

NCTCOG Path Towards Advanced Analytical Tools

TRAVEL MODEL DEVELOPMENT
AND
DATA MANAGEMENT GROUP

PRESENTED TO

TMIP

APRIL 25, 2013



Presenters



Kathy Yu



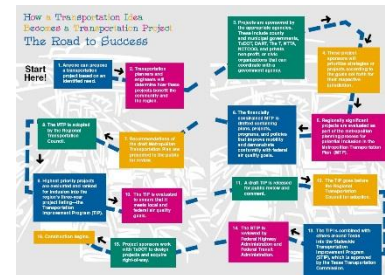
Arash Mirzaei



Behruz Paschai

The Planning Process

1. Understand existing conditions (different stakeholders see the system differently)
2. Propose future projects (Anyone can propose a project)
3. Find potential sponsors (maybe the same proposers)
4. Find the regionally significant (good) projects for the plan
5. Make the plan financially feasible
6. Meet Air Quality conformity requirements
7. Approve the plan
8. Get NEPA and other clearances and converge political forces behind the project
9. Select TIP projects for implementation (TIP, STIP) to secure funding



The Role of Model

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2. Propose future projects (Anyone can propose a project)
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Use of Model - 2013

**Mostly
Network
Questions**

Occasional
Demand Questions

Speed by Time Period

Daily Transit Ridership
Traffic Volume
By time period

VMT, VHT, ...

Peak Spreading

HOV, Toll, Mng. Lane

Use of Model - 2007

Modeling Services Requests	
1. Land use/Demographic Forecast integrated with economic and transportation	10. Noise Analysis
2. Sustainable Development/TOD	11. TCM Credits for Conformity Analysis
3. Parking Study	12. Transit Planning, Ridership Forecast
4. Truck Modeling and Goods Movement Analyses in Planning	13. Transit Revenue
5. HOV Analysis	14. New Starts
6. Toll Revenue Analysis	15. Thoroughfare Planning
7. Congestion Pricing	16. Emergency Planning using Transportation System
8. EJ Analysis	17. Evacuation Planning
9. Emission Analysis	18. Ability to Expand Detail Modeling
Not currently addressed in the model (6)	
Partially addressed in the model (12)	

Source: NCTCOG Model and Data Plan 2007

Survey Plan - 2007

Survey Cost Breakdown

(in Thousands)	Outsource	Staff	Total
Household	\$2,000	\$315	\$2,315
DART Onboard	\$350	\$35	\$385
FWTA & DCTA Onboard	\$400	\$73	\$473
Airport	\$300	\$88	\$388
Workplace	\$300	\$88	\$388
Parking	\$200	\$70	\$270
Count & Speed	\$500	\$70	\$570
Commercial Vehicle	\$500	\$70	\$570
Survey Total	\$4,550	\$809	\$5,359

Source: NCTCOG Model and Data Plan 2007

Survey Plan Status

Household Survey

- 2009 NHTS add-on (6,000 HHs)
- Recession 2008
- Being adjusted (\$1M to \$2M)

Transit Survey

- 2007-08 completed
- 2014 is coming up (\$1.5M)

Workplace and Special Generators

- Adjusted and ongoing (\$1.2M)
- TxDOT-TTI-NCTCOG partnership

Commercial Vehicle

- Adjusted and ongoing (\$0.4M)
- TxDOT-TTI-NCTCOG partnership

Airport

- Postponed

Parking

- Adjusted and completed

Traffic Count

- Adjusted and ongoing
- TxDOT-NCTCOG partnership

Speed

- Adjusted and ongoing
- DART-NCTCOG partnership

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Setting the Stage for Model Development

Need

- Implicitly defined by final users of the products who make real decisions that affect people
- Translation from public level to technical level is important and needs staff

Model application staff knowledge

- Level of translation is limited to effectiveness of the people who present or publish the results
- Training and communication skills matter

Model development staff knowledge

- Hiring consultants to develop models that model development staff do not understand creates more problems than solutions

Setting the Stage for Model Development

Data

- Models cannot be tested where adequate data do not exist

Theory and Technology

- Accepted theories, even if they are not proven, need to be established before models are created
- Technology should accommodate reasonable use of model in terms of runs time and ease of use

Preservation

Data

- Maintaining institutional memory/knowledge about data is a huge challenge
- Databases are created and documented inside the database
- Meaningful reports maintained
- More efficient methods are needed
 - Summary factsheets maintained
 - New methods are being explored (such as Adobe presenter)

Preservation

Model

- Version maintenance
- Output archiving
 - An active system is in place since 2004 at NCTCOG, it means we can recover all the files that was used or generated in any project since 2004; we can also replicate them
 - Metadata is semi-automatically generated in the model run that feed a database
 - Immediate, short term, and long term storage system is in-place with search capabilities
 - About 110 TB of storage and growing about 10-20 TB per year

If you implement what you know
you should implement, you have
done plenty.

