NJ TRANSIT’s Smart Bus Program: Operations Feedback and Quality Control

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Agenda

- NJ TRANSIT Bus System
- GIS at NJ TRANSIT
- Brief history of Smart Bus at NJ TRANSIT
- Smart Bus system data flow
- Addressing Challenges
NJ Transit Bus Service Overview

- NJT Bus Network covers a large service area and undergoes frequent changes
  - Service linking major points in NJ, NY, & Philadelphia
  - Approx 20,000 bus stops…(changes occur on daily basis in approx 400 towns that comprise the NJT service area)
  - Over 2,000 buses
  - 262 bus routes consisting of 2,200 bus patterns; scheduled service (“pick”) changes occur on quarterly basis (plus mid-pick changes for holidays)
GIS Unit Overview

- **Geographic Profile of Bus Operating Plan**
  - Bus route operating patterns (Intergraph)
  - Bus Stop Field Mapping (MapText)
  - Periodic Road network updates using HERE

- **GIS Processes that support Customer Information and Bus Operations**
  - Oracle-based procedures to generate stop sequences on operating patterns, stopping distances (Geodecisions)

- **Signage Design Installation and Maintenance**
  - Trailblazing sign (MapText)
  - Facility Signage
  - Public Information Display case
  - Transit Arts Program

- **Published Map Displays** (Michael Baker International)
  - Transit System Maps, Station Area Maps, Station Directories

- **Web Map Intranet Applications** (Intergraph)
  - Transit Map intranet application

- **Operations Analyses & Reporting**
  - Farebox Recovery Analysis
  - NTD Reporting
  - Smart Bus Data Analysis
  - Title VI Compliance Reporting
NJ TRANSIT Smart Bus History

- Originally had NOVA buses for local fleet and MCIs for commuter routes
- NABI buses with IVN (intelligent vehicle network) computers delivered between 2009-2013 and largely replaced NOVAs
- 2013 full deployment

* Courtesy of: Clever Devices
Smart Bus Modules (Clever Devices)

- Automatic Voice Annunciation (AVA)
- Automatic Passenger Counting (APC)
- Automatic Vehicle Monitoring (AVM)
- Automatic Vehicle Location (AVL)
The NABI contract includes BusLink™ Wireless LAN systems at 11 of 15 operating facilities.

- BusLink™ provides access to our vehicles using WiFi to support:
  - Automatic Voice Annunciation
  - Automatic Passenger Counting
  - Automatic Vehicle Location (BusTime™)

* Courtesy of Clever Devices
Original Data Flow for Each Service Change

1. Use survey vans to drive each geopath* in the system to determine stop locations and waypoints
2. Bus Tools software assembles geopaths into patterns
3. Check and correct data for each pattern (re-survey if necessary)
4. Load data onto buses at the start of each service change

*geopaths: unique pairs of origin-destination bus stops, and connecting 50-foot interval waypoints, that combine to form bus route patterns
Challenge #1: Surveying Geopaths

- Survey vans required to drive every geopath
- Took 4 years to do 1st pass
- Solution: The “virtual van” GIS Loader application
  - Geopaths can be interpolated by software in the office based on current stop location and road network (HERE) data without need to survey in the field
  - Makes it practical for route changes to be updated for each pick (service change)
Challenge #2: Precise Stop Locations

- Clever Devices requires stop locations to be accurate within 50 feet
- Solution: Field Survey
- GIS Unit ramped up its field survey program using MapText’s iPad FieldMap application and mapping grade GPS units (Geneq SX Blue II) to ensure bus stop location accuracy
- Field survey project locates actual bus stop sign pole locations within 3m accuracy statewide
Challenge #3: The Port Authority Bus Terminal

- GPS / WiFi signal problems inside the building
- Bus re-assignments common, making predictions difficult
- Unscheduled trips prevent IVN from assigning a valid trip number
- Buses do not always use the same gate for the same pattern
- Solutions not yet known: will likely require additional hardware (wi-fi beacons, RF ID, or other), software, and/or operator training
Challenge #4: Finding and Addressing Field Problems

- Occasionally received anecdotal reports of announcement/display problems
- Needed systematic way to identify problems
- Solution: Examine malfunctioning buses in multiple ways
  - Maintenance staff check hardware (computer, sensors, storage media)
  - GIS / Data Integration staff check data input
  - GIS staff analyze log file from buses for anomalies
- Example: Odometer calibration issue evident in “BusState” log files
Questions