GIS based Land Use and Transportation modeling

ESRI International Users Conference

San Diego, CA July 16, 2014

Prepared by: Troy Hightower
Kern Council of Governments

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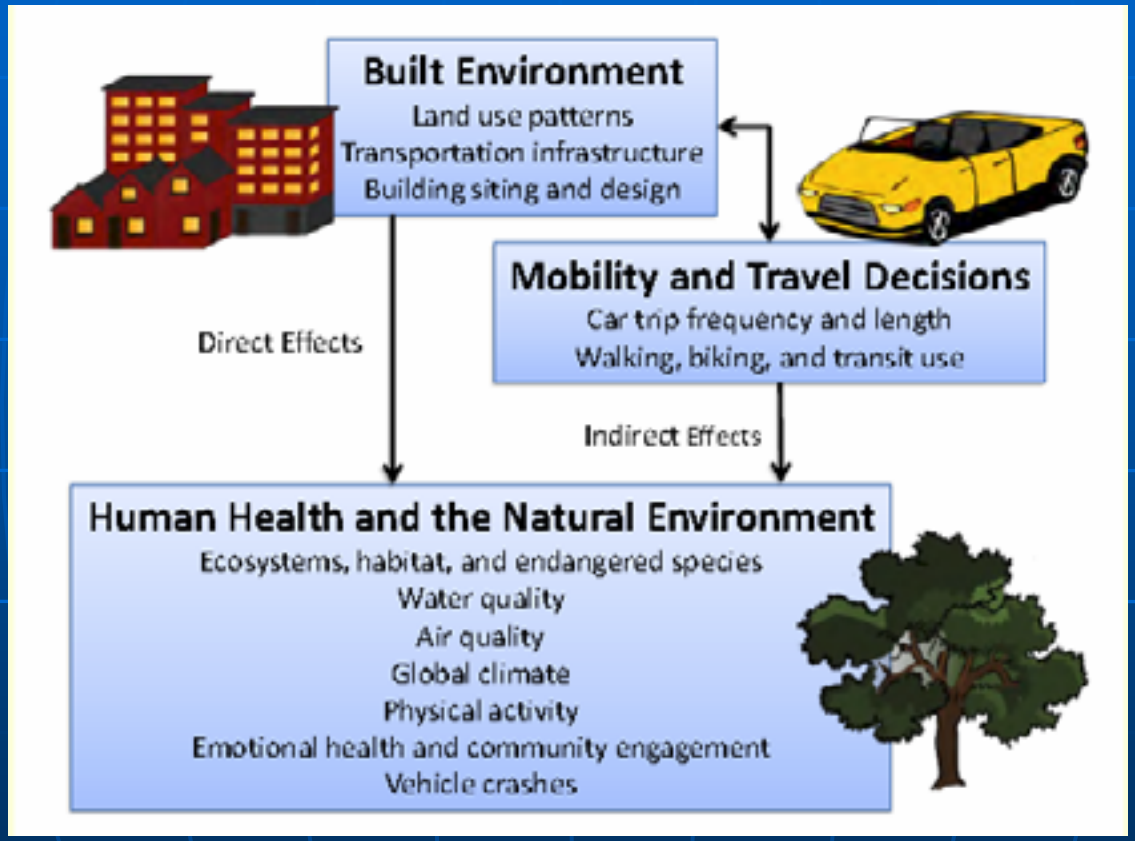
Land Use and Transportation
GIS based modeling



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** Image curtesy of US EPA*

Introduction

- This presentation will explain the following
  - Overview of Kern COG and SB 375 requirements
  - How GIS is used to support modeling efforts
  - GIS based performance measures and indicators
- Review some of the challenges and lessons learned

The goal is to demonstrate how GIS plays an increasing role in Land Use and Transportation modeling.

California Climate Change Law Senate Bill 375

