

UVM Transportation Research Center Roadway Finance, Traffic Safety and other VT Research Updates

Vermont House Transportation Committee Meeting

May 1, 2024

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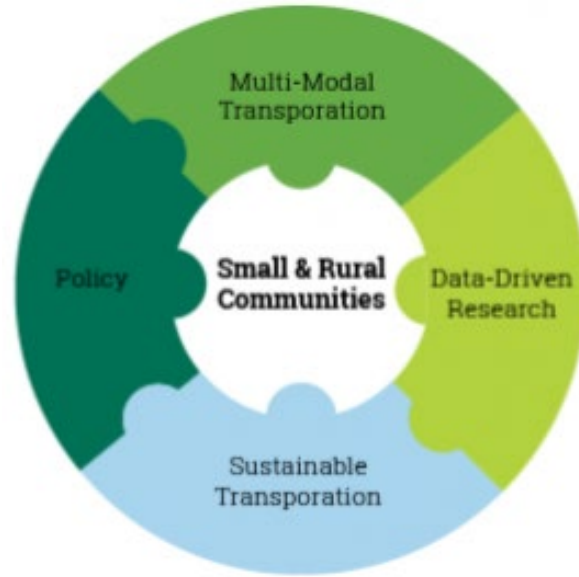


TRC Overview

- Established in 2006 with \$16 million grant from US DOT
- Located in the College of Engineering and Mathematical Sciences
 - 40+ year research partnership with VTrans
- 8 core faculty and research staff + additional part time and affiliated researchers from across campus
- Provides research opportunities for undergraduate, MS and PhD students
- Home to several affiliated transportation research and outreach programs
 - National Center for Sustainable Transportation (<https://ncst.ucdavis.edu/>)
 - Transportation Infrastructure Durability Center (<https://www.tidc-utc.org/>)
 - Vermont Clean Cities Coalition (<https://vtccc.w3.uvm.edu/>)
 - Northeast Transportation Workforce Center (<http://netwc.net/>)



Diverse Research Portfolio Centered on Sustainability in Small and Rural Communities



Current Research Areas & Expertise:

- Alternative and Multi-Modal Transportation
- Energy, Emissions & Environmental Impact Modeling
- Equity and Travel Behavior Analysis
- Safety, Infrastructure and Maintenance
- Sustainable Communities and Land Use
- Full list of projects with details:

<https://www.uvm.edu/cems/trc/current-projects>

External Research Sponsors & Partners



How You Can Address Mileage Fee Concerns: Evidence from Three Studies



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A USDOT University Transportation Center

Research Team



Clare Nelson

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M.S. Student, Civil & Environmental Engineering



Dr. Greg Rowangould

Director, UVM Transportation Research Center
Associate Professor, Civil & Environmental Engineering

The Transportation Funding Problem

- Declining gasoline consumption
 - Electric vehicles, increasing fuel economy, and lower VMT.
- Declining purchasing power
 - Inflation (increasing costs of materials, labor, etc.)



Background

Study 1

Study 2 & 3

Takeaways



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What do we do?

- Raise the gas tax
- Indexing the gas tax to inflation
- Raise vehicle registration and inspection fees
- Shift funding from other streams (income tax, local options taxes, etc.)
- Distance-based charges (i.e., mileage fees, road user charges, VMT taxes... many names)
- Tolling
- Congestion charging
- Cut down on inefficiencies



Background

Study 1

Study 2 & 3

Takeaways

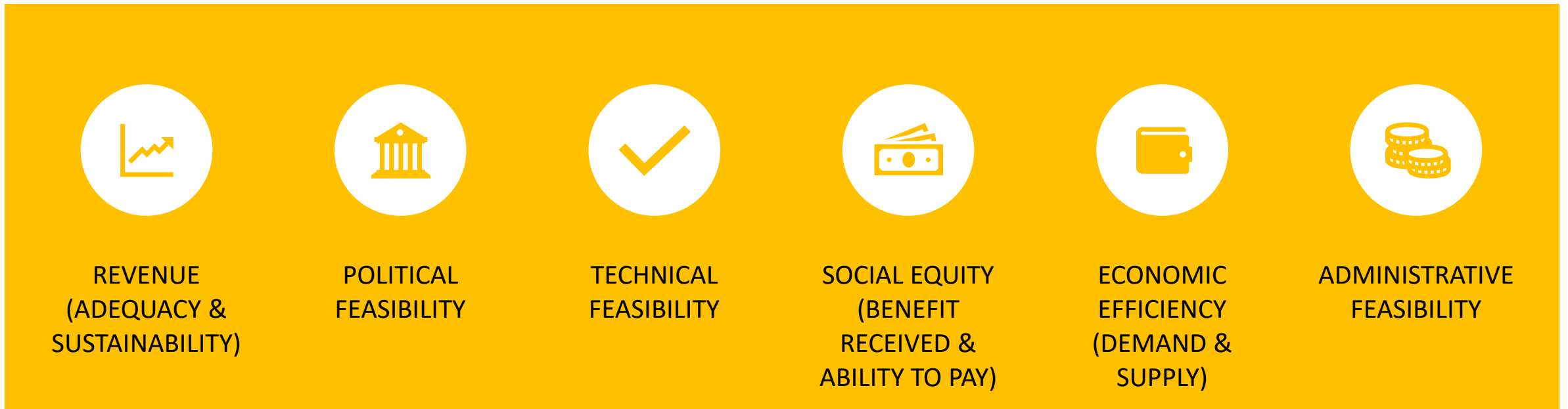


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Criteria for Transportation Funding Sources



EVALUATED IN OUR WORK

NEEDS MORE EVALUATION

Background

Study 1

Study 2 & 3

Takeaways



What do we do?

- Raise the gas tax
- Raise registration and inspection fees
- Shift funding from other streams (income tax, local options taxes, etc.)
- Distance-based charges (i.e., mileage fees, road user charges, VMT taxes... many names)
- Tolling
- Congestion charging
- Cut down on inefficiencies



Background

Study 1

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Takeaways



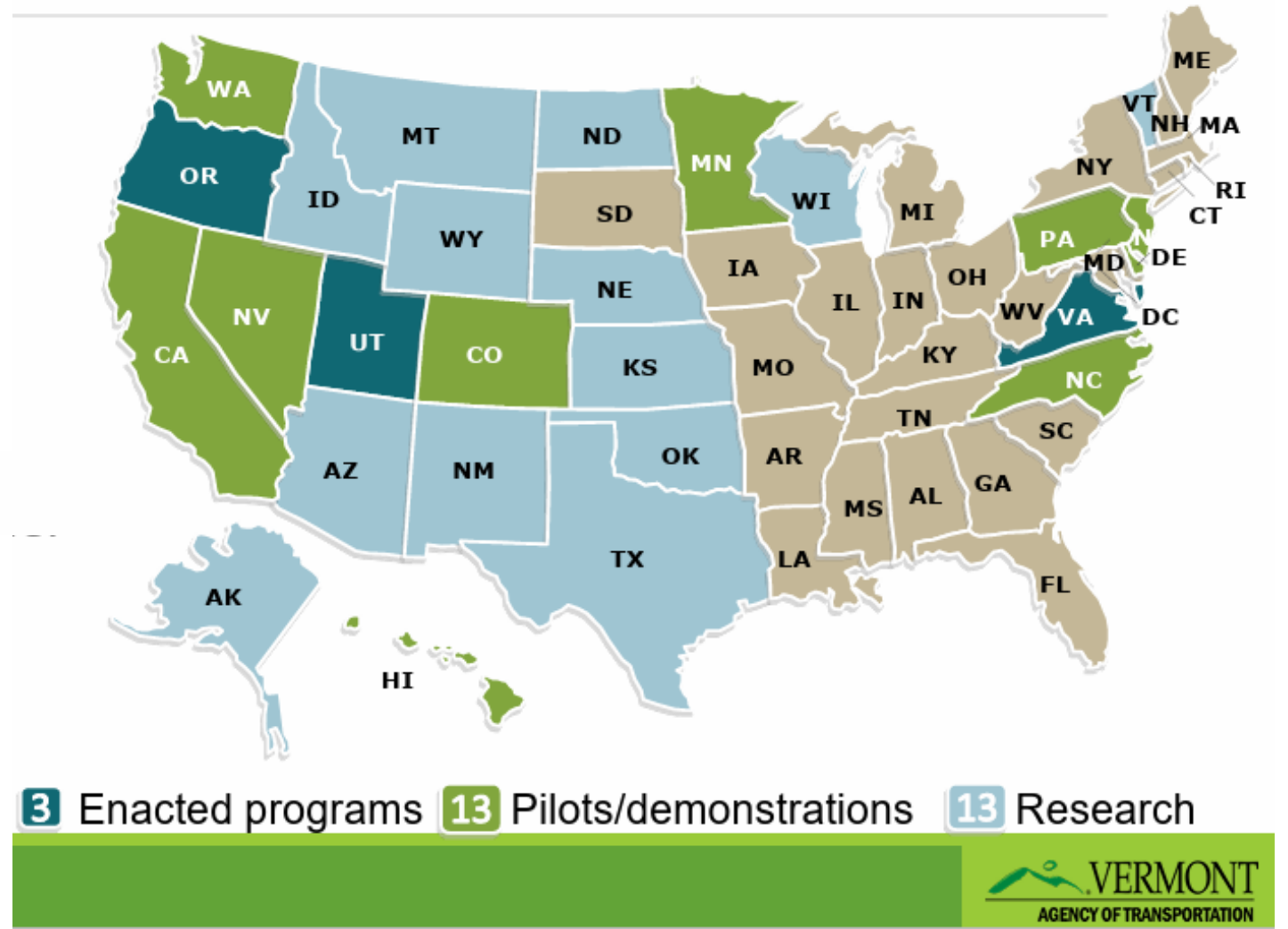
Mileage Fees

Pros

- User fee
- Long term financial sustainability
- Feasible (odometer readings, in-vehicle navigation units, etc.)