NCTCOG Travel Surveys

PROJECTS, PLANS, AND EXPERIENCE



Initiated Projects

- **Regional Household Travel Survey**
 - **Data Availability**
 - NHTS Data Review and Analysis
 - **Model Framework**
 - ABM Framework
 - **Data Collection Methods and Accuracy**
 - Technology Demonstrations
- **Regional Transit Travel Survey**
 - DART, The T, DCTA

NHTS Data Review and Analysis

PLANS AND CURRENT GOALS



NHTS Data Review and Analysis

- **Add-On purchased by Texas Department of Transportation**
 - 5,943 households total in NCTCOG region.
 - Of this, 4,265 households surveyed on a weekday.
- **Question:**
 - Does this dataset contain what is needed to update the travel demand model?

NHTS Project –Process Review

- **Understanding NHTS Data Collection in the NCTCOG Area**
 - Administration
 - Sampling
 - Data Collection
 - Recruitment
 - Retrieval
 - Weighting

NHTS Project - Data Checks

- **Original Process**
 - Online Editing
 - Automated
- **Checks Defined through this Project**
 - Geocoding
 - Range and Non-Response
 - Consistency
 - Derived Fields
 - Logic and Accuracy

NHTS Project - Remaining Tasks

- **Data Imputation**
- **Data Identification**
- **Re-Weighting of the Data**
- **Table Summaries**
- **Documentation**

ABM Framework Project

(lots of choice models)

PAST EXPERIENCE AND CURRENT GOALS



Choice Models – NCTCOG Past Experience

- **Lessons Learned from previous outsourced Projects**
 - Difficult to write an exact scope
 - General RFP terms not sufficient for receiving quality products
 - Early dive in to the model building process
 - Need for more input data analysis
 - Little focus on necessary and available samples by stratum

Choice Models – NCTCOG Past Experience

- **Lessons Learned from previous outsourced Projects**
 - Lack of flexibility in the process
 - Left with the feeling that we could do something better



Developed hands-on in-house choice modeling skills
Redeveloped the outsourced models in-house

