New Data to Support Transit Planning
FDOT/FPTA/CUTR Professional Development Workshop

Steven E. Polzin, Ph.D.

June 5, 2012
Outline

• Introduction – Polzin 3:15 – 3:25
• NHTS data and transit planning – Xuehao Chu 3:25 – 3:45
• LEHD data for transit planning – Martin Catala 3:45 – 4:05
• Census/ACS data/CTPP data – Chu/Bunner 4:05 – 4:20
• InfoUSA data, parcel data – Rodney Bunner 4:20 – 4:30
• TBEST data and data display capabilities Rodney Bunner 4:30 – 4:50
• Questions – 4:50 – 5:00

“Without data, you're just another person with an opinion.”
Panel

• Xuehao Chu, PhD. Economics, Senior Research Associate, expertise in statistics, data analysis, economic analysis.

• Martin Catala, Martin Catala, MPA. Manager GIS and Informatics Group, Geographic Information Systems, Transit Accessibility and Mobility Evaluation, Livability and Census and Journey to Work data user

• Rodney Bunner, Transportation Software Developer, 1991 West Virginia University BA Geography, 1995 Shippensburg University MS Environmental Studies, TBEST development and implementation, transportation Networks including GTFS
Data for Transit Planning

Data on Travel Behavior

- NHTS
- ACS
- LEHD
- On-Board surveys
- Farebox, APC data
- Customer feedback
- Driver/employee feedback
- Etc.

Data on Travel Market

- Census
- ACS
- LEHD
- Property Parcel Data
- InfoUSA data

Knowledge about travel behavior

Knowledge of the number and location of people and activities that define travel needs
Fundamentals on Interpreting Data

“If you torture the data long enough, nature will confess.”

Ronald Coase – 1991 Nobel Prize in Economics

“If you torture the data long enough you can make it confess to anything.”

Alan Pisarski – No Nobel Prizes
A Perfect Storm for Travel Data

• Discontinuation of census long form
• Emergence of American Community Survey
  – Difficulty of working with multi-year data
• Costs, privacy, respondent cynicism, declining landline phones availability, etc. have complicated data collection/availability
• Desire for geographic precision as minor modes are very place sensitive
Dynamic Changes Requiring Fresh Data

• Evidence of fundamental behavior changes
  – Aging boomers
  – Different behavior for millennial generation
  – Dramatically slower economy
  – Real estate bubble burst
  – High and fluctuating energy prices
  – Environmental concerns
  – Technology changes
And...

- Scarce resources leverage the importance of well-informed decisions
DATA -- A FIX FOR DATA ADDICTS AND INOCULATION AGAINST UNINFORMED DECISIONS
Transit Planning Data Analysis and Presentation Using TBEST
FDOT/FPTA/CUTR Professional Development Workshop

Rodney Bunner
June 5, 2012
TBEST Introduction

What is TBEST?
Transit Demand Modeling/Analysis Software Developed by Florida Department of Transportation Public Transit Office

Software Goal
“Comprehensive Transit Network Modeling, Management and Analysis Software with a focus on short to mid-term transit planning”

Software Objectives
• Sensitive to service adjustments (operational, schedule, alignment, system, and fare)
• User-friendly
• Cost-Effective
• Scalable (Indian River to LA Metro)
• Modest Data Requirements
• Standard modeling methodology to be used by any agency for ridership estimation
TBEST in Florida

TBEST provides a standardized transit modeling tool for agencies to develop and submit the required ridership estimation portion of the Transit Development Plan (TDP) report - it also provides a convenient framework for exploring transit market data.
TBEST FEATURES

- Utilizes readily available data sources with minimal configuration time
- Utilizes industry-standard GIS and Database software tools
- Fills the industry gap for a short-term ridership estimation tool
- Provides scenario-based modeling with extensive scenario comparison tools
- GTFS network import and full network editor
- Includes tools to analyze land use and socio-economic markets, network accessibility and model results
- Easily understandable by technical staff with GIS, database, and modeling experience
TBEST Socio-Demographic Data

• Socio-Economic
  – Traditionally derived from Census long form
  – Transition to 2010 Census with SF1 and ACS variables

• Employment
  – FDOT provided InfoUSA address-based data
  – Optionally include locally provided zonal data

• Land Use
  – Florida Department of Revenue parcel data
TBEST Census and ACS Implementation

- TBEST 4.0 and prior versions utilized Census 2000 SF1 (Block) and SF3 (Block Group) variables
- TBEST 4.1 will make available Census 2010 data which will require transition from SF3 long form to ACS derived variables
TBEST Census 2010 Implementation

- Statewide 2010 Census Block Geography
- Process SF1 data into eight transit sensitive variables
- One variable not available in 2010: ‘Households with Children < 16’ replaced by ‘Households with Children < 18’.
TBEST ACS Implementation

SF3 to ACS Transition Issues

1. **Symmetry** - determine the ACS fields that are equivalent to the SF3 long form fields

