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The Route to Success in Transit GIS

TBEST: A COMPREHENSIVE GIS-BASED STOP-LEVEL TRANSIT BOARDINGS ESTIMATION AND SIMULATION TOOL

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Outline

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The TBEST Model

What is TBEST?
Comprehensive transit analysis and ridership forecasting model capable of simulating travel demand at the individual stop level.

Software Goal
To make TBEST the most comprehensive and robust tool for modeling transit and performing GIS-based transit planning analysis.

Software Objectives
- User-friendly
- Cost-Effective
- Scalable
- Versatile
- Minimal Data Requirements
- Sensitive to service adjustments (operational, schedule, alignment, system, and fare)
History of TBEST

Transit Boardings Estimation and Simulation Tool (TBEST) is the 3rd generation (2004 - current)

1st generation: Integrated Transit Demand and Supply Model (ITSUP) (late 90’s)

2nd generation: Regional Transit Feasibility Analysis and Simulation Tool (RTFAST) (2002)

TBEST 3.2 (latest version)
Motivation

- FDOT and transit planners were in need of a software tool for short-term transit service planning designed to address specific transit-related factors.
  - Walk access to transit stops
  - Accessibility through transit network
TDP Rule

In Florida, TBEST is intended to be used for the development of Transit Development Plans in many areas. TBEST is the planning tool currently supported by the FDOT that enables agencies to comply with State rules. Florida Administrative Code: Rule 14-73.001 Public Transit, states:

An estimation of the community’s demand for transit service using the planning tools provided by the Department, or a Department approved transit demand estimation technique with supporting demographic, land use, transportation, and transit data. The result of the transit demand estimation process shall be a 10-year annual projection of transit ridership.
TBEST Approach to Modeling

Stop-level Ridership Estimation
- Direct Demand, Micro-level Model (not mode choice or interactive with auto travel)
- Stops defined uniquely by Route and Direction
- Stop estimations can be aggregated to Route, Segment, Corridor, Sub-area, or System level
- 1-10 year Forecast Horizon

Scenario-based Modeling
- Develop the Base Year Model
- Create Future year models as new scenarios
- Adjust Socio-economic data at the system, area, or stop level
TBEST Approach to Modeling

- Direct vs. Transfer Boardings
  - Separate equations for accounting for stop buffer characteristics, but also to analyze the impacts of transfer opportunities on the network.

- Competing and Complementary System Effects
TBEST Approach to Modeling

- **Time of Day Based Analysis**
  - Weekday AM peak period
  - Weekday PM peak period
  - Weekday Off-peak period
  - Weekday Night period
  - Saturday (all day)
  - Sunday (all day)

- Coefficients developed from Portland, Oregon (TriMet)
TBEST Approach to Modeling

**Spatial Accessibility (socio-economic characteristics)**

Ridership is based on specific socio-economic factors such as age, employment status, income, car ownership etc. who can access the transit system (within buffer areas of ¼ mile from each individual stop).

**Time-Space Network Connectivity**

- Overall connectivity of the system
- Time-of-day variation due to service supply differences (frequency and travel speed)
TBEST Approach to Modeling

**ArcGIS-Based Software Tool**
- Interface provides FULL GIS functionality.
- Scenarios, attributes, and route and stop configurations can be changed and edited on the fly, thus making TBEST a truly user-friendly forecasting tool.
TBEST Approach to Modeling

- **Automatic Calibration to Local System Ridership**
  - Accounts for conditions not directly captured in the model variables including scale, roadway congestion, parking availability and cost and other local context conditions.
TBEST Approach to Modeling

**Performance Measures**

TBEST includes estimates of several performance measures in its output at the route and system level:

- Route miles
- Revenue Service Miles
- Revenue Service Hours
- Boardings per Service Hour
- Boardings per Service Trip
- Avg. Boardings per Stop Visit

![TBEST Report](image)
TBEST Software Specifications

- Desktop application developed with Visual Basic 6 and ArcEngine development tools
- Integrated with ArcGIS
  - Requires ArcView 9.3 or ArcGIS Runtime 9.3 license
- SQL Server 2005 Database Engine
  - SQL Server Express comes with Installation
- Personal Geodatabase Spatial Data format
TBEST Transit Systems

- A TBEST Transit System is composed of model Scenarios which contain editable routes, stops, socio-economic data and network attributes.
- Create new Transit Systems
- Manage Multiple Transit Systems
- Delete Systems
- All GIS/Database files managed internally
- Download/Install Released Models (most Florida systems)
- Validation
TBEST Distribution Files

TBEST is able to create Distribution Files that encapsulate all components of a transit system are incorporated into a single file.