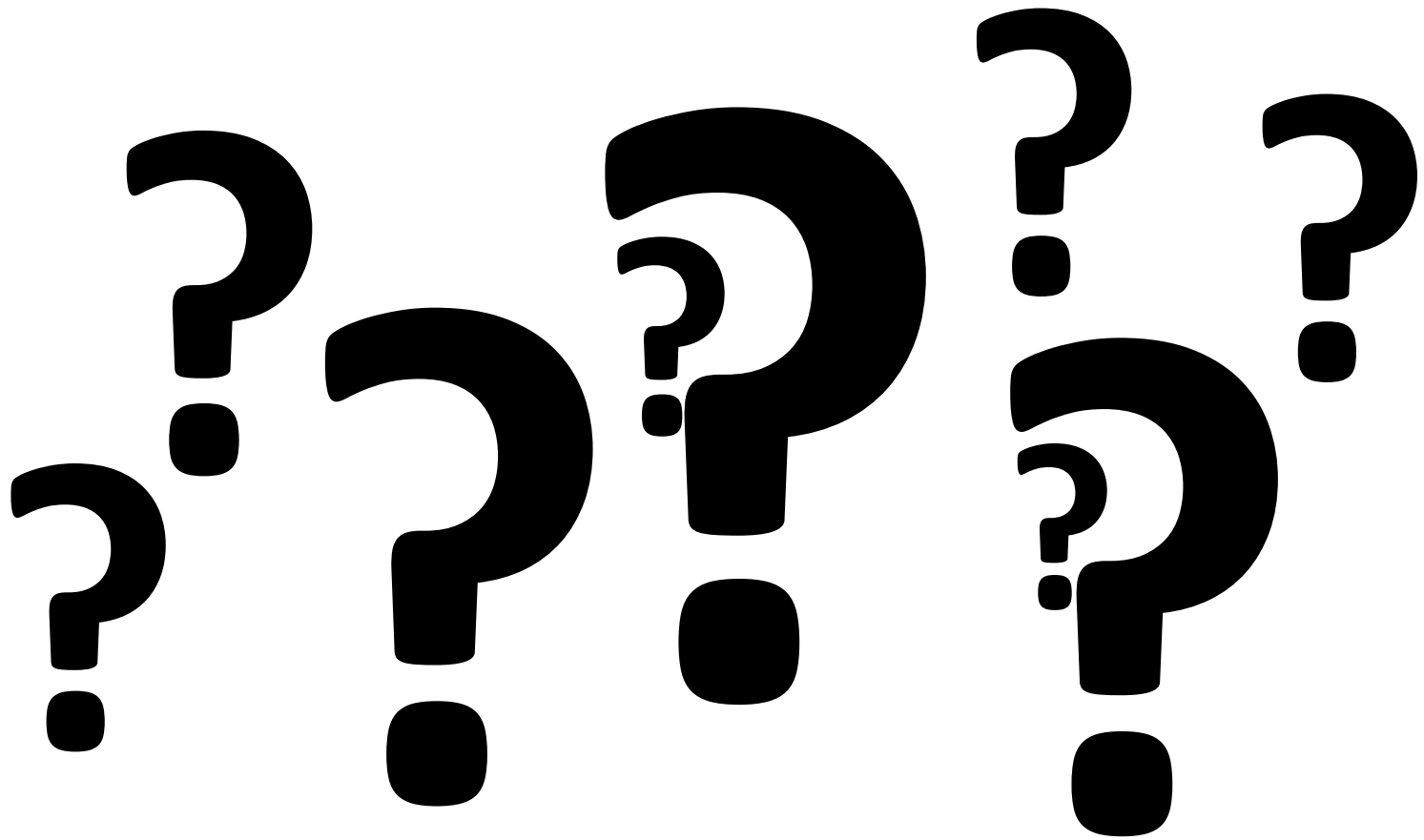
ABM Framework – General Goals

- **Model Structure**
 - State of the practice
 - Short-term advantages
- **Model Components**
 - Estimation, calibration, and validation
 - Performance
 - Statistical validity

ABM Framework – General Goals

- **Data Needs**
 - Per model component
 - Sample size
 - Sampling plan
 - Cost

ABM – Questions



PopSyn – Questions

- **General Questions**
 - What is the statistical significance of the model components (controlled and uncontrolled variables)?
 - How many controlled and un-controlled variables to include?
 - How is the inherent randomness in the process analyzed?

Choice Models – Questions

- **General Questions**
 - How many samples do we need to estimate a choice model with X number of parameters?
 - What are the appropriate calibration and validation geographies?
 - What are the reasonable measures that need to be carefully looked at during the estimation process?

Choice Models

(Vehicle Ownership Model)

INTERNAL EXPERIENCE – AN EXAMPLE

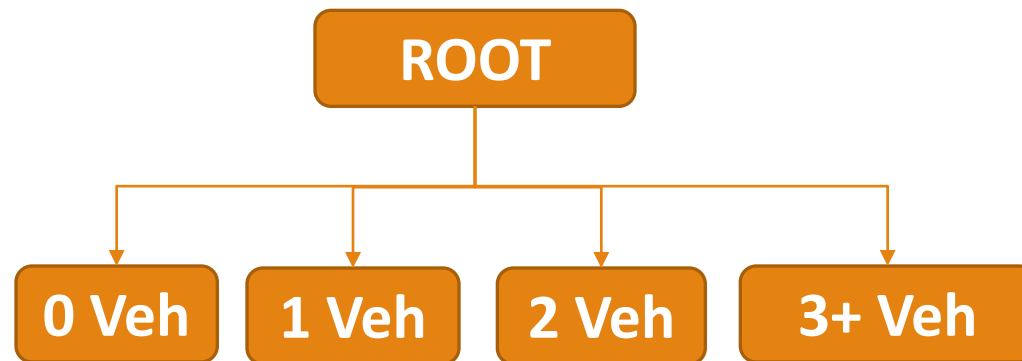


Choice Models – Internal Experience

- **Implementation**
 - Vehicle ownership model estimated based on 2009 NHTS data (5,510 records)
 - Regional model calibrated based on ACS-5YR (2005-2009)
 - Model tested at tract level (1,058 tracts)

