ATG

DCCM

Developing a Statewide Land Use Forecasting Model with Integration Capabilities for Travel Demand

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Ali Riahi Samani
ariahisamani@dccm.com

Project Team

Ali Riahi Samani, Ph.D.
Travel Demand Modeler
Alliance Transportation Group (ATG|DCCM)

Sabya Mishra, Ph.D., PE
Professor, Department of Civil Engineering,
University of Memphis (UofM)

Mihalis Golias, Ph.D.
Professor, Department of Commerce, Finance and Shipping,
Cyprus University of Technology

David Lee, Ph.D.
Assistant Director,
Long Range Planning Division, Tennessee Department of Transportation (TDOT)

Jerry Everett, Ph.D.
Associate Director,
Center For Transportation Research, University of Tennessee at Knoxville (UTK)

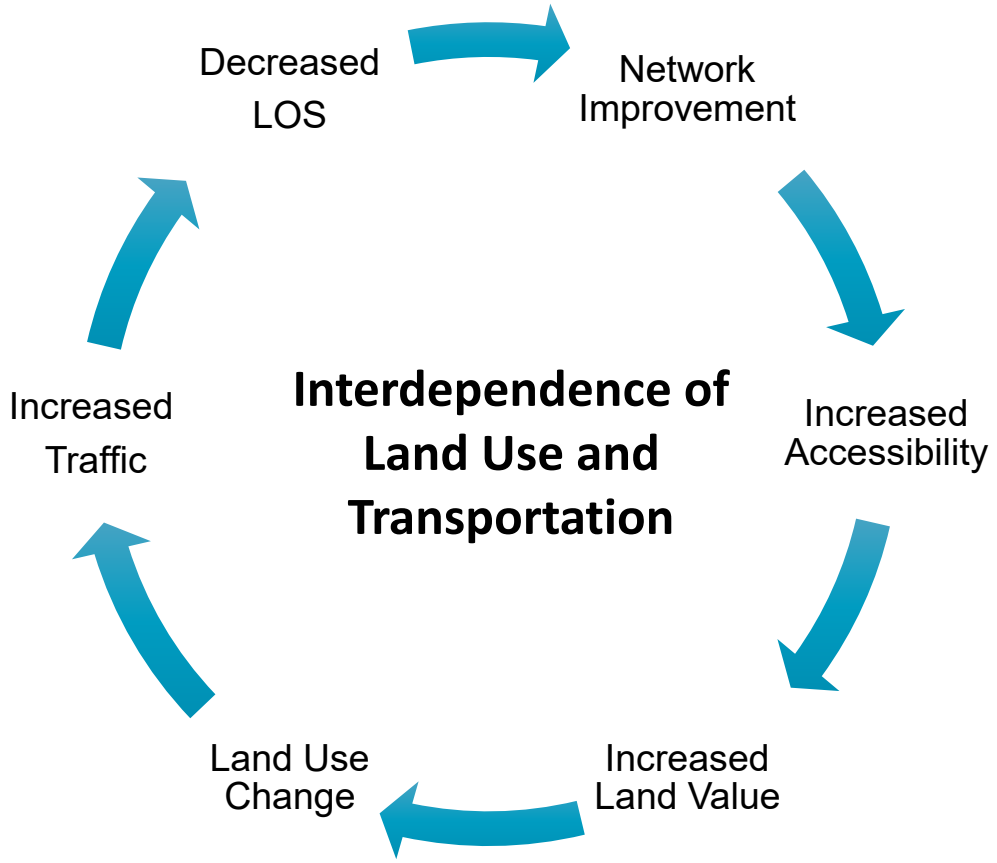
Introduction

Aim:

- To develop a statewide land use forecasting model for TN
  - Integrated with Tennessee Statewide Travel Demand Model
  - High accuracy with reasonable run time
  - Low data requirement (extendable to other study areas)

Benefits:

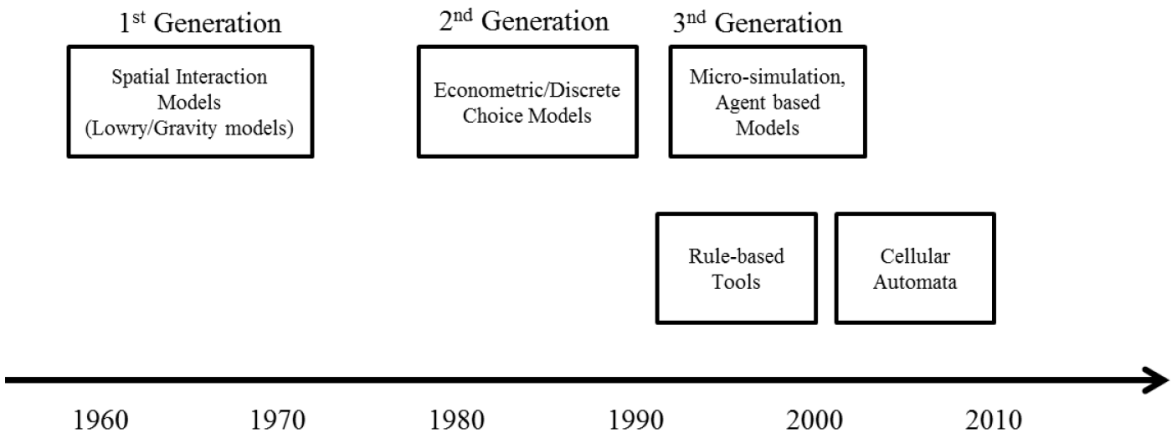
- Increasing the accuracy of future-year land use forecasts
- Assess cumulative and indirect effects of projects.
- Evaluate economic effects of various state and regional policies.
- Obtain land use impact because of travel behavior change