Cons

- Low public support
- Concerns about privacy, fairness, and cost
- Uncertain administrative costs



Background

Study 1

Study 2 & 3

Takeaways

Study #1

Data: Vermont Vehicle Registration and Inspection Data

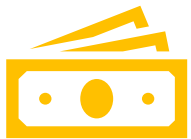
Paper Status: Published



REVENUE



TECHNICAL FEASIBILITY



SOCIAL EQUITY



Background

Study 1

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Takeaways



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Nelson, C., Rowangould, G. (2023). [A Data Driven Analysis of Rural Equity and Cost Concerns for Mileage-Based User Fees in Vermont](#), Transportation Research Record.

Mileage Fee Equity

- 1 What is the appropriate mileage fee rate to replace the current revenue stream from the Vermont state gas tax?
- 2 How would a revenue-neutral mileage fee impact Vermont households?
- 3 Do financial impacts differ by household income and community type (rural, suburban, urban)?

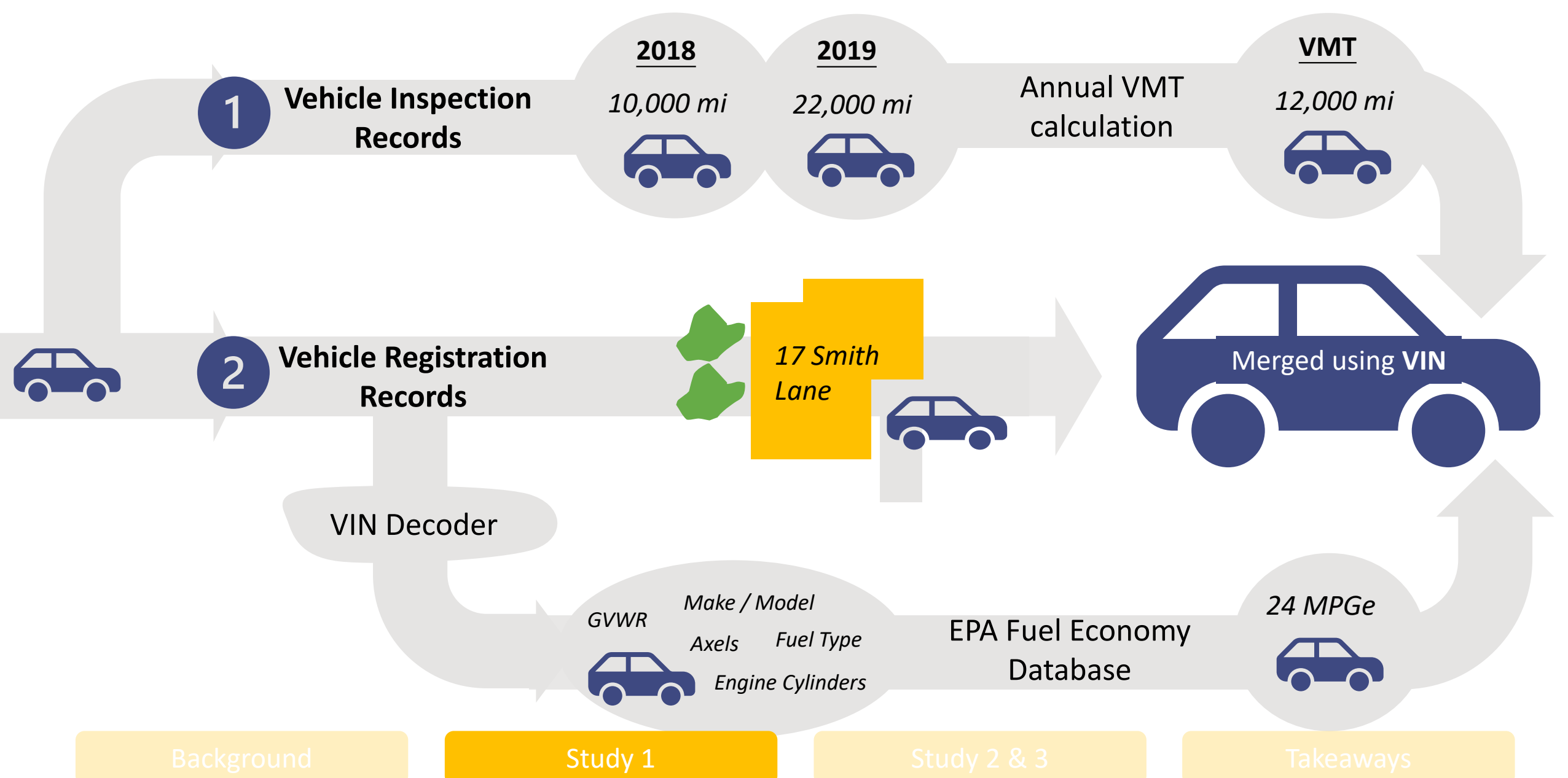
Background

Study 1

Study 2 & 3

Takeaways







For this vehicle, we now know...

- VMT in 2018
- Address
- Fuel economy

We can **aggregate by address** to look at household characteristics

Background

Study 1

Study 2 & 3

Takeaways





For each address in Vermont, we know...

- All the vehicles registered there
- Each vehicle's mileage for any year

We **excluded commercial and heavy-duty vehicles**, allowing us to focus on personal vehicles.

Background

Study 1

Study 2 & 3

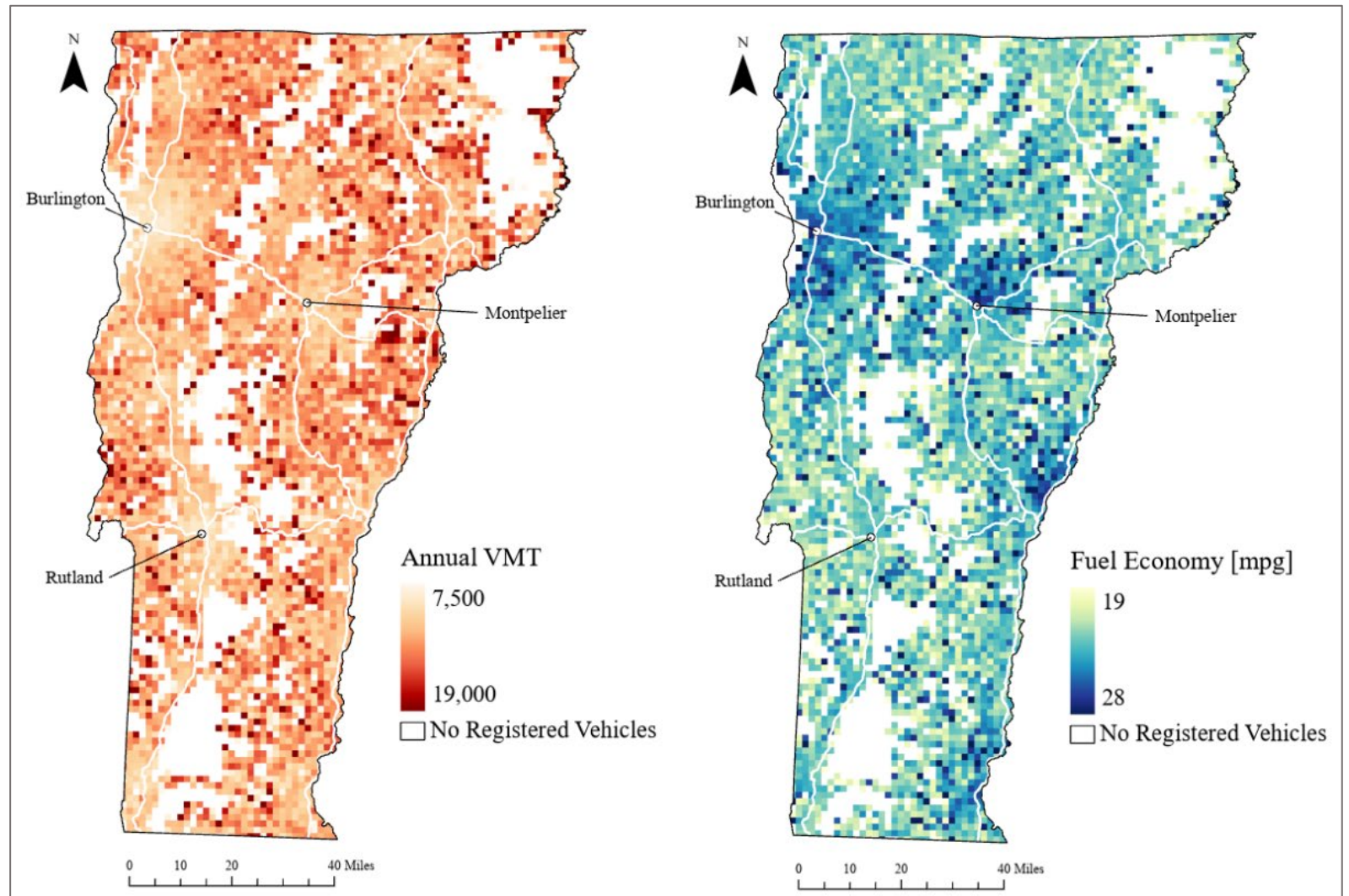
Takeaways



Final Dataset

310,661 vehicles

189,251 households



Vermont vehicle miles travelled (VMT) and fuel economy. Mean values per 2 km² grid cell

