Using Activity Based Models for Policy Analysis

presented by
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Goal of presentation


1. Demonstrate how one might use an Activity Based Model (ABM) differently for policy analysis

2. Draw a distinction between policy analysis using an ABM v. trip based model (but specifically not to indicate that one method is inherently better)

3. Introduce a creative way of performing benefit/cost analysis using an ABM which could improve project selection

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Two illustrative scenarios

1. Tampa Fixed-Guideway Scenario
   - Completely hypothetical

2. Benefit Cost Software
   - Example to be applied in Jacksonville and Tampa

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First Example

Fixed Guideway Analysis in Tampa using an Activity Based Model

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Fixed-Guideway Alternative

- Existing bus route converted to a light-rail line
  - PSTA 19 between Tarpon Springs and St. Petersburg
  - 35 miles (approx.) route length
- Removed loops in the route
- Improved headways
  - 20 mins -> 10 mins (peak)
  - 30 mins -> 15 mins (off-peak)

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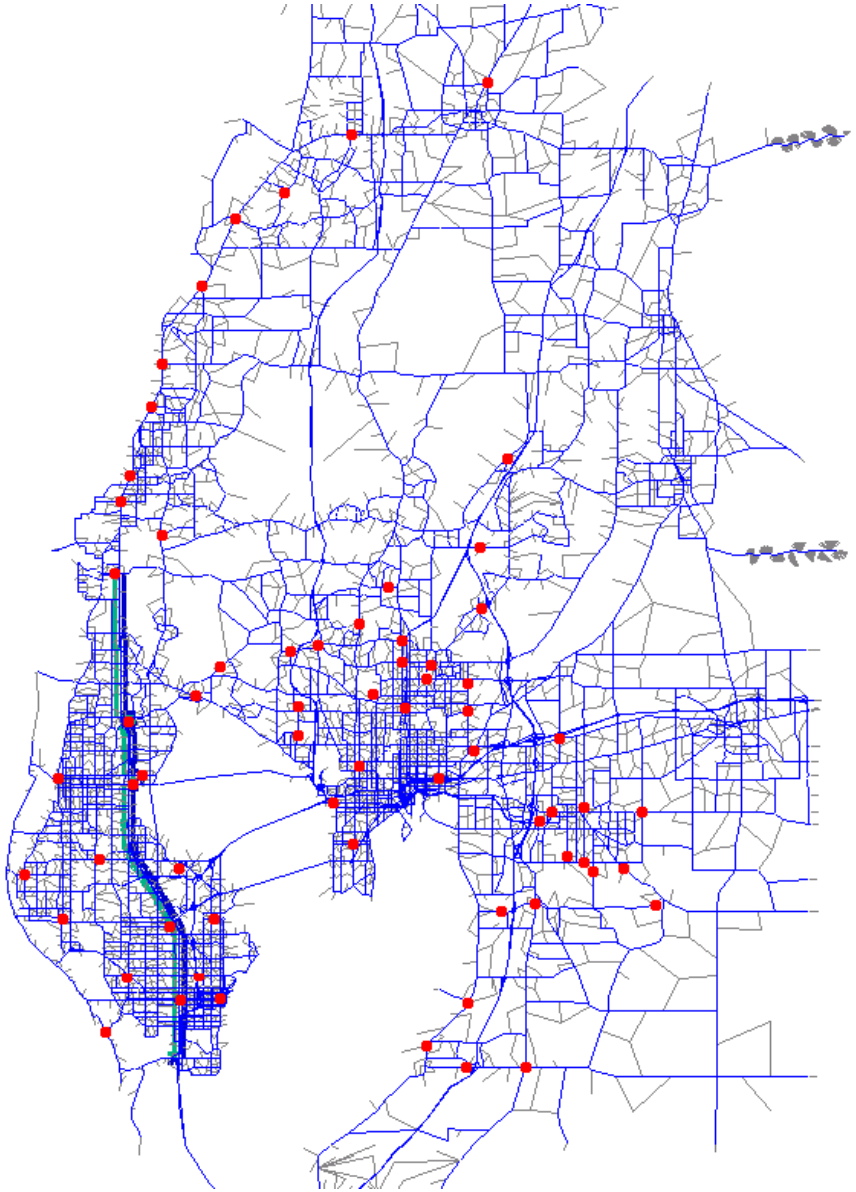
Park & Ride / Kiss & Ride



- Assumed a high level of accessibility to the system. The red dots are P&R/K&R
- Additionally, ensured adequate bus feeder system

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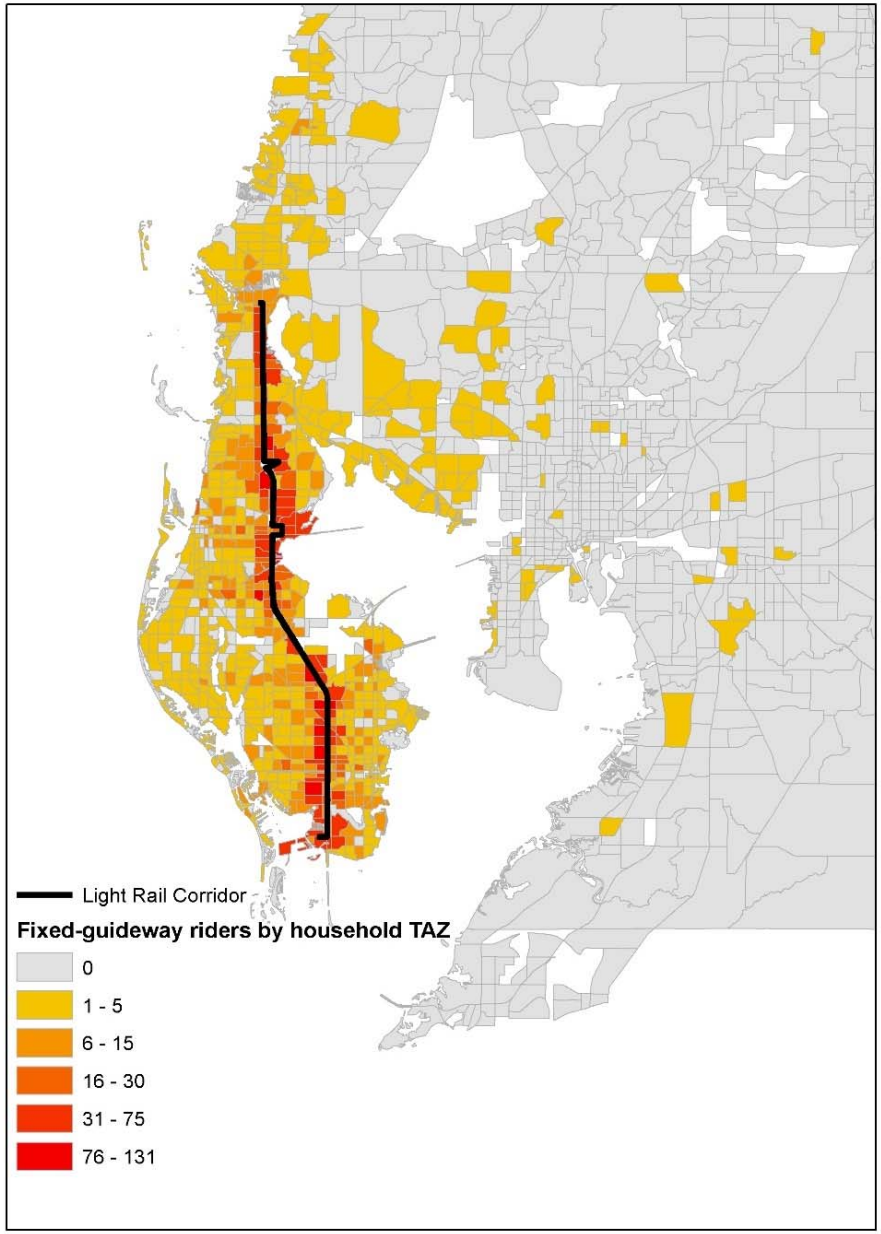
Riders by Household Zone



