

Estimating the Effects of Smart Growth Strategies on VMT and GHG Emissions in Vermont

VTrans Research Symposium

September 14, 2022

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 Vehicle Miles Traveled (VMT) to meet transportation related GHG emission reduction targets as promulgated in the Vermont Pathways Analysis Report (“Pathways” report).
- 2. Quantify** the co-benefits of smart growth strategies beyond GHG emission reductions. Such benefits include **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** located in downtowns and community centers.

Data Sources

Built Environment Data

The nature of the space (ie, *smart growth* characteristics)

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

Passively-Collected Location Data

How do folks move?

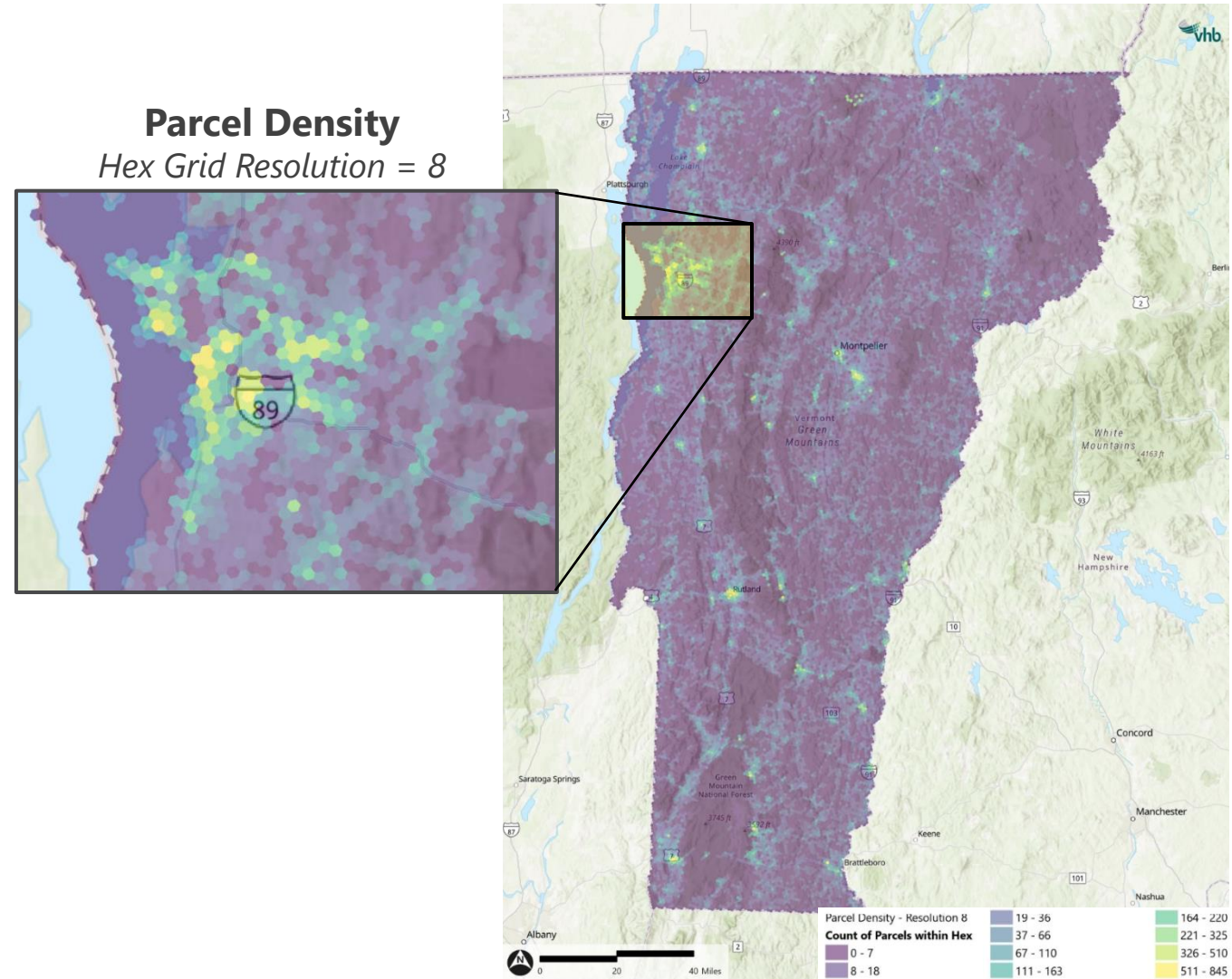
- Smartphones + apps reporting user location at regular intervals