2. **Reliability** - Loss in data accuracy with ACS both in levels of the population sampled and aggregated data

3. **Application** – Does the transition significantly impact the TBEST software and model?
TBEST ACS Transition Process

• Transition from SF3 to ACS
  – Identify the ACS tables and fields which correspond to SF3 fields utilized in TBEST
  – Develop a crosswalk table from TBEST SF3 variables to ACS variables
  – Must combine multiple ACS fields to attain symmetry with SF3 fields
  – Census provides a conversion tool to assist

# TBEST ACS Transition Process

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>Table</th>
<th>Sequence/Field</th>
<th>Cell values calculation</th>
<th>Description</th>
<th>Geography level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>Census 2010: SF1_00001</td>
<td>P1</td>
<td>P0010001</td>
<td>1</td>
<td>Total Population</td>
<td>Block</td>
</tr>
<tr>
<td>Total Households</td>
<td>Census 2010: SF1_00005</td>
<td>P16</td>
<td>P00160001</td>
<td>1</td>
<td>Population In Households By Age</td>
<td>Block</td>
</tr>
<tr>
<td>Population 65+</td>
<td>Census 2010: SF1_00004</td>
<td>P12</td>
<td>(P0120020 - (P0120025 + (P0120044 - P0120049))</td>
<td>(20 + 21 + 22 + 23 + 24 + 25 + (44 + 45 + 46 + 47 + 48 + 49))</td>
<td>Sex by Age Table: Summarized the male and female over 65 population</td>
<td>Block</td>
</tr>
<tr>
<td>Population &lt; 16</td>
<td>Census 2010: SF1_00004</td>
<td>P14</td>
<td>(P0140003 - P0140018 + (P0140024 - P0140039))</td>
<td>(P0140003 through P0140018) + (P0140018 through P0140039))</td>
<td>Sex By Age For The Population Under 20 Years: Summarized the male and female under 16 population</td>
<td>Block</td>
</tr>
<tr>
<td>Median household income</td>
<td>2006 – 2010 5yr ACS</td>
<td>B19013</td>
<td>53</td>
<td>1</td>
<td>Median Household Income In The Past 12 Months (In Inflation-Adjusted Dollars)</td>
<td>Block Group</td>
</tr>
<tr>
<td>Working Population</td>
<td>2006 – 2010 5yr ACS</td>
<td>B08006 and B01003</td>
<td>25 and 11</td>
<td>1 / 1</td>
<td>Sex Of Workers By Means Of Transportation To Work: Total workers divided by total population total population</td>
<td>Tract (ratio applied to Total Block Group Population)</td>
</tr>
<tr>
<td>Zero-vehicle Households</td>
<td>2006 – 2010 5yr ACS</td>
<td>B08201</td>
<td>30</td>
<td>2 / 1</td>
<td>Household Size By Vehicles Available: Zero vehicle households divided by total households.</td>
<td>Tract (ratio applied to Total Block Group Households)</td>
</tr>
</tbody>
</table>
TBEST ACS Data Development

2010 Decennial Census
1. Download Florida 2010 Census block geography, Geo file and SF1 data files in raw form from Census website
2. Imported the required segment tables and geo table into SQL Server (data was too large for Access)
3. Used SQL to assemble data and create a block and block group tables
4. Export final, formatted SF1 table for use in TBEST
5. Export Block Group table with Total Population and Total Households to be used with ACS data
TBEST ACS Data Development

5-year ACS (2006 – 2010) data

1. Download Florida ACS sequence tables from the Census with Geo template

2. Using the SF3 to ACS crosswalk table, load the sequence tables containing the data to construct TBEST variables into Microsoft Access

3. Import Block Group table from 2010 Census

4. Constructed a series of SQL queries to calculate and format TBEST variables

5. Applied tract-level demographic population shares (ratio) to Block Group total population and total households to calculate block group level shares
TBEST Census/ACS Summary

Symmetry - Only one variable was not transitioned from 2000 to 2010: ‘Households with Children < 16’. Variable replaced by ‘Households with Children < 18’.

Accuracy – 6 of the 17 socio-economic variables were transitioned from block group to tract level summarization. Shares were applied to block group totals for compatibility and data integrity.

Application – Combined 2010 Census and 5yr ACS was tested in TBEST with no observed issues. Households with children variable was not part of TBEST model equation thus model recalibration was not required.
TBEST Employment Data

FDOT provided 2010 InfoUSA dataset includes:
• X,Y location, # of employees, SIC code

TBEST groups employers into:
• Commercial
• Service
• Industrial
TBEST Land Use Data

Enhance the Transit Boardings Estimation and Simulation Tool (TBEST) travel demand forecasting software by improving the predictive capability and its value to transit planners.