Distribution Files can be used as a backup of the current Transit System or distributed to other TBEST users to be imported into any TBEST installation.
TBEST Socio-Economic Data

- Pre-formatted Florida State-wide Census and Address-based Employment data available for download within the software.
- Census geometry is Block-level; attributes are both Block and Block Group level.
TBEST Network

- Route-based network stored in Segment and Stop Feature Classes
- Linear referenced stop locations along segments
- Service attributes (arrivals, headway, stop-to-stop travel-time) stored in SQL Server for all TBEST Time Periods.
- Full- network editing environment.
- Each Scenario contains it’s own network
Scenario Management

- Create, Edit and Remove within TBEST
- Three modes for Scenario Development:
  - **Base Year Scenario Development** (un-validated model)
  - **Future Year Application** (alternative testing with validated model)
  - **Sector Scenario** (regional or sub-area model to reduce model run-time and network maintenance)

Define Employment Source
Network Development Components

- TBEST Route Manager
- Map Window
- Map Control
- Segment Tab
- Stops Tab
- Calculator
Network Properties

- Service Span
- Fare
- Transfer Stations
- Interliners
Socio-Economic Growth

- System-Level
- Zonal Growth
- Localized
TBEST Model

- Model Equations
- View
- Edit with extreme caution
- Model Run
- Efficient/Edit-based
- Select Time Period
- Single Model Run
- Batch Model
TBEST Analysis Features

Attribute Search Engine

- Search Service, Network, Demographic and Model Estimations together.
- For instance, show me the stop locations in the AM Peak where: Headway is < 30 and Total Boardings < 5 and Route Direction = ‘Inbound’
- Save Search Parameters to apply across multiple models
TBEST Analysis Features

Analysis Toolbar

- Create Spatial Analysis Areas (Area Analysis, Corridor Analysis, Site Analysis)
- Update data within the Analysis Areas to reflect localized demographic changes or network properties
- Model will “lock-on” to the localized changes and not re-calculate during model run
- Save Analysis Areas to be utilized across multiple scenarios. Example, three scenarios to test DRI impact with 10%, 20% and 30% growth.
TBEST Analysis Features

- **Analysis Area**
  - Polygon Feature
  - Free-hand or select polygons from input dataset

- **Corridor**
  - Free-hand or buffer selected segments

- **Site Analysis**
  - Buffer free-hand
TBEST Analysis Features

Reporting

- Dynamic Reports for System or Selected Features
- Works with Search and Analysis Toolbar
- Summarize by Time Period, Weekday or Weekend
- TBEST Reports generated by:
  - Route (with Performance Measures)
  - Stop
  - Segment
  - Region
- Map Output Option
- Output to Excel/Manage with TBEST Explorer
TBEST Model Tools

- Auto-Generate Stops
- Route Simulation
- Import Routes
- Import Routes from other Systems/Scenarios
- Loaded Network
- Output all TBEST Attributes to ArcGIS Segment and Stop feature classes
- Sector Scenario
- Sub-Area and/or Regional Modeling
- Online Maps
- ESRI Services/Bing Maps

TBEST
TBEST in Florida

- **TBEST 3.2 software development complete**
- TBEST website ([www.tbest.org](http://www.tbest.org))
- Software and documentation downloads are available to the public
- **TBEST Networks developed for 25 Transit Properties**
- Networks are published and available for download within TBEST
TBEST Support in Florida

*Technical Support*
- FDOT is supporting TBEST by providing:
  - Guidance for implementation
  - Classroom and Web-based training
  - Software Maintenance

*Enhancements*
- FDOT adopting a proactive approach in building the TBEST foundation for the future:
  - Parcel-level Socio-Economic data
  - Expanded Park-n-Ride analysis
  - Sensitivity Testing
Other TBEST Projects

- **FDOT Small Starts and Very Small Starts**
  - Test TBEST compatibility with “Starts” model requirements
  - Develop Guidelines for Model Support of “Starts” in Florida

- **Los Angeles Metro**
  - Network-generation tool
  - Expanded TBEST model capacity to > 64,000 stops
  - Model calibration to develop coefficients for Metro Service Area
  - Sector Scenario for regional or corridor modeling

- **Anchorage, Alaska**
  - Network Development and Analysis

- **Pennsylvania DOT**
  - Pilot Project to develop network and alternatives for two Transit Properties
  - Interest from many Transit Properties in the US and Internationally
Current and Future Initiatives

- Tech support and refinement based on user feedback
- Updates to accommodate software releases (Windows 7)
- Development of a capability to use parcel level data to assign address households to locations (funded – next 6-9 months)
- Development of enhanced park and ride capabilities (exploration funded)
- Develop model coefficients for BRT and/or Rail modes
- Google Transit compliant network tool
- Enhanced treatment for special generators
- Development of more refined trip attraction variables at the parcel level
- Automated output report production (various formats)
Questions?

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