Built Environment Data

- **Population**
 - American Community Survey Data (*US Census*)
- **Employment**
 - Business Analyst Output (*ESRI*)
- **Median Household Income**
 - American Community Survey Data (*US Census*)
- **Land Use Diversity**
 - E911 Data: SITETYPE attribute (*VCGL*)
 - Statewide Parcel data: Land Use Category (*VCGL*)
 - SafeGraph POI output: Employer Type (*SafeGraph*)
- **Destination Access**
 - Building Footprints (*OpenStreetMap*)
 - E911 Data: Building Footprint (*VCGL*)
- **Transportation Network**
 - Transportation Network (*OpenStreetMap*)
 - VTrans Roadway Centerline (*VCGL*)
 - Chittenden County Sidewalks & Paths (*CCRPC*)
- **Public Transit**
 - General Transit Feed Specification GTFS Data: Transit Routes & Stops (*GMT*)
- **Other Data Sets**
 - Smart Growth Designation Boundaries (*VCGL*)
 - Broadband Accessibility (*VCGL*)
 - Existing Wastewater Service Area (*VCGL*)
 - Drinking Water Infrastructure (*VCGL*)
 - Electric Vehicle Charging Stations (*VCGL*)

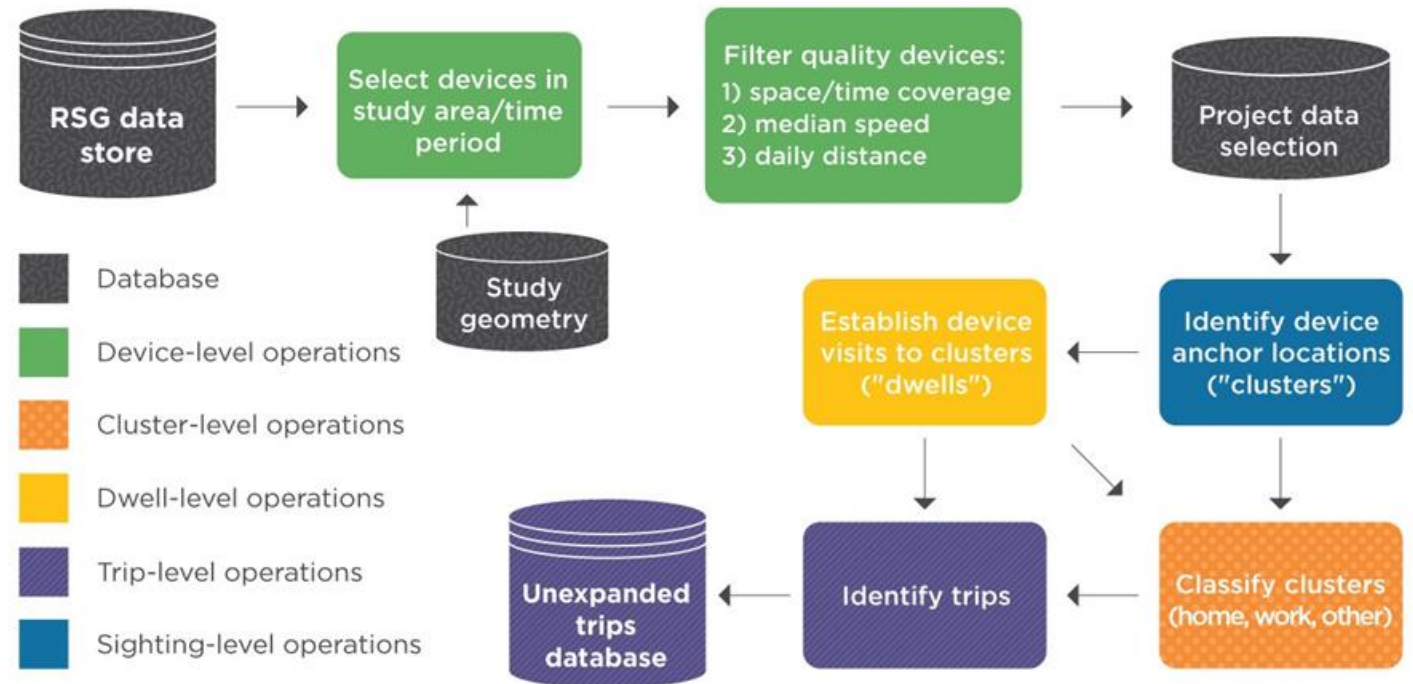
Built Environment Data

- Using **H3** hexagonal grid geospatial indexing system to analyze multiple large datasets
 - Originally developed by Uber to optimize pricing & dispatch
 - Covers geographic space with hexagonal grids
 - Grid resolution adjustable
 - Creates uniform grid to facilitate more efficient analysis
 - Hexagonal grids take on attributes of underlying data (point, polyline, polygon)



