Vermont AOT Research Overview and Selected Projects

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Vermont Agency of Transportation
Addison County Regional Planning Commission TAC Meeting
October 18, 2023

Presentation will Include

- Overview
- Symposium Substitute Report and Symposium Lite pages
- Speed Countermeasures Toolbox Project
- SmartGrowth Project
- Additional Projects

VTRANS RESEARCH HIGHLIGHTS

- Variety of projects: materials, structures, snow and ice, environmental, etc.—directly and indirectly research funded, other
- Project Champions from across the Agency
- Annual Research and Innovation Symposium—this year a Symposium Substitute Report
- New communications—we want our research to be used so we need to share about our projects!

AOT RESEARCH OVERVIEW

- When Research was part of the Materials Lab, there was more staff and more field and internal research.
- Now, two staff and greater emphasis on research management
  - External research projects led by VTrans
  - Maximizing utilization of external payments
    - FHWA Pooled funds
    - National Cooperative Highway Research Program/TRB

2023 EXTERNAL RESEARCH PROJECTS (Potential and **Funded**)

- Using DCP in Preliminary Design – Geotech
- New UAS Technology Public Sector Impacts – Aviation
- **Small Culvert Performance Monitoring – District Maintenance**
- **Travel Time Data from Work Zones – Proj Dev/Traffic Design**
- **Pavement Performance Models – Asset Management**
- **RAS as an FDR Mechanical Stabilizer – Asphalt Materials**
- Phosphorus Removal from Stone-Lined Ditches – Stormwater Mntce
- Laboratory Aging Procedures for Asphalt Mixtures – Asphalt Materials
- Rural GHG Reductions Toolbox – Planning

TECHNICAL ADVISORY COMMITTEE (TAC)

- All VTrans led projects have TACs
- Technical Champion
- Research Staff
- AOT staff from different Bureaus, Divisions
- Technical staff from other Agencies
- RPC Staff
- More participation, more project guidance, more implementation potential

2023 AOT Research and Innovation Symposium Lite

- Due to July flooding, no in-person Symposium this year
- Gathered Fact Sheets for 16 projects, 9 funded by Research and 7 external, separated into four groupings:
  - Materials and Pavements
  - Structures and Stormwater Design
  - Asset Management
  - Planning, Public Transportation, and Safety
- Symposium Lite webpages: 2023 Research and Innovation Symposium Lite
- Sharing a Symposium Substitute Report in October 2023 with Research program overview and Fact Sheets

2023 SYMPOSIUM SUBSTITUTE REPORT

RESEARCH

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AOT Research and Innovation Symposiums

- 26-30 Projects in Four Groupings:
  - Asset Management and Maintenance
  - Materials
  - Environmental, Resilience, Planning and Public Transportation
  - Structures and Construction
- Virtual 2020, 2021, Hybrid 2022
- Each project includes
  - Web page—permanently available!
  - Fact Sheet
  - Poster
  - 3-5 Minute Recording (support team failed in 2022)
  - Half of the projects in 2022 included table demos

Speed Countermeasures Toolbox

- Report completed in early June
- Includes 15 potential speed countermeasures
  - Horizontal deflections
  - Vertical deflections
  - Passive or perceptual measures
- Also includes field data (from four locations) and four case studies

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FACT SHEET

Traffic Safety Toolbox—Addressing Speeds

PROJECT TITLE
Traffic Safety Toolbox—Addressing Speeds

STUDY TIMELINE
April 2022 – March 2023

INVESTIGATORS
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KEYWORDS
Speeding, countermeasures, toolbox, safety, rural transition zones

FUNDING
RDWP022-928
$85,000

VTRANS PROJECT PAGE
21-1 Traffic Safety Toolbox - Addressing Speeds | Agency of Transportation (vermont.gov)

FINAL REPORT
20230606 Speeding Countermeasures for Vermont Final Report.pdf

TOOLBOX
20230606 Toolbox.pdf (vermont.gov)

More information about the VTrans Research Program, including additional Fact Sheets, can be found at: http://vtrans.vermont.gov/planning/research

Introduction or Problem Statement

Speeding on lower speed and local roadways is a major contributor to speeding-related fatalities in Vermont. In 2018, over half of all fatal crashes occurring on local and collector roadways were classified as speeding-related. Vermont does not currently have a "toolbox" for engineers and local officials to help determine the most effective speeding countermeasures to improve safety on roads. While our engineers have experience using various tactics to improve road safety and reduce speeds, compiling all our resources into a single location will help identify the correct measures to take and how to implement them. This project will help the Districts and Towns where the responsibility of addressing speeds and improving safety often falls to local engineers or DPW superintendents, many of whom have limited experience in transportation safety.