Land Use Models' Categories

Land use models can be categorized into

- Macro models
  - Gravity based
- Meso models
  - Logit Based
- Micro models
  - Agent based and Cellular automata models



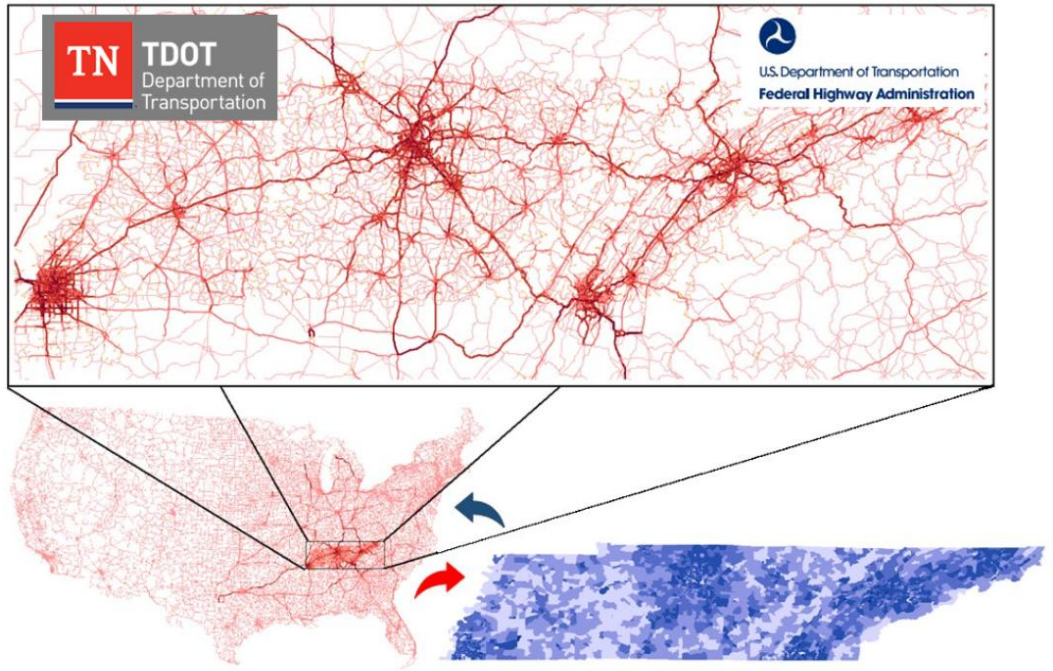
Selecting an approach for developing a land-use model

- Data availability
- Geographic level of zones (parcels, blocks, TAZs, …)
- Number of zones (the scale of study area)
- Future/interval years
- Run-time
- Accuracy

