



# ARC Land Use Modeling in 5 Minutes

## *Terse and Cogent Version 1.0*



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# The Past: ARC Models

- **IPEF** Interactive **Population** and **Econometric** Forecasting model  
(Regional Forecast)
  - 1970s FORTRAN open source code model from San Diego
  - Consumed substantial staff time, offered few output variables, and little ability for scenario testing
  - Still required purchase of a national forecast
- **DRAM/EMPAL (D/E)** (Small-Area Land Allocation)
  - Distributed regional control totals
  - Developed by Dr. Steve Putman and first used late 1980s
  - Refined in early 2000s via Metropolis interface
  - Recent runs experienced calibration difficulties, produced results of irregular “quality”, and support was ‘disappearing’





# Forecasting Goals



- Improve our Modeling activities while meeting all Federal Modeling Requirements**
  - Keep D/E on as a redundant modeling choice available for use in the next modeling process.**
  - Much richer data from the new land use model**
  - New model to dramatically improve the relationship between transportation and land use**
- Scenario Evaluation Key**
  - Impacts of combinations of infrastructure and policy decisions**



- **High Number of Counties (20) in our Forecast Area**
  - **Parcel Data Demands (Collection, Zoning Classifications, Value/ Rent Data)**
    - Did not feel like we could “clean” the data sufficiently to meet norms of data quality for other models
- **Strength of Economic Theory (AA Module)**
- **The Agile Development Approach**
- **Benefits of work done elsewhere that we use- *Thanks San Diego and Baltimore and Montgomery for the Memories!!!***



# Progress to Date



- **Small Area model selection and model design late 2007**
- **IMPLAN Used for AA Coefficient Development early 2008**
- **Four consultant workshops for AA and SD development 3/08-10/08**
- **Running Model (uncalibrated)—as of 7/08**
- **In 2009, holding regular online meetings with HBA Specto, Inc. and semimonthly workshops with focus on:**
  - **2<sup>nd</sup> and 3<sup>rd</sup> stage calibration of AA and SD**
  - **Groundwork for Model Enhancements 2010/2011**
- **Ongoing Data Collection (Parcels—Assessors Files; Base CoStar Data; file); Base Population and Employment Data (ARC Estimates); PUMS/ SF3 / ACS Data; Freight/ Commodity Data)**