Methodology or Action Taken

This project identified a collection of 15 countermeasures that can be implemented by towns in Vermont to lower roadway speeds. Their application in the Vermont context was supported by 4 speeding field tests and 4 interview-based case studies. For each countermeasure, the research team created a profile sheet that includes illustrations, description, context discussion, design considerations, implementation pros & cons, and links to local case studies, field tests, and sources of further information. These profile sheets were compiled into a dynamic pdf document for use by towns in identifying countermeasures suited to their specific context.

Potential Impacts and VTrans Benefits

This resource will improve VTrans' workflow, providing access to a much-needed resource for our districts and towns to identify the most effective ways to reduce speeding and prevent future speeding-related fatalities on our roadways.

++ most favorable / most common
+ moderately favorable / moderately common
– not favorable / not common
seek seek Agency review/assistance

Type	Speeding Countermeasure	Frequency of Use in Vermont	Snow and Ice Control	Emergency Response	Cost / Maintenance	Speed Reduction Potential	Within Village or Town Center (< 35 mph)	Within Transition Zone (> 35 mph)	Acceptable on VT Highways?
Horizontal deflections	Lane or street narrowing	+	+	+	+	+	++	++	seek
	Lateral shift	+	+	+	+	+	+	+	seek
	Bulbout / pinchpoint / choker	+	+	+	+	+	++	–	seek
	Median island	+	+	+	+	+	+	+	seek
	Mini-roundabout	–	–	+	–	++	++	–	seek
	Neighborhood traffic circle	+	+	+	–	++	++	–	no
Vertical deflections	Speed hump or cushion	+	–	+	–	++	++	–	no
	Raised crosswalk / speed table	+	–	+	–	++	++	–	no
	Raised intersection	–	–	+	–	++	++	–	no
Perceptual, or passive, measures	Road diet	+	++	++	+	+	++	+	seek
	Radar speed feedback signs	++	++	++	+	+	++	+	seek
	Transverse line markings	+	++	++	+	+	+	++	no
	Gateway signing / landscaping	++	++	++	++	+	–	++	seek
	Transverse mumble strips	–	+	+	+	+	+	+	no
	[SLOW]/[-- MPH] pavement word marking	–	++	++	+	+	+	–	no

15 Countermeasures

- List of the speeding countermeasures that are recommended for use in Vermont, their acceptability on the state highway system, and the applicability and frequency of each countermeasure's use across seven criteria.
- For each criterion, the countermeasure is rated as follows:
  - ++ indicates most favorable or most common
  - + indicates moderately favorable or moderately common
  - – indicates not favorable or not common
  - Seek: may be possible, seek guidance from your District

PROFILES OF SPEEDING COUNTER-MEASURES

PERCEPTUAL / PASSIVE

RADAR SPEED FEEDBACK SIGN

Encouraging speed reduction through feedback

adar speed feedback signs in Vergennes (left) and Burlington (right), Vermont

FACTS AT A GLANCE

PROS

- Cost effective when compared with construction of physical measures
- Moderate speed reductions (2 to 8 mph), with more significant reduction of excessive speeds (10+ mph over posted speed limit)

CONS

- Not appropriate where very high daily traffic volumes (above 20,000) are present
- Effectiveness may reduce over time unless regularly enforced by local police
- Radar speed estimation is compromised by occlusion
- Not as effective as regular consistent law enforcement

USE IN VERMONT

- Common
- Newfane and Williston Case Studies and Vergennes VT-22A Field Test

Radar speed feedback signs (RSFS) provide a real-time dynamic display of a driver's speed to encourage compliance with posted speed limits. Used in conjunction with a regulatory speed limit sign, drivers receive immediate confirmation of their actual speed in comparison to the speed limit.

