Annual Estimation of Vehicle Miles Traveled in San Francisco

Presented by:

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SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

7th TRB Innovations in Travel Modeling Conference
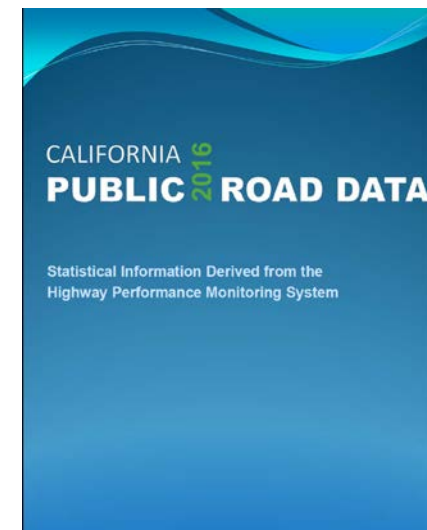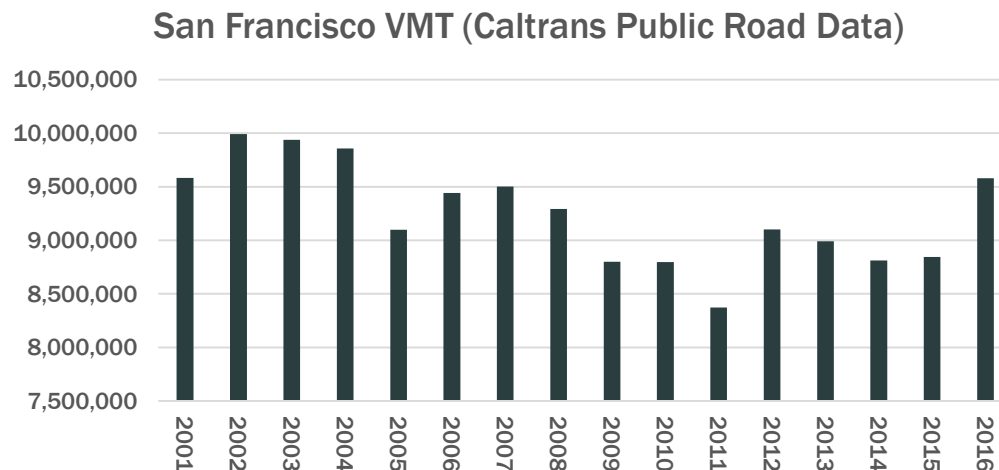2018.06.26

Monitoring Vehicle Miles Traveled (VMT)

► **San Francisco is a member of C40 Cities, a network of world cities committed to addressing climate change**

► **C40 Cities Compact of Mayors:**

  ▶ **"standardized measurement of emissions and climate risk, and consistent, public reporting of their efforts"**

► **San Francisco Department of Environment needs annual estimate of citywide GHG**

► **VMT is a key input in GHG estimates**

► **VMT estimate must track changes in behavior, not just forecast changes**

| Phase	Badge	Description	Timeframe
Commitment	COMMITMENT	Commit to reducing GHG emissions and adapting to the impacts of climate change	
Phase 1: Inventory	INVENTORY	Measure city-wide GHG emissions using the GPC	Within 1 year of commitment
		Identify climate hazards	
Phase 2: Target	TARGET	Set a GHG reduction target(s)	Within 2 years of commitment
		Assess climate vulnerabilities	
Phase 3: Plan	PLAN	Develop climate action plans to deliver on their targets	Within 3 years of commitment
		Develop climate adaptation plan	

www.c40.org/

Existing VMT Estimates

▶ **Caltrans (state DOT) produces annual estimates of VMT by county, based on Highway Performance Monitoring System (HPMS):**

  ▶ **San Francisco estimate: 8.8 million VMT (2015, daily)**

  ▶ **Applies factors to count date to estimate systemwide VMT**

▶ **SFCTA activity-based model (ABM) estimates 9.8 million VMT in San Francisco (2015, typical weekday)**

  ▶ **Changes in outcomes driven by land use and transportation network changes**

  ▶ **Not designed for yearly monitoring**

San Francisco VMT (Caltrans Public Road Data)

CALIFORNIA
PUBLIC 2016 ROAD DATA

Statistical Information Derived from the
Highway Performance Monitoring System

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People + Project

- **Light effort seeking better VMT estimates. Constraints:**
  - **Starting from scratch**
  - **Use existing, accessible data resources**
  - **Use pre-existing or easy-to-implement tools**
  - **Hard to validate OD matrices**