Background

Study 1

Study 2 & 3

Takeaways





Calculated costs for each vehicle and each household

$$\text{Annual Gas Tax Cost} = \left(\frac{\$}{\text{gal fuel}} \right) \left(\frac{\text{gal fuel}}{\text{mile}} \right) \left(\frac{\text{miles}}{\text{year}} \right)$$

$$\text{Annual Mileage Fee Cost} = \left(\frac{\$}{\text{mile}} \right) \left(\frac{\text{miles}}{\text{year}} \right)$$

$$\text{Household Costs} = \sum_{i=1}^{\text{All VT Addresses}} (\text{Vehicle Costs})_i$$

Background

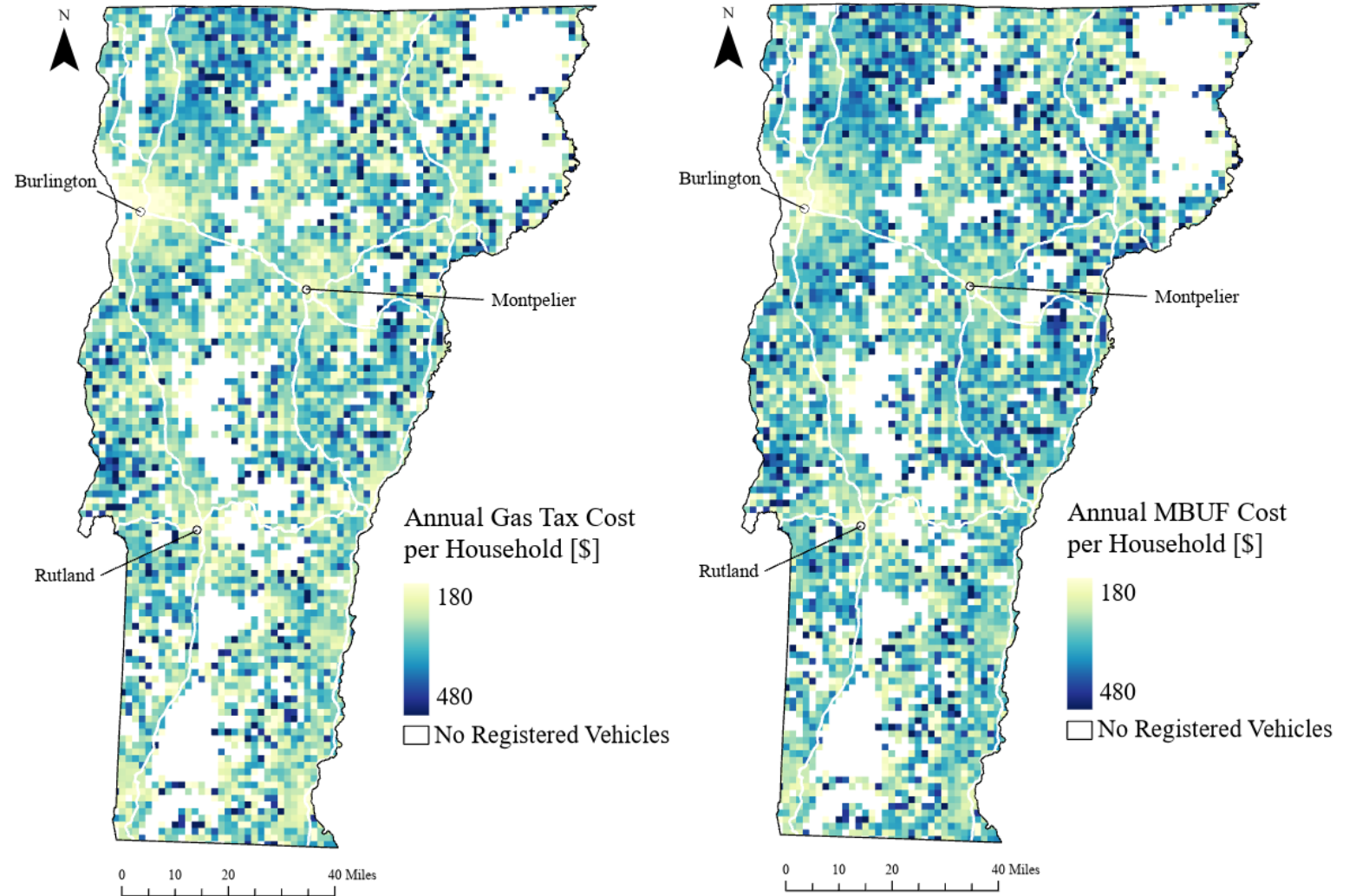
Study 1

Study 2 & 3

Takeaways

Costs Across Communities

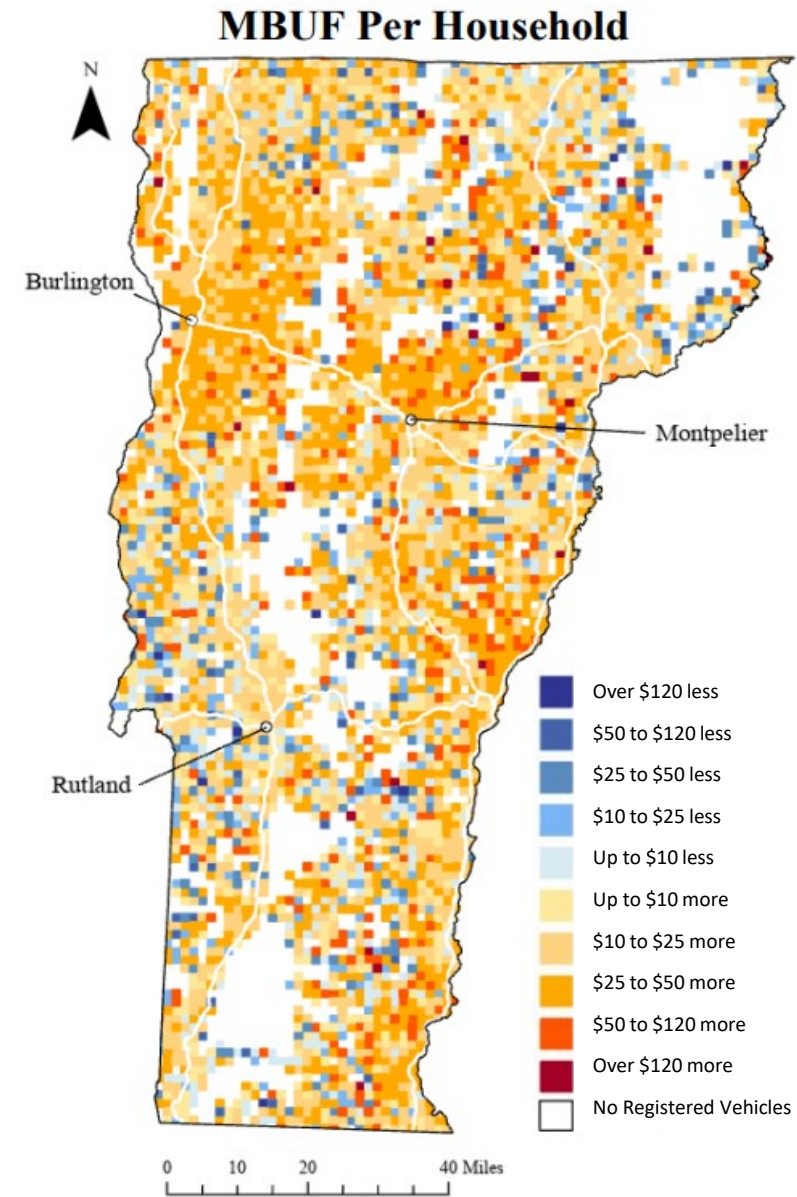
- Rural households *generally* pay more in transportation taxes than urban households
- Even within similar types of communities, costs vary widely



Average value per 2 km grid cell shown for privacy reasons.