Three Primary Target Areas

1. TBEST model calibration with parcel level data
2. Incorporate Land Use Trip Attractions into the model framework
3. Provide Market Analysis capabilities
TBEST Land Use Data Purpose

• Provides more precise geographic distribution for transit walk access market which is vital to ridership estimation

• Surrogate for population and employment for trip generation. Especially in Florida, with seasonal population, extensive tourism, and beach activity with little dependence on traditional pop/emp for trip generation

• Provide extensive land use categorization. Categories can be utilized in combination with available information on building sq. ft, land area, and dwelling units as input to trip attraction calculations and market analysis
TBEST Land Use Data - Definition

• 2011 Florida Department of Revenue (DOR) parcels
• Statewide dataset contains parcel level land use code, building sq. ft., land area, dwelling units
• 100 land use definitions
• Population data synthesized to parcel level using Census block group to calculate average population per dwelling unit
• Yearly update of data
Land Use Data Development

Automated the data development process steps including:

1. Statewide data download from DOR website
2. Parcel centroid creation from parcel polygons
3. Calculating individual parcel population value
4. Format data for use in TBEST
TBEST Land Use Data Application

• Matched Florida DOR Parcel Land Use Codes to ITE Land-Use based Trip Generation Rates
  – Most of the ITE trip rates are available for one or more of the following time periods: (1) weekday, (2) weekday AM peak one-hour (3) weekday PM peak one-hour, (4) Saturday and (5) Sunday.
• To match ITE rates to TBEST model time periods, temporal distribution of trips in the 2009 NHTS database
• Synthesized vehicle trip rates to person-level trip rates
• Trips are calculated for every parcel
• Essentially, every parcel becomes a special generator
Incorporating Trip Rates into TBEST

- Spreadsheet was developed to calculate person trip rates for each DOR Land Use Code and TBEST model time period
- Spreadsheet will be distributed with the model so that users are able to make modifications
- Adaptable to any parcel database
Land Use Data Status

• TBEST software has been updated to utilize land use data for modeling and market analysis
• Parcel model equations incorporate parcel trip generation for stop buffers and network accessible stops
• Model sensitivity testing is needed on different systems
• The DOR parcel database for Florida provides a generally high quality, current data resource for modeling
• Land Use Market Analysis Tool
Socio-Demographic Data Download

• The Census, Employment and Land Use data can be downloaded from within TBEST and seamlessly used to build a TBEST Transit System

• Historical data is also available
TBEST Software Updates

• TBEST 4.1 to be released later this summer
• Streamlined data analysis capabilities with the TBEST GTFS Network Import Tool
• Model independent functions for Market and Network Accessibility analysis
• Contains 2010 Census, 2010 Employment and 2011 Land Use
• Multiple model structure – can accommodate independent models for BRT, Land Use and the classic TBEST model
• TDP-specific report for Florida properties utilizes parcel data
Network Generation - GTFS

- TBEST GTFS Network Import Tool
  - Network development and maintenance
  - Iterative updates to support Service Planning with a validated model
TBEST Market Analysis

• The TBEST Market Analysis functionality works to summarize land use, socio-economic, and employment data distribution for a given market area
• Market Analysis functions are not model dependent in that you don't have to run or validate a TBEST model to use the functions
• Incorporates spatial distribution, chart illustrations and summary table for a complete visualization of the market
• Maps, data and charts are interactive so that the user can create the summary the best communicates the intended analysis theme
• FTA Title VI specific summarization
Defining a TBEST Market

• Markets can be defined based on a user defined buffer around selected stops, segments, routes or the entire route network.
  – Buffer can occur around stops or around linear segments

• Market can also be defined as a TBEST Area, Corridor or Site Analysis features
Summary Options

Land Use Market Analysis
- Person Trips, Population, Dwelling Units, Building Sq. Ft. or Land Area
- Person Trips are time period dependent and are calculated on the fly from the land use trip rates defined for model associated with the scenario.

Socio-Economic Market Analysis
- Each of the TBEST socio-demographic variables are available for summarization within the market.

Employment Market Analysis
- Summarized as a single option but can be visualized as Commercial, Service and Industrial within the summary.
- If local zonal data has been optioned as the employment source data, the Employment Market Analysis will summarize this data
Land Use Market Analysis
Socio-Economic Market Analysis
TBEST Network Accessible Market Analysis

- Summarize network accessible land use, socio-economic or employment from an origin stop(s) or to destination stop(s)
- Networking parameters defined by the user with a Network Accessibility Build
  - Maximum Impedance
  - Maximum Transfers
  - Impedance Weight Factors
  - Fare Penalty
  - Transfer Penalty
  - Walking Speed
  - Transfer Options
  - Timed Transfer Wait-time
Network Accessibility Analysis

- From or To origin stop(s) or an area
- Land Use, Socio-Economic and Employment Variables
Demonstration

TBEST data and data display capabilities
NHTS Data and Transit Planning

Xuehao Chu

June 5, 2012  ●  New Data to Support Transit Planning
FDOT/FPTA/CUTR Professional Development Workshop
Outline