Choice Models – Internal Experience

- **Vehicle Ownership Model**



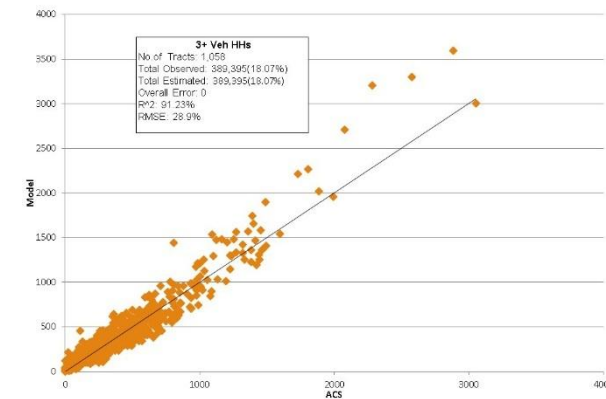
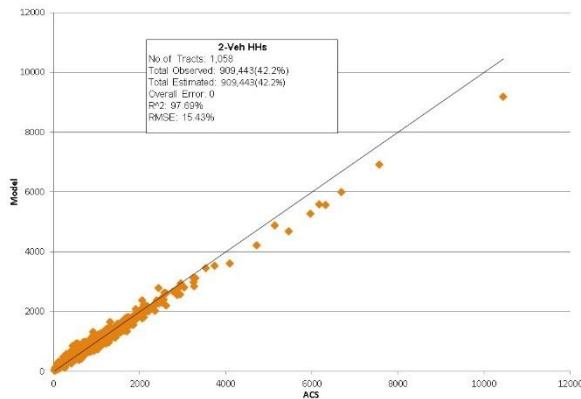
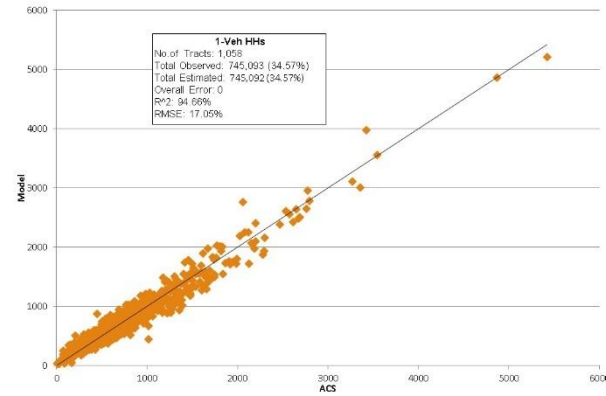
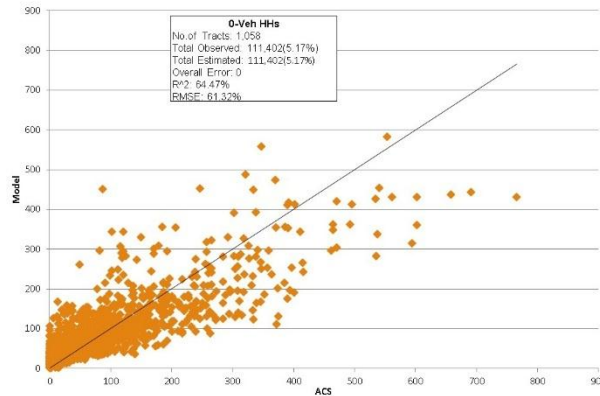
Choice Models – Internal Experience

- **Vehicle Ownership Model**

Number of Observations:	5510
Number of estimated parameters:	19
Rho-square	0.388
Adjusted rho-square	0.386