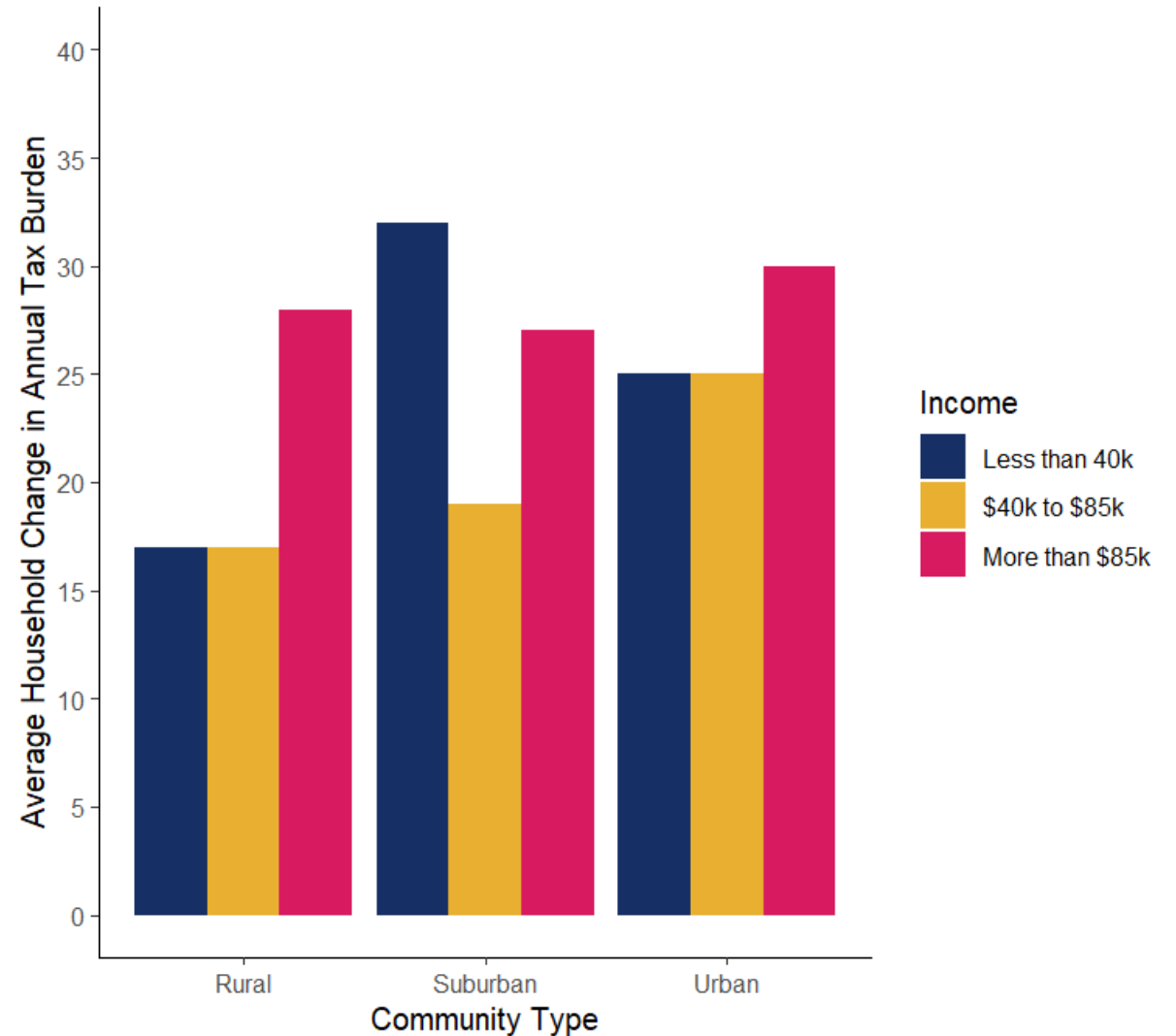
Costs Across Communities

- **Most households will see cost differences between \$5 less and \$50 more, with \$23 more on average**
- Even though the 1.5 cent per mile fee is revenue-neutral, *households* pay more on average because of a decrease in contributions from *larger commercial vehicles* that tend to have lower fuel economies.



Changes in Costs

- Low-income and rural households, on average, see lower cost increases than urban and higher-income households



Based on 2016 USDA RUCA codes (Rural = 10; Suburban = 2,3,5,6,8,9; Urban = 1,4,7).

Study #1: Key Findings

- Revenue-neutral mileage fee for Vermont \approx 1.5 cents per mile
- Most households pays more because trucks pay less and no contribution from out of state drivers
- Mileage fees will have *minimal financial impacts* on Vermont households
- Mileage fees are somewhat less regressive than the gas tax
- Mileage fees will result in lower cost increases for rural and low-income households relative to urban and high-income households



Background

Study 1

Study 2 & 3

Takeaways



Study #2

Data: Survey (VT, NH, ME)

Paper Status: Under Review

Study #3

Data: Survey (National)

Paper Status: Under Review



PUBLIC AND POLITICAL SUPPORT

Background

Study 1

Study 2 & 3

Takeaways



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Nelson, C., & Rowangould, G. (2024). Education as a Key Factor in Policy Support: An Evaluation of National Mileage Fee Support as it Varies with Information and Attitudes. UC Davis: National Center for Sustainable Transportation. <http://dx.doi.org/10.7922/G20G3HH6> Retrieved from <https://escholarship.org/uc/item/4ft4h3xt>

Mileage Fee Support

- 1 What is the current level of support for a mileage fee to replace the gas tax?
- 2 How does support vary with demographics, geography, and personal attitudes?
- 3 To what extent is policy support guided by information (or misinformation)? To what extent is support shifted by providing education?

Background

Study 1

Study 2 & 3

Takeaways





Do you support replacing the gas tax with a mileage fee collected using annual odometer readings?

No

Yes



730 Responses



Do you support replacing the gas tax with a mileage fee collected using a plug-in device *without* GPS?

No

Yes



691 Responses



Do you support replacing the gas tax with a mileage fee collected using a plug-in device with GPS?

No

Yes



693 Responses

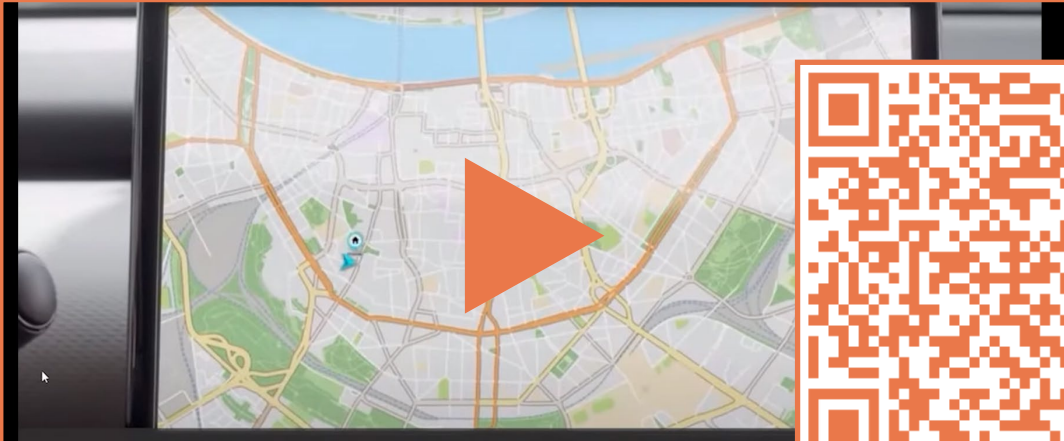
Vote 1





The Gas Tax: Drivers pay an additional fee for every gallon of gas they purchase

YouTube



Mileage fee: Drivers pay a fee for every mile they travel

YouTube





Do you support replacing the gas tax with a mileage fee collected using annual odometer readings?

No

Yes



730 Responses



Do you support replacing the gas tax with a mileage fee collected using a plug-in device *without* GPS?

No

Yes



691 Responses



Do you support replacing the gas tax with a mileage fee collected using a plug-in device with GPS?

No

Yes



693 Responses

Vote 1

Policy
Education

Vote 2



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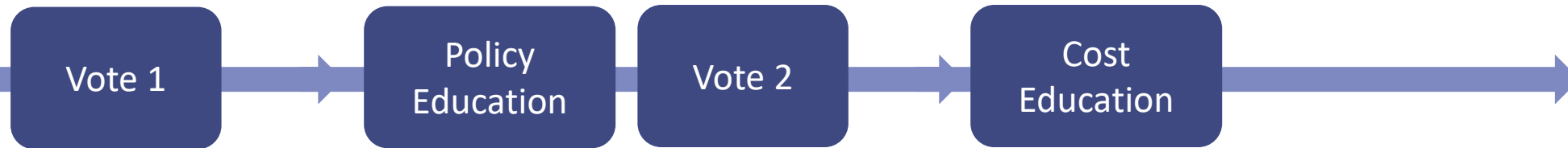
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Nelson, C., & Rowangould, G. (2024). Education as a Key Factor in Policy Support: An Evaluation of National Mileage Fee Support as it Varies with Information and Attitudes. UC Davis: National Center for Sustainable Transportation. <http://dx.doi.org/10.7922/G20G3HH6> Retrieved from <https://escholarship.org/uc/item/4ft4h3xt>

Based on your estimated vehicle fuel economy and mileage, we calculated your annual costs for a \$0.31 per gallon fuel tax and a 1.5 cents per mile fee.