• Characteristics of the NHTS
• Data for Each Household
• Data for Each Person
• Data for Each Worker
• Data for Each Linked Trip
• The Florida Sample
• Florida Add-on Questions
• Some Results
• Conclusions
Characteristics of the NHTS

- Inventory of daily travel nationwide
- Who, when, where, why, how
- Annual travel
- Linked trips
- All modes
- All purposes
- All persons 5+
- Similar in content to RHTS, which are rare & a snapshot
- Smaller sample than ACS
- Actual trips made rather than usual mode (ACS)
- No monetary cost of travel
- No road type
- No specific routes
- Most variables in on-board surveys (duration of use, alternative modes)
Data for Each Household

- Number of people, drivers, workers and vehicles
- Income
- Housing Type
- Owned or rented
- Number of cell phones*
- Number of other phones
- Race of reference person
- Hispanic status of reference person
- Tract and Block Group characteristics
- Internet Use & Delivery to households**
Data for Each Person

- Age/Gender
- Driver status
- Worker status/Primary activity
- Internet use*
- Home deliveries from Internet shopping**
- Travel Disability / Effect of disability on mobility*
- Education level
- Immigrant status*
- Views on transportation
- Annual miles driven
- Incidence of public transit use in past month
- Incidence of motorcycle use in last month
- Incidence of walk and bike trips in past week
- Usual mode to school/Usual mode from school (children)**
Data for Each Worker

- *Full or part-time*
- More than one job
- Occupation (four categories)*
- *Workplace location*
- *Usual mode to work*
- *Drive alone or carpool*
- *Usual distance to work*
- Usual time to work**
- Work from home
- Usual arrival time at work
- Flexibility in work arrival time**
Data for Each Linked Trip

- Origin and Destination address (for Add-ons)
- *Time trip started and ended*
- *Distance*
- *Means of transportation:*
  - vehicle type
    - if household vehicle, which one
    - if transit, wait time
    - if transit, access & egress modes*
    - if transit, access time & egress time*
- Interstate Use**
- Tolls Paid**
- *Trip Purpose*
- *Travel Party Size*
The Florida Sample in 2009 NHTS

- 15,884 households
- Paid 2.95 million for add-on households
- Designed to have 1,200+ households per region

- 1,437 households in 2001 NHTS
Florida Add-on Data in 2009 NHTS

• For workers:
  – For public transit to be a good option for your commute, which of the following would be most important to you?

• For persons 16+:
  – For public transit to be a good option for the trips you make most frequently, which of the following would be most important to you?

• For households:
  – How many months of the year do you live in Florida?
  – How long ago did you move to this home?
  – What is the most important reason you chose your current home location? Being close to public transit was one of 11 reasons.
  – What is the most important reason you have stayed in your current home? Being close to public transit was one of 14 reasons.
Some Illustrative Results

- Public transit trips are those linked trips whose main mode is one of these:
  1. Local public bus
  2. Commuter bus
  3. Commuter train
  4. Subway/elevated train
  5. Streetcar/trolley

- Illustrative results are shown for:
  - Magnitude of sampling error
  - Size of transit markets
  - Transit’s mode share
  - Distribution across all modes
  - Relative general mobility
Magnitude of Sampling Error

- Need to measure sampling error when precise estimates are important
- 100 sets of replicate weights are available
- Use software that can handle complex surveys (e.g. WesVar)
- Or use the NHTS online Table Designer
- The following illustrates the magnitude:

<table>
<thead>
<tr>
<th>Population Segments</th>
<th>Sampled Transit Trips</th>
<th>Estimated Annual Transit Trips (millions)</th>
<th>95% Margin of Error (millions)</th>
<th>Standard Error (millions)</th>
<th>Coefficient of Variation (COV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. total</td>
<td>8,521</td>
<td>7,520</td>
<td>493.4</td>
<td>251.7</td>
<td>3.3%</td>
</tr>
<tr>
<td>Florida total</td>
<td>513</td>
<td>228</td>
<td>55.5</td>
<td>28.3</td>
<td>12.4%</td>
</tr>
</tbody>
</table>
Size of Transit Markets

- Work trips: Florida 27.4%, US 36.3%
- Use transit 30+ times/month: Florida 36.3%, US 43.4%
- Zero-vehicle: Florida 41.9%, US 48.5%
- Income under $15,000: Florida 28.9%, US 36.8%
- Non-Hispanic Blacks: Florida 32.2%, US 38.2%
- Hispanics: Florida 29.0%, US 38.2%
- With medical conditions: Florida 10.9%, US 13.7%
- New immigrants: Florida 8.2%, US 23.2%
- Non-drivers: Florida 10.7%, US 12.4%
Transit’s Modal Share

