

Estimating the Effects of Smart Growth Strategies on VMT & GHG Emissions

VTrans Research Symposium 2024

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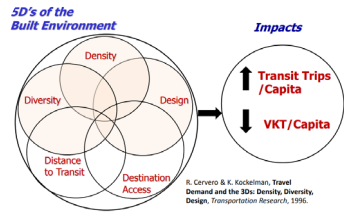
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Project Objectives

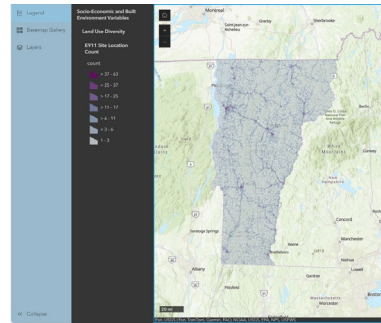
Overarching Hypothesis: Compact, mixed use development patterns intrinsically generate less VMT and GHG emissions per person than more dispersed or rural settlement patterns.

RESEARCH OBJECTIVES:

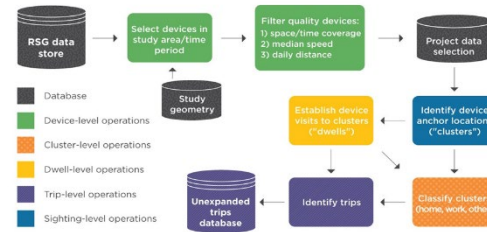
- 1. Demonstrate** the degree to which smart growth strategies, particularly in the Vermont context, can reduce VMT to meet transportation related GHG emission reduction targets as promulgated in the *Vermont Pathways Analysis Report*.
- 2. Quantify** the co-benefits of smart growth strategies beyond GHG emission reductions, including **health** benefits of increased active and multimodal travel, **safety** benefits for reduced VMT, **reduced maintenance** associated with fewer vehicles and possibly fewer lane miles, and **increased economic activity** in downtowns and community centers.



Literature Review

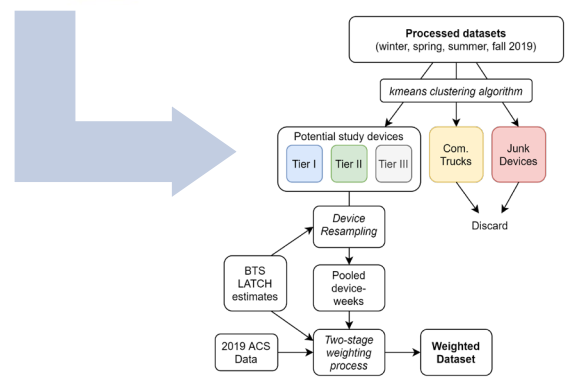


Compile Built Environment & Socioeconomic Variables



Methodology

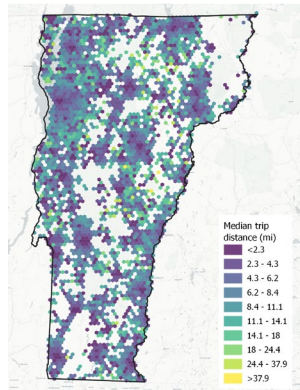
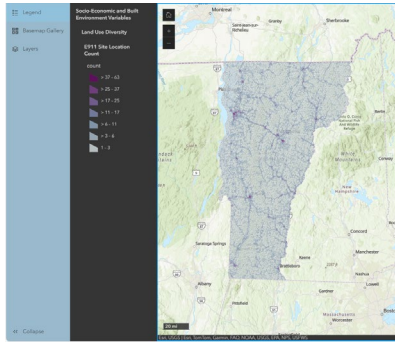
Passively Collected, Location-Based Services Data Processing



Data Post-Processing for VMT Estimates

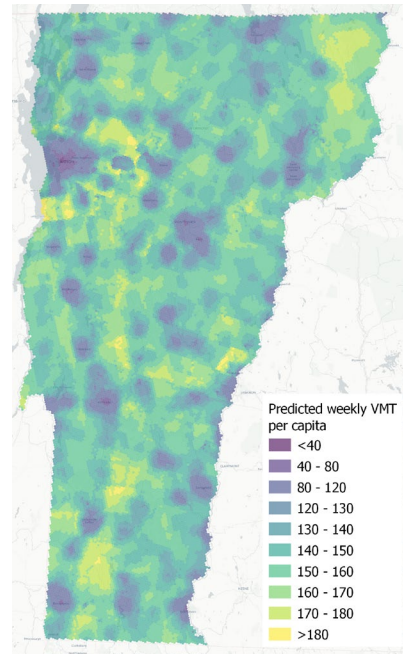


Built Environment & Socioeconomic Variables



Weighted Device Weekly Trip Making & Adjusted VMT Estimates

VMT Model



BUILT ENVIRONMENT VARIABLE	UNIT CHANGE IN BUILT ENVIRONMENT MEASURE	MARGINAL EFFECT ON WEEKLY VMT
Median household income	\$10,000 increase in median income	+4.7 (+3%)
OSM-derived sidewalk density	1 unit increase in sidewalk density	-7.2 (-5%)
Intersection density	50-unit increase in intersection density	-8.4 (-6%)
Transit service density	5-unit increase in transit service density	-4.7 (-3%)
Population density in 2-mile buffer ^a	100 persons/m ² increase in population density	-10.6 (-7%)
Retail job in 3-mile buffer ^a	100 jobs/m ² increase in job density	-15.3 (-10%)
Office job density in 2-mile buffer ^a	100 jobs /m ² increase in job density	-21.4 (-15%)
Land-use mix in 3-mile buffer	0.10 increase in land-use mix	-0.7 (-0.5%)