# Model Design Diagram



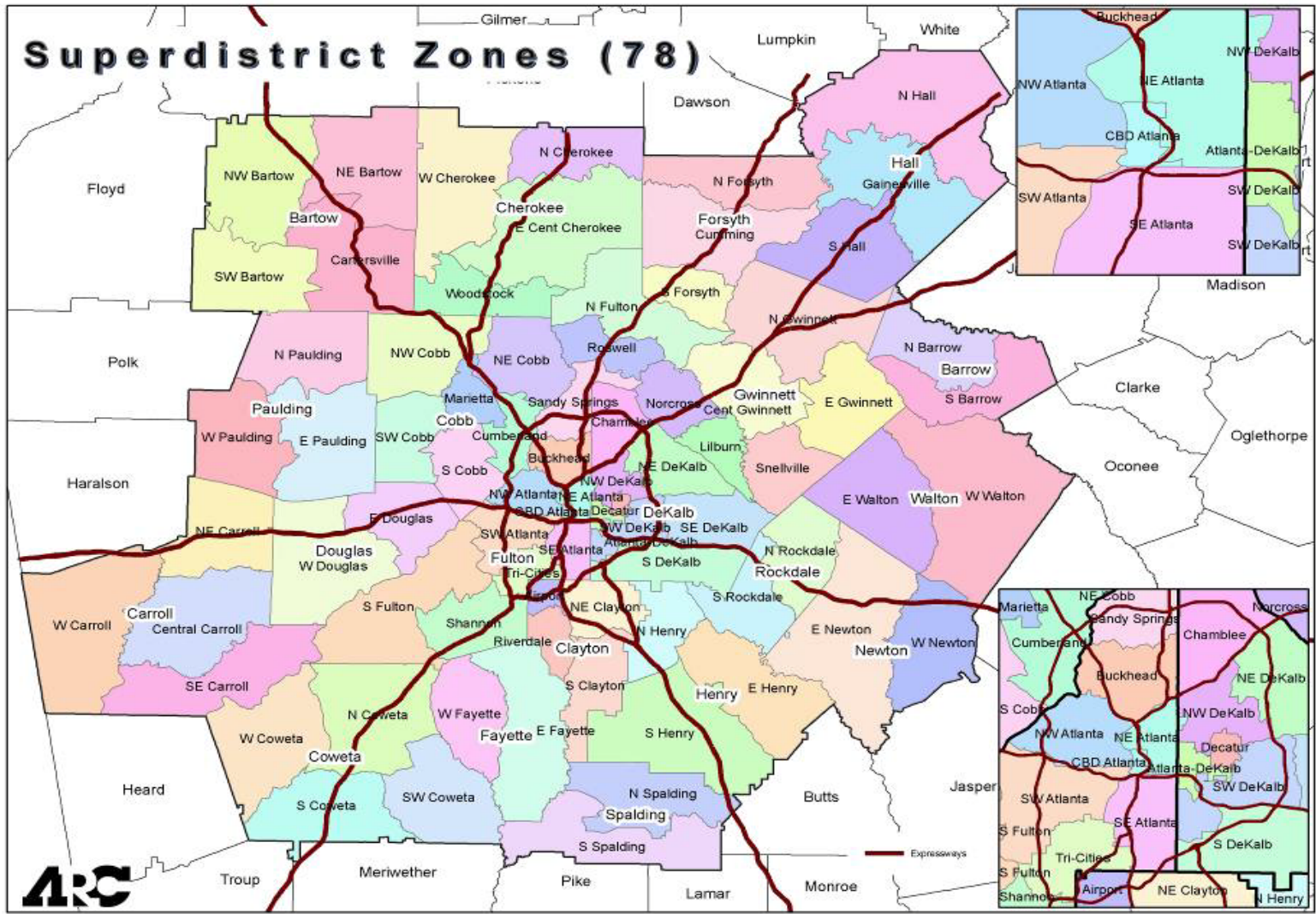
PRODUCING ACTIVITIES	COMMODITIES	SPACE	LAND / PARCEL ZONING
agriculture and mining management	agriculture and mining production	agricultural and mining space	agricultural or mining zoned land
agriculture and mining production	agriculture and mining output	industrial	very low density residential zoned land
construction management	construction direction	retail	low density residential zoned land
construction production	construction output	residential	medium density residential zoned land
manufacturing management	manufacturing direction	industrial	high density residential zoned land
manufacturing production	manufacturing output	industrial	highrise residential
transport comm and utilities management	transport comm and utilities direction	industrial	mixed-use highrise residential
transport comm and utilities production	transport comm and utilities output	industrial	majority use mixed use commercial
wholesale services	wholesale output	industrial	school zoned land
retail services	retail output	retail	institutional land
finance insurance and real estate services	finance insurance and real estate output	retail	passive park zoned land
professional services (437-450)	professional services output	retail	active park zoned land (ballparks)
management services (451-452)	management services output	retail	manufacturing (heavy) industrial zoned land
personal and business services office based (413-421)	personal and business services office based output	retail	other (light) industrial zoned land
personal and business services retail based (432-435)	personal and business services retail based output	retail	office park industrial zoned land
personal service industrial based (484-485)	personal service industrial based output	retail	office zoned land
religions services activity (491)	religions services activity output	retail	low density commercial retail zoned land (office in retail)
business services onsite (453,454,458,460)	business services onsite output	retail	high density commercial retail zoned land (office in retail)
personal services onsite (494)	personal services onsite output	retail	transportation communications utilities zoned land
federal government services	federal government services output	retail	military base land
state-local government services	state-local government services output	retail	
military	military output	military space	
gradeschool education	gradeschool education output	educational	
higher education	higher education output	educational	
health services	health services output	educational	
federal government accounts	federal government accounts output	educational	
state-local government accounts	state-local government accounts output	educational	
capital accounts	capital accounts output	educational	
households 0-50k income and 1-2 persons	households 0-50k income and 1-2 persons output	residential	
households 0-50k income and 3+ persons	households 0-50k income and 3+ persons output	residential	
households 50+k income and 1-2 persons	households 50+k income and 1-2 persons output	residential	
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IMPORTS			
EXCHANGE LOCATIONS			
EXPORTS			
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TRANSPORT FLOWS			
home-based work	home-based work output		
home-based other	home-based other output		
non-home-based	non-home-based output		
light truck	light truck output		
medium truck	medium truck output		
heavy truck	heavy truck output		

