission

Leverage the collaborative use of real-time data to improve travel safety, reliability, and mobility, as well as to give the public the tools to make better informed travel choices.

The Goals of RM3P

- **Optimize** transportation system performance by improving the efficiency of agency responses to travel disruptions.
- **Enhance** travel time reliability.
- **Support** on-demand, multi-modal trip choices for travelers.

RM3P Scope



- **This data-driven multi-modal mobility program, serving Northern Virginia and Metropolitan Fredericksburg, is comprised of four active projects:**

  - **Data-Exchange Platform (DEP)**
  - **AI-Based Decision Support System (AI-DSS)**
  - **Dynamic Incentivization (DI)**
  - **Commuter Parking Information System (CPIS)**

Considering

Automated Speed Enforcement

Automated Speed Enforcement in Work Zones

- Automated Speed Enforcement (ASE) in Virginia: § 46.2-882.1. Use of photo speed monitoring devices in highway work zones and school crossing zones; civil penalty.

- Equipment that uses radar or LIDAR-based speed detection and produces one or more photographs, microphotographs, videotapes, or other recorded images of vehicles.

Automated Speed Enforcement in Work Zones

Where We Are Now in the process

- Virginia State Police (VSP) developed a Request for Proposals (RFP) to review prospective vendors and select a contractor to pilot the Work Zone ASE in long term interstate projects throughout the Commonwealth.

- VDOT is providing the funding for the pilot program.

- We anticipate having a contractor on board by the end of 2022.

Automated Speed Enforcement in Work Zones

Guidelines for Implementing ASE in Work Zones

- “Photo Enforced” plaques will be installed under the work zone speed limit signs coming into a project.

Considering

Safety Data Analytics Project

Safety Data Analytics Project

- When a human reviews hundreds of crashes over the years you start to pick up on patterns and we call that experience, but there are just too many factors for the human mind to track and make sense of.

- The Safety Data Analytics Project (SDAP) is the beginning of the search for a unified theory of traffic crashes if such a thing does exist.

	Analysis/Insight	Data Sources Used	Analysis Approach	Primary Tools
1	Distracted Driving Has a Larger Impact in Rainy Conditions	• VA Roads Crash Data • NOAA Weather Data	Analyze NOAA weather data and a range of pre-crash conditions to identify influence of precipitation and potential interactions with other crash attributes	tableau
2	Pavement Quality and Speeding Tie to More Severe Crashes	• VA Roads Crash Data • Pavement Rating Data	Analyze IRI pavement ratings and a range of pre-crash conditions to identify influence of pavement conditions and potential interactions with other crash attributes	tableau
3	Patterns in Roadway Departures Point to Specific Countermeasures	• All Data Sources	Apply machine-learning clustering analysis to 40+ fields across the Analysis Dataset, and evaluate cluster traits for crash patterns that might inform specific actions	python, Azure Machine Learning, ArcGIS
4	Clustering of Intersection Crashes Shows Patterns in Attributes & Locations	• All Data Sources	Apply machine-learning clustering analysis to 40+ fields across the Analysis Dataset, and evaluate cluster traits for crash patterns that might inform specific actions	python, Azure Machine Learning, ArcGIS
5	A Multi-Attribute Analysis of Intersection Crashes Ranks Relative Factors	• All Data Sources	Carry out logistic regressions of sets of crash attributes on specific types of crashes, to develop a multi-factor model of severe crashes; iterate on models to improve predictability	python, Azure Machine Learning
6	Community Characteristics are Reflected in Crash Outcomes	• VA Roads Crash Data • Health Opportunity Index • US Census Data	Through hypothesis testing with Health Opportunity Index and Census data, we have identified crash trends reflected in area characteristics	tableau
7	Curve characteristics have an impact on crash outcomes	• VA Roads Crash Data • Curve Data	Group curves together based on similar measurable characteristics to identify trends	python, tableau
8	Analysis of Curve Data Reveals Specific Hot Spots for Severe Crashes	• VA Roads Crash Data • Curve Data	Identify hot spots by grouping like curves together based on specific measurable characteristics and evaluating counts and rates of severe crashes	tableau, ArcGIS
9	Sharper Curves Exacerbate the Impact of Speeding	• VA Roads Crash Data • NOAA Weather Data • Curve & Pavement Data	Using the engineered field Curve Sharpness, analyze the impact of curves in tandem with specific crash attributes to explore how those attributes are impacted by curves	tableau

