

# TBEST Modifications

presented to  
**MTF Public Transportation Committee**

presented by  
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## Motivation

- FDOT/planners wanted a software tool for short-term transit service planning – designed specifically for transit.
- Serve as FDOT provided ridership estimation technique for TDPs
- Transit Boardings Estimation and Simulation Tool (TBEST) has been in production for several years and is on its 4<sup>rd</sup> Major Version (4.1).
- FDOT is continually supporting the improvement of TBEST.



## 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

### *Major Benefits:*

- Standardized method to insure consistency and equity
- Opportunities to leverage computing power and GIS capabilities
- TBEST reduces burden on FDOT for evaluating a variety of ridership estimation methodologies
- TBEST reduces burden on agencies to prepare and conduct more expensive and complex modeling efforts
- Also serves purposes of being an enterprise service and strategic planning tool



## TBEST Characteristics



TBEST is designed to:

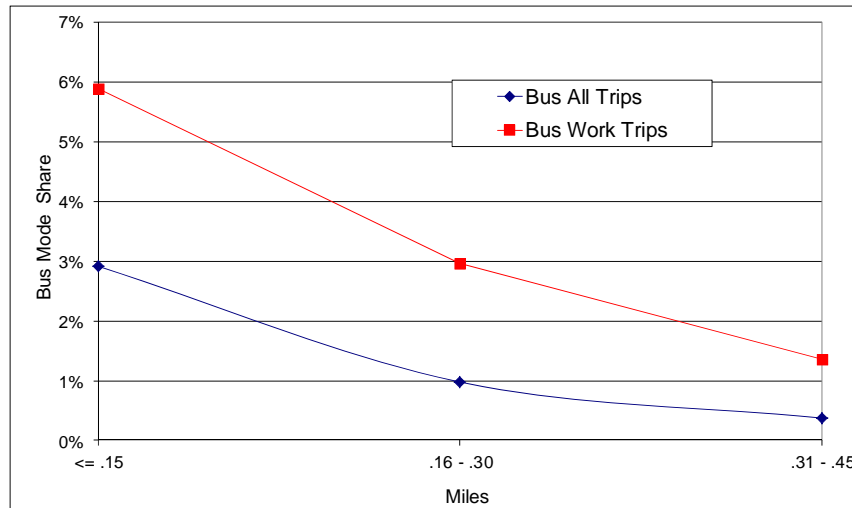
- Capture access at the walk scale to/from transit
- Respond to resident demographics
- Allow for special generators including park-n-ride
- One-half of homes in the U.S. are within a half mile of transit -- one half aren't
- Capture accessibility via the transit network
- Respond to workplace employment type
- *Responds to parcel level trip attraction/production based on ITE Trip Generation rates?*
- *Parcel data provides geographic precision and a richer basis of understanding trip generation than population and employment alone.*



## Almost 50 % of U.S. Households Live within 1/2 mile of a Bus Route



### Transit Use Varies Dramatically as a Function of Distance to Stop



Based on 2001 NHTS analysis



## TBEST Characteristics



TBEST is designed to:

- Incorporate the fact that 1/3 of transit boardings are transfers (50% transfer rate)
- Accommodate service features of fare, speed, frequency, etc.
- Accommodate fundamental differences in route types (local, circulator, express)
- Automatically adapt to different urban locations without developing new model equations (transferable)



## Nature of TBEST



- **Direct Demand Models**
  - No mode choice, no trip table, not interactive with roadway travel
  - Early work based on route-level analysis
  - Recent work based on segment/stop-level analysis
    - Consider inter-route relationships (complementarity and competition)
- **TBEST Based on Stop-Level Analysis**
  - Allow flexibility in evaluating service changes
  - Allow flexibility in level of analysis



## What can TBEST be used for?



- Strategic Planning (5 and 10 year forecasts for TDPs)
- Service Planning (Fixed route bus based operations)
- Analysis/Scenario Tools (Corridor, Area, Sites)
- Scalable/transferable to various property sizes
- Market analysis/accessibility analysis
- Title VI Analysis
- Transit GIS Data Management and Visualization



## Data for TBEST



### ORIGINAL DATA REQUIREMENTS

- Census 2000
- Employment
  - FDOT provided InfoUSA address-based data
- Manually coded Route Network
- Special Generator Specification