Where do the riders live?

Ability to assess the number and type of people using the system even if trip has no home end

With this information we could plot income, or focus on populations of interest along many dimensions.

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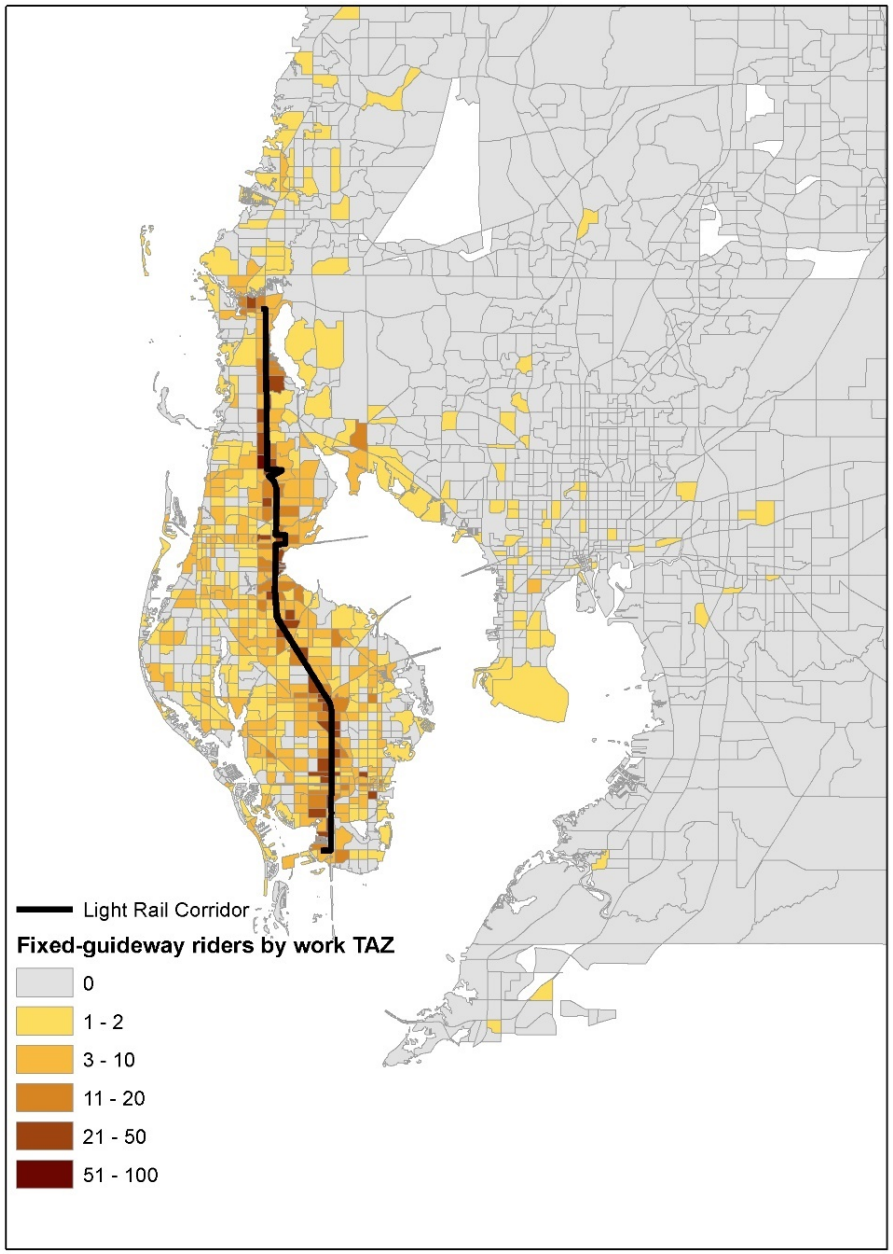
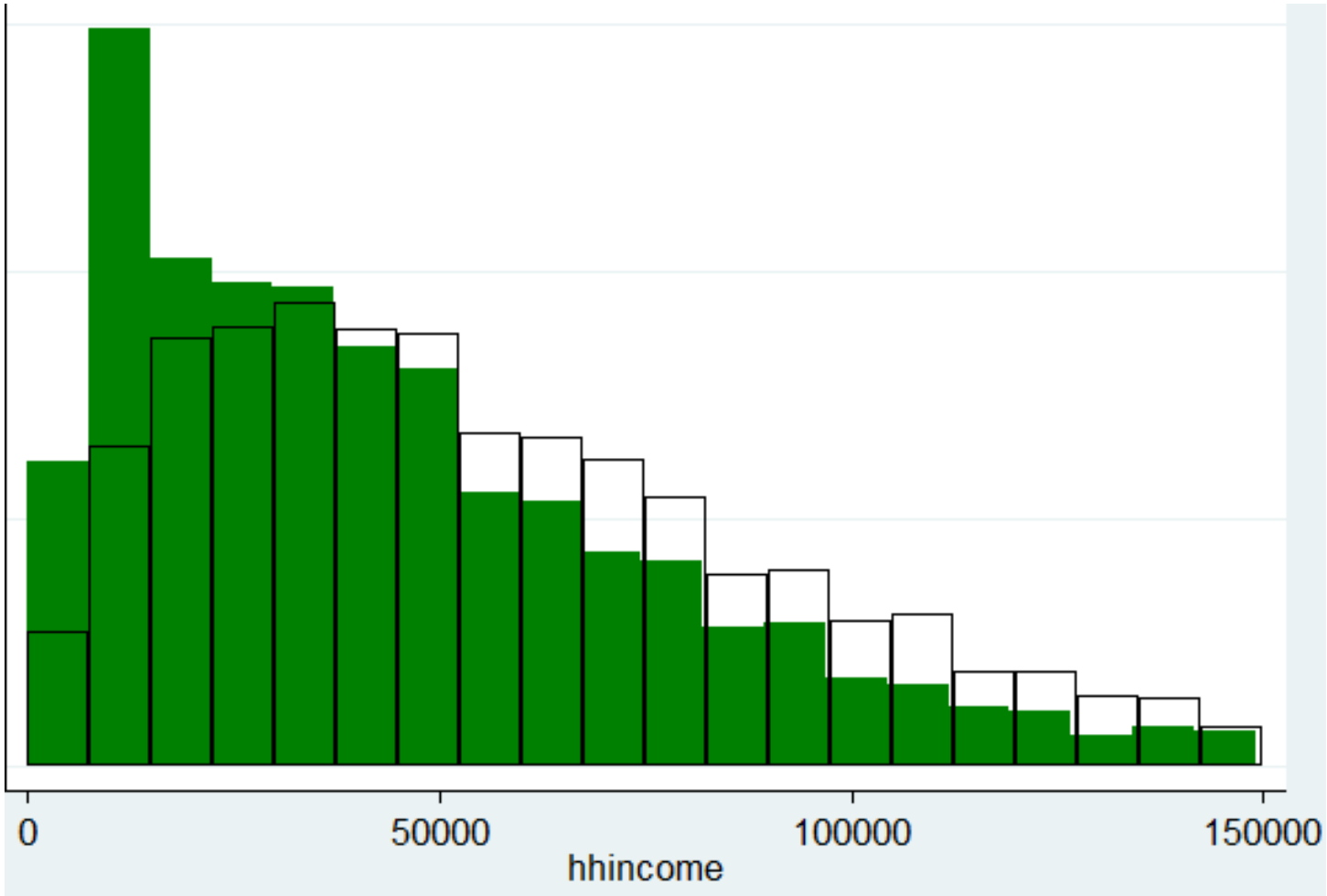
Riders by Work Zone



