Presented to the Florida Model Task Force
Wade L. White

May 2010
Work Order Subtasks

- Develop Documentation and Materials to Support the MTF Decision Making Process
- Document MTF Recommendations and Identify Strategies
- Develop Implementation Plan
- Provide Ongoing Support for Integrated FSUTMS/Land Use Model Development

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Subcommittee Membership Overview

- **Chairmen**
  - Gary Kramer - Data Committee Chairman
  - Marlie Sanderson - Subcommittee Chairman

- **Members**
  - MPOs
  - DOT Districts
  - Local Government Land Use Planner
  - Consultants
First Step: Explore and Understand the Issues

This is the online document library for the Florida Model Task Force Land Use Modeling special committee that is exploring the topic of integrated transport/land use models. The repository is organized into several topic areas:

- **Webinars**: The schedule and topics for the upcoming webinar series (1 hour each) to help inform the subcommittee
- **Issues**: Past and current issues to consider
- **Experiences**: Land use model information from agencies inside and outside Florida
- **Comparisons**: Documents comparing various options
- **Papers**: Technical papers on specific models
- **Vendors**: Links to providers of specific models
- **Contact**: Links to send suggestions, comments or additional materials you would like included on the website

Check back often as documents will be added regularly. There are (pending) placeholders for some documents pending their acquisition.

Assembled by Whitehouse Group Inc. - Last Updated May 7, 2010
Webinars to Build a Common Understanding

Part 1: Land Use Modeling Frameworks
- February 19, 2010 (3:00-4:00 ET) - Basic Approaches to Land Use Models Employed Throughout the US. Materials
- March 19, 2010 (3:00-4:00 ET) - Data Development and Maintenance. Materials

Part 2: Integrated Transport and Land Use Models
- March 26, 2010 (3:00-4:00 ET) - Transport Accessibility and Other Measures. Materials
- April 16, 2010 (3:00-4:00 ET) - Feedback Concept & Implications. Materials

Part 3: Policy Evaluation
- April 30, 2010 (3:00-4:00 ET) - Real-world Experiences in Policy Evaluation: A candid discussion from veterans. SACOG Materials/DOT Website
- May 7, 2010 (3:00-4:00 ET) - Policy Sensitivities: A discussion of state and federal issues important to consider. Materials

Part 4: Rule-based Models
- May 14, 2010 (3:00-4:00 ET) - The roles, data and applicability of rule-based land use models in practice. Materials
Interactive Webinar Series

- Basic Approaches to Land Use Modeling
- Data Development - the Florida Context
- Transport Accessibility and Other Measures
- Feedback Concepts and Implications
- Real-world Experiences with Integrated Models
- Current and Upcoming Policy Considerations
- Uses and Limitations of Rule-based Models
Basic Approaches to Land Use Modeling

February 19, 2010
Basic Approaches to Land Use Modeling

- Presenters
  - Dr. Michael Clay, University of Auburn AL
  - Dr. Zhong-Ren Peng- University of Florida
  - Wade White

- Topics
  - General Theoretical Frameworks
  - History
  - Applied Examples
  - A bit on Development Costs/Experience
  - UF Development Efforts
Introduction

- What is a Land Use Model?
  - Land Use Models use economic theories and simplified statistic methods to explain and estimate the layout of urban land uses.
  - Land Use Model is quantitative method to predict future changes in land use, socioeconomic and demographic data based on economic theories and social behaviors.
Purposes of Land Use Modeling

- Facilitate Transportation Modeling: Forecast future land use changes and allocations and incorporate those changes into the transportation demand models.
- Policy Analysis: helps to determine economic and environmental impacts of land-use transportation policies.
- Capture the interactive relationship between land use and transportation: integrated land use and transportation models can help capture the feedback loop of traditional four-step models.
Basic Types Out There

- **General Classes**
  - Bid Rent- Analytical models based on real estate pricing and “willingness to pay” theory.
  - Input-Output- Analytical models based on economic flow theory (production/consumption of goods & services)
  - Gravity/Logit- Analytical models founded on the concept of spatial separation or accessibility similar to a gravity model used in many four-step transportation models
  - Microsimulation- Analytical that use Monte Carlo and other simulation techniques to estimate choices at the individual level agent level (like traffic simulation or activity-based models).
Basic Types Out There

- **General Classes (continued)**
  - Rule-Based- Those models that use rule-based decision trees. Sometimes referred to as “gaming models” or “what if” models where choice probabilities are asserted using a given set of rules.