Passively Collected Location Data

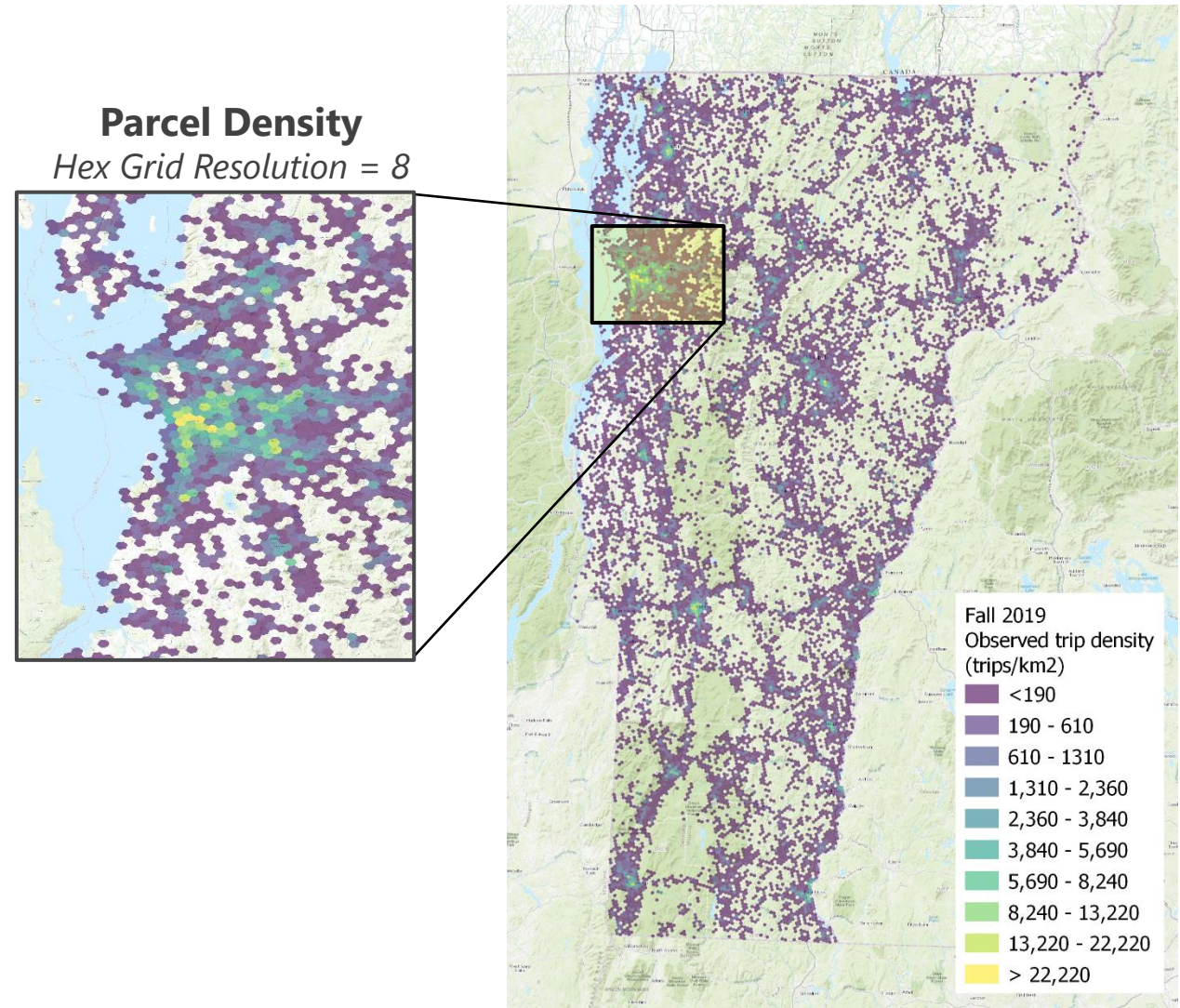
- **Identify trips** in Vermont using passively-collected location data
- Infer device **home and work locations**
- Combine observed trips with local demographic and traffic count data **to develop transparent, locally calibrated device-level VMT** estimates across Vermont
- **Summarize VMT** estimates at home location