Should we extend the line?

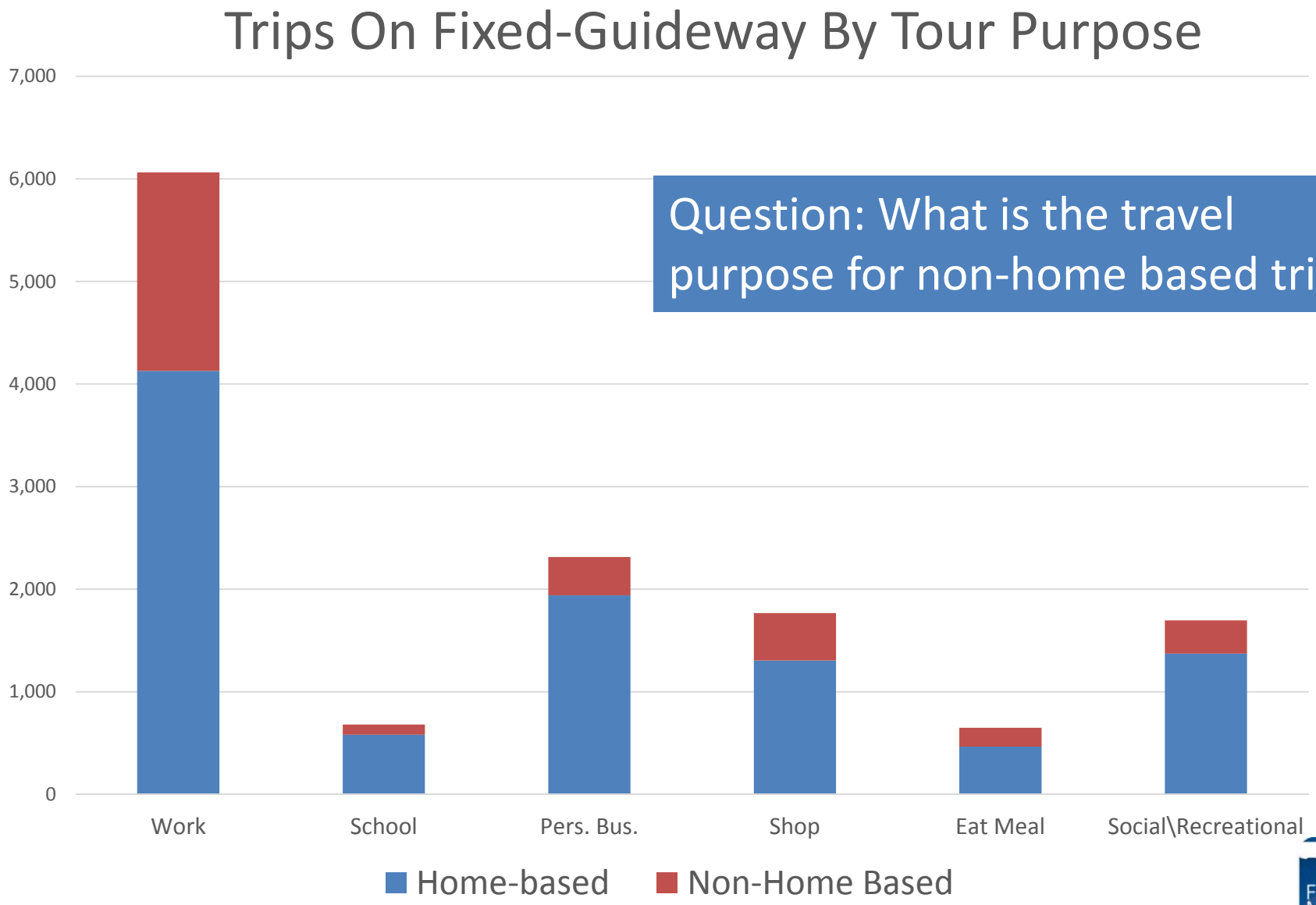
Knowing the work zone of all riders (not just those using the system for work) can indicate potential ridership increases

Use of Continuous Variables



Fixed-guideway rider Not fixed-guideway rider

Those pesky non-home-based trips



Question: What is the travel purpose for non-home based trips?