- Work trips
  - Florida: 1.3%
  - US: 3.3%

- Use transit 30+ times/month
  - Florida: 35.3%
  - US: 35.0%

- Zero-vehicle
  - Florida: 20.9%
  - US: 26.7%

- Income under $15,000
  - Florida: 5.2%
  - US: 6.9%

- Non-Hispanic Blacks
  - Florida: 3.0%
  - US: 5.9%

- Hispanics
  - Florida: 2.1%
  - US: 4.2%

- With medical conditions
  - Florida: 2.3%
  - US: 3.7%

- New immigrants
  - Florida: 5.8%
  - US: 6.5%

- Non-drivers
  - Florida: 2.4%
  - US: 4.5%
Distribution across AllModes

- Work trips
- Use transit 30+ times/month
- Zero-vehicle
- Income under $15,000
- Non-Hispanic Blacks
- Hispanics
- With medical conditions
- New immigrants
- Non-drivers

- pov driver
- pov passenger
- transit
- walk
- bike
- other
Relative General Mobility

- Use transit 30+ times/month
- Zero-vehicle
- Income under $15,000
- Non-Hispanic Blacks
- Hispanics
- With medical conditions
- New immigrants
- Non-drivers

Florida vs US (relative general mobility)
Where to Get the NHTS Data?

• Nationwide data \textbf{without} geocoded locations or add-on data:
  – Official NHTS website

• Florida data \textbf{with} geocoded locations and add-on data:
  – Florida Department of Transportation
Conclusions

• The 2009 NHTS is a rich source of data on the who, when, where, why, and how of daily travel by households in Florida and U.S.
• Florida sample is 10 times of previous ones
• Sufficient for statewide analysis of transit
• Careful for aggregate analysis at regional level
• Learn a lot about transit and alternatives
Employment Origin Destination Data

Examining Census LEHD Data to Support Transit Planning

May 5, 2012 • FPTA Mid-Year Conference
Overview

- Understanding LEHD Data
- Mapping LEHD Online
- Using LEHD Desktop
- Data Limitations
Understanding LEHD

• Longitudinal Employer-Household Dynamics (LEHD) is a U.S. Census Bureau program
• Coordinated effort with state partners
• Designed to offer new information on workers and employers from existing data sources
• Based on administrative records
• Includes all employment subject to state unemployment insurance (UI) laws
What is LEHD

• LEHD Origin-Destination Employment Statistics (LODES)
  – Annual data on locations and characteristics of workers by residence and workplace, and home-to-work flows
  – Compiled from federal administrative records, not surveys
  – Data covers 90 percent of all U.S. workers
  – Home-to-work flows between Census Blocks
  – On May 31, Federal employment data for 2010 were added
LEHD Data Availability

• Arizona – Data available for 2004-2010 only.
• Arkansas – Data available for 2003-2010 only.
• District of Columbia – Data available for 2010 only.
• Mississippi – Data available for 2004-2010 only.
• New Hampshire – Data available for 2003-2010 only.
• *Massachusetts, Puerto Rico, and U.S. Virgin islands – No data available.*
• All other states – Data available for 2002-2010.
Accessing LEHD Data

• Two Mechanisms to Access Data
  – Web based Mapping Application
    • ONTHEMAP
  – Data Repository
    • Raw Data Downloads
Web Based Access
Raw Data Access

1. Residence Area Characteristics (RAC)
   Number and characteristics of workers summarized by residence geography and reporting year

2. Workplace Area Characteristics (WAC)
   Number and characteristics of workers summarized by workplace geography and reporting year

3. Origin-Destination Flows (OD)
   Number and summary characteristics of workers who reside in one location and work in another location

- Large Datasets
  - Relational database
  - FL O-D over 8 million
Data Access – OD File Format

• Origin-Destination Characteristics

<table>
<thead>
<tr>
<th>Pos</th>
<th>Variable</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>w_geocode</td>
<td>Workplace Census Block Code</td>
</tr>
<tr>
<td>2</td>
<td>h_geocode</td>
<td>Residence Census Block Code</td>
</tr>
<tr>
<td>3</td>
<td>total</td>
<td>Total number of jobs</td>
</tr>
<tr>
<td>4</td>
<td>age1</td>
<td>Number of jobs of workers age 29 or younger</td>
</tr>
<tr>
<td>5</td>
<td>age2</td>
<td>Number of jobs for workers age 30 to 54</td>
</tr>
<tr>
<td>6</td>
<td>age3</td>
<td>Number of jobs for workers age 55 or older</td>
</tr>
<tr>
<td>7</td>
<td>earn1</td>
<td>Number of jobs with earnings $1250/month or less</td>
</tr>
<tr>
<td>8</td>
<td>earn2</td>
<td>Number of jobs with earnings $1251/month to $3333/month</td>
</tr>
<tr>
<td>9</td>
<td>earn3</td>
<td>Number of jobs with earnings greater than $3333/month</td>
</tr>
<tr>
<td>10</td>
<td>ind1</td>
<td>Number of jobs in Goods Producing industry sectors</td>
</tr>
<tr>
<td>11</td>
<td>ind2</td>
<td>Number of jobs in Trade, Transportation, and Utilities industry sectors</td>
</tr>
<tr>
<td>12</td>
<td>ind3</td>
<td>Number of jobs in All Other Services industry sectors</td>
</tr>
<tr>
<td>13</td>
<td>createdate</td>
<td>Date on which data was created, formatted as YYYYMMDD</td>
</tr>
</tbody>
</table>
Web Interface – On the Map
On The Map – Analysis