- In reality, no land use model belongs exclusively to one of these broad classes. Each incorporates concepts from the other; sub-models in each may use elements from the others.
Conclusion

- Every model has its strengths and limitations and no model is best suited for every situation
- The selection of a land use model depends on:
  - The purpose of the modeling
  - Sensitivities to land use and transportation policies
  - Data requirements and availability
  - Modeling efforts (time, expertise and budget)
Data Development- The Florida Context

March 19, 2010
Data Development- the Florida Context

- Presenters
  - Mary Stallings, Grimail Crawford
  - Wade White

- Topics
  - Experiences Working with FL Data Used in Some Frameworks
  - Actual vs. Theoretical Development Patterns
  - Data Quality
  - Data Common Across the State and Suitability
Framework Data Considerations

- Is the data available everywhere?
- How consistent is it?
- What quality is it?
- Is it credible, gospel?
- How much preparation / cleaning work is needed to:
  - Prepare it?
  - Maintain it?
- How are local policies represented?
Discussion of Base Year Data Sources

- Parcel Data - acquisition cost issues
- Zoning/Existing Land Use (ELU)
- Water & Sewer Service
- Building Permits
- FSUTMS Model Data Sets
  - ZDATA
  - Networks & Skims
- InfoUSA and Other Disaggregate Data Sets
- Agency for Workforce Innovation (AWI) - some disclosure issues
- Bureau of Economic and Business Research (BEBR)/Census
- Environmental Constraints
Discussion of Forecast Year Data Sources

- Future Land Use Maps (FLUM)
  - Overlays
  - Planned Unit Developments (PUDs)
  - Evaluation & Appraisal Reports (EARs)
  - Redevelopment
- BEBR Forecasts
- Developments of Regional Impacts (DRI’s)
- Future Water/Sewer Service Areas
  & Permits and Urban Service Areas
- Master & Other Plans
- FSUTMS Model Data Sets
  - Networks
  - Skims
Transport Accessibility and Other Measures

- Presenter
  - Wade White

- Topics
  - Common Transportation Measures Used in Integrated Models
  - What Proportion of Location Choice Relates to Transportation vs. Other Measures
  - How Location Choice Varies by Lifestyle
  - Inertia
  - What “should” be Included in the Framework to Achieve Desirable Sensitivities
Framework Accessibility Considerations

- Accessible to what?
- By what means?
- Causality and order of operation
- Lags
- Data availability
- What measures?
Types of Accessibility

- Mobility
- Mobility Substitutes
- Connectivity
- Land Use

Accessibility typically a function of:
  - What?
  - Where?
  - How much does it cost?
  - Do/will I want/need it?
Common “To What”

- Households/Population
- Downtown
- Jobs
- Airports
- Colleges/Universities
- Schools
- Good Schools
- Interchanges
- Waterfront/Recreation
Personal and Professional Observations

- What are the factors that made you choose where you live?
  - Accessibility
  - Other

- What are the factors that made your employer choose its location?
  - Accessibility
  - Other

- What are the factors you’ve observed that make land attractive for development?

- What accessibility-based policies do your local policy-makers hope to use to shape development?
Factors That Impact Location Choice

- Accessibility
- Quality
- Amenities
- Policy
- Services
- Price
- Cost
- Return on Investment (Price-Cost)
- Affinity
- Etc.
Feedback Concepts and Implications

April 16, 2010
Feedback Concepts and Implications

- Presenter
  - Wade White

- Topics
  - Measures
  - Types of Models and Implications for Feedback
  - Run-time
The short of it …

- Tradeoffs are complex
- Occur at different times and at different rates
- Growth is incremental
- Redevelopment pressures increase as an area reaches “build out”
- Feedback provides the best mechanism to capture the interactions and demands of transport and land use
If the FSUMTS Model Runs in an Hour …

- Land use includes known accessibility (no feedback)
  - 1 hour + land use model run time

- A single year transport/land use (convergent feedback)
  - (1 hour + land use) * iterations

- Evolution model (non-convergent or convergent)
  - (1 hour + land use) * iterations * step years
Issues and Constraints

- Run time
- Model Convergence
- Comparison of Alternatives
- One Solution May Not Fit All Needs
- Framework Alternatives Each Provide Opportunities and Challenges
Real-world Experiences in Policy Evaluation

April 30, 2010
Real-world Experiences with Integrated Models

- Presenters
  - Gordon Gary, Sacramento Area Council of Governments
  - Becky Knudsen, Oregon DOT

- Topics
  - Rationale Behind Models
  - MPO vs. Statewide Applications
  - When Rule-Based or Other Methods Are Appropriate
  - How to Use Findings to Inform Public Decision Making
Examples of the Types of Policies That an Integrated Framework Can be Used to Evaluate

- **Transport**
  - Road
  - Transit
  - Freight

- **Land Use**
  - Households & Job Locations
  - Economic Development
  - Impact Assessment

- **Environmental**
  - Air Quality
  - Impervious Surface
  - Fuel & Energy Consumption
Why Improve SACOG Models?