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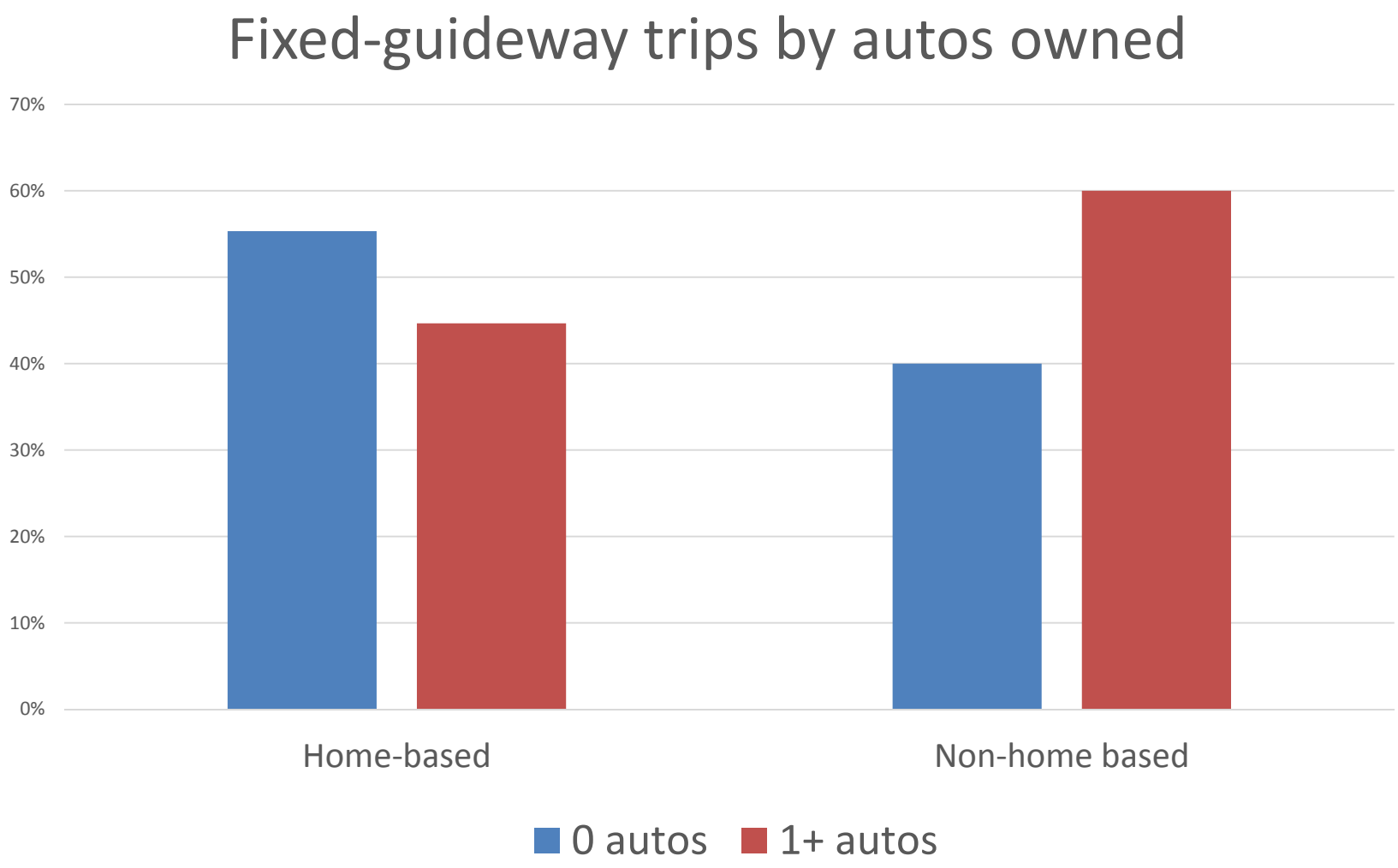
Those pesky non-home-based trips

Question: How many transit dependent people use the system?



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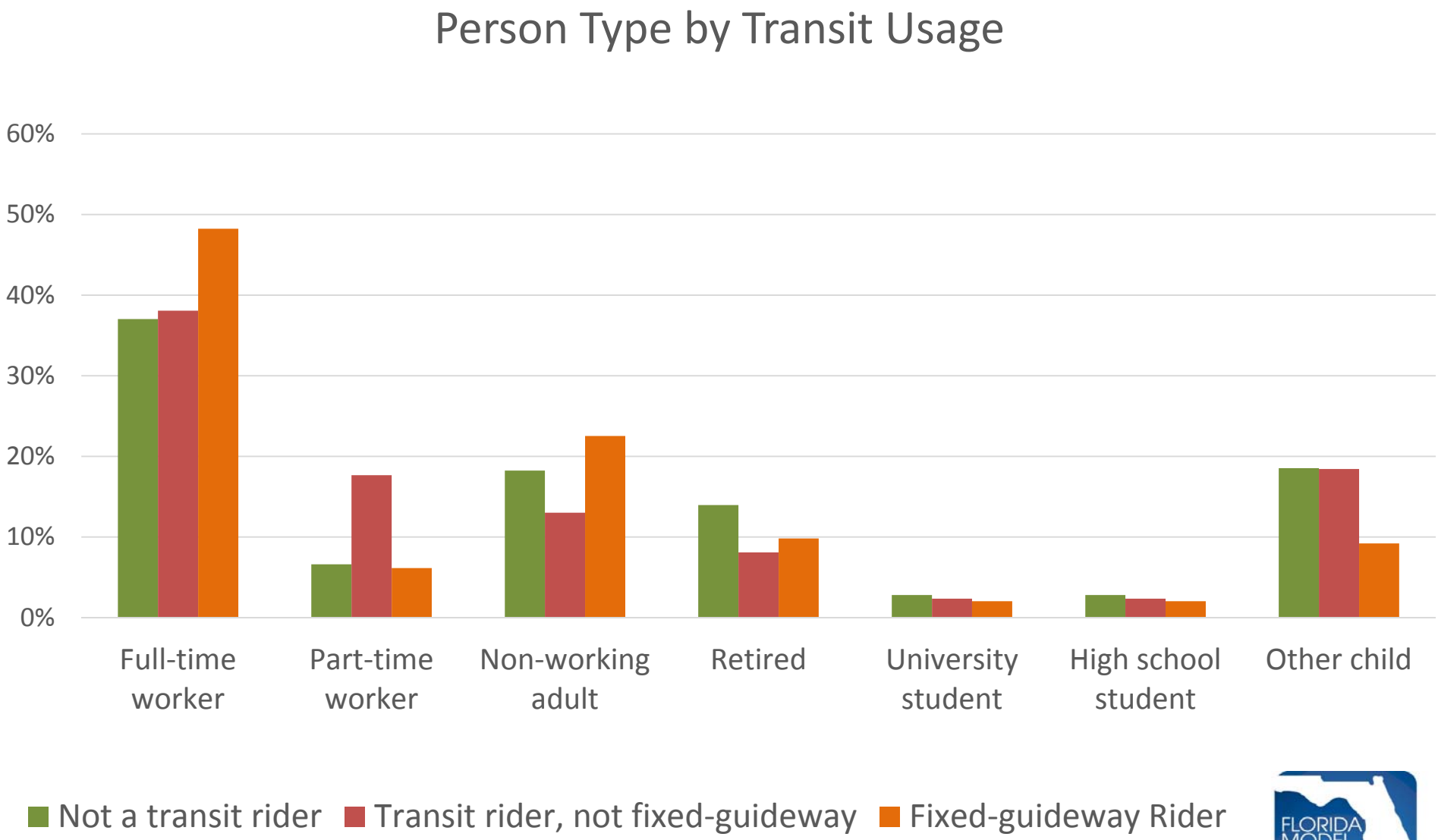
Who rides fixed-guideway?