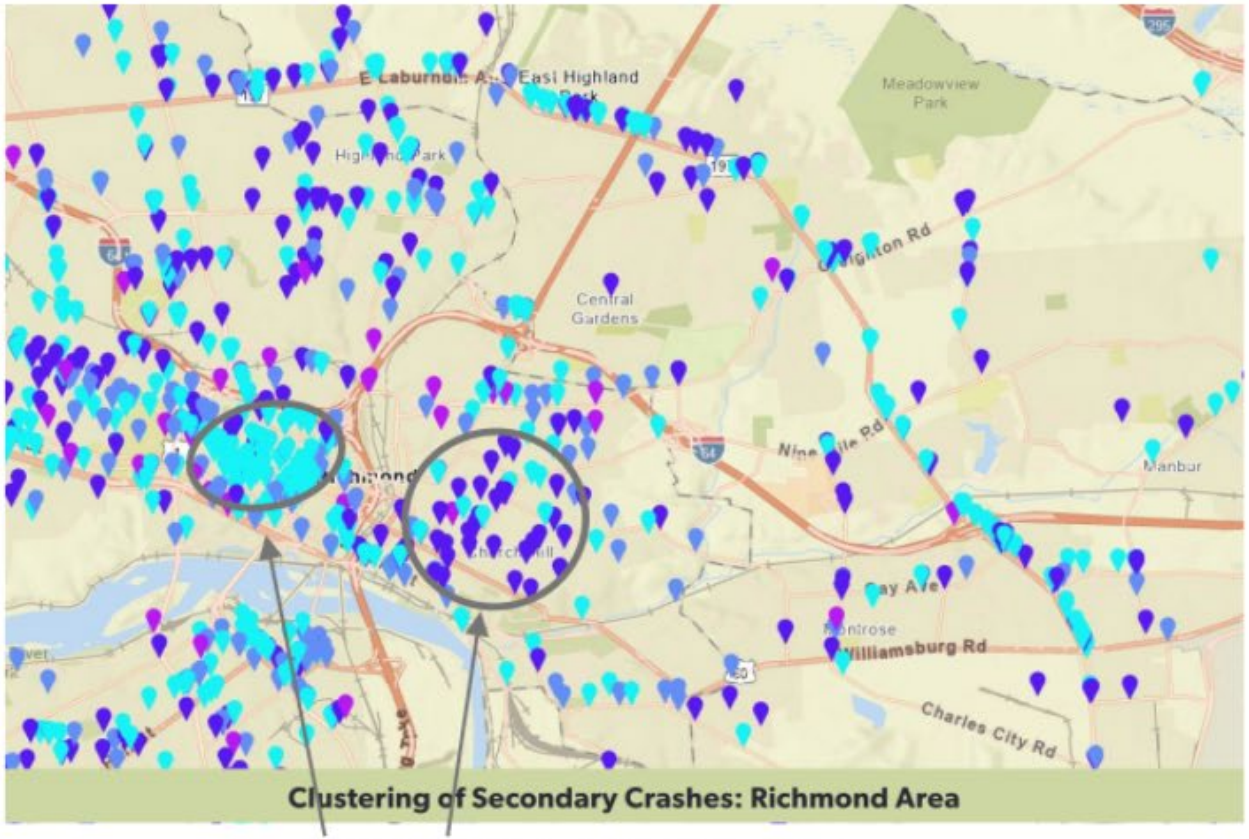
4 Clustering of Intersection Crashes Shows Patterns in Attributes & Locations

Summary

A multivariate, hierarchical clustering analysis of intersection accidents yields thematic crash patterns that align with intuitions of different intersection types. Some geographic patterns emerge, without including geography in the analysis

Takeaway: Clustering of intersection crash attributes reveals intuitive patterns, driven strongly by roadways and environments

Analysis



Clustering of Secondary Crashes: Richmond Area

Geographic similarities in clusters arise, without including crash locations in the analysis

Cluster		Characteristics
	0	• Two Car • Traffic Signal/Stop Sign intersections • Tend to be Angle/Rear crashes
	1	• 3-way intersections • Tend to 2 car crashes
	2	• Angle Crashes • Urban • Low Speeding % • Four-way intersections • 2 car crashes
	3	• High Severity • Fixed Object Off Road • Distracted, Unbelted, Alcohol, Higher Speed crashes • Evening/Late Night • Tends to be unsignalized
	4	• Low counts; one-car accidents • Two-way Intersection • No traffic control device • High severity • Located frequently near DC

CapTech

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