CONTEXT

RSFS are typically used in a transition zone or in an area where driving the appropriate speed for the highway conditions is particularly critical, such as school speed zones. The RSFS measures an approaching car's speed and displays it in large, lighted numbers, but does not initiate enforcement. RSFS are most effective upstream of staffed speed enforcement. When requested by towns for state highways, RSFS are considered only where the 85th percentile speed exceeds the posted speed limit by at least 3 MPH during the time-period of concern, the posted speed is 35 mph or less, and a speed transition exists.

DESIGN CONSIDERATIONS

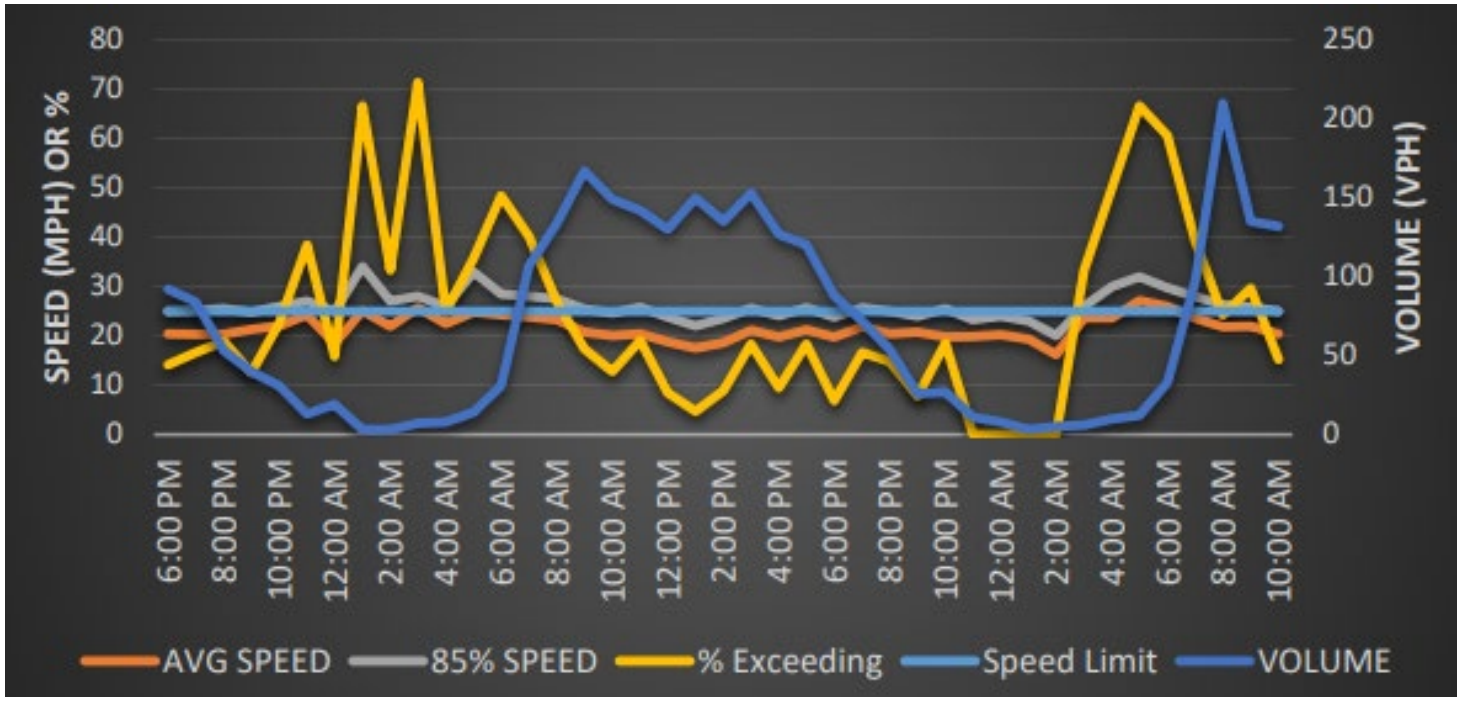
The display text must be at least 12 inches high and visible from distances up to 800 feet. In rural areas without raised curbs, the device should be 78.7 to 157.5 inches from the edge line. In urban or residential areas with raised curbs, the device should be within 78.7 inches of the curb. When the RSFS are activated, the display format shall NOT include animation, rapid flashing, strobing, dissolving, scrolling or other dynamic elements. On state highways, RSFS must be permitted by VTrans with compliance and acceptance documented by the district. Adherence with MUTCD Chapter 2L is imperative.