Methodology

Future Scenarios



Dispersed Growth



Concentrated Growth & Jobs in Dense Areas



Concentrated Growth in Dense Areas with More Dispersed Job Growth



Concentrated Growth and Jobs Emulating Places with Low VMT



Concentrated Growth Emulating Places with Low VMT and Jobs in Other Core Places

Dashboard Tool

Introduction | **Smart Growth Explorer** | Case studies | Reference

Select Scenario

Select scenario parameters

Select scenario
Concentrated Growth Concentrated Jobs

Projection year
 2035 2050

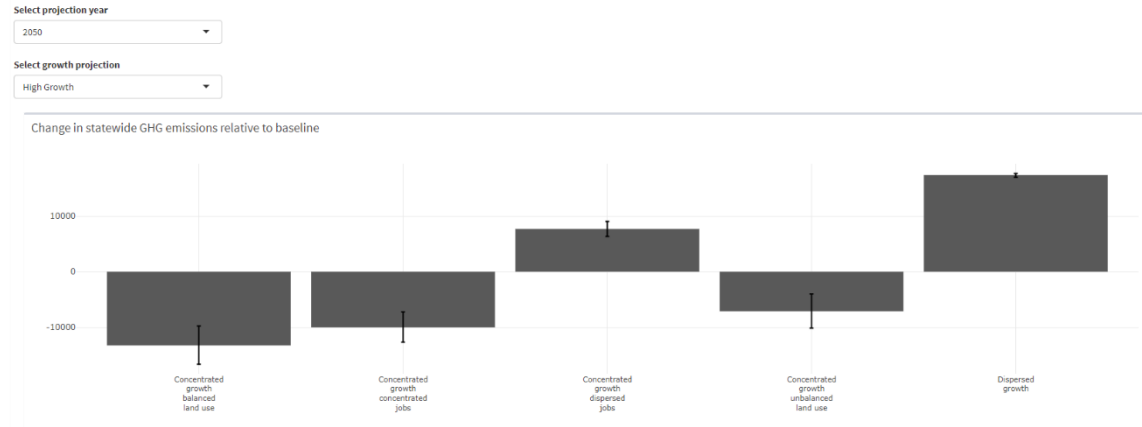
Growth projection
 Low growth High growth

