Lightweight Calibration of a Bicycle Travel Demand Model for the Salt Lake City Region Using Passive Data

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SUMMARY

- A **lightweight framework** was developed to calibrate travel demand models using passively collected OD data
- This framework was applied to calibrate the Salt Lake City region's bike model using **passively collected OD data for bikes trips** obtained from StreetLight

1 THE BIKE MODEL

MAG and WFRC maintain a bike demand model for their region:

- Consists of **trip generation**, **destination choice**, and **trip assignment** submodels implemented in Python
- Contains **19,214** microzones
- Model coefficients originally estimated using travel survey data from Sacramento, CA

Passively collected bicycle OD data were obtained from StreetLight for 110 districts aligned with the model's zone system to **localize the model** through calibration. Before calibration, the model dramatically **overpredicted bike trips**, particularly south of downtown Salt Lake City.

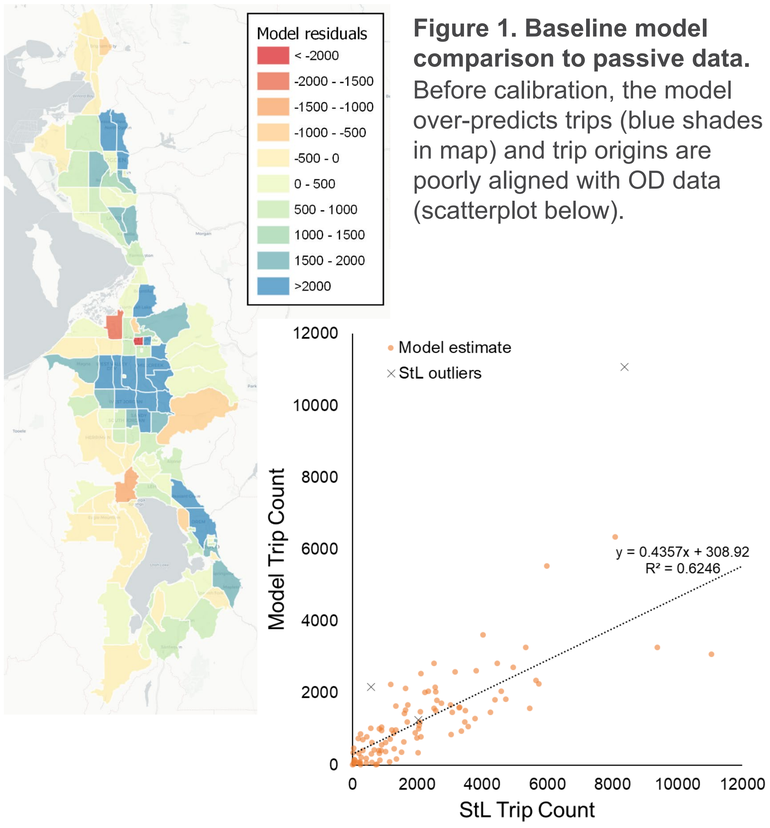

Figure 1. Baseline model comparison to passive data. Before calibration, the model over-predicts trips (blue shades in map) and trip origins are poorly aligned with OD data (scatterplot below).

2 CALIBRATION FRAMEWORK

The calibration framework comprises two stages:

1. **Sensitivity analysis**: Model coefficients were varied systematically, and changes in model performance were measured relative to OD data.
2. **Regression analysis of model residuals**: Model residuals from the stage 1 model were used in a regression model to further adjust model coefficients.

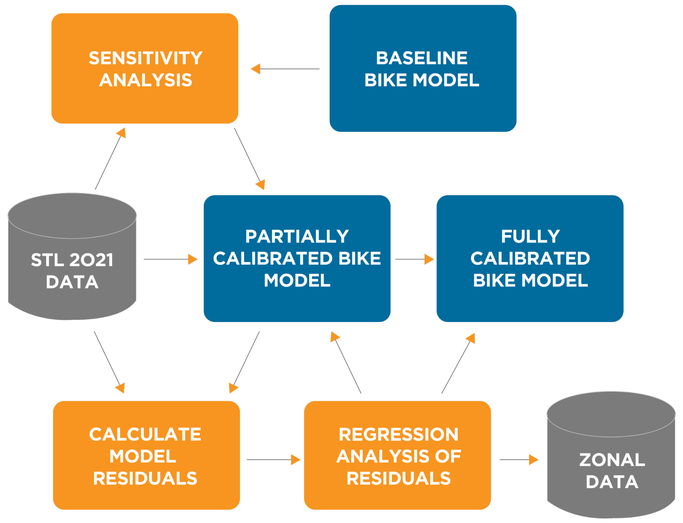

Figure 2. Two-stage calibration process.