For Further Information: VTrans, 2009; MUTCD, 2009 (2022), DelDOT, 2012; Swan, 2019; Kingston, undated; FHWA, 2016b

Countermeasure Example

- Page for each of the 15 countermeasures
- Each countermeasure has list of pros and cons
- Explains if common in Vermont
- Provides context
- Explains design considerations
- Lists additional resources

Middlebury VT-125 EB Field Test



- Posted speed limit drops from 50mph to 40 mph, then to 25mph
- Countermeasures used: Lane Narrowing and Bulbouts
- Speed data collected from 6pm January 16, 2023 to 10am January 18, 2023 (40 hours)
- Countermeasure successfully reduced speeds; average vehicle speeds were under 25mph for almost the entire observation period

Middlebury Case Study: Middlebury College Campus

- Speed limit 35mph
- Goals: Improve pedestrian safety and reduce speeding
- Several features added:
  - Visual cues and horizontal deflections
  - Bulbouts with decorative streetlights
  - Expanding and illuminating crosswalks
- Changing the driving environment to appear more congested with on-street parking has been considered the most effective change

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FACT SHEET

Vermont Smart Growth, VMT and GHG Research

PROJECT TITLE
Vermont Smart Growth, VMT and GHG Research

STUDY TIMELINE
July 2022 – October 2023

INVESTIGATORS
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KEYWORDS
Smart Growth
Vehicle Miles Traveled
Land Use Planning
Greenhouse Gas Emissions

FUNDING
RDWP022-701
$140,000

VTRANS PROJECT PAGE
22-4 SmartGrowth, VMT and GHG | Agency of Transportation (vermont.gov)

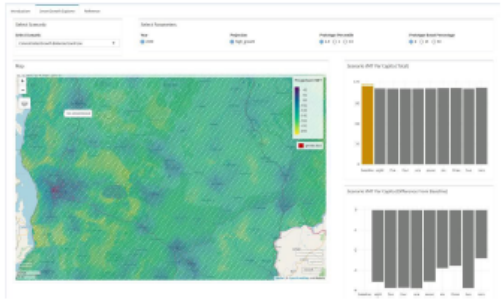
vhb

RSG
the science of insight

More information about the VTrans Research Program, including additional Fact Sheets, can be found at: http://vtrans.vermont.gov/planning/research

Introduction or Problem Statement

This project has leveraged big data to understand how compact, mixed-use development in Vermont affects vehicle miles travelled (VMT), mode share, greenhouse gas (GHG) emissions, and other VMT reduction co-benefits (i.e. health, safety, and reduced maintenance costs) compared to more dispersed development patterns.



Methodology or Action Taken

The research team has developed a model estimating VMT based on passively collected location-based data and built environment factors across Vermont. The model is linked to downstream estimates of changes in GHG emissions, health impacts, and other co-benefits associated with VMT reductions. The project team, in coordination with stakeholders, has developed several future growth scenarios, modeling the implications of land use policies and influential built environment parameters. The various future scenarios and adjustable parameters are embedded in an interactive dashboard tool that will be shared with decision makers and the public.

Conclusions or Next Steps

The team is finalizing a dashboard tool that will allow policy makers to evaluate a host of different growth scenarios. Users will be able to adjust model parameters to better understand the implications of land use policies on vehicle miles traveled and the co-benefits of reduced VMT out into the future.

Potential Impacts and VTrans Benefits

The project helps VTrans and other stakeholders understand how land use policy and future development patterns may help meet GHG emission reductions targets as promulgated in the Vermont Pathways Analysis Report. Further, this project seeks to understand how smart growth development patterns may reduce infrastructure maintenance costs, provide health benefits, and spur economic development opportunities in Vermont communities.