- **People: SFCTA intern Yiming Cai**
- **Staffing: Part-time effort over two-three months**
- **Components: methodological research, tool selection, data preparation, model setup, evaluation**
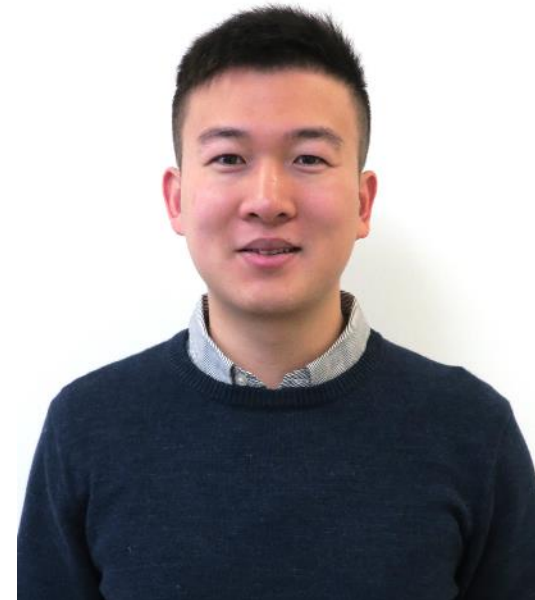
Approach – Use ODME to Estimate Annual VMT Changes

▶ **Use framework of existing model and matrix estimation to estimate VMT**

▶ **Base year model run trip tables as starting matrices**

▶ **Analysis year traffic counts for matrix adjustment**

Scenario	Base Year e.g. 2015	Analysis Year e.g. 2016
Prior/starting matrix (model run trip tables)	2015	2015
Traffic count data	2015	2016
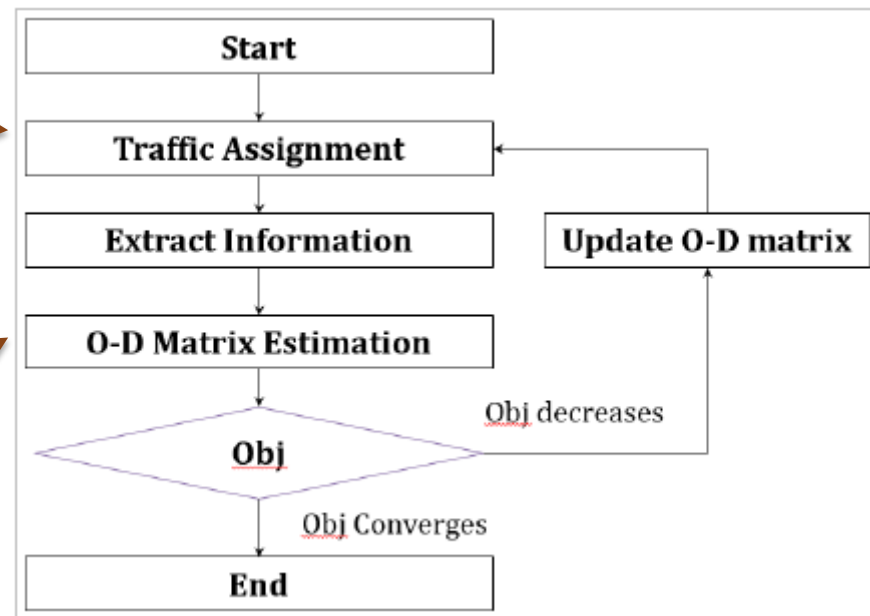
Resources