Analysis Settings

Inflow/Outflow Analysis in 2010 by Primary Jobs

<table>
<thead>
<tr>
<th>Home/Work Area</th>
<th>Analysis Type</th>
<th>Year</th>
<th>Job Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determines whether the selection area is analyzed on where workers live (&quot;Home&quot;) or where workers are employed (&quot;Work&quot;).</td>
<td>Determines the type of results that will be generated for the selected area.</td>
<td>Determines the year(s) of data that will be processed in the analysis.</td>
<td>Determines the scope of jobs that will be processed in the analysis.</td>
</tr>
<tr>
<td>○ Home</td>
<td>○ Work</td>
<td>○ Area Profile</td>
<td>○ All Jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Labor Market Segment:</td>
<td>○ Primary Jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ All Workers</td>
<td>○ All Private Jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Area Comparison</td>
<td>○ Private Primary Jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Areas to Compare:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Places (Cities, CEPs, etc.)</td>
<td></td>
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<td></td>
<td></td>
<td>○ Labor Market Segment:</td>
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<td></td>
<td></td>
<td>○ All Workers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Distance/Direction</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>○ Destination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Destination Type:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Places (Cities, CEPs, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Inflow/Outflow</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Home/Work choice does not affect results</td>
<td></td>
</tr>
</tbody>
</table>

Cancel Go!
Distance and Direction Analysis

Jobs by Distance - Work Census Block to Home Census Block

<table>
<thead>
<tr>
<th>Distance</th>
<th>Count</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Primary Jobs</td>
<td>21,433</td>
<td>100.0%</td>
</tr>
<tr>
<td>Less than 10 miles</td>
<td>11,564</td>
<td>54.0%</td>
</tr>
<tr>
<td>10 to 24 miles</td>
<td>5,405</td>
<td>25.6%</td>
</tr>
<tr>
<td>25 to 50 miles</td>
<td>1,717</td>
<td>8.0%</td>
</tr>
<tr>
<td>Greater than 50 miles</td>
<td>2,667</td>
<td>12.4%</td>
</tr>
</tbody>
</table>

- 220 - 385 Jobs/Sq.Mile
- 386 - 599 Jobs/Sq.Mile
  - 1 - 3 Jobs
  - 4 - 11 Jobs
  - 12 - 24 Jobs
  - 25 - 42 Jobs
  - 43 - 66 Jobs

Analysis Selection
DESTINATION ANALYSIS
Home Locations of Workers

Top 25 Origins Commuting Into Downtown St. Petersburg

<table>
<thead>
<tr>
<th>Jobs Counts by Census Tracts Where Workers Live</th>
<th>2010 Count</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Census Tracts</td>
<td>21,433</td>
<td>100.0%</td>
</tr>
<tr>
<td>236 (Pinellas, FL)</td>
<td>257</td>
<td>1.2%</td>
</tr>
<tr>
<td>202.01 (Pinellas, FL)</td>
<td>239</td>
<td>1.1%</td>
</tr>
<tr>
<td>240.02 (Pinellas, FL)</td>
<td>221</td>
<td>1.0%</td>
</tr>
<tr>
<td>286 (Pinellas, FL)</td>
<td>215</td>
<td>1.0%</td>
</tr>
<tr>
<td>202.06 (Pinellas, FL)</td>
<td>213</td>
<td>1.0%</td>
</tr>
<tr>
<td>235 (Pinellas, FL)</td>
<td>207</td>
<td>1.0%</td>
</tr>
<tr>
<td>202.09 (Pinellas, FL)</td>
<td>203</td>
<td>0.9%</td>
</tr>
<tr>
<td>215 (Pinellas, FL)</td>
<td>200</td>
<td>0.9%</td>
</tr>
<tr>
<td>240.04 (Pinellas, FL)</td>
<td>200</td>
<td>0.9%</td>
</tr>
<tr>
<td>221 (Pinellas, FL)</td>
<td>190</td>
<td>0.9%</td>
</tr>
<tr>
<td>All Other Locations</td>
<td>19,288</td>
<td>90.0%</td>
</tr>
</tbody>
</table>
Work Location of Employed Residents