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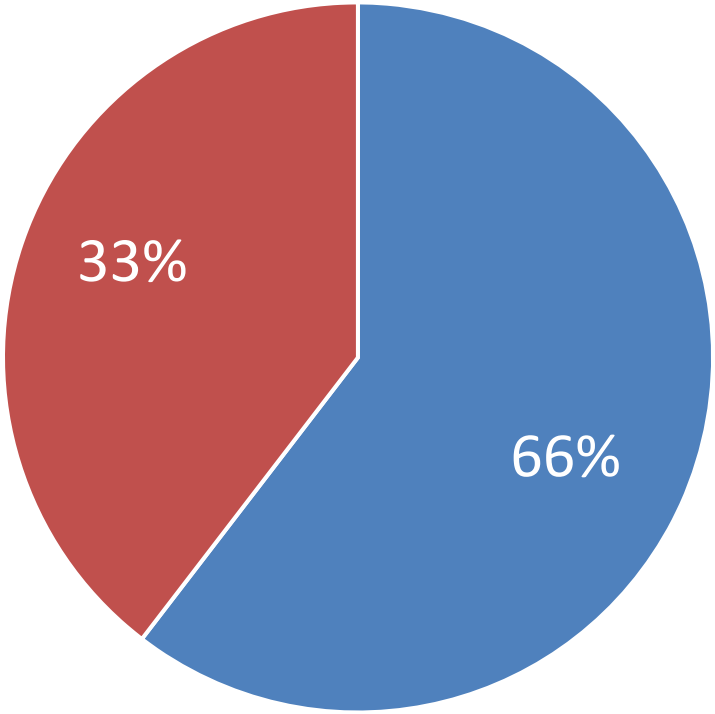
Baseline versus Build Comparisons

How many Fixed-Guideway Riders Rode Transit In Base Alternative?



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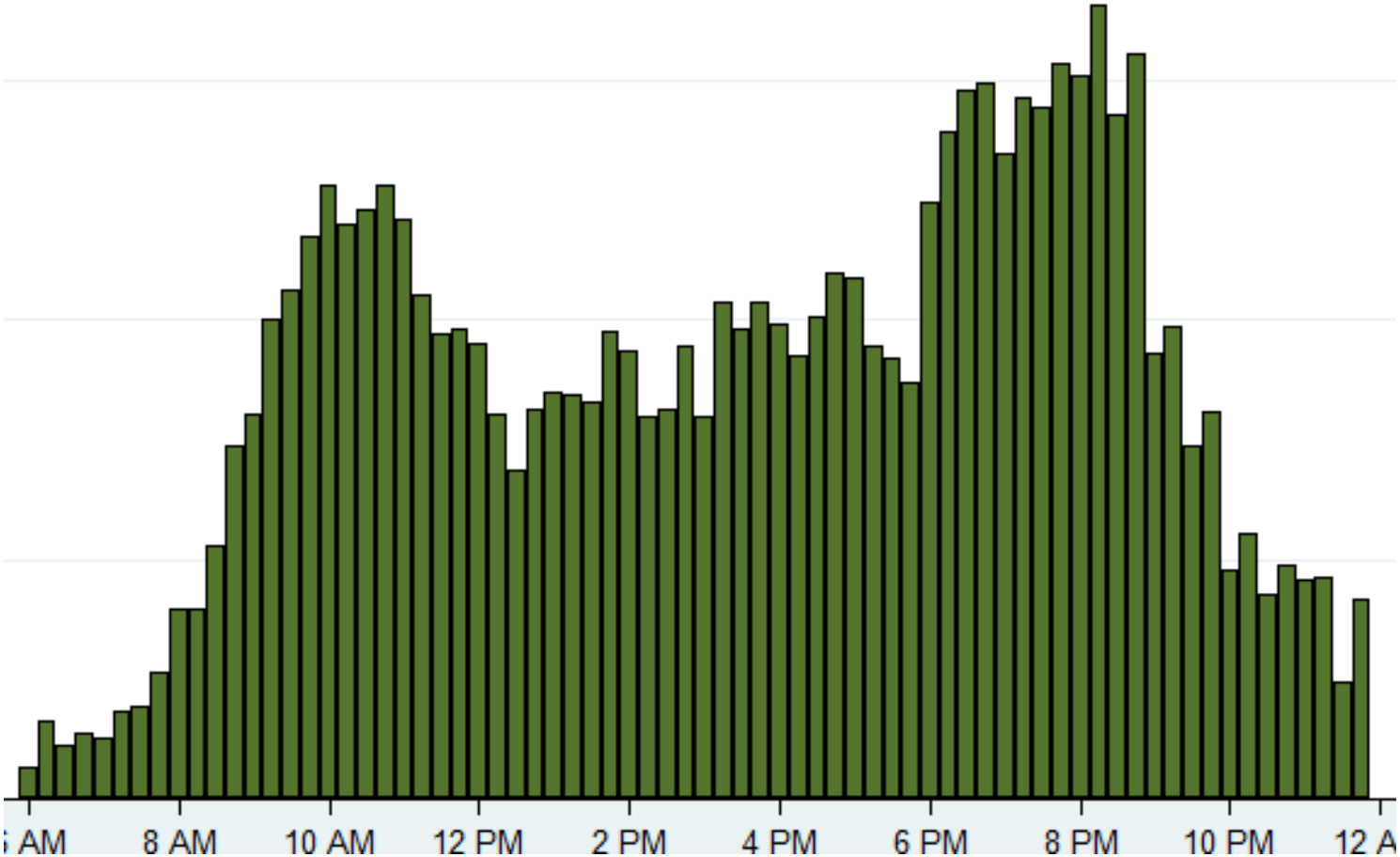
Fixed Guideway Trip by Origin Departure