Count data

▶ **Recurring San Francisco traffic count data sources**

  ▶ Caltrans PeMS sensor data: approx. 30 locations

  ▶ Caltrans AADT estimates: approx. 60 records

  ▶ Congestion Management Program: 42 mainline, 14 turning movement

▶ **Non-recurring San Francisco traffic count data:**

  ▶ Approx. 200-300 counts in a given year

Land Use Data

▶ **Usually long lead time to release, often at high levels of aggregation**

Modeling Tool

▶ **Cube Analyst Drive software (through existing license)**

Testing + Evaluation

▶ **Considerations**

  ▶ **Looping structure and number of iterations**

  ▶ **Highway assignment convergence: relative gap**

  ▶ **Matrix estimation: input matrix and count confidence levels, upper/lower bounds for adjustments**
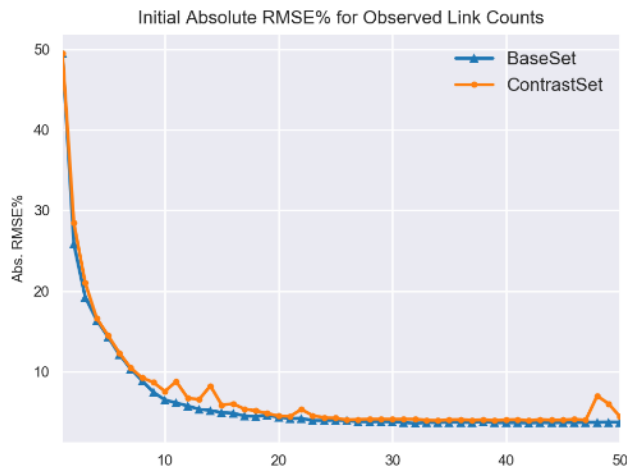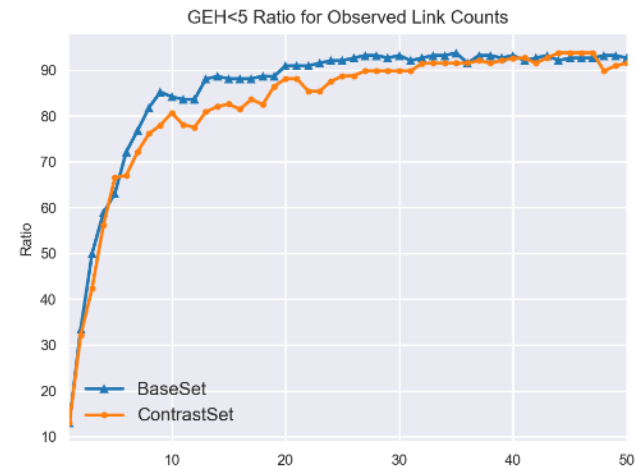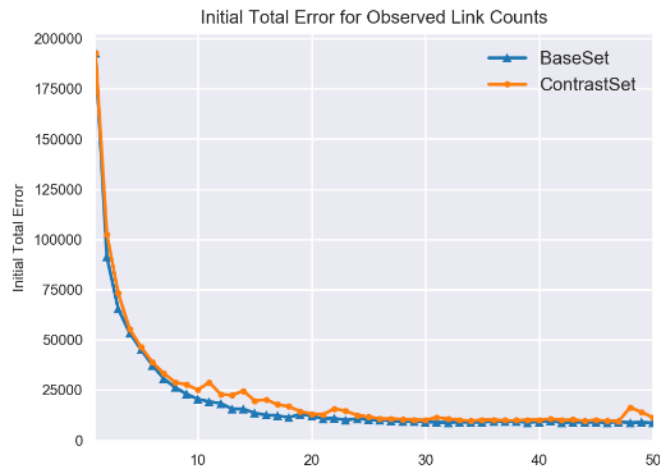
  ▶ **Quantity, type, and location of traffic counts**

  ▶ **Application to forecast years**

Testing + Evaluation

▶ **Loop iterations**

    ▶ **About 30 with loose assignment convergence**

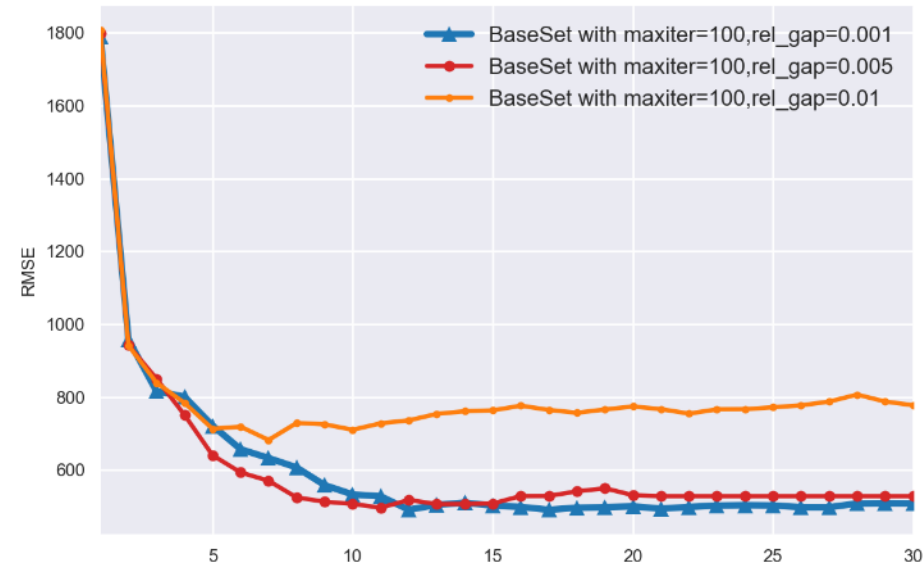   ▶ **Fewer with tighter convergence**
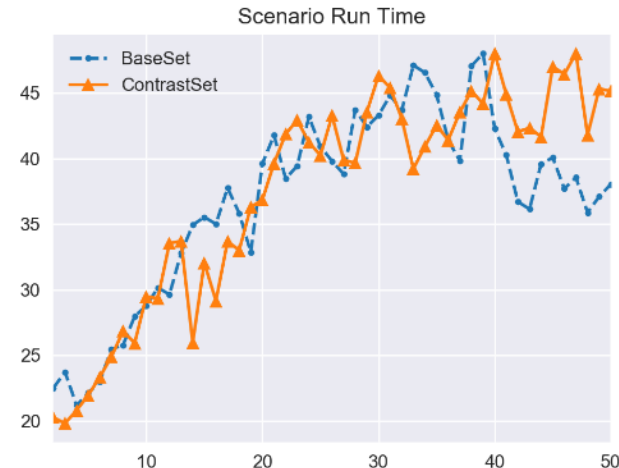
Testing + Evaluation