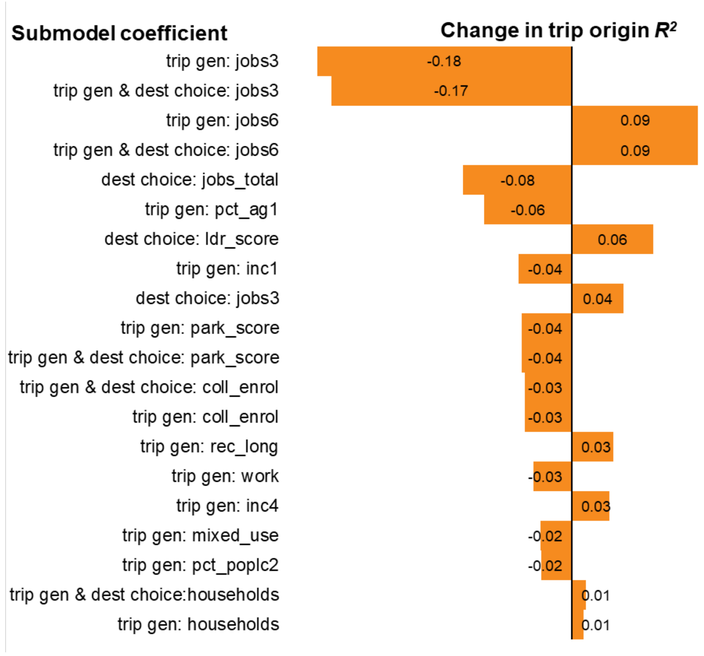

Figure 3. Example tornado diagram illustrating model sensitivities (stage 1).

3 RESULTS

Model performance dramatically improved:

- Trip origin R2 increased from **0.62 to 0.80**
- Total trip counts **within 2%** of the OD data

The model underpredicts in two geographies where StreetLight OD data seem unrealistic: trip to/from the airport (>2,000 daily trips in OD data) and trips in downtown (>11,000 daily trips in OD data).

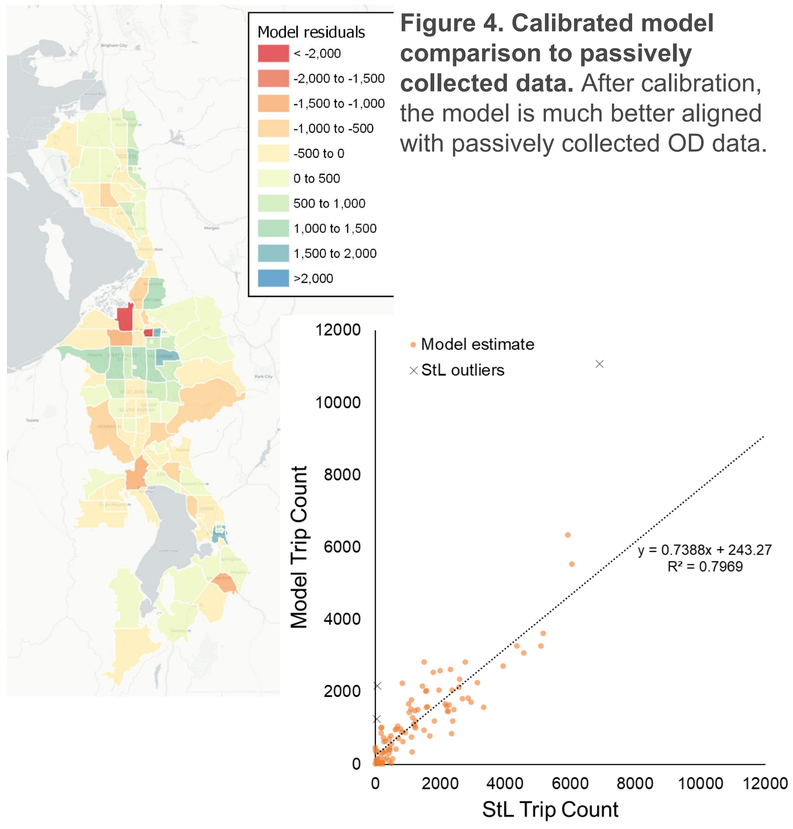

Figure 4. Calibrated model comparison to passively collected data. After calibration, the model is much better aligned with passively collected OD data.

4 CONCLUSIONS

Passively collected data have important limitations:

- Mode is imputed, and may overrepresent bike trips in certain geographies
- May underrepresent long recreational bike trips

Future work should consider how to **leverage passively collected data and local travel survey data in a single framework** to better calibrate travel models.