### CURRENT DATA REQUIREMENTS

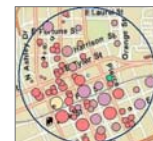
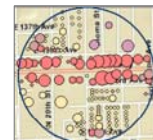
- Census 2010
- American Community Survey
- Employment
  - FDOT provided InfoUSA address-based data
  - Optionally include locally provided zonal data
- Land Use
  - Florida Department of Revenue parcel data
- ITE Trip Generation Tables
- GTFS network import and full network editor
- Special Generator and Stop Amenity Specification



## WHY PARCEL DATA?



- 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.
- Parcel data is readily available at the state level



## Parcel Data Development



- Parcels originate from state-wide Department of Revenue (DOR) tax records
- Address-level data - Convert DOR polygons to centroids and retain attributes
- Assign average population at each parcel from Census 2010 Block data based on population per dwelling unit
- Data is up-to-date and largely accurate especially in urban areas

### Parcel Attributes

- Land Use Code
- Bldg. sq. ft.
- Structure Construction Year
- Land area
- Dwelling units
- Population



## PARCEL LAND USE TRIP RATES



- 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 2001 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 THE MODEL



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

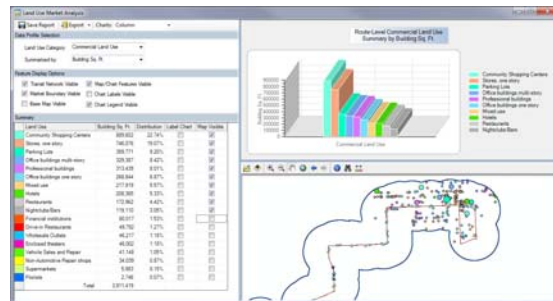
Dept. of Revenue land-use code	PROPERTY TYPE	TRIP RATE FROM ITS TRIP GENERATION MANUAL		Key Parcel File Variable (Urban, Rural)	Group Code, 1=Residential, 2=Office based non-residential, 3=Employee-based non-residential	ITE or Other Source Data							
		Unit (Independent Variable)	Remarks			Vehicle Trips							
						Weekday Total	Weekday AM Peak Hour	Weekday PM Peak Hour	Calculated AM Peak Period	Calculated PM Peak Period	Saturday Total	Sunday Total	
	Vacant Residential	Dwelling Units		0	1	0	0	0	0	0	0	0	0
1	Single Family	Dwelling Units	ITE LU - 230	1	1	9.57	0.77	1.02	1.63	2.93	10.08	8.77	
2	Mobile Home	Dwelling Units	ITE LU - 240	1	1	4.99	0.44	0.60	0.93	1.78	5.00	4.36	
4	Condominiums	Dwelling Units	ITE LU - 230	1	1	5.81	0.44	0.52	0.93	1.50	5.67	4.34	
5	Cooperatives	Dwelling Units	ITE LU - 220	1	1	6.65	0.55	0.67	1.17	1.93	6.59	5.86	
3	Multi-family - less than 10 units	Dwelling Units	ITE LU - 221	1	1	6.59	0.51	0.62	1.08	1.78	7.16	6.07	
8	Multi-family - 10 units or more	Dwelling Units	ITE LU - 222	1	1	4.20	0.34	0.40	0.72	1.15	4.98	3.65	
6	Retirement Homes	Dwelling Units	ITE LU - 251	1	1	3.71	0.29	0.34	0.61	0.98	2.77	2.33	
7	Miscellaneous Residential (migrant camps, boarding homes, etc.)	Dwelling Units	average of 260 and 270	1	1	5.33	0.44	0.52	0.93	1.48	4.95	4.01	



## TBEST PARCEL MODEL CALIBRATION

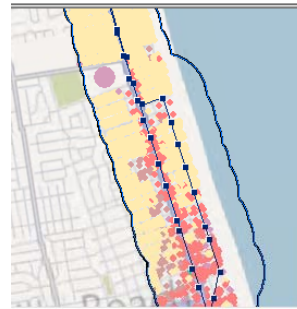


- Modified the TBEST software and data model to accommodate parcel data storage, processing and summarization
- Through TBEST model runs, prepared estimation datasets that included 120 variables including parcel buffer trip ends and destination trip attractors for each stop
- The calibration process combined rigorous technical analysis combined with judgment and art in exploring various combinations of variables
- Results were promising, but more sensitivity testing is underway before full deployment