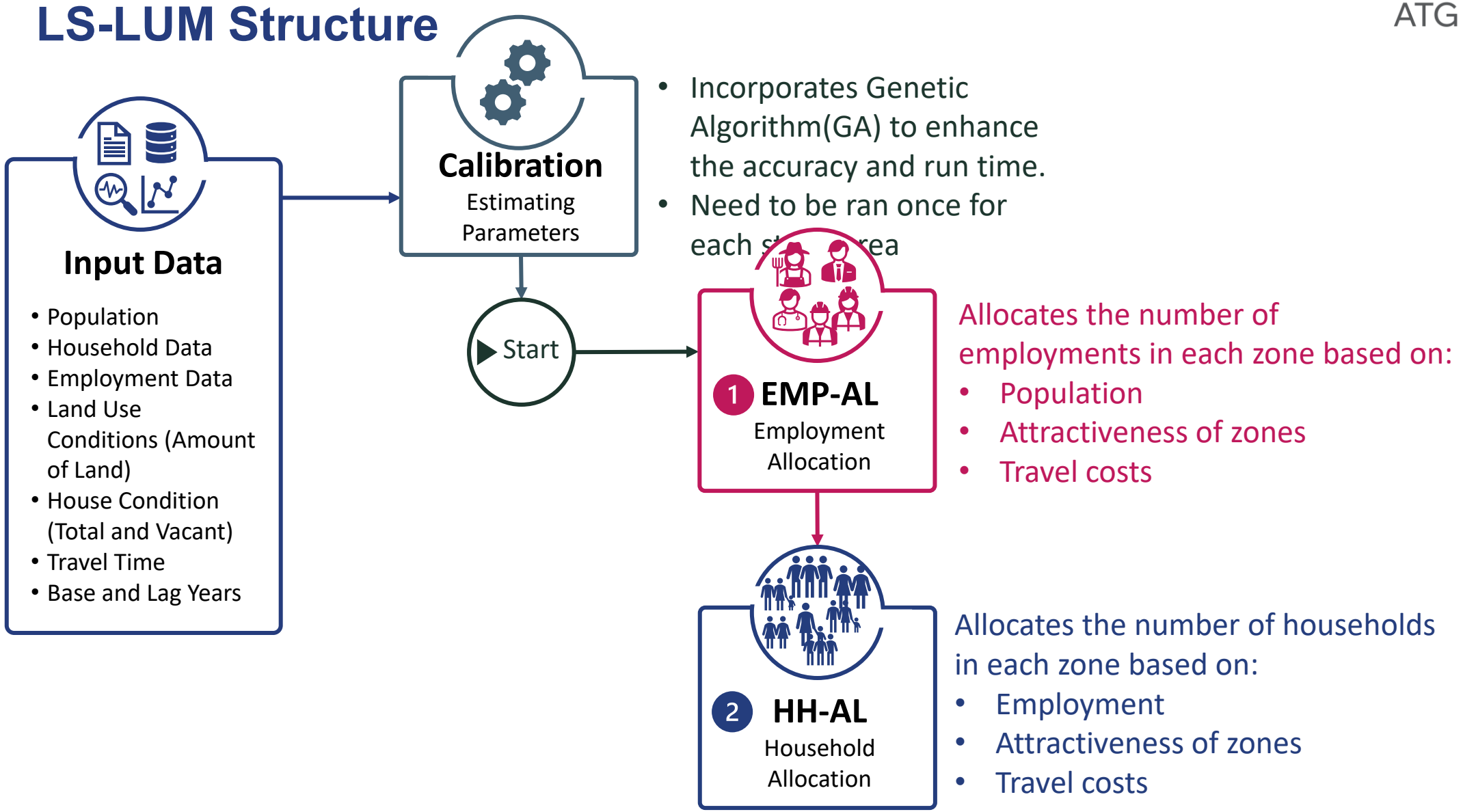
Research Goals

Development of Large-Scale Land Use Model (LS-LUM)

- Tennessee first statewide land use model
- Tightly integrates with TDM
- Uses publicly available data
- Reasonable run + High accuracy
- User friendly interface
- Online interactive tool



LS-LUM Structure



- Incorporates Genetic Algorithm(GA) to enhance the accuracy and run time.
- Need to be ran once for each study area

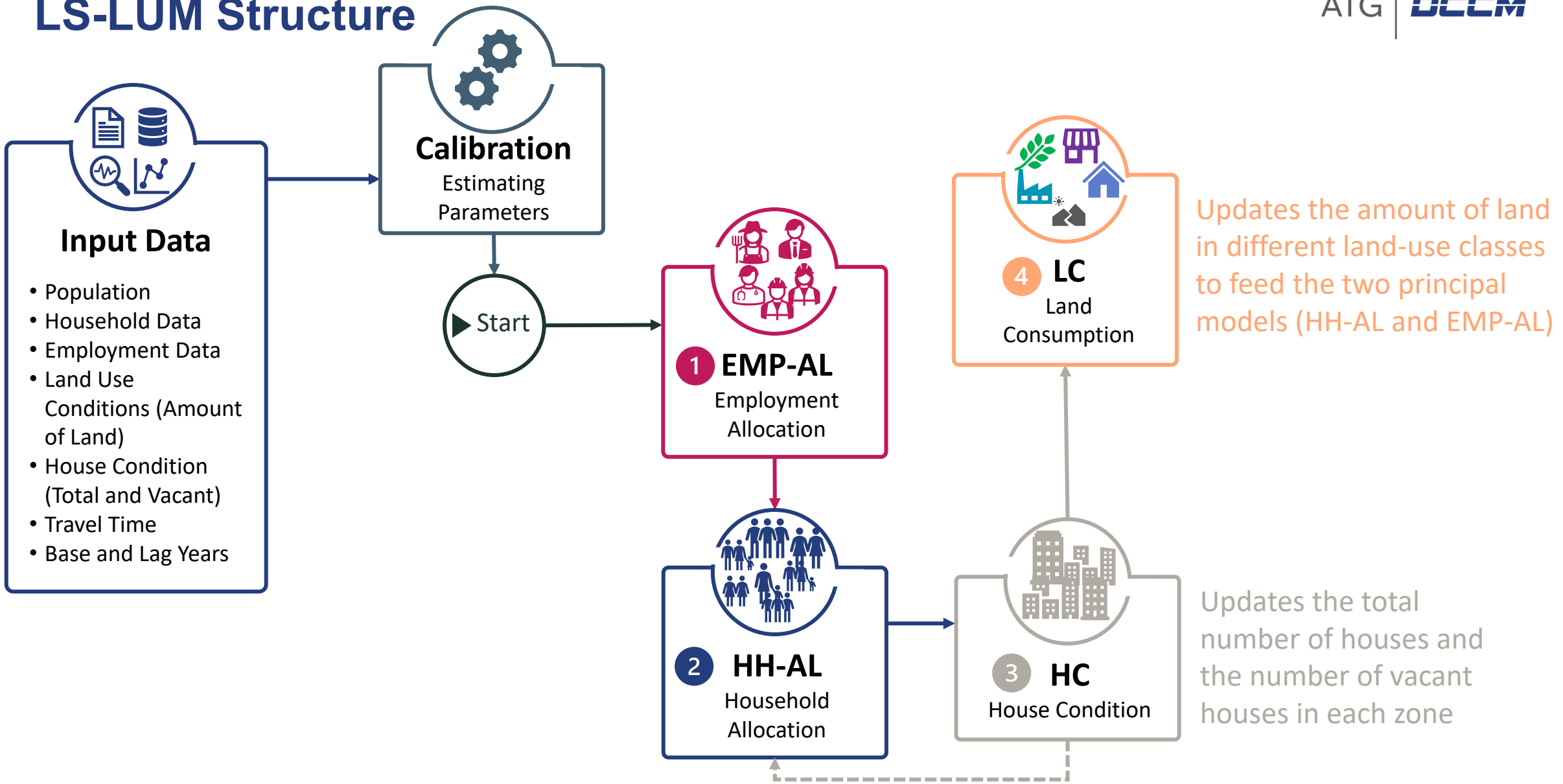
Allocates the number of employments in each zone based on:

- Population
- Attractiveness of zones
- Travel costs

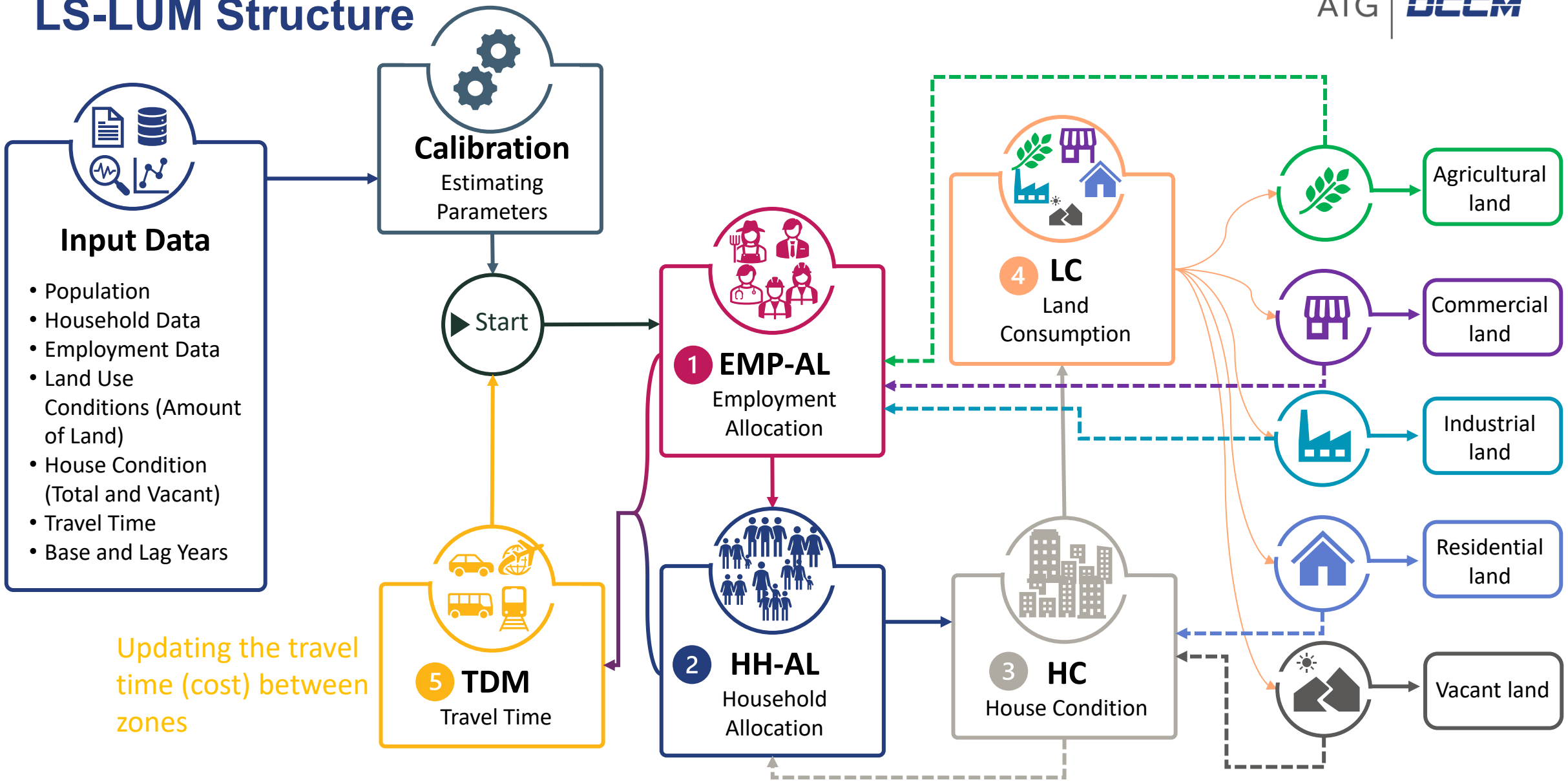
Allocates the number of households in each zone based on:

- Employment
- Attractiveness of zones
- Travel costs

LS-LUM Structure

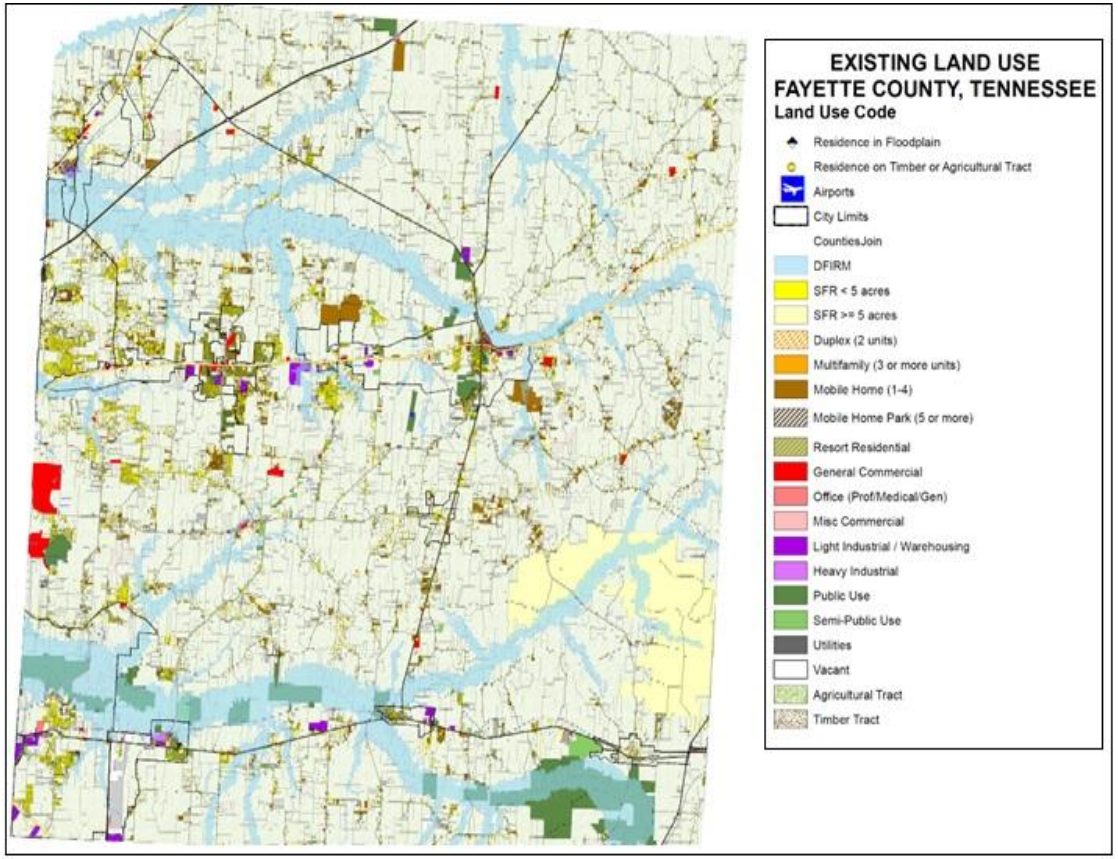


LS-LUM Structure



Data Collection

- **Census data**
  - Population
  - Households
  - Group Quarters
  - House Conditions
    - Total Houses
    - Occupied/vacant houses
- **Longitudinal Employer-Household Dynamics (LEHD)**
  - Total Employment
  - 20 NAICS
- **Parcel Data**
  - Land use conditions (Residential, Commercial, Industrial, Agricultural, Developable (Vacant))