▶ **Highway assignment convergence criteria has big impact on citywide VMT estimate**


Total VMT in San Francisco, 2015

- BaseSet with maxiter=100, rel_gap=0.001
- BaseSet with maxiter=100, rel_gap=0.005
- BaseSet with maxiter=100, rel_gap=0.01

RMSE for Observed Link Counts

- BaseSet with maxiter=100, rel_gap=0.001
- BaseSet with maxiter=100, rel_gap=0.005
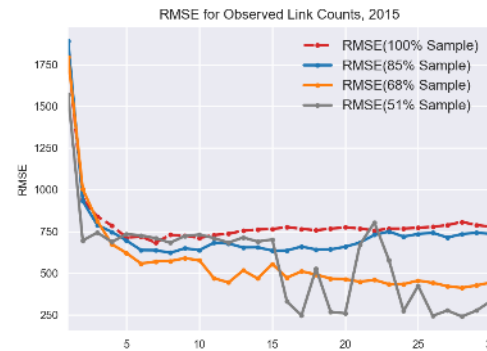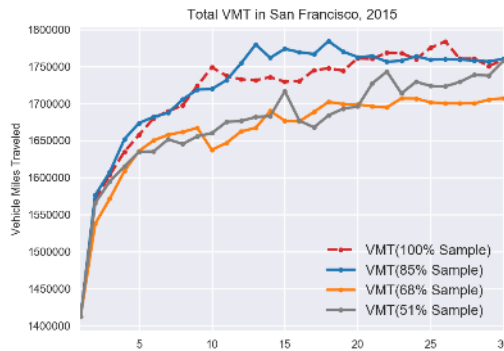- BaseSet with maxiter=100, rel_gap=0.01