- 32 Production and Consumption Activities
  - Manufacturing Management
- 27 Commodity Types
  - Manufacturing direction
- 8 Space Types
  - Offices
- 20 Zoning Types
  - Office zoned land





# Activity Allocation Module Zone Structure



# PECAS Task List–Progress

## task\_group 1 SD Development

- 01: Establish parcel-level space rent equations**
- 02: Establish space transition costs calculation system
- 03: Establish space maintenance costs equations
- 04: Establish base-year parcel database
- 05: Establish base-year quantities of space by type in each zone
- 06: Establish all-year parcel-level inputs for calibration period

## **07: Identify space transition constants**

## task\_group 2 Transport Utility Equation Establishment

## **08: Establish transport utility equations**

## task 3 Technology Option Point Development

- 09: Identify household technology option points:**
- 10: Identify industrial technology option points:**
- 11: Identify accounts categories technology option points:**

## task\_group 4 AA Target Development

- 12: Develop labor production zonal-level targets:**
- 13: Develop labor consumption zonal-level targets:**
- 14: Develop labor spatial flow targets (CTPP)**
- 15: Develop commodity production zonal-level targets:**
- 16: Develop commodity consumption zonal-level targets:**
- 17: Develop commodity spatial flow targets: (CFS)**
- 18: Develop import and exports targets:**

## task\_group 5 Import Export Calibration

## **19: Establish imports and exports functions equation parameters:**

## task\_group 6 AA Inputs Development

- 20: Develop skim matrices from transport model:**
- 21: Develop X-Vector Attribute values (e.g. schools, air quality)**

## task\_group 7 Stage 2 Calibration

- 22: Establish buying and selling utility equation parameters
- 23: Establish size terms for imports and exports in external zones
- 24: Establish technology allocation utility equation parameters

## 25: Establish location allocation utility equation sensitivity parameters

## 26: Establish location allocation utility equation zonal constants

## task\_group 8 Stage 3 Calibration

## **27: Set-up semi-automated calibration process**

Red = Complete

Green = Not Started





# Plan 2040 Needs Assessment



- REMI Used for Development of Regional Controls 1/09-5/09
  - Technical Advisory Committee
  - Calibration Work
- Use of Parallel Allocation Process (*TAZ-D*) as Small Area Allocation 'Bridge' to PECAS
  - Developed with PBSJ—ArcGIS Module
  - Adds Spatial Component to D/E Small Area Allocation
  - Influential Layers for Allocation Include Impedance, Highways, Major Roads, Redevelopment Potential, Like Land Use, as well as Vacant Land
  - Jurisdiction Meetings May-June 2009
- Needs Assessment Data and Process to Inform PECAS Calibration and Next Steps for 2009-2011



# Next Steps: PECAS



- **Run Model Through Time September-October 2009**
- **Target Assistance with Scenario Modeling as part of Plan 2040 Process: 2010**
- **Goal of PECAS Use for Conformity Runs 2014-2015**
- **Pursue & Implement Model Enhancements:**
  - X-Factor Attributes
  - Interface (GUI, GIS Link)
  - Integration with Tour-Based Travel Model
  - Improve Output Evaluation

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# Our Opinion(s) Thus Far



- Further than we expected to be thus far
- Our GIS capabilities have helped us overcome parcel problems
- Excellent consultant support
- As clients, understand maybe a third of what is happening...on good days
- BUT...confident we have made right choice going forward