Fuel Tax Cost: \$245 per year

Mileage Fee Cost: \$218 per year





Do you support replacing the gas tax with a mileage fee collected using annual odometer readings?

No

Yes



730 Responses



Do you support replacing the gas tax with a mileage fee collected using a plug-in device *without* GPS?

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No

Yes



693 Responses

Vote 1

Policy
Education

Vote 2

Cost
Education

Vote 3



Reflect on Voting Attitudes and Beliefs Demographics

- Age
- Gender
- Household income
- Race
- Political affiliations
- And more...

State your level of agreement...

Taxes are an irreplaceable form of funding for state and federal programs.

Sometimes the government needs to pass laws to help protect vulnerable populations.

I trust my state government.

I would prefer less government involvement in my life.

Funding for state programs is mismanaged.

Environmental threats such as global warming and deforestation have been exaggerated.

I frequently think about how my choices will impact my community.

Vehicle emissions in my state have a large impact on air quality.

I frequently think about whether my travel choices have an impact on the environment.

Driving a car is good for society.

My lifestyle is dependent on having a car.

Owning a vehicle provides me with freedom.

Technology does more harm than good.

I'm tracked everywhere I go through my phone.

Technology has made life too complicated.

Vote 1

Policy
Education

Vote 2

Cost
Education

Vote 3

Reflection



Public Knowledge about the Gas Tax

- Respondents lack information on or are misinformed about their state gas tax
- It's difficult to gather accurate public opinion data when people know very little about the questions they're being asked...
 - Misinformed respondents are more likely to answer randomly, rather than consistently

54% Did not know the gas tax was an excise tax in most states

81% Did not know when their state gas tax was last increased

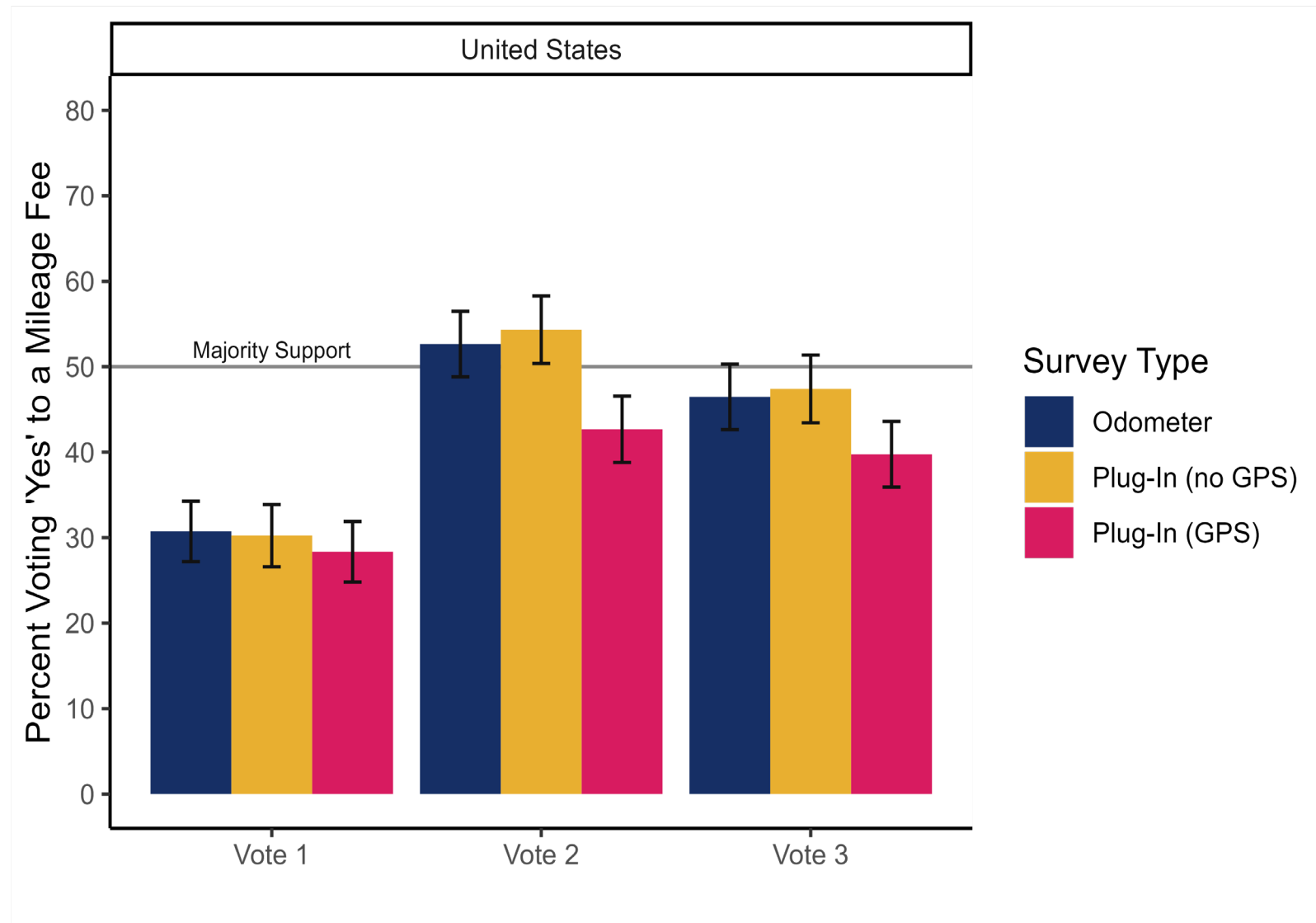
50% Thought their state gas tax was increased in the last year

NOT TRUE FOR ALMOST ALL STATES...

57% Did not know what the gas tax funds

Changes in Mileage Fee Support After Education

- Mileage fee support increases after education
- Larger increases in support for mileage fees collected using odometer readings or non-GPS plug-in devices



Background

Study 1

Study 2 & 3

Takeaways



Changes in Mileage Fee Support After Education

- All respondents were *more likely* to support a mileage fee after education
- Effects were stronger with non-GPS options

FIXED EFFECTS MODEL

	After policy education	After policy & cost education
Odometer Readings	10x (p << 0.01)	5x (p << 0.01)
Plug-in (no GPS)	13x (p << 0.01)	6x (p << 0.01)
Plug-in (GPS)	6x (p << 0.01)	4x (p << 0.01)

Background

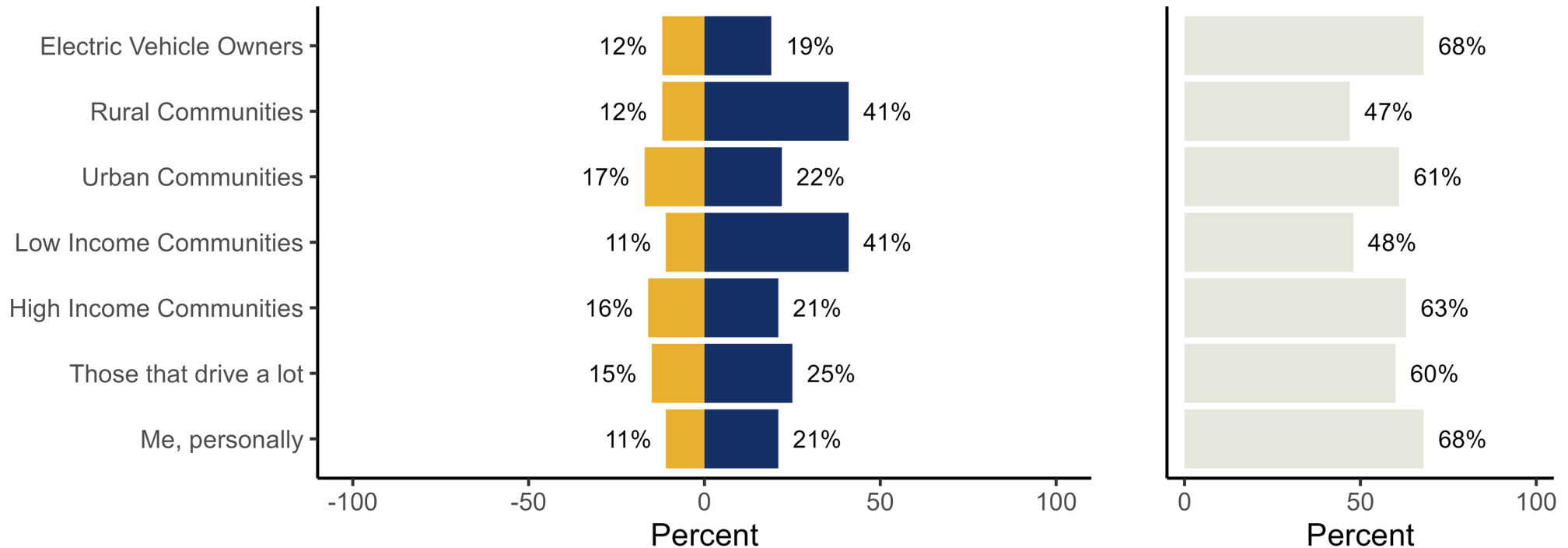
Study 1

Study 2 & 3

Takeaways



Perceived Fairness of Mileage Fees



After education, felt a mileage fee was **less fair** to the community
 After education, felt a mileage fee was **more fair** to the community
 No change in perceived fairness