Top 10 Commuting Destinations by Census Tracts

<table>
<thead>
<tr>
<th>Jobs Counts by Census Tracts Where Workers are Employed - Primary Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Count</td>
</tr>
<tr>
<td>All Census Tracts</td>
</tr>
<tr>
<td>241.12 (Pinellas, FL)</td>
</tr>
<tr>
<td>206 (Pinellas, FL)</td>
</tr>
<tr>
<td>215 (Pinellas, FL)</td>
</tr>
<tr>
<td>245.12 (Pinellas, FL)</td>
</tr>
<tr>
<td>45 (Hillsborough, FL)</td>
</tr>
<tr>
<td>244.10 (Pinellas, FL)</td>
</tr>
<tr>
<td>230.11 (Pinellas, FL)</td>
</tr>
<tr>
<td>234 (Pinellas, FL)</td>
</tr>
<tr>
<td>51.01 (Hillsborough, FL)</td>
</tr>
<tr>
<td>215.05 (Pinellas, FL)</td>
</tr>
<tr>
<td>All Other Locations</td>
</tr>
</tbody>
</table>
On The Map – Analysis In-Out Flow

10,761
129
860

-82.63912, 27.77723
# On the Map – Analysis

## Worker Profile

### Total Primary Jobs

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>10,910</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Worker Age

<table>
<thead>
<tr>
<th>Age</th>
<th>2010</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>Share</td>
<td></td>
</tr>
<tr>
<td>Age 29 or younger</td>
<td>1,762</td>
<td>16.2%</td>
</tr>
<tr>
<td>Age 30 to 54</td>
<td>6,787</td>
<td>62.2%</td>
</tr>
<tr>
<td>Age 55 or older</td>
<td>2,361</td>
<td>21.6%</td>
</tr>
</tbody>
</table>

### Earnings

<table>
<thead>
<tr>
<th>Earnings</th>
<th>2010</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>Share</td>
<td></td>
</tr>
<tr>
<td>$1,250 per month or less</td>
<td>1,147</td>
<td>10.5%</td>
</tr>
<tr>
<td>$1,251 to $3,333 per month</td>
<td>4,599</td>
<td>42.2%</td>
</tr>
<tr>
<td>More than $3,333 per month</td>
<td>5,164</td>
<td>47.3%</td>
</tr>
</tbody>
</table>
Data Used in ArcMap
Customize Data In GIS

Legend
Location of Employment
Jobs
- 1 - 24
- 25 - 63
- 64 - 134
- 135 - 532
- 633 - 1869
Data Limitations*

• Excludes some employment categories
  – Self employed & Sole Proprietors (6-17%)
  – Federal/Military/Railroad Workers (1% - 20%)
  – Employment exempt from UI laws (0% - 2%)

* Source:
NCHRP 08-36/Task 81: “Enhancing the American Community Survey Data as a Source for Home-to-Work Flows”
http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(81)_FR.pdf
Federal Data Limitations

- Board of Governors of the Federal Reserve
- Central Intelligence Agency
- Defense Intelligence Agency
- Foreign Service personnel at the State Department (included until March 2006)
- National Geospatial-Intelligence Agency
- National Security Agency
- Office of the Director of National Intelligence
- Office of the Vice President
- Postal Regulatory Commission
- Tennessee Valley Authority
- U.S. Postal Service
- White House Office

Full Description
http://www.fedscope.opm.gov/datadefn/aboutehri_sdm.asp#cpdf3
Data Limitations*

• Multiple Worksite Employers
  – Some multi-worksite employers refuse to file multiple worksite reports (MWR)
  – Employers with multiple worksites may show all employees located at primary employer address
  – MWR non-compliance affects about 5% of all employment, nationwide:
    • Rates vary significantly from state to state
    • Lower in States with mandatory MWR reporting
    • Highest non-compliance among local government agencies

*NCHRP 08-36/Task 81: “Enhancing the American Community Survey Data as a Source for Home-to-Work Flows”
http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(81)_FR.pdf
LEHD Highlights

• Annual Updates to Data
  – Comprehensive source of home-to-work flows
  – Small Geography
  – Analysis supported at multiple levels of geography (Census Blocks, Tracts, zip codes, places, urbanized areas, counties, states)
  – Worker characteristics include: industry type, age, income, race, ethnicity, and education
Conclusions

• LODES is a good source of data on work locations and the distribution of home-to-work flows

• LODES data should be used carefully and supplemented with local knowledge
  – Multiple worksite employers
Census/ACS/CTPP data for transit planning

Xuehao Chu

June 5, 2012 • New Data to Support Transit Planning
FDOT/FPTA/CUTR Professional Development Workshop
Outline

• Census 2010
• American Community Survey
• Census Transportation Planning Package
• Forms of Data
• Usage of Data
• Precision of ACS/CTPP Data
• ACS Statistical Analyzer
Census 2010

- Census 2010 provides these data items:
  - Household size
  - Housing type
  - Person age
  - Gender
  - Race
  - Ethnicity
- Data are available at the block level
- Data represent a census and have no sampling error
American Community Survey