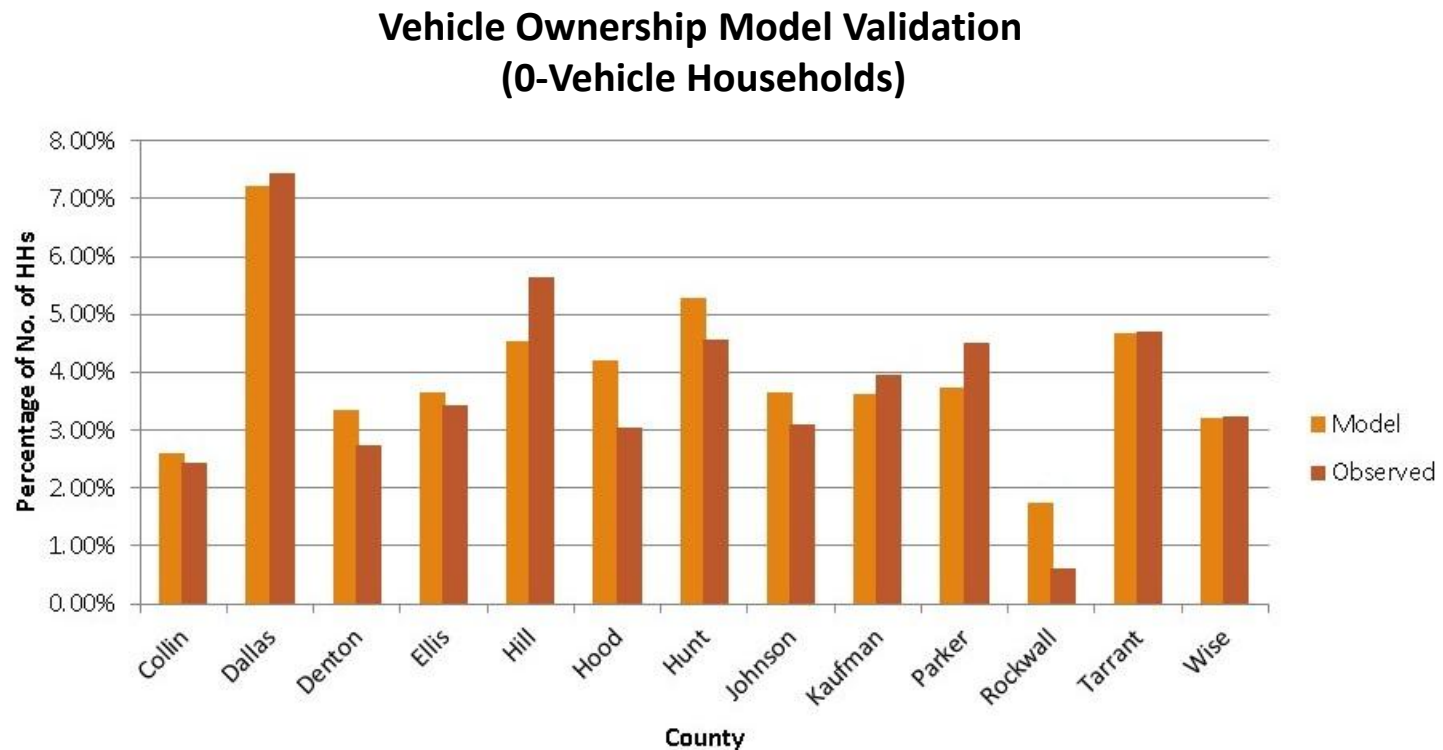
Choice Models – Internal Experience

- Vehicle Ownership Model Calibration



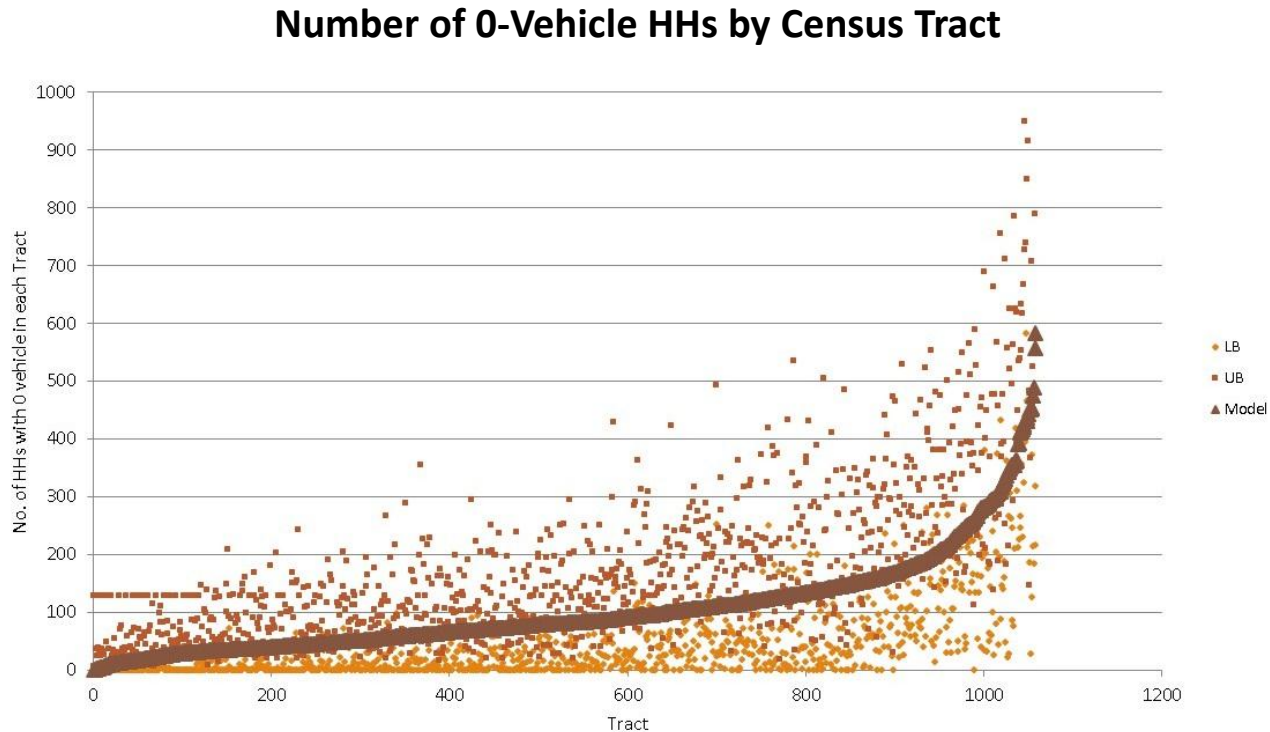
Choice Models – Internal Experience

- Vehicle Ownership Model Validation



Choice Models – Internal Experience

- **Vehicle Ownership Model Validation**



ABM Framework Project

PRELIMINARY LESSONS LEARNED



ABM Framework

- **Preliminary Lessons Learned**
 - Data limitations
 - Estimation, calibration, and alternative specific constants
 - Need for rigorous validation
 - Need for rigorous sensitivity tests
 - Large validation geographies
 - Model complications vs performance
 - Statistical validity of model results

ABM Framework

- **Preliminary Lessons Learned**
 - Downstream model correction concerns
 - Controlled and uncontrolled variables
 - Inherent variability, and randomness
 - Level of practical uses in decision making
 - In-house model development capabilities
 - End user perception and resistance to complicated models
 - Step-wise implementation of ABMs

Technology Demonstration Project

PLANS AND CURRENT GOALS



Technology Demonstrations

- **Purpose:** Demonstrate capabilities of household survey technologies
- **Investigate**
 - Accuracy of the data collection
 - Reduction of household burden
 - Types of data that can be collected
 - Types of data that can be determined(post-process)
 - Support for multi-day surveys