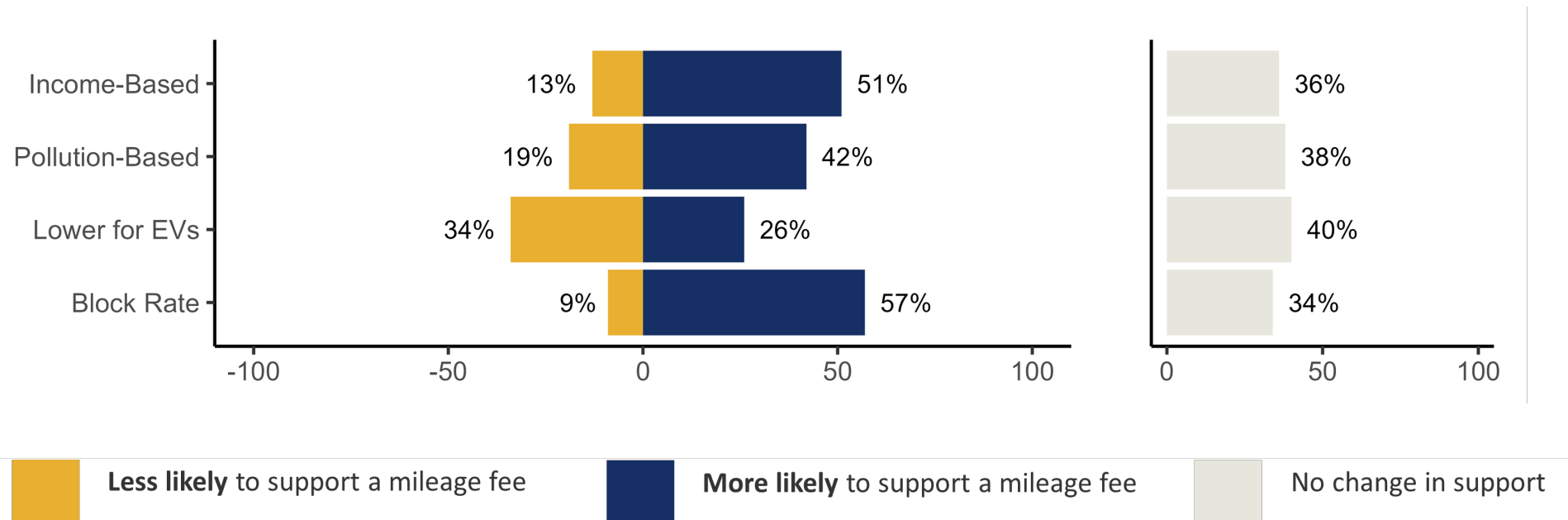
Background

Study 1

Study 2 & 3

Takeaways

Mileage Rate Structure Preferences



Background

Study 1

Study 2 & 3

Takeaways

Key Findings

- Most people lack accurate information about gas taxes and mileage fees. This knowledge gap affects support for mileage fees.
- Preferences for transportation funding options are not fixed, but rather a reflection of a person's current level of policy knowledge and engagement with the policy.
- While simple educational experiences increase support for mileage fees by addressing misunderstanding, intrinsic values (attitudes) are harder to change.
- It is unclear how simple educational experiences shape long-term values and decision-making. This could be explored in the future.

Background

Study 1

Study 2 & 3

Takeaways



Key Takeaways

Mileage fees would be more equitable than the gas tax.

- **Evidence from our study.** Rural and low-income households will see smaller cost increases relative to urban and higher-income households, and mileage fees appear to be slightly less regressive than the gas tax.
- **Implication.** Misinformation or lack of information about mileage fees is common, despite the number of studies that note inequity is not a concern with mileage fees.

Background

Study 1

Study 2 & 3

Takeaways



Key Takeaways

Separate mileage fee rates are needed for personal and commercial vehicles.

- **Evidence from our study.** All car-owning households will see an increase in costs under a revenue-neutral mileage fee with a single rate.
- **Implication.** States implementing flat mileage rates for all vehicles, including commercial vehicles, are disproportionately placing the tax burden onto households. More research is needed to understand how commercial vehicles fit into mileage fee programs.

Background

Study 1

Study 2 & 3

Takeaways



Key Takeaways

For states looking to implement mileage fees, addressing public concerns is key.

- **Evidence from our study.** National support for a mileage fee is low, at approximately 32%. After education, support increased by 14%.
- **Implication.** Misinformation or lack of information can be addressed through simple educational experiences. Based on the number of respondents who changed their support for a mileage fee, it is clear mileage fee misinformation is widespread and affecting public support for transportation tax reform.

Background

Study 1

Study 2 & 3

Takeaways



Key Takeaways

For states looking to implement mileage fees, cost information is key.

- **Evidence from our study.** Most respondents said that learning about costs was the most important factor in their voting. After receiving personalized cost information, respondents were nearly 10 times as likely to support a mileage fee regardless of whether they learned they would likely save or lose money.
- **Implication.** Public perceptions of transportation tax burdens are likely inflated, causing additional opposition. Methods for cost education: driver profiles, online calculators, or mailing campaigns (like Hawaii).

Background

Study 1

Study 2 & 3

Takeaways



Key Takeaways

The public has preferences for mileage fee collection options and rate structures.

- **Evidence from our study.** Half the respondents preferred certain mileage fee rate structure and collection option. Odometer readings are particularly popular, as are block rate and income-based structures. Lower rates for EVs were less popular.
- **Implication.** The public likely makes assumptions that they may be tracked to collect mileage data which affects their support. By addressing these underlying assumptions through transparent policy communication or through allowing user choice, support may be changed.

Background

Study 1

Study 2 & 3

Takeaways



Key Takeaways

Uninformed survey respondents are not reliable sources of public opinion data.

- **Evidence from our study.** Most respondents did not know how much the gas tax is, what it pays for, or when it was last increased. After learning, many respondents shifted their policy opinion.
- **Implication.** Uninformed survey respondents are more likely to answer questions randomly, which is not a true reflection of how they will respond to an implemented policy. Current public opinion surveys would likely see dramatic shifts in preferences by using an informed respondent approach.

Background

Study 1

Study 2 & 3

Takeaways





Rectangular rapid flashing beacons (RRFB)



LED-embedded sign (LES)

The effectiveness of pedestrian-activated crossing treatments in rural and small communities

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Why is this study important

Rural specific concerns

Pedestrian **risks are higher** in rural areas

US rural areas have:

- 8% of pedestrian travel (miles and trips)
- 19% of pedestrian deaths

Little is known about **transition zones**:

- Coming from a rural area into town
- Drivers less often expect pedestrians.

- Limited pedestrian infrastructure
- Limited Lighting
- High Speed Limits
- Limited Public Transportation
- Lack of Crosswalks



Why these? (Unsignalized and pedestrian-activated)



- **Cost:** RRFBs and LESs are less expensive to install.
- **Maintenance:** require less frequent and less costly maintenance than PHBs and HAWK.
- **Simplicity**
- **Flexibility:** RRFBs and LED signs can be installed in more locations.

Research question

Do RRFBs and LED-embedded signs improve pedestrian safety in small and rural communities?