Jobs-population ratio used to allocate employment
 0.5 1 2

Maximum allowed population density
 5000 7500 10000

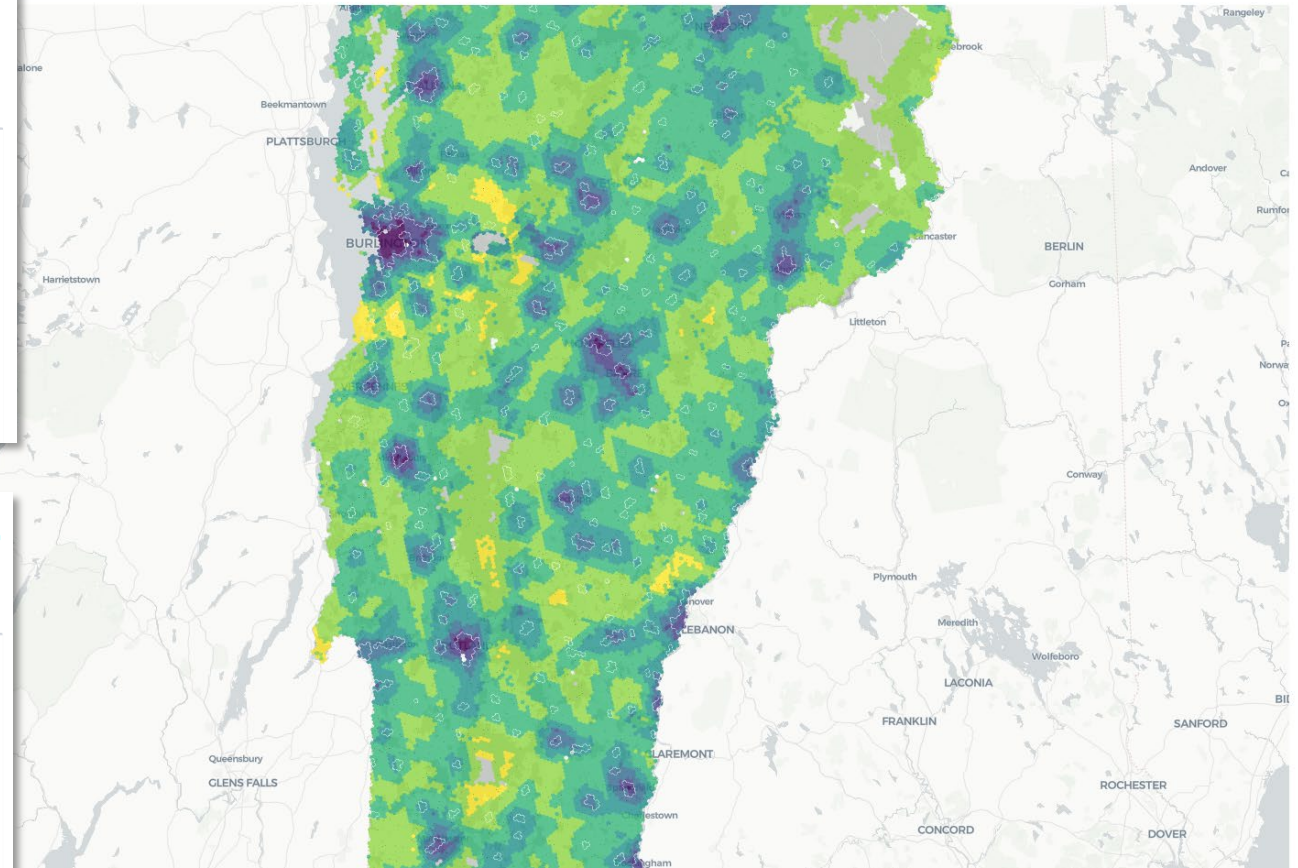
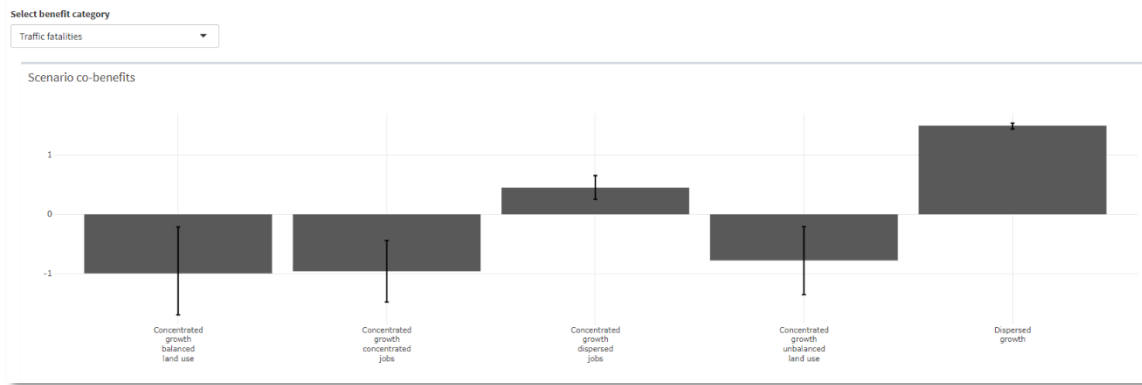
Which scenarios meet GHG emissions reduction goals?

Use the drop-downs below to explore how the development scenarios described above are estimated to impact transportation GHG emissions across the state, relative to a business-as-usual (baseline) scenario. You can see how these estimates change based on the time horizon (2035 or 2050) and the growth projection (high or low growth). The error bars represent the range of values for each scenario across all combinations of scenario parameters



How else do these scenarios benefit Vermont residents?

Use the drop-downs below to explore co-benefits for each scenario. Negative values represent an improvement relative to the baseline (e.g., reduced traffic fatalities) while positive values represent a worsening situation relative to the baseline (e.g., increased traffic fatalities). Like above, you can see how these estimates change based on the time horizon and the growth projection, and range of values across all combinations of scenario parameters for each scenario are represented by the error bars.



[Link to Tool](#)

Conclusions

■ Smart growth contributes to the solution.

- Global Warming Solutions Act (GWSA) requires 80% reduction in GHG below 1990 levels by 2050
- Most effective scenario achieves 15% of the annual reduction required to meet the target

■ Concentrate growth by mimicking low VMT places.

- Emulated “prototype” communities in Vermont with smart growth characteristics
- Prioritized residential and job growth in low VMT areas
- Reduced VMT by 10 miles per person per week compared to dispersed growth

■ Benefits reach beyond VMT and GHG reductions.

- Safety co-benefits included 1 avoided traffic death per year and 30 avoided traffic injuries per year
- Reduced physical inactivity mortality saved 4 lives annually
- Reduced maintenance costs could save up to \$1.5M per year

■ Case study communities tell more of the story.

- Denser, mixed land uses require job proximity
- Vermont’s “good bones” support smart growth strategies
- Proximity of neighboring town centers with complementary land uses play a role in VMT patterns