- Models are tools to apply research in the most effective and comprehensive manner to address policy issues
- Research points to interrelated causes and consequences
- Policy issues are often, and more frequently, interrelated
Comparing PECAS (Behavioral) and I-PLACE3S (Rule-based)

- **Differences**
  - Economic forecast vs. vision development
  - Path dependent vs. horizon year

- **Common elements**
  - Parcel data
  - Development policy tools
  - Development costs and rents

- **Partial overlap**
  - Employment types, residential definitions
SACOG Conclusions on Land Use Models

- Policy drives data and models
- Incremental improvement = continuity
- Model development is “pushed” by research advancements and “pulled” by policy needs
- Integrated cross-discipline planning and decision-making can be improved with good analysis
Model Comparison – Unit of Analysis

- **SACMET = TAZ and Trip**
  - TAZ is a geographic area with number of people, jobs, etc.
  - Trips are “disembodied” and treated as a “gravitational” event

- **SACSIM = Persons and Tours**
  - Population represents variety of people in a “real” way
  - Travel is an outgrowth of activities—a way of stringing activities together
A Practical, Regional Planning Application

- Vehicle miles traveled as primary indicator
  - Defining area types by average VMT per household
- Land use characteristics of VMT-defined areas
- Drilling down to specifics in prototype areas
- Forecasting results
Oregon DOT Experiences

- Process is Ongoing
- Builds Staff Capacity
- Multitude of Uses
- Mix of Custom and “Off-the-shelf” Solutions
- Communicating Results is a Challenge
California & Oregon Applications

- California (MPO Perspective)
  - Regional LU & Transport Plans
  - Impacts (Travel & Emissions)
  - Quality-of-Life Analyses
  - Better & Smarter Staff

- Oregon (DOT Perspective)
  - Economy & Job Impacts
  - Impacts of Higher Fuel Costs
  - Energy Sector & Impacts
  - Commodity Flows & Industrial Activity
  - Household Location Choice
Current and Upcoming Policy Considerations

- **Presenter**
  - Kathy McNeil, FDOT Policy Planning
  - Chris Stahl & Tom Rogers, FDEP (attend but no presentation, available for Q&A)
  - Jo Laurie Penrose, DCA (attend but no presentation, available for Q&A)

- **Topics**
  - Major Policy Issues (Air Quality, Water, HSR, etc.)
  - Recent Legislative Actions
  - Likely Federal Actions
Economy: Emerging Megaregions

Source: America 2050

6/7/2010
Environment: Growing Challenges

- Coordinating natural habitat conservation
- Meeting future water demands
- Adapting to changing air quality standards
- Reducing GHG emissions

6/7/2010
Federal Outlook: Climate Change

- Overlap of climate and transportation bills
  - Both include changes to transportation planning process
  - House bills passed, timing of Senate action uncertain

- Waxman-Markey (section 222) and House T&I climate provisions virtually identical, key provisions:
  - State DOTs and TMAs: Planning process must include transportation related GHG reduction targets and strategies
    - Report on progress: sustaining/reducing GHG (transp. related)
      - Include efforts to increase transit ridership and travel by walking, biking and other non-motorized transport
      - Models/methodology: determined by EPA
    - Reduction targets, strategies, progress posted web site
    - Enforcement: certification process
Possible Scenarios

In red on these maps are the CBSAs above various ozone standards (between 60-70 ppb proposed, currently 75 ppb) based on 2007-2009 data.
Key Issues in Authorization

- **Formula vs. Discretionary/Earmark Funding**
  - TIGER grants model?
  - Impacts Florida’s rate of return

- **Program Structure**
  - Asset Preservation vs. Capacity
  - New Freight Program
  - High Speed and Intercity Passenger Rail

- **Performance-based Planning**
  - Will it include needed flexibility?