Question: What is the detailed ridership distribution throughout the day?




Benefit/Cost analysis using an Activity Based Model

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Benefit-Cost Analysis Overview

Uses monetary value as the metric to support decision-making by comparing different characteristics

- Q: Does an investment (relative to *no or different investment*) produce more benefits than costs?
  - To invest or not to invest
  - To prioritize investments
  - To better "design" a given investment
- Q: Who benefits?
  - Harder to answer this question with past tools

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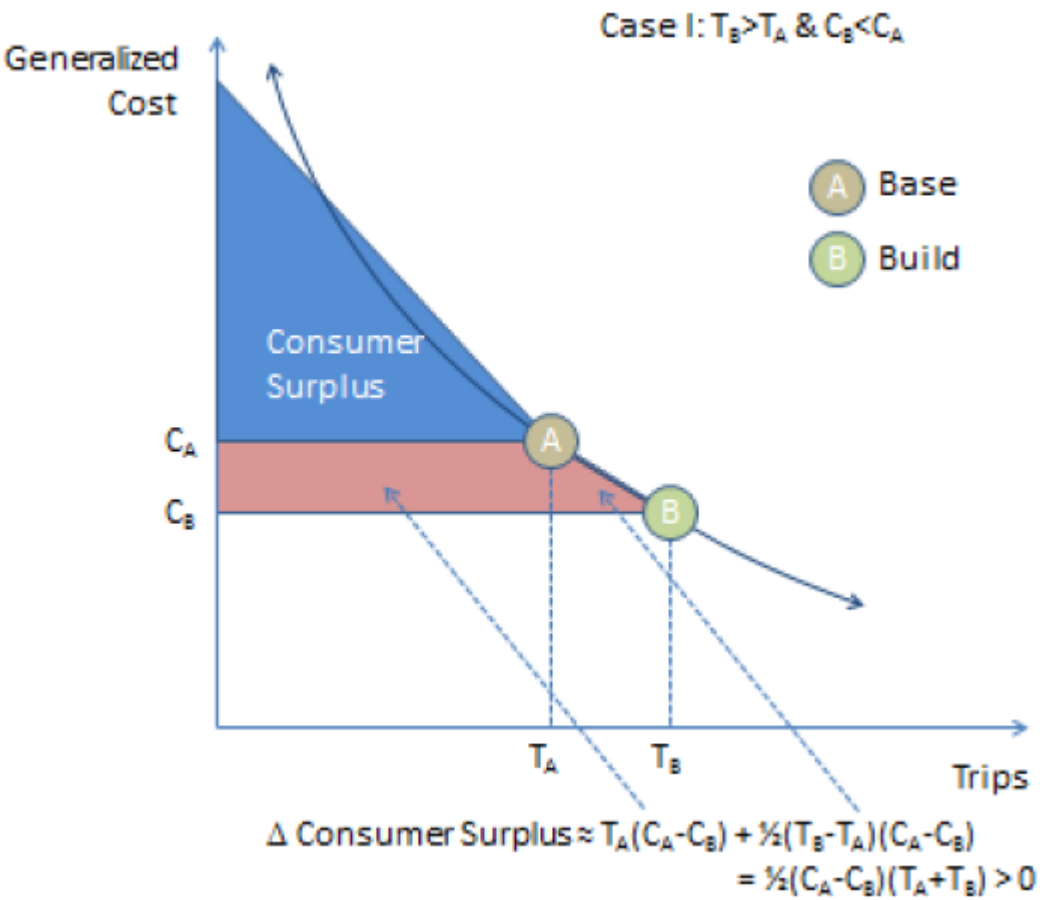
BCA Founded in Economic Theory



Consumer Surplus

- "Good" = travel from O to D
- $ Willing to Pay
- $ Actually Paid
- Willing minus Actual = Surplus
- Build Alternative Changes the Surplus
- Additional Surplus can be invested in some other good and thus has economic and personal value

Source: Ohio DOT : "Enhancement of Economic Analysis Capabilities: Initial Review and Recommendations". 2011

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Benefit-Cost Analysis Principles

- Analysis should…
  - Be comprehensive across the population at hand
  - Keep both costs and benefits mutually exclusive
  - Explicitly treat difficult-to-monetize benefits and costs
  - Be transparent

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Benefit-Cost Analysis Metrics

- Direct benefits
  - Mobility cost savings
    - Actual travel time savings
    - Reliability benefits
  - Out-of-pocket cost savings (e.g. fuel and tolls)
- Indirect benefits
  - Accident reduction benefits
  - Emissions (and other environmental) cost savings
  - Auto ownership cost savings
  - Physical activity health benefits

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BCA Assumptions


- Value of Travel Time Savings (VTTS or VOT)
- Value of Reliability Benefits (VOR)
- Value of Accidents Prevented (by type)
- Value of Quantities of Emissions Reduced
- Vehicle Operating Costs
- Vehicle Ownership Costs
- Value of Meeting Physical Activity Threshold
- Economic
  - Discount Rate
  - Inflation Rate

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Aggregate vs. Activity-Based

- Aggregate potential level of detail:
  - Zone
  - Market Segment (e.g. Home-Based-Work-Low-Income)
- Activity-based potential level of detail:
  - Person, along any characteristic (e.g. HH income, age, etc.)
  - Person-trips linked throughout day