RSG passively collected data processing workflow

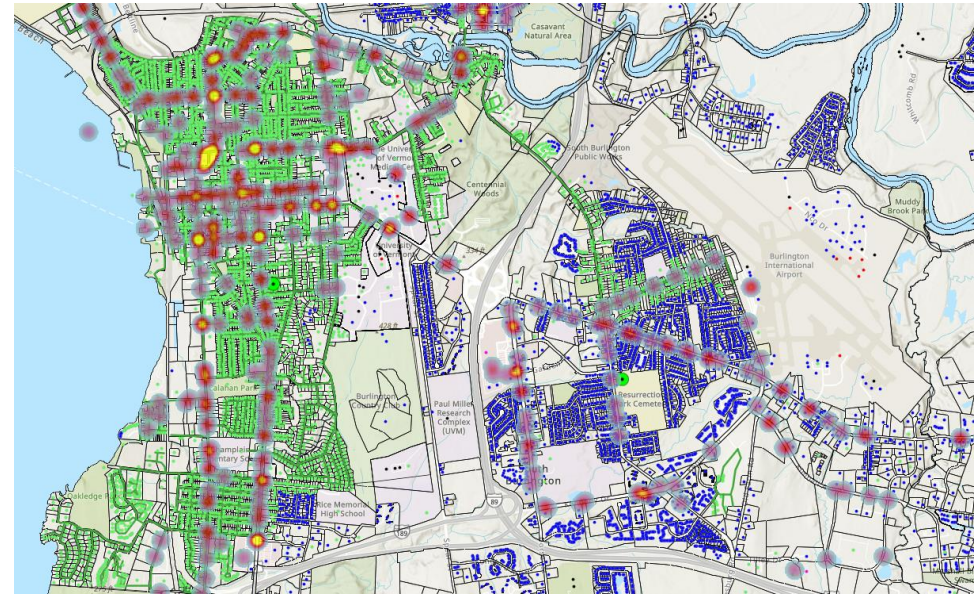
Passively Collected Location Data

- Initial rMerge query results for Fall 2019 time period
- Same **H3** hexagonal grid tagged to trips
- Grid cells will be used to join built environment measures to passive data results

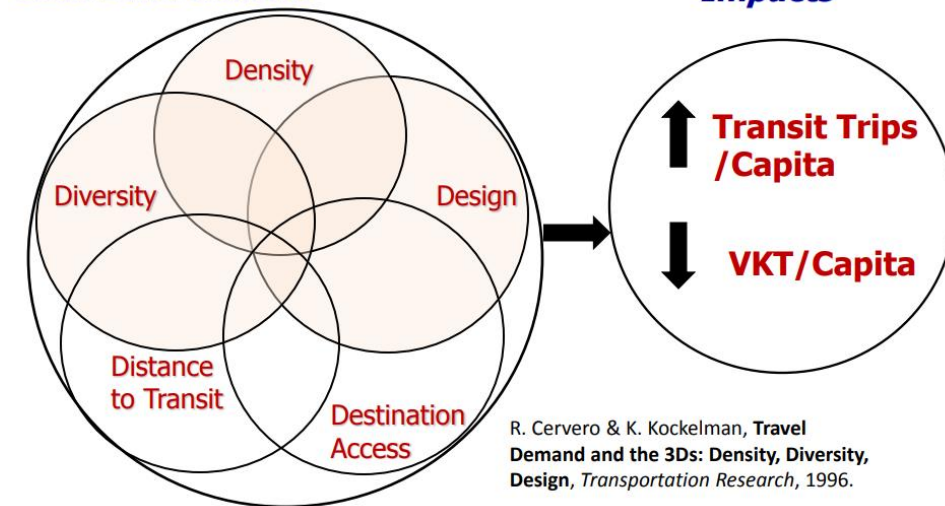


Next Steps

- Q4 2022:
 - Estimate **VMT** using passively collected data
 - Develop **VMT-Land Use Model**
 - Estimate GHG emissions
- Q1 2023:
 - Quantify **additional co-benefits**
 - Health
 - Safety
 - Reduced maintenance
 - Economic activity
 - Prepare **future scenarios**
 - Develop **case studies** and final report



5D's of the Built Environment



Applications

Policy

Create Strategies for the Vermont Context

- Land use, zoning, infrastructure investment, public transit provision
- RPCs + municipalities, public transit – informing future plans

Safety and Health

Reduce Vehicle Usage because of Proximity, Comfort of Experience

- Reduced GHG emissions, crash exposure
- Operations and Safety Bureau – allocating roadway capacity to alternate modes

Maintenance

Reduce Operations Costs through Concentration of Assets

- Repaving, snow removal
- Maintenance districts, asset management – less VMT in maintenance, materials costs