Smart Growth Project

- Project started last year
- Expecting completion this calendar year
- TAC includes AOT, ACCD, data folks, advocates
- Research team has spent a lot of time building a Vermont model based on cell phone location data
- Using future VT population forecasts by county, can we consider the travel impacts of various growth scenarios:
  - More population and activities in Town Centers (SmartGrowth)
  - Disbursement

Project Objectives

Overarching Hypothesis: Compact, mixed use development patterns generate less VMT and per capita GHG emissions than more dispersed development.

RESEARCH OBJECTIVES:

1. **Demonstrate** the degree to which smart growth strategies can reduce VMT and transportation-related GHG emissions in the Vermont context.
2. **Quantify** the co-benefits of smart growth strategies, including **health** benefits of increased active and multimodal travel, **safety** benefits and **reduced maintenance** associated with reduced VMT, and **increased economic activity** in downtowns and community centers.

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Data Sources

Built environment data

The nature of the space (i.e., *smart growth* characteristics)

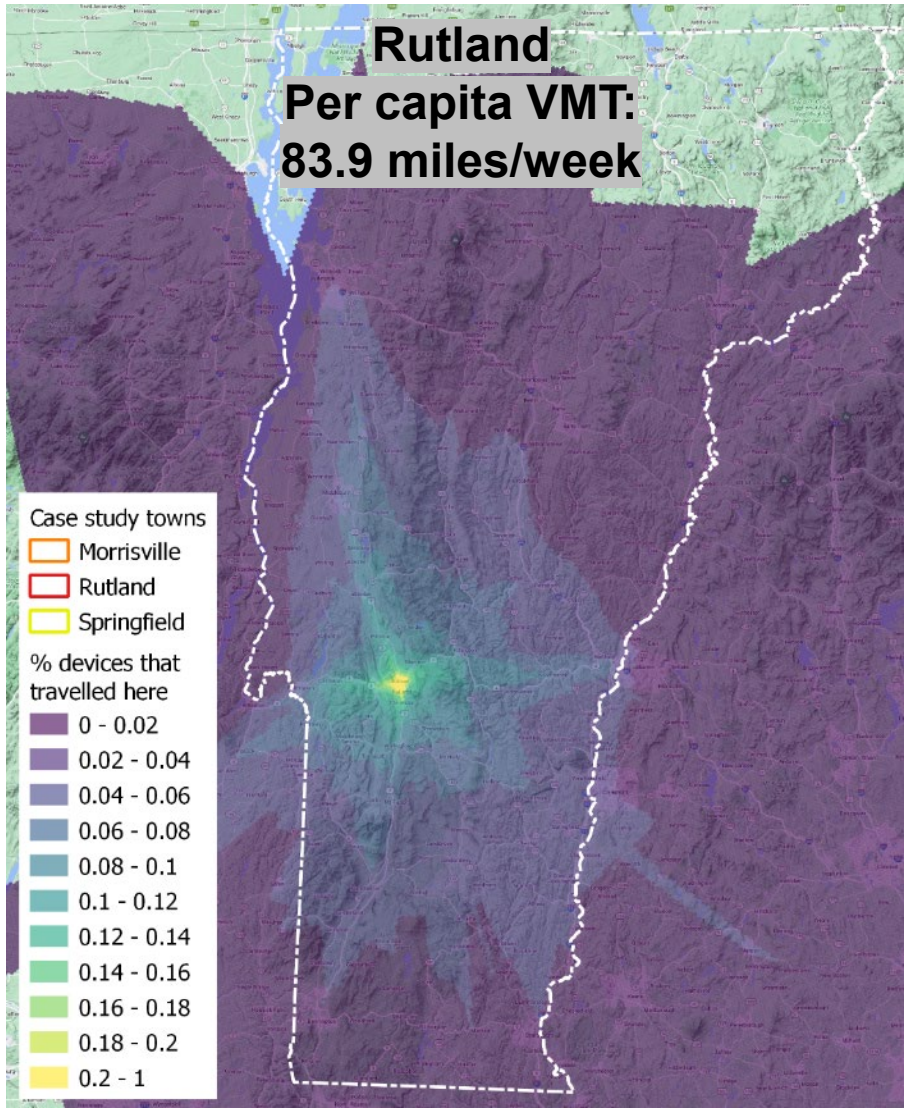
- Parcel data, land use, transportation system, census, etc.