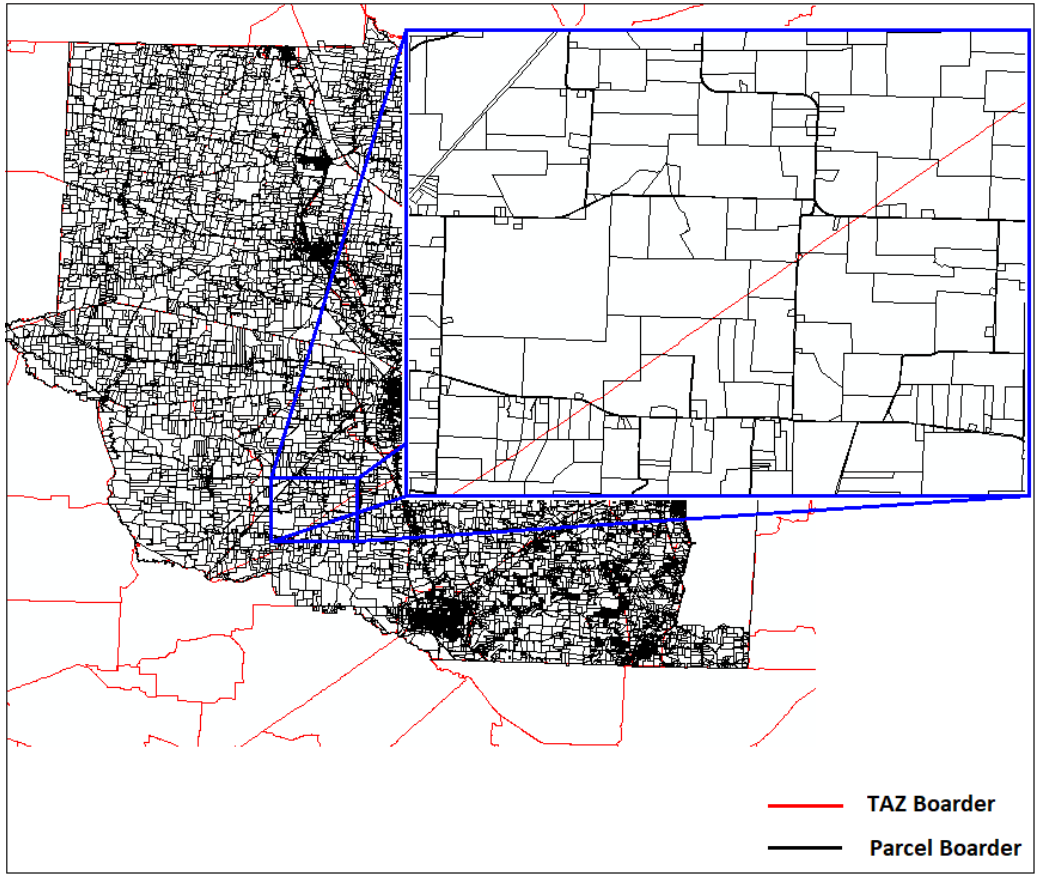
Parcel Data

Parcel data refers to a combination of both spatial and nonspatial attribute files, presenting land ownership in a local jurisdiction

- Land properties (lands uses)
- Year of built
- Status of the land (vacant/occupied)
- Land's price
- Land's owner
- The date of last transition
- …

Some of the challenges include:

- An understanding of data availability and completeness
- The willingness of local governments to provide data
- The varying content, format, and structure of data among counties
- Conflicts between parcels and TAZs (one parcel might drop between multiple TAZs)