- **“Livability” and urban mobility**
Uses and Limitations of Rule-based Models

- **Presenters**
  - Dr. Richard Klosterman, University of Akron, OH
  - Paul Van Buskirk, Van Buskirk, Ryffel and Associates

- **Topics**
  - How Rule-based Models Fit into the Landscape
  - Uses and Experience
  - Suitability and Limitations
  - Alternate Population Forecast Methodologies
  - Specific Applications of:
    - What If?
    - Interactive Growth Model (IGM)
Rule-Based Models…

- Incorporate explicit decision rules which determine the implications of user-specified assumptions
- Impact models
  - CommunityViz – Placeways, LLC
  - INDEX – Criterion, Inc.
- Growth models
  - UPLAN – Robert Johnson, UC, Davis
Strengths of Rule-Based Models

- Low cost
- Tied directly to GIS
- Smaller data requirements
- Easy to understand and implement
- Policy-oriented
- Can be linked with other models (transport, spreadsheet, etc.)
- Appropriate for public hearings
Weaknesses of Rule-Based Models

- Do not consider spatial interaction and markets
- Do not consider land use-transportation interaction
- Not widely adopted for transportation applications
- Cannot be calibrated
Example – What if? 2.0

- Projects
  - Residential and employment-related land uses
  - Residential and group quarters population
  - Housing units, households, and average household size
  - Employment by place of work for 19 NAICS sectors

- For
  - Census tracts and block groups
  - TAZs
  - Any user-defined areas
Suitability Scenarios

- Reflect user’s assumptions concerning
  - Development potential
    - Natural features (slopes, floodplain, etc.)
    - Access to amenities and disamenities
  - Public policies
    - Open space/environmental protection policies
  - Public desires
    - Development preferences
A research report for the Jacksonville, Florida Region entitled “Comparing Short Term Traffic Projections With Traffic Counts-The JUATS 2015 Model” prepared for FDOT (Florida Department of Transportation), concluded that having forecasted 2000 demographic and socioeconomic data from a 1990 baseline and then comparing the 2000 Census data that:
“For a fast growing urban area in Florida like Jacksonville, the transportation demand models in the past are likely to underestimate the overall number of trips produced since socioeconomic, demographic and employment data may be underestimated…. The difference between the estimated and observed at the zonal level were significant.”
They found that those TAZs (Traffic Analysis Zones) that were approaching built-out were overestimated and those that were developing were underestimated an average of a 25% variance for a 10-year projection.
A research report by the University of Washington’s Institute on public policy and Management stated in its executive summary that while much has been written about the transportation/land use relationship, the more we learn about transportation and land use the worse the traffic jams and the sprawl gets. According to the study the major reason for this apparent negative learning curve is the way we have separated authority for transportation at the state and regional level from the powers of land use at the local level.
The Interactive Growth Model™ (IGM) address these disconnects and solves these issues that results in more accurate forecasted demographic and socioeconomic attributes at the zonal level and then for forecasting accurate trip productions.

The IGM has several sub-models to determine the forecasted demand for and the apportionment of land uses by type and intensity as well as its spatial distribution to mitigate trip lengths and to meet the demands of the characteristics of future populations over time.
The IGM addresses the disconnect by generating accurate demographic and socioeconomic data at the local level. For example, through an analysis of adopted future land use plans, the IGM can be used to test those plans to identify deficiencies in land uses and lead to suggested adoptive amendments to address those deficiencies and then generate the data for the MPO traffic models for state transportation authorities.
The Population Model vs. The Interactive Growth Model™

- The population forecast model produces the gross, non-spatial build-out population of a jurisdiction of any size in 5 year increments.
- The Interactive Growth Model™ (IGM) by comparison, uses the gross population forecast to build-out as an input and distributes population spatially in 5-year increments throughout the jurisdiction or study area.
Accurate Population Forecast

- Accurate forecast is a key parameter
- Historically, population forecasting in South Florida has underestimated growth
- Methods
  - Cohort Component
  - Extrapolation
  - Exponential
  - Pearl-Reed (Sigmoid)
8 Key Design Steps For an Interactive Growth Model

- Accurate Population Forecast
- Disaggregate Community Into Zones
- Current Inventory of Development and Demographics by Zones
- Build out Inventory of Development and Forecast of Demographics by Zones
- Develop Sub Models
- Criteria and Formulas For Spatial Distribution of Development Over Time
- Data Output For 5 Year Increments
- Graphic Interpretation of Results
Dialogues and Discussions Start during MTF
- Candid assessments of needs, resources, constraints and opportunities both short-term and long-term
- Formulate recommendations on which (if any) paths to follow

Document Recommendations
Develop Action Plan
Identify Resource Opportunities