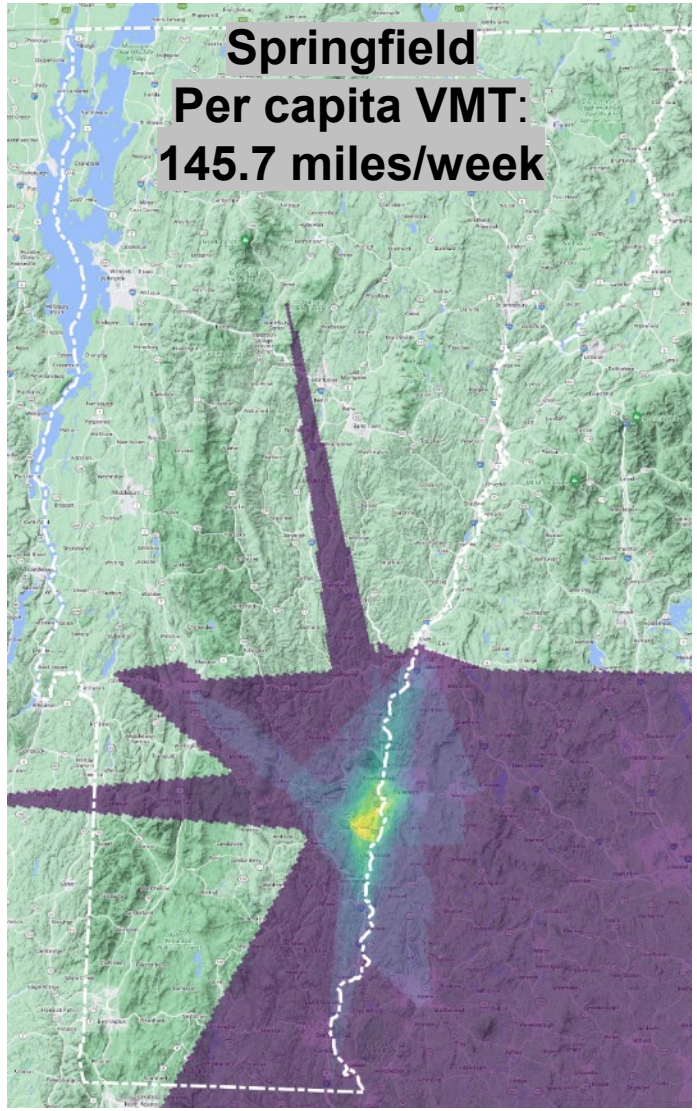
Passively collected location data

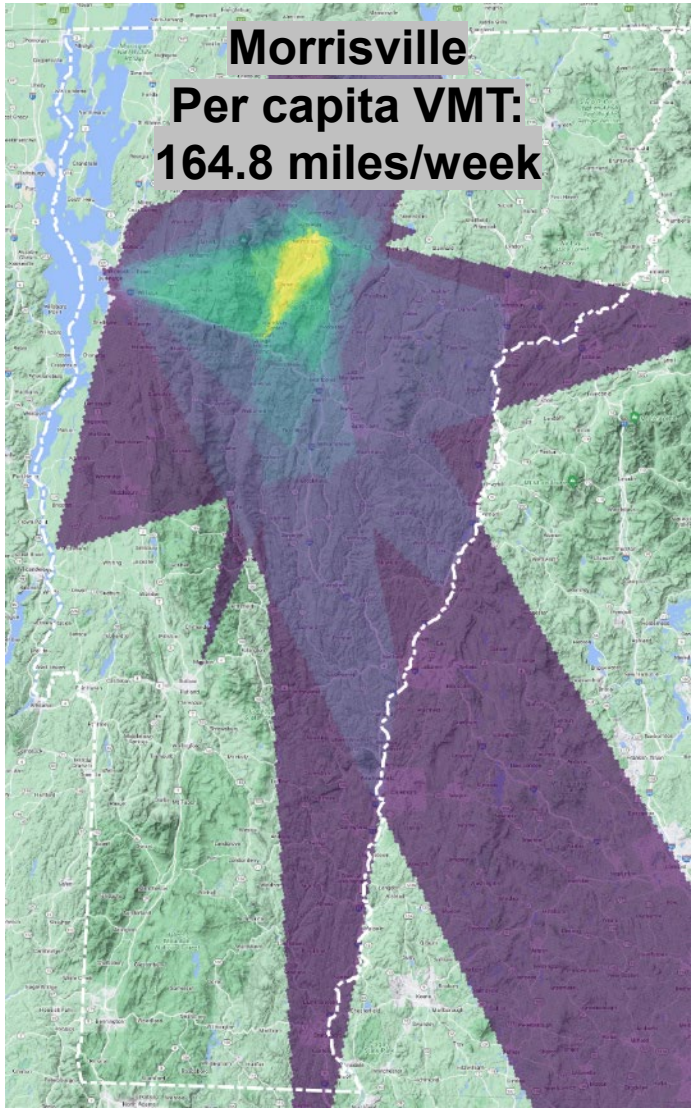
How do folks move?