• Designed & administered by the U.S. Census Bureau
• Instrument is similar to the traditional long form
  – Socio-demographic and housing
  – Economic and journey-to-work
• Administration is different from the Census long-form
  – Residence rule - current vs. usual
  – Measurement - continuous vs. snapshot (April 1st)
  – Reference period for some characteristics
  – Frequency - annual vs. every 10 years
  – Sample size - 1 in 40 (2.5%) vs. 1 in 6 (16.7%)
Type of ACS Data

- **Type of data products**
  - Pre-derived estimates
  - Sub-samples
- **Format of pre-derived estimates**
  - Published tables
  - ACS Summary File
- **Type of pre-derived estimates**
  - Place of residence characteristics
  - Place of work characteristics
- **Sub-samples**
  - 1% PUMS by state
## Availability by Geography & Period

<table>
<thead>
<tr>
<th>Population in the Geography of Data</th>
<th>Period of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-Year</td>
</tr>
<tr>
<td>Large: 65,000+</td>
<td>X</td>
</tr>
<tr>
<td>Medium: 20,000-65,000</td>
<td></td>
</tr>
<tr>
<td>Small: under 20,000 (include block groups)</td>
<td></td>
</tr>
</tbody>
</table>
CTPP Data from ACS

• Supported by pooled funds from states
• CTPP produces three sets of tables:
  – Part 1, Residence-Based Tables
  – Part 2, Workplace-Based Tables
  – Part 3, Worker Home-to-Work Flow Tables
• CTPP based on 2006-2008 3-year ACS data are now available
  – Geographies with populations 20,000 or greater
• CTPP based on 2006-2010 5-year ACS data are expected by May 2013
  – Part 1 and Part 2 tables -- TAZ and TAD geographies
  – Part 3 tables -- most to TAZ and TAD but some to larger geographies
• All tables come with SE and 90% MOE
• More data are suppressed for Part 3 tables to protect privacy
You can access CTPP data at AASHTO’s CTPP home page
Advantages of CTPP Flow Data

• With the 3-Part data from CTPP, you can measure things for multiple geographic orientations. You are interested in geography A and want to compare average commuting times between transit and driving:
  1. For workers living in A
  2. For workers working in A
  3. For workers commuting from A to geography B
  4. For workers commuting from B to A
  5. For workers living and working in A
Advantages of CTPP Workplace Data

- Worker residences and workplaces distribute differently
- Both distributions are important for transit to serve workers
- Transit planning traditionally has had detailed data on workers by residence but only total industry-specific employment by workplace
- CTPP workplace data provide detailed characteristics of workers at their workplaces
Customizable tables
Auto-generated chart for arrival time at workplace, 2006-2008 CTPP
Auto-generated charts for distribution of commute Time in Florida, 2006-2008 CTPP

All Modes

Transit, Bike, Walk, Other
Shape files available for download

Work flows to Hillsborough County
Usage of ACS/CTPP

• Indicating conditions of a geography or a population group using individual estimates, e.g.:
  – Average commuting time
  – Median household income
  – % workers commuting to work by transit
• Indicating differences by comparing estimates
  – Over time
  – Across population groups
  – Across geographic areas
• Input data for modeling
• Input data for multivariate analyses (e.g., TBEST applications)
Advice for Using ACS/CTPP Data as Individual Estimates or Comparisons

- "As the ACS estimates are based on a [relatively small] sample survey of the U.S. population, information about the sampling error [i.e., precision] associated with the estimates must be taken into account when analyzing individual estimates or comparing pairs of estimates across areas, population groups, or time periods."
Concept of Precision

<table>
<thead>
<tr>
<th>High Precision</th>
<th>Low Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="High Precision Targets" /></td>
<td><img src="image2.png" alt="Low Precision Targets" /></td>
</tr>
</tbody>
</table>
Measures of Precision

- Independent of confidence:
  - **Standard Error** (SE)
  - **Coefficient of Variation** (CV)

\[
CV = 100 \times \frac{SE}{\text{Estimate}}
\]

- Dependent on confidence:
  - **Margin of Error** (MOE)
    
    \[
    \text{MOE}_{90\%} = SE \times 1.645
    \]
  - **Confidence Interval** (CI) =

\[
(\text{Estimate} - \text{MOE}_{90\%}, \text{Estimate} + \text{MOE}_{90\%})
\]
Precision of Estimates

- Pre-derived MOE:
  - Published ACS estimates come with an MOE but not other measures of precision
  - CTPP ACS estimates come with SE and an MOE but not other measures of precision
- Users need to derive measures of precision
  - User-derived estimates from published ACS estimates
  - User-derived estimates from published CTPP estimates
  - User-derived estimates from an ACS PUMS
The ACS Statistical Analyzer

- It derives all four measures of precision
- It tests if the difference between two estimates is statistically significant at a given confidence level
- It does these for all six forms of estimates
- It focuses on ACS but deals with Census 2000 too (for comparing ACS to Census 2000)
- It is a 2003 Excel-based template
- 4 functions
- 15 sub-functions
- Users just need to enter the required data
- It takes care of the statistical procedures and formulas involved