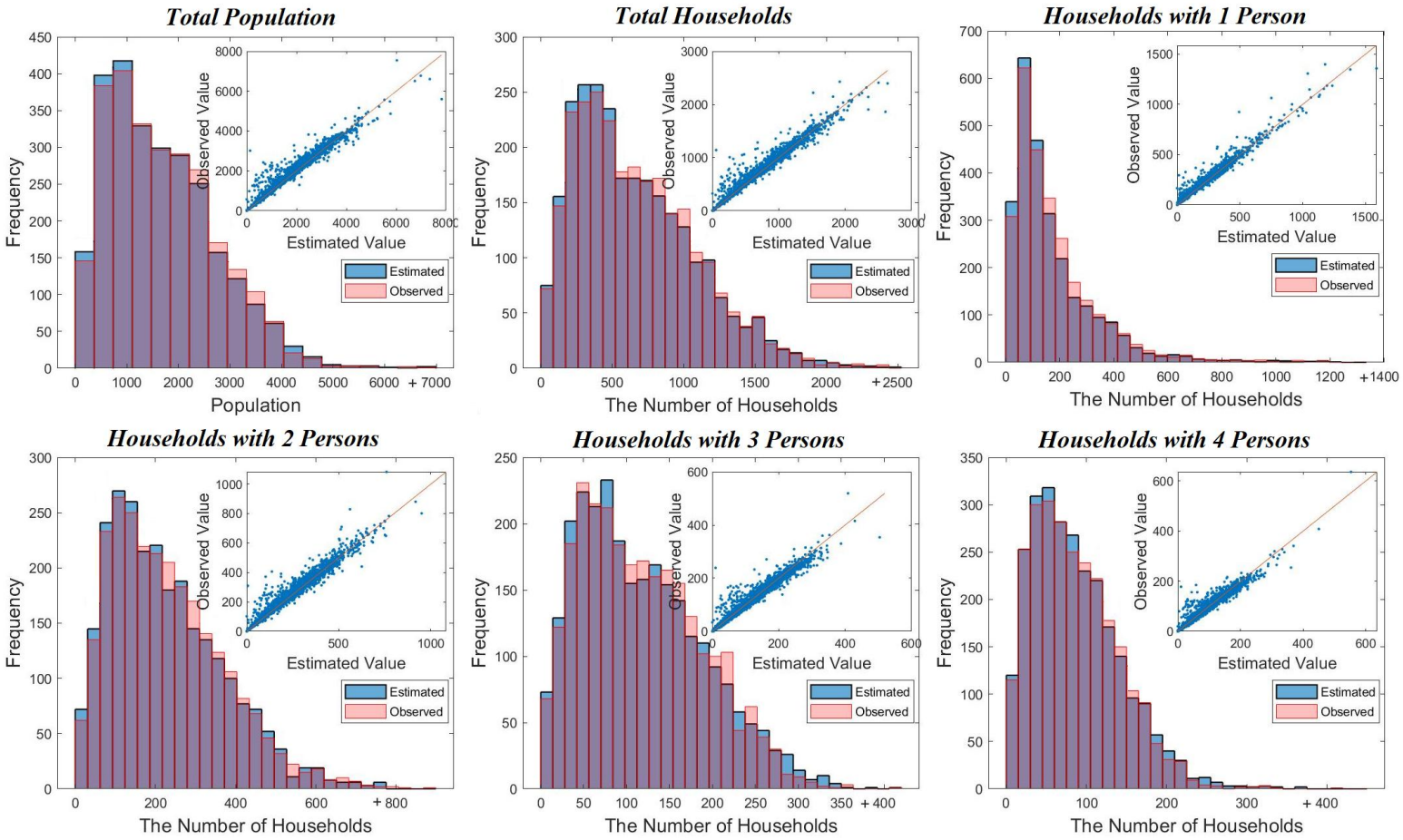


Model Validation/Performance

Land use filed	R^2	MAPE (%)	PGP
Total Population	0.95	7.76	0.969
Total Households	0.956	9.15	0.97
HH with 1 Person	0.967	14.6	0.955
HH with 2 Persons	0.951	14.22	0.962
⋮			
HH with 7 or more	0.905	29.41	0.863
Total Employment	0.956	199.9	0.904
Emp in NAICS 11	0.893	72.73	0.771
Emp in NAICS 21	0.848	77.01	0.709
⋮			
Emp in NAICS 92	0.842	80.51	0.741
Residential Land	0.997	3.32	0.974
Commercial Land	0.974	13.53	0.962
Industrial Land	0.890	75.28	0.83
Agricultural Land	0.998	21.27	0.999
Vacant Land	0.933	29.31	0.926

- The developed model shows acceptable accuracy in all categories and in a disaggregated environment both in backcasting and forecasting.
- Based on the studies R-squared and PGP greater than 0.66 represents acceptable accuracy.
- Model shows high accuracy in predicting households and land use conditions

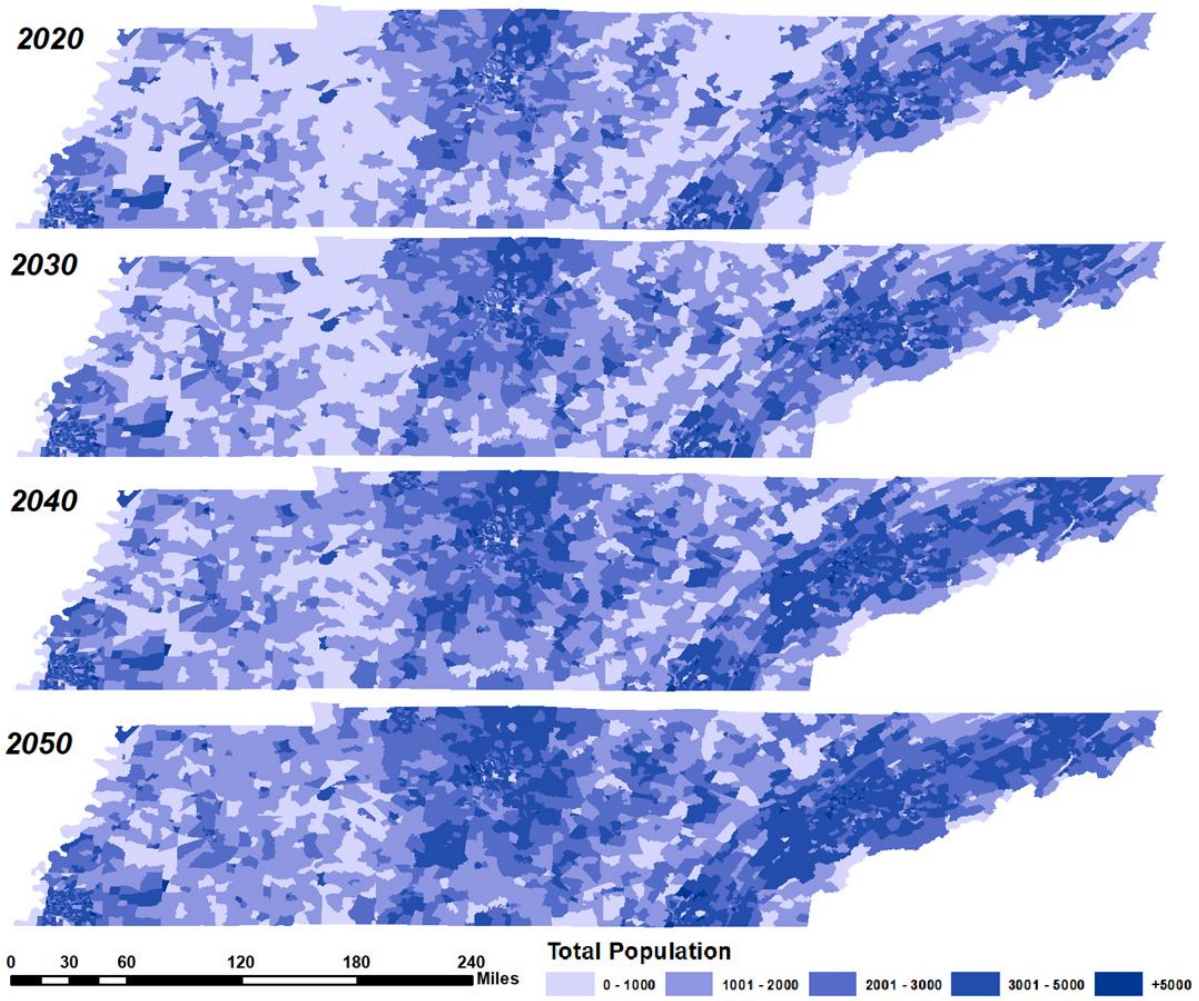
Model Validation



Histogram and Correlation Plot of estimated and observed households 2005 (backcasting)