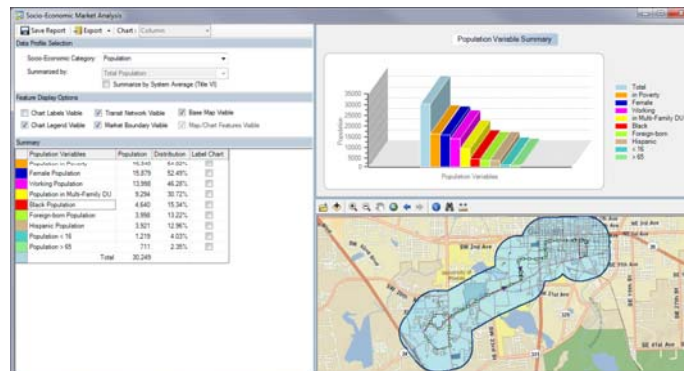
## MODEL APPLICATION

- Aggregate trips-ends at each stop by Land Use category (distance decay for walk access and account for overlapping buffers to avoid double counting)
- Calculate the system stop accessibility matrix and summarize destination trip attraction
- Future-Year parcel modifications
  - Parcel Editor to input synthetic parcel types at user-defined densities (not implemented)
  - Parcel trip rates are grown based on growth rates entered by the user



## OUTCOMES

- Parcels minimized the need to incorporate Special Generators into the model network
- Parcel level data increases the overall amount of data used by the model and impacts the processing speed and creates challenges in manipulating and storing the data

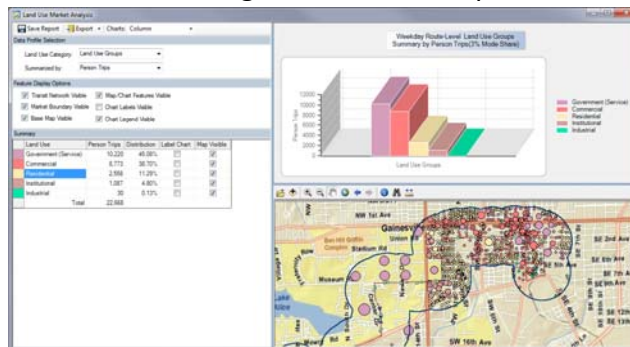




## TBEST Parcel Data Visualization



- Off-model tools to summarize land use within a corridor or any geographic region
- Summarizes network accessible land use
- Provides interactive report, map and charting capabilities to identify land use profiles within the defined area
- Export results to ESRI geodatabase or reports



## Parcel Data Availability



- Yearly updates to data made available for download within TBEST
- State-wide data is in ESRI file geodatabase format
- When creating a transit system, TBEST will extract parcels from counties which define the system service area
- State-wide data also available upon request



## STEPS UNDERWAY



- Model refinement through rigorous sensitivity testing using GoLine (Indian River) data
- Possible modifications to parcel model coefficients based on testing results
- Refine process for incorporating American Community Survey (ACS) data into the model
- Make Florida state-wide Parcel data available to TBEST users
- Update the software documentation
- Software and Model deployment



## Modeling Premium Transit Modes



- FDOT research project underway to incorporate sensitivity to premium transit modes into the TBEST model
- There is an acknowledged preference of travelers for guideway and BRT modes that is not fully captured by reflecting the cost, speed and geographic coverage differences in technologies.
- Project seeks to determine the intangible or typically unquantified metrics of guideway or BRT service that can be quantified or otherwise integrated into forecasting model equations for premium modes
- Rider preference appears to be related to a combination of factors including the image of the technology, its physical presence, and perhaps its reliability or comfort levels.



## BRT



TBEST includes sensitivity to a wide-range of BRT features including those that add physical presence, impact systems image, and provide other customer service improvements ranging from comfort and convenience to reliability and enhanced customer information

Address the varying features of BRT routes including:

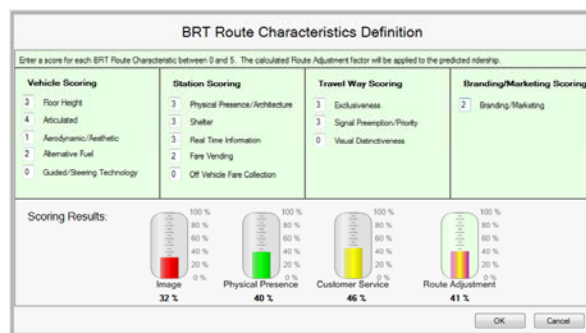
- Vehicle Amenities
- Station Amenities
- Travel Way
- Branding/Marketing



## BRT Model Application



- Model estimates ridership based on speed, service levels and geographic coverage
- Impact of ridership estimates is adjusted based on user specification of BRT features



**CONTACT INFORMATION**



Thank You!  
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