Conceptual framework

**RRFB or LED-
embedded sign
treatment**

Control variables

Timing of
interaction

Pedestrian
characteristics

Vehicle
circumstances

Location
characteristics

Measured outcomes

Compliance related

Yield rate

Pedestrian waiting time

Pedestrian crossing out of
crosswalk

Safety related

Risky vehicle stopping position

Vehicles stopping suddenly

Pedestrian in roadway before
drivers yield

Study design

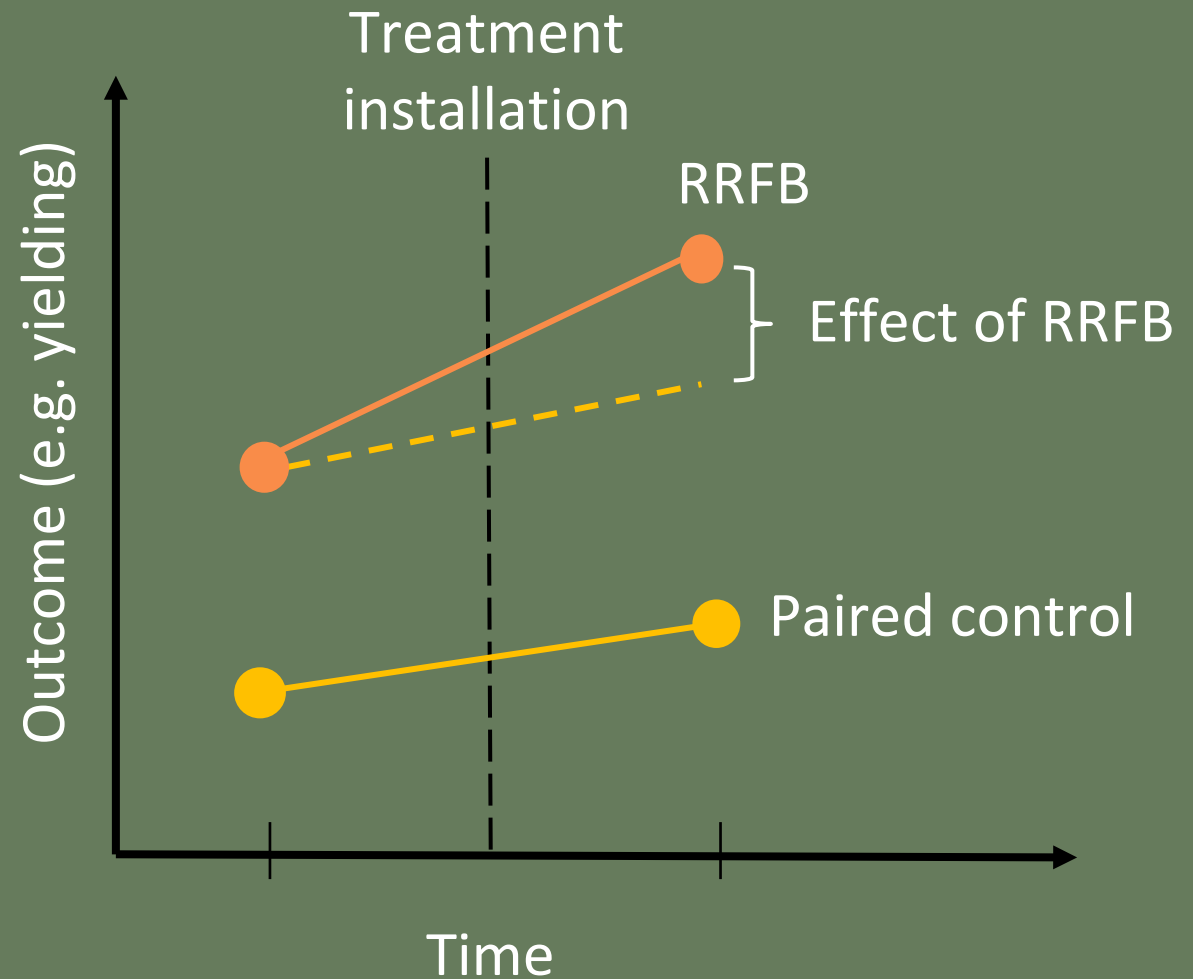
(Before and after controlled study design)

Data is collected both before and after the intervention

Paired control sites are used to account for any external factors

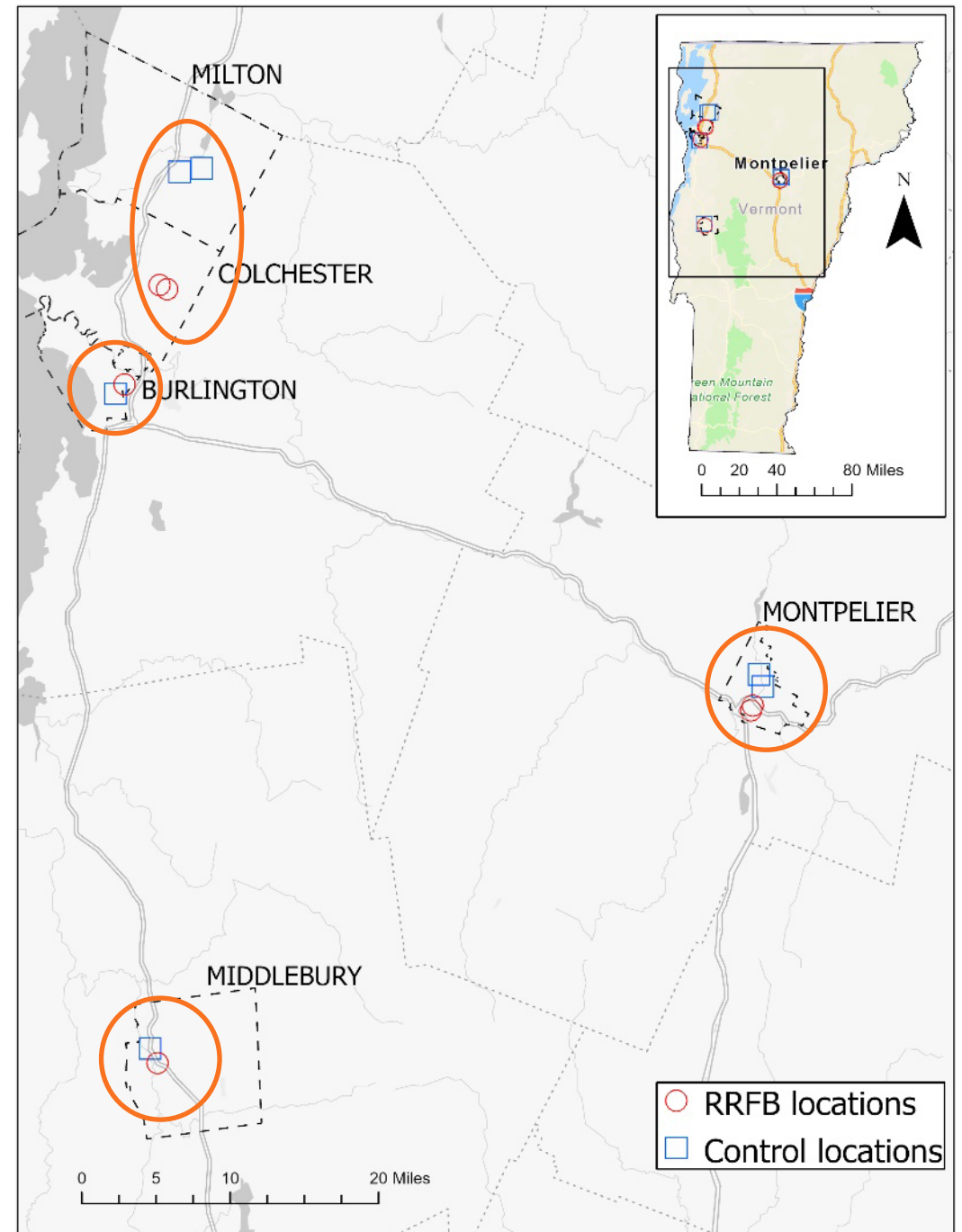
Causal relationship between the RRFB installation and any changes observed in the outcomes

Before/After with paired control

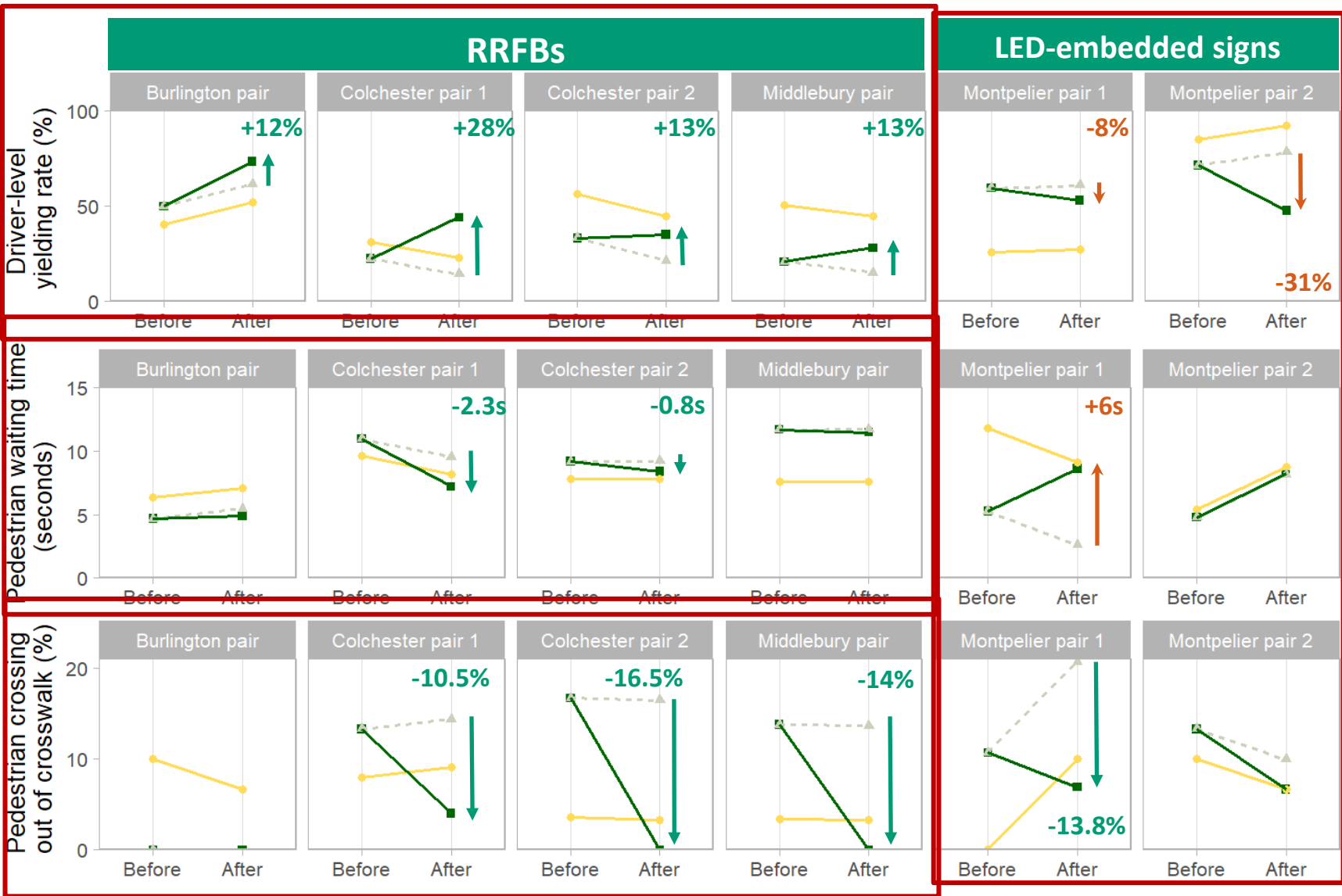


Study design

- Chose 6 locations with planned RRFB installations



DD method: Compliance-related outcomes



● Control
 ▲ Counterfactual path
 ■ Treatment
 ↑↓ Improved
 ↑↓ Worsened

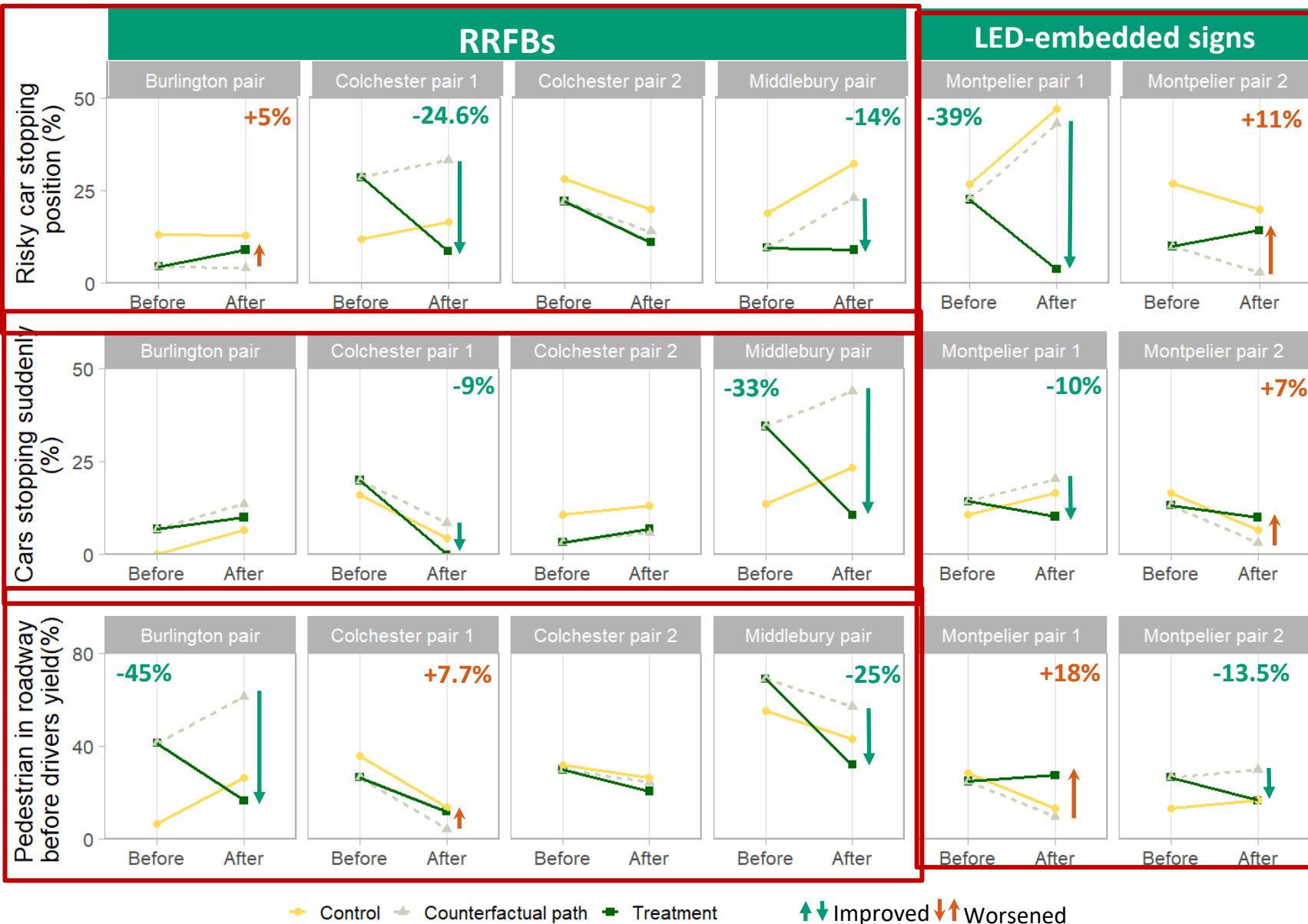
RRFB locations

- ✓ 12 ~ 28 % improvement in absolute yielding rate compared to before
- ✓ 0.5s to 2.3s improvement in absolute pedestrian waiting time
- ✓ Substantial improvement in out of crosswalk crossing

LES locations

- ✗ Yielding worsens
- ✓ Substantial improvement in out of crosswalk crossing

DID method: safety-related outcomes



RRFB locations

- ? Mixed results in risky car stopping position
- ✓ Up to 33% Improvement in cars stopping suddenly
- ? Mixed results in pedestrians crossing before drivers yield

LES locations

- ? Mixed results in all three categories

RRFBs

**Effective in rural areas
to improve compliance**

**Effectiveness is similar
in transition areas and
central areas**

LESs

No significant impact

Acknowledgments

This study was funded by the Vermont Agency of Transportation (VTrans). I like to thank Jon Kaplan, and the VTrans Technical Advisory Committee. And all who helped me in this project.

More Information on Mileage Fee Studies

- Nelson, C., and Rowangould, G. (2024). *Education as a Key Factor in Policy Support: An Evaluation of National Mileage Fee Support as it Varies with Information and Attitudes*. National Center for Sustainable Transportation. [Report] <https://doi.org/10.7922/G20G3HH6>
- Nelson, C., and Rowangould, G. (2024). *Mileage Fees: An Equitable and Financially Viable Alternative to the Gas Tax*. National Center for Sustainable Transportation. [Policy Brief] <https://doi.org/10.7922/G2TT4PB9>
- Nelson, C., and Rowangould, G. (2023). *Data-Driven Analysis of Rural Equity and Cost Concerns for Mileage-Based User Fees in Vermont*. Transportation Research Record. [Journal Article] <https://doi.org/10.1177/03611981231206167>

More Information on Rural Traffic Safety

- Pezeshknejad, P., Rowangould, D., (2024). *Evaluating safety and compliance of pedestrian crossings in rural contexts: A before and after study of RRFBs and LED-embedded signs*. Accident Analysis & Prevention 198, 107462. <https://doi.org/10.1016/j.aap.2024.107462>
- Rowangould, D., J. Sullivan, and P. Pezeshknejad. (2023) Effectiveness of Rectangular Rapid Flashing Beacons (RRFBs) in Small and Rural Communities. Prepared by the University of Vermont Transportation Research Center for the Vermont Agency of Transportation. [Report] <https://scholarworks.uvm.edu/trc/285/>
- Pezeshknejad, P., and Rowangould, D., 2024. Policy Brief: Evaluation of the Safety of Pedestrian Crossing Treatments in Small and Rural Communities. University of Vermont Transportation Research Center. [Policy Brief] <https://scholarworks.uvm.edu/trc/291/>
- Sullivan, J., D. Rowangould, D. Dytioco, and E. Quallen (2023). Traffic Safety Toolbox: Speeding Countermeasures Toolbox for Vermont. Prepared by the University of Vermont Transportation Research Center for the Vermont Agency of Transportation. [Report & Toolbox] <https://scholarworks.uvm.edu/trc/295/>