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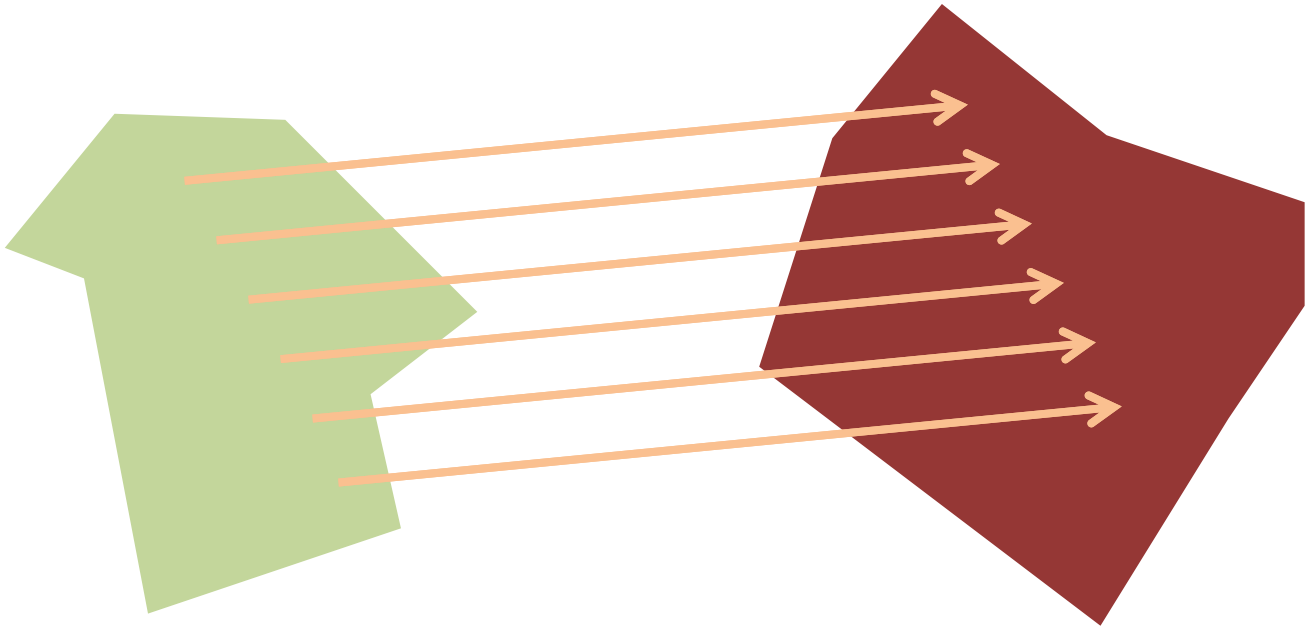
Aggregate: Environmental Justice

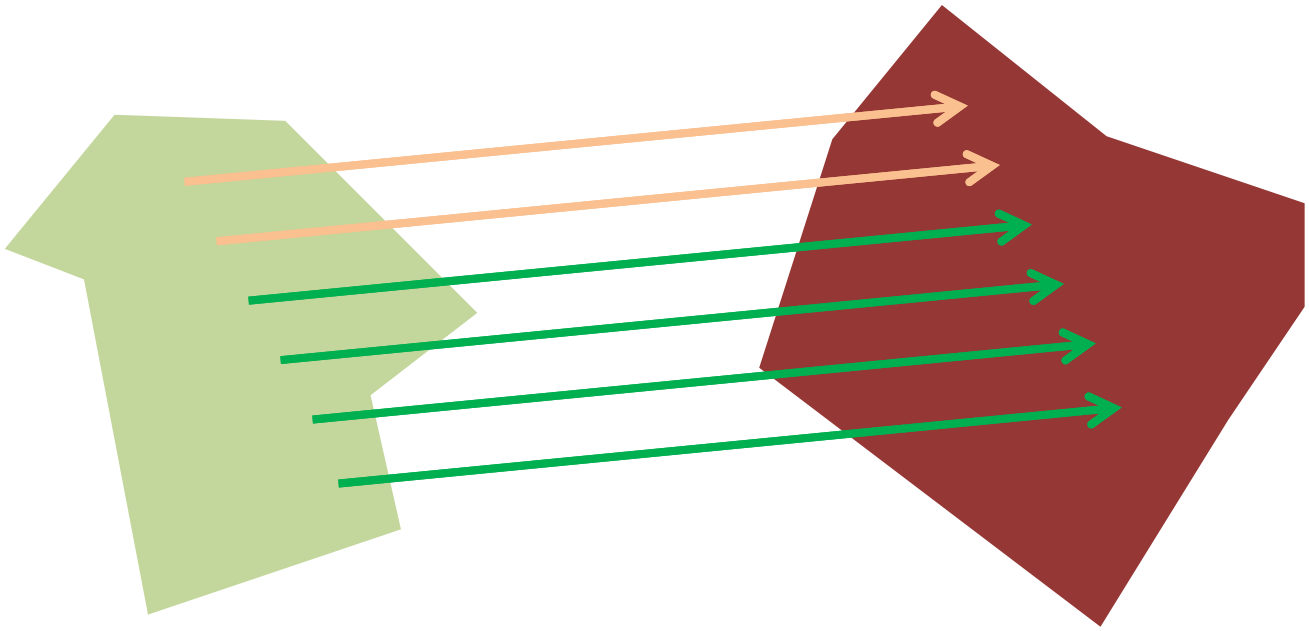
- In aggregate modeling the zone becomes a proxy for the people



- Typical: Green is an "EJ" zone because threshold percent of residents meet EJ criteria; assume global proportion of trips

ABM Environmental Justice

- In ABM modeling we know exactly who the EJ individuals are (dark green arrows) because model simulates individual characteristics