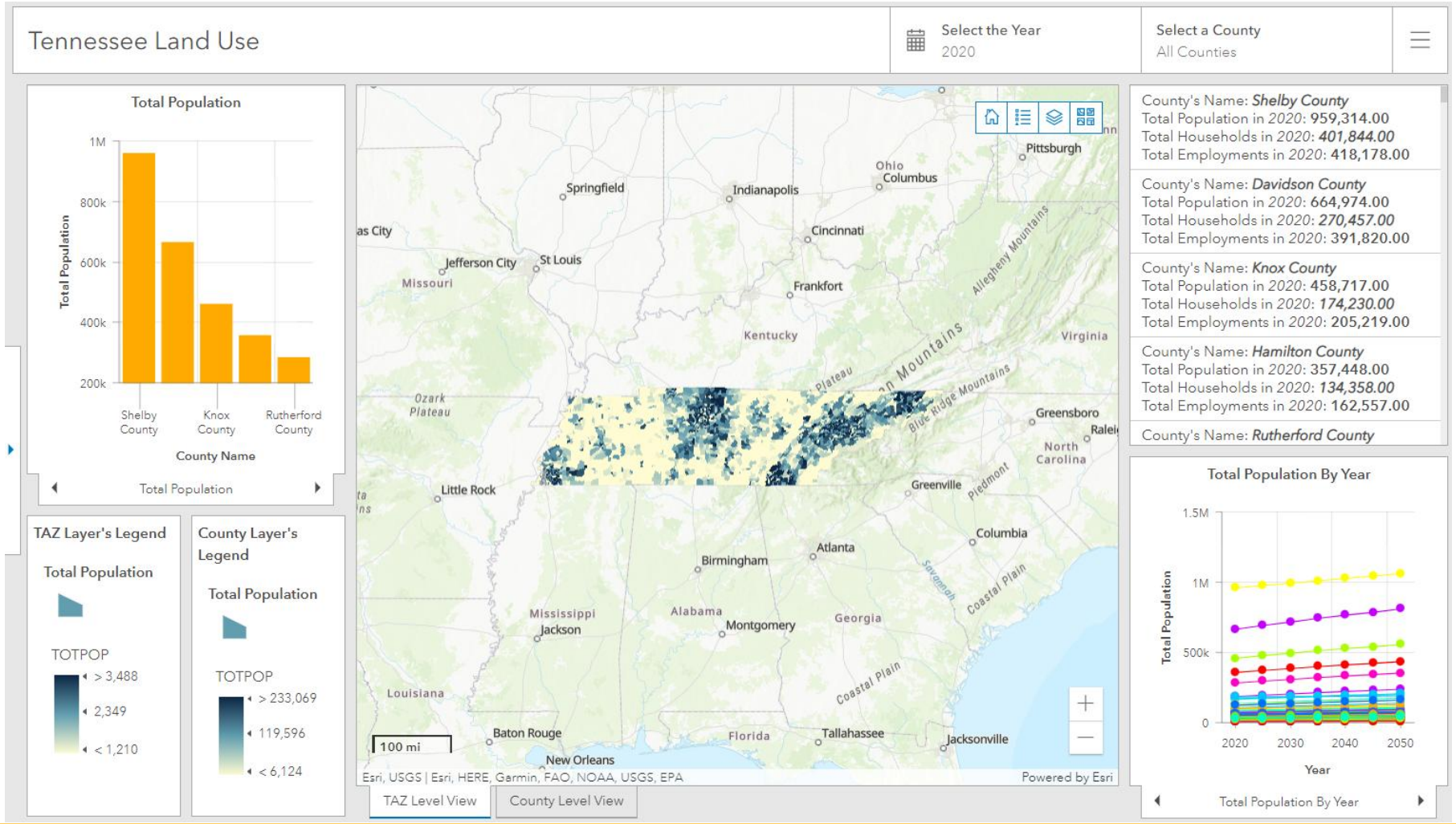
Scan for more validation results

Forecast Results



The forecasted total population form year 2020 to 2050

Interactive Online Tool



Scan to access the online dashboard

Final Notes

- LS-LUM is currently used by TDOT's Long Range Planning Division.
- It provides a powerful scenario analysis tool with a wide range of variables and highly detailed outputs.
- Its user-friendly interface is intuitive and easy to learn.
- The updated version of LS-LUM is fully integrated with the Tennessee statewide TDM.
- The performance and accuracy of the model is tested have been tested at various regional scales by multiple agencies in Tennessee.

Thank you!

For more information please contact:

Ali Riahi Samani

ariahisamani@dccm.com