GIS & GPS Devices for Travel Behavior Surveys

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Abt SRBI

• Abt SRBI is a global strategy and research organization
  – Specializing in public policy and opinion surveys, banking and finance, telecommunications, media, energy, insurance health care and transportation.

• Founded in 1981 as “SRBI”, now a subsidiary of Abt Associates

• Abt SRBI employs ~150 full-time employees, 800 field staff.

• Abt SRBI offices in NYC, Chicago, DC, Arizona, Boston, Kentucky, Florida, and North Carolina.

• Clients include major financial institutions, Fortune 500 companies, federal, state and local governments, foundations and universities.
Timothy Michalowski

• GIS Manager at Abt SRBI

• Dedicated to GIS for 10+ years

• Master of Urban Planning / GIS
  – University of Il at Chicago (UIC)

• Previous employment:
  NYC Department of Transportation (NYC DOT)
  Puget Sound Regional Council (Seattle, WA)
Abt SRBI GIS

- Abt SRBI GIS supports Abt SRBI research projects/proposals, with data collection, data sampling/surveys, geocoding, spatial analysis and final deliverables.

- ESRI ArcGIS Desktop 10.0
  ESRI ArcGIS Server 10.0
  Windows Server 2008 R2 64 bit
  SQL Server
Travel Surveys

- Metropolitan Planning Organizations (MPOs)
  Regional Transportation Planning Organizations (RTPOs)
  - Federally mandated & Federally funded organizations
  - Urbanized areas with population's over 50,000
  - Funding for transportation projects are managed by these organizations
  - Examples: Southern California Association of Governments (SCAG)
  San Diego Association of Governments (SANDAG)

- Gathering travel data is essential for planning
  - Planners depend on accurate recent travel data
  - Road capacity, changes in travel behaviors, regional growth, etc.
  - Linked to regional planning issues
  - Inputs to land use / transportation / economic forecasting models
  - Regional travel data needs be updated every 5-10 years
Traditional Travel Surveys

- Traditional travel data collection = Travel Diaries
  - All participants report travel activity in paper diaries
  - Mail diaries → Reminder calls → Self-reporting → Diary retrievals

- Paper based travel surveys are challenging and costly
  - Complex and laborious
  - Data inaccuracies – Self-reporting trips / locations / times / passengers / trip purpose / travel modes
  - Post-processing of paper data
    - Data entry in databases
    - GIS geocoding addresses / origins & destinations
Traditional Travel Surveys

Travel: How did you get to Location 1?

1. What type(s) of transportation did you use to go to Location 11?

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<td>Commuter Rail</td>
<td>Motorcycle/Moped</td>
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2. If you used a bus/train for this trip, did you use a pass?  □ Yes  □ No → How much did you pay?____

3. If you used car/van/truck or motorcycle/moped for this trip . . .
   A. Were you the . . .?  □ Driver  □ Passenger
   B. Including yourself, how many people were in the vehicle?  1 2 3 4+
   C. Was this vehicle from your household?  □ Yes  □ No
   D. Did you pay a toll?  □ Yes  □ No
   E. How much, in total, did you personally pay for parking?  □ Nothing
      $____ ____ . ____ ____  Was the rate . . .?  □ Hourly  □ Daily  □ Monthly  □ Other
Abt SRBI GPS Travel Surveys

- **(2009-2011) Greater Cincinnati GPS Travel Survey**
  - Ohio Kentucky Indiana Council of Governments (OKI)
  - 3,000+ GPS households

- **(2010-2012) Greater Minneapolis Travel Survey**
  - Metropolitan Council of Governments
  - Sub-sample of 500 GPS households

- **(2011-2013) Greater Los Angeles Travel Survey**
  - Southern California Association of Governments (SCAG)
  - 1,750 GPS households
  - 4,000 non-GPS households
Greater Los Angeles GPS Survey Project Scope
Greater Los Angeles GPS Survey Project Scope

- ~2,000 households (~4,500 persons)
- GPS devices for all persons age 13 and over
- Participants carry GPS devices with them everywhere to record all travel over 3-7 days
- Send / receive GPS devices in waves to households
  - August 2011 to August 2012
  - 700 GPS devices used
  - $25 incentive provided for every person in study
  - Barcode / scanner technology used for deployment
Abt SRBI GPS Device

• Purchased from manufacturer in Taiwan

• Portable, pocket size, weighs 2oz

• Automatically turns on with movement

• Passive GPS = no input needed from participants

• Records GPS location every 1 second of travel activity
  – Stores 4MB of data = 1 month of continuous travel

• Participants carry GPS units everywhere
  – In pocket, in car, in bag, key chain, etc.
Abt SRBI GPS Device

Abt SRBI's GPS device captures the data stream from GPS satellites including:

- Longitude/Latitude of position
- UTC time/date
- Speed of travel
- Direction of travel / Course (degrees)
- Altitude
- Fix quality / Number Of Satellites
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GPS Data

- 1 point every 1 second of activity

- 1 person, 3 days of travel = 20,000 to 30,000 GPS points
Abt SRBI GPS Data Processing with ESRI

- Los Angeles GPS Travel Survey =
  - 2,000 Households
  - 1 second of GPS data for all travel
  - 200+ Million GPS data points!

- What exact points are the origins / destinations of trips?
- What are trip segments? Trip distance / time / speed?
- What are travel modes? # of passengers?
- How does GPS data compare with non-GPS travel?
Abt SRBI GPS Data Processing with ESRI

Use of ESRI ModelBuilder - Customized algorithms, Tracking Analyst, Python scripts, automated and manual steps...
Abt SRBI GPS Data Processing with ESRI
Abt SRBI GPS Data Processing with ESRI
Conclusions

Successful data collection method
- 200+ million GPS points collected
- 30,000+ days of travel information collected

Expanded use of GPS for travel studies
- Eventually will all travel surveys be GPS based?
- Use of smartphone GPS apps for data?

ESRI products provide all the tools necessary
- SQL Server 64bt for all data storage
- Tracking Analyst, GPS Toolbar, ModelBuilder
Conclusions

• Managing of GPS devices requires effort
  – Multiple reminders to households
  – Prepaid FedEx envelopes
  – Customized letters/GPS device name labels
  – Use of barcode technology is very helpful
  – Provide phone/email helpline

• Anticipate loss rate of GPS devices
  – 700 devices needed for Los Angeles (2,000 households)
  – 85% return rate compounded = ½ devices lost in study
Contact

Thank you

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