- ABM enables more-precise accounting by person and characteristic

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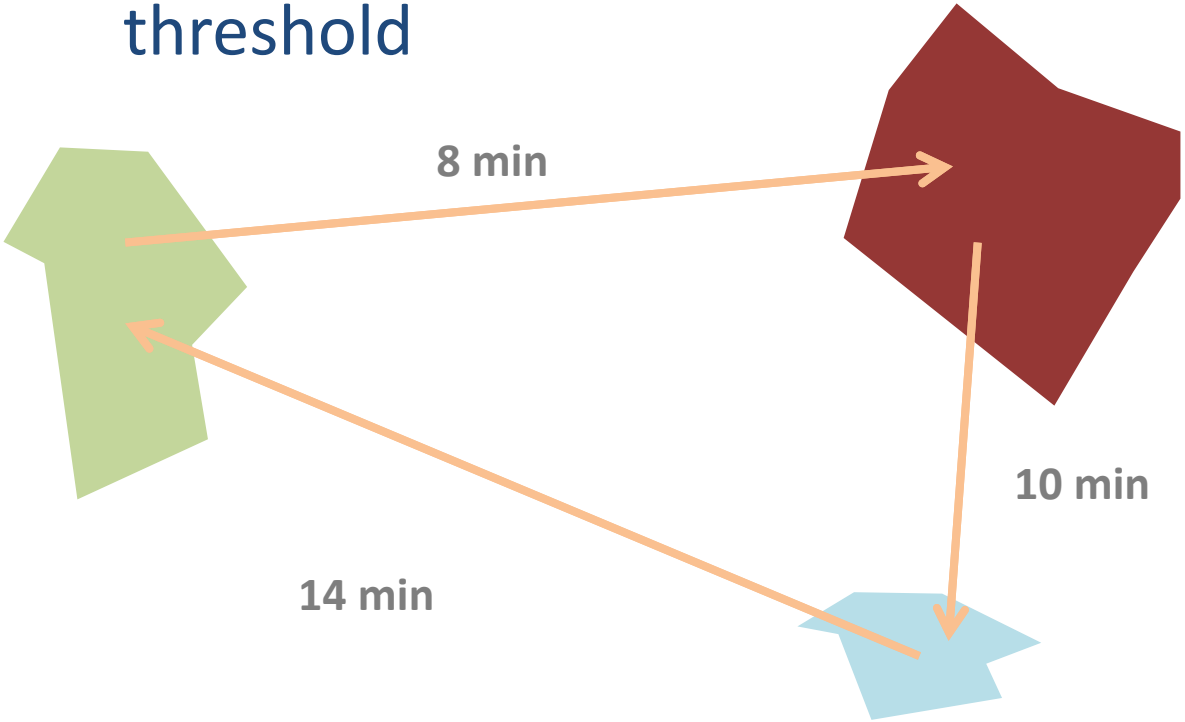
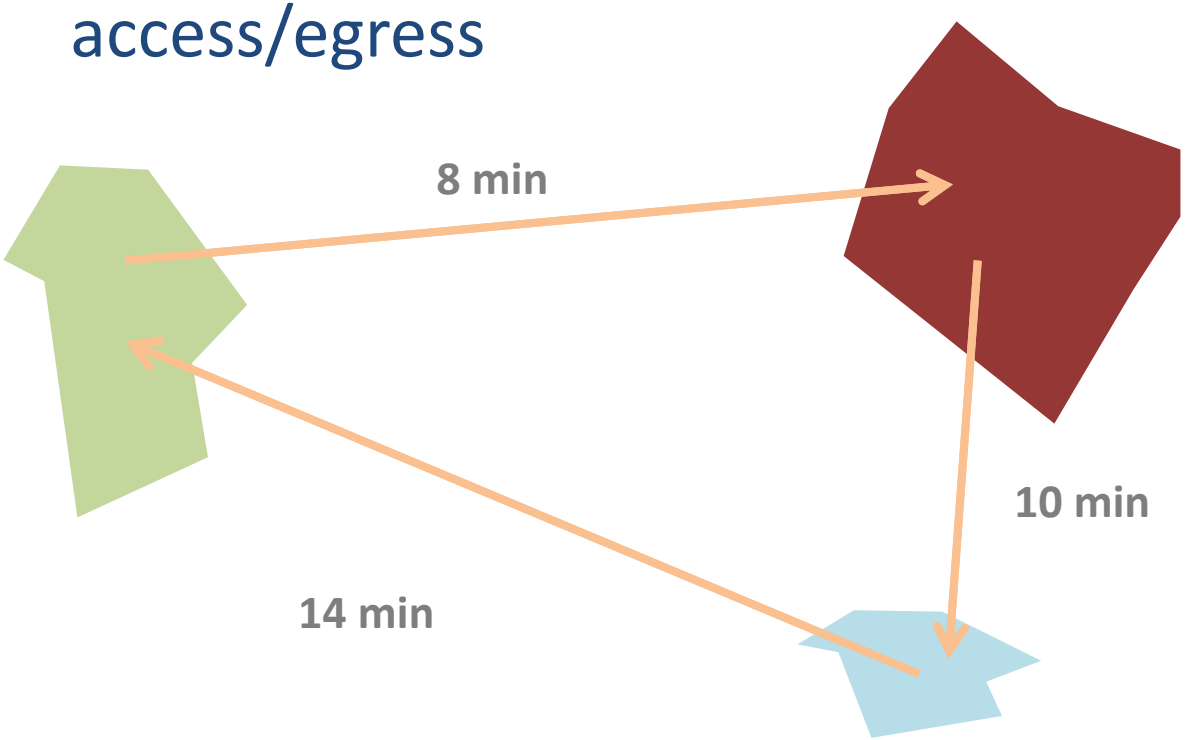
Aggregate Calculation of Activity

- Physical Activity Threshold = 22 min/day (eg.)
  - Aggregate model sees three trips below threshold so this individual did not meet the threshold



ABM Calculation of Activity

- Physical Activity Threshold = 22 min/day (eg.)
  - ABM sees one daily activity that in total crosses threshold. Spatial disaggregation also captures access/egress



BCA Findings

- Who benefits?
  - Benefits by individuals belong to a "Community of Concern" (similar to Environmental Justice)

Benefits by Community of Concern	Total	COC	Non-COC
Mobility - Residents	$30,752,893,835	$22,175,101,816	$8,577,792,019.52
Mobility - Trucks / Commercial	$3,529,976,260	n/a	n/a
Emissions	$436,512,590	n/a	n/a
Accidents	$1,521,366,983	n/a	n/a
Reliability	$1,077,013,183	n/a	n/a
Vehicle Operating	$15,985,470,110	n/a	n/a
Auto Ownership	$2,279,791,318	$1,437,465,400	$842,325,917.56
Physical Activity	-$37,814,803	-$27,557,321	-$10,257,482.37
Total	$55,545,209,476	$23,585,009,895	$9,409,860,454.71

Source: RSG, SANDAG

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Conclusion

When seeking to maximize and explain an investment it can be useful to understand:

- value of time distribution & income
- auto ownership or other household characteristics
- Time of day trips and choices (suppressed & induced demand)

Examples could include managed lanes/tolling

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Thank You!

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