- Smartphones + apps reporting user location at regular intervals
- Processed data informs baseline VMT estimate

Device Activity Spaces Over a Week







RAS as an FDR Mechanical Stabilizer

- Recycled Asphalt Shingles (RAS) is a recycled material; Agency eager to use Recycled Materials (RMWG)
- Full Depth Reclamation (FDR) is needed when a roadway and its base is in such poor condition, they both need to be rebuilt (roadway reconstruction)
- Research project
  - What is the performance of using RAS to enhance the roadway base?
  - Are there environmental impacts from using RAS in the enclosed subbase?

HIVE II and HIVE III projects

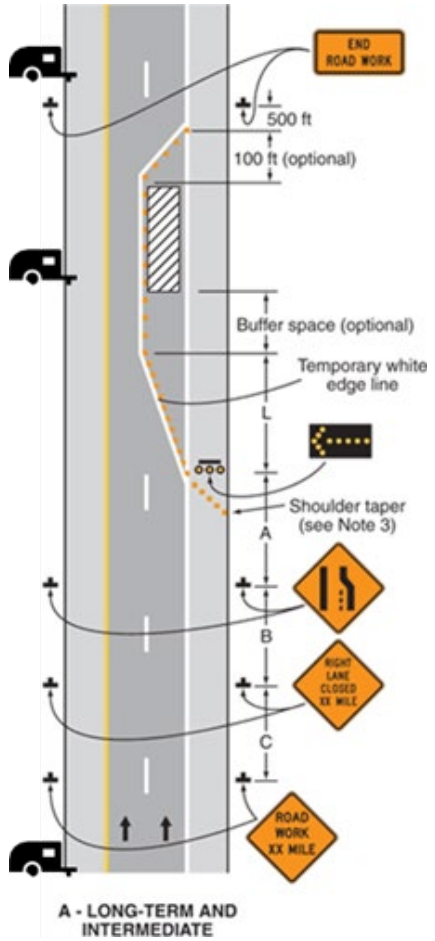
- 50,000 culverts in Vermont
- Hydraulic Inspection Vehicle Explorer (HIVE) started in MnDOT
- VT asset management staff worked with District staff on improvements
- HIVE II—UVM project –robot car to robot tank
  - RAC HVR Video
- HIVE III project starting now
  - Crawler can maneuver around turns—from above ground drop points
  - Several HIVE IIIs to use by District Maintenance staff

RRFB Evaluation

- Rectangular Rapid Flashing Beacon (RRFB)—signals used at mid-block crosswalks
- Selected as a 2023 High Value Research project (one of 16 projects selected nationally)
- Considered six pairs of signals across Vermont
  - Newly installed RRFB compared to a similar intersection in same town
- Results include:
  - RRFBs did increase the number of vehicles stopping at crosswalks
  - RRFBs functioned similarly in town centers and rural transition zones

Work Zone Travel Time Delay

- Another project started in 2023
- How close are work zones to the specified 10 minutes of delay per operation and 15 minutes total per project?
- Collecting work zone delay field data either before construction and during construction or during construction and after construction
- Considering four different types/sizes of roadways/projects
- Collecting field data and utilizing new “big data” traffic data purchased by AOT



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Questions? Comments?

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