Technology Demonstrations

- **Data Collection Methods**
 - GPS Logger (Abt SRBI)
 - Smart Phone Application (NuStats)
 - Cell Phone Triangulation (NuStats/Traffic Technology Solutions)
- **Comparison against one-day travel diary**
- **Joint data collection**



Joint Technology Demonstrations

- **Merging of Milestones and Schedule**
- **Habitual Locations Form**
- **One-Day Travel Diary**
- **Joint division of panelists into waves**

Technology Demonstrations Prep

- **Testing use of technology**
- **Reviewing raw data of technology**
- **Reviewing Scripts, Cover Letters, and Information Sheets to be used with panelists.**
- **Recruitment procedure**
- **<http://www.nctcog.org/survey>**

Technology Demonstration Project

PRELIMINARY LESSONS LEARNED



Technology Demonstrations Recruitment

- **Positive Reactions**
 - Excited to try 1 or more technologies
 - Interested in helping project within agency
 - Interest in testing technology on different modes
- **Hesitations**
 - Privacy
 - Security
 - Battery consumption, Data plan/Text Messaging Usage
 - Carrying an extra device
 - Survey Duration
 - Incentives

Technology Demonstrations

- **Many steps in this process, even for our small survey.**
- **Need to balance concerns on forms and diaries.**
- **Testing of devices, forms, and diaries is essential.**
- **Wordings and approaches with volunteer requires careful review and consideration.**