Testing + Evaluation

▶ **Matrix estimation parameter settings less significant in aggregate measures**
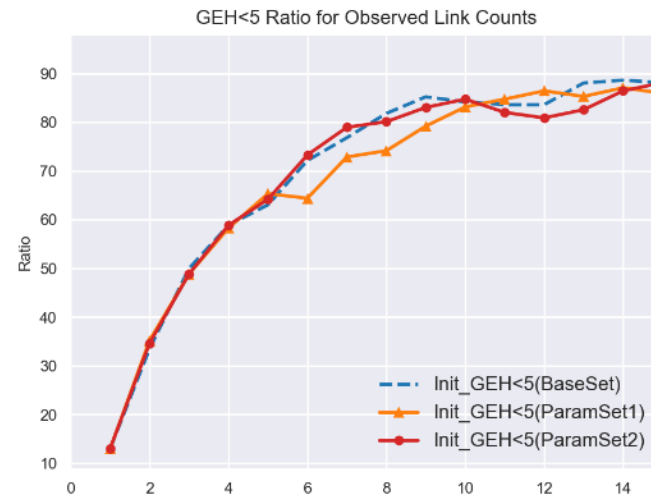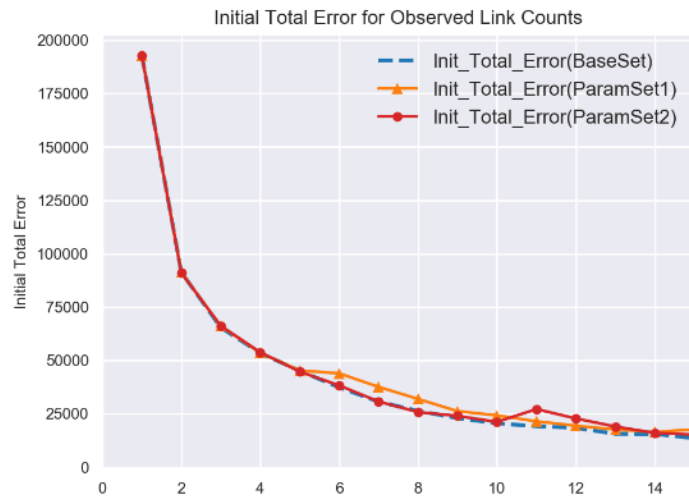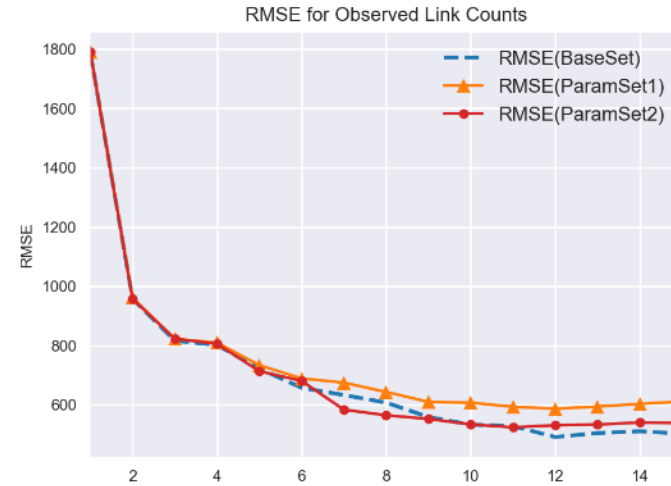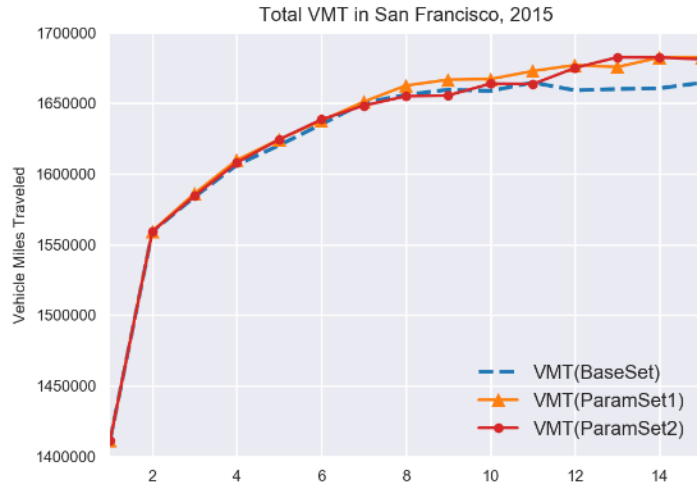
Testing + Evaluation

▶ **Traffic counts – 100%, 85%, 68%, and 51% samples**

   ▶ **Modest change in VMT estimate with small reduction in counts**

   ▶ **Error for hold out counts increases significantly**

▶ **Traffic counts – reduce sample for specific road classes**

   ▶ **Bigger impact on total VMT estimate than number of counts**

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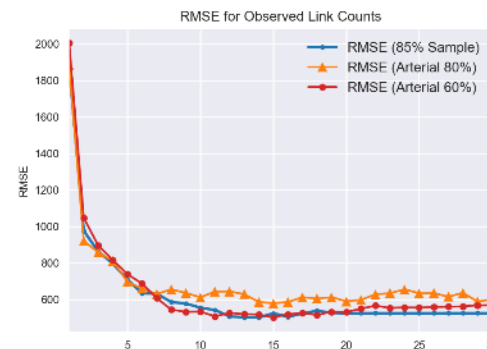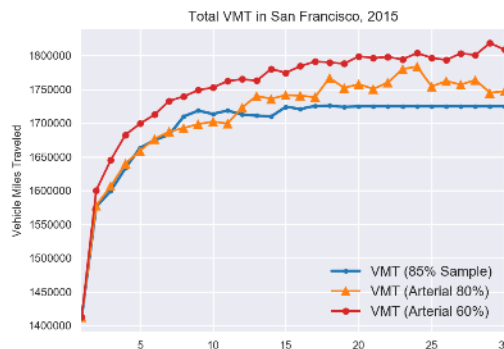
Status, Assessment, and Next Steps

Status and Assessment

▶ **Too early to make overall assessment**

▶ **Identified several issues requiring additional review**

▶ **Just getting started with n+1 year estimates**

Next Steps

▶ **Refine count data, search for more**

▶ **Additional testing at tighter relative gap**

▶ **Consider inclusion of annual land use changes**

Thank you!

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