

2024 CATMA Transportation Summit

UVM Transportation Research Center Student Research Posters

Silver Maple Ballroom (all day)

The poster session will profile student-led research from the UVM Transportation Research Center (TRC). Posters highlight findings from the TRC's policy-oriented research on building sustainable and equitable transportation systems in the Vermont context.

1. Charging on the Margins: Electric Vehicle Home Charging Patterns in Northern Vermont

Authors: Amine Barzegar and Dana Rowangould

As electric vehicle (EV) adoption expands into rural areas across Vermont, understanding rural charging behavior is essential to effectively plan for local grid capacity and reliability. This study examines residential EV charging patterns in a largely rural region of northern Vermont using over 23,000 home charging session records. We analyze when, how often, and how much these EV drivers charge at home, as well as the vehicle attributes that shape this behavior. We observe variation in charging patterns seasonally, for EV type (plug-in hybrid electric versus battery electric), and for vehicles with longer versus shorter electric range. When controlling for other factors, we confirm that EV type and electric range are the strongest predictors of charging outcomes while factors such as body style or annual EV energy demand play a smaller role. These results provide insights for electric utilities seeking to plan for electricity demand as EV adoption continues to grow. By focusing on Vermont's rural context, this research supports both utility planning and transportation policy for a sustainable EV transition in the state.

2. Attributes and Use of Electric Vehicles in Multivehicle Households in Vermont

Authors: Binaya Rajbanshi and Dana Rowangould

Battery electric vehicles (BEV) have potential to displace fossil-fuel based transportation. However, their limited driving range may hinder their use, particularly in rural contexts where people typically travel farther to reach destinations. This study evaluates the driving patterns of over 1,200 multivehicle Vermont households with both a BEV and an internal combustion engine vehicle (ICEV.) We evaluate the relationship between BEV usage and vehicle attributes in rural and urban areas of the state. We find that rural study households are more likely to have larger vehicles and travel almost 25% more annually than urban study households. BEVs are used more than ICEVs in both urban and rural study households, with a larger difference observed in rural households. Additionally, long-range BEVs (220+ miles) are associated with greater use in both urban and rural regions. Overall, our findings indicate that rural vehicle attributes and BEV usage differ from urban regions. Importantly, rural vehicle electrification demonstrates equal, if not greater, effectiveness in terms of usage, with significant potential as the market continues to expand to provide more long-range and larger vehicles.

3. Regional Planning for Sustainable and Equitable Goods Movement: Identifying Barriers and Best Practices from a Study of 48 Metropolitan Planning Organizations

Authors: Griffin Brown and Gregory Rowangould

Effective freight travel is essential to urban environments. However, urban freight activity generates significant impacts on public health and the environment through emissions of greenhouse gases and air pollution. Negative health effects are most pronounced among residents in close proximity to freight operations, in which low-income households and people of color are disproportionately impacted. Despite this, existing research and practice surrounding urban transportation planning has exhibited a greater focus on passenger vehicles, with less attention to freight. In the United States, metropolitan planning organizations (MPOs) develop long-range regional transportation plans to identify goals and prioritize infrastructure investments. Until recently, most MPOs exhibited limited attention to freight, in relation to passenger travel. As a result, this has left significant gaps and wide variation in how MPOs plan for goods movement. To address these gaps, we ask three core questions in our research. What methods are currently used to forecast and evaluate freight impacts and plan for improvements? What are the limitations of these methods? What barriers exist to implementing best practices broadly? We evaluate these questions through a comprehensive assessment of long-range regional transportation plans from a representative sample of 48 MPOs with a focus on their modeling methods, as well as through conducting interviews with MPO planning staff. Answers to these questions will provide the knowledge necessary to identify critical barriers to improved freight planning and create a roadmap for research and policy guidance to transform how MPOs in the U.S. plan for goods movement, with specific attention to addressing critical sustainability and equity challenges.

4. The Rural Transition: Assisting Small Communities as they Prepare for Demographic, Economic, and Energy Change

Authors: Tanzila Tabassum, Clare Nelson and Gregory Rowangould

As electric vehicle (EV) adoption grows, rural communities face unique challenges and opportunities at the intersection of transportation, energy, housing, and local economic development. How will existing travel behaviors evolve? Can local grids support increasing electricity demand? And how might these shifts reshape household costs and community dynamics? At the University of Vermont, an interdisciplinary team is examining these questions through an ongoing project focused on three small and rural communities navigating the transition to renewable energy. Focusing on EV adoption, our team leverages vehicle inspection and registration records from the Vermont Department of Motor Vehicles, combined with demographic and economic data from the U.S. Census, to assess current rural travel behaviors at the household level. We then use forecasting tools from the National Renewable Energy Laboratory and Argonne National Laboratory to explore how changes in housing, economic trends, and vehicle sales may influence future transportation patterns and energy needs. Our goal is to help communities weigh the tradeoffs of different energy and planning scenarios. To do this, we: (1) assess how household travel and energy demands evolve under different EV adoption pathways; (2) evaluate the

implications for costs, greenhouse gas emissions, economic development and grid resilience; (3) provide a user-friendly web platform by collaborating closely with town planners, utilities, and residents to ensure our modeling reflects local realities and supports long-term planning and informed decision-making.

5. Driving Toward—or Away from—GHG Reduction? Rethinking Vehicle Efficiency Gains in Vermont

Authors: Narges Ahmadnia and Gregory Rowangould

Transportation is the largest contributor to the greenhouse gas (GHG) emissions in Vermont and the state has set aggressive targets to reduce these emissions. Improvements in vehicle fuel efficiency play a large role in expected GHG emission reductions overtime. However, efficiency gains can lead to a “rebound effect,” where lower fuel costs encourage additional driving, reducing the actual emissions savings. Ignoring this rebound effect in GHG projections can result in inaccurate estimates of emission reductions with over- or underestimated reductions possible. Accurate forecasts are important since they are used to determine the strategies required to meet emission reduction targets. Using Vermont vehicle registration and inspection records, we constructed a household-level panel dataset covering 87,475 households, capturing vehicle characteristics, ownership, and usage from 2018 to 2023. This dataset is used to measure the magnitude of the rebound effect and examine how it varies across rural, suburban, and urban areas. We then apply these estimates to project GHG emissions through 2050 and quantify the estimation errors that occur if the rebound effect is not considered. Our results show that emission reductions from vehicle efficiency improvements are underestimated in urban areas and overestimated in rural and suburban areas. The rebound effect and its variation across community types should be considered in planning decisions at both local and regional levels to ensure more accurate GHG projections and effective policy design.

6. New Trends in Chittenden County Travel Behavior: The Power of Applying Vermont’s Administrative Vehicle Records for Local Policy Analysis

Authors: Clare Nelson and Gregory Rowangould

For nearly a decade, the Transportation Research Center has maintained an enhanced version of the Vermont Department of Motor Vehicles’ inspection and registration records. We previously leveraged the power of this data, in a partnership with the Chittenden County Regional Planning Commission (CCRPC), to create a public-facing website where users can track and assess trends in personal travel behavior and vehicle ownership across the county. Now, as we add more years of data to this dashboard, we are seeing new trends that offer insights into our state’s progress towards reaching its electric vehicle adoption and greenhouse gas emission reduction goals. This poster will share our interpretation of these trends and open the floor to discussing how these vehicle records can be leveraged to create policy that is directly responding to observed, local travel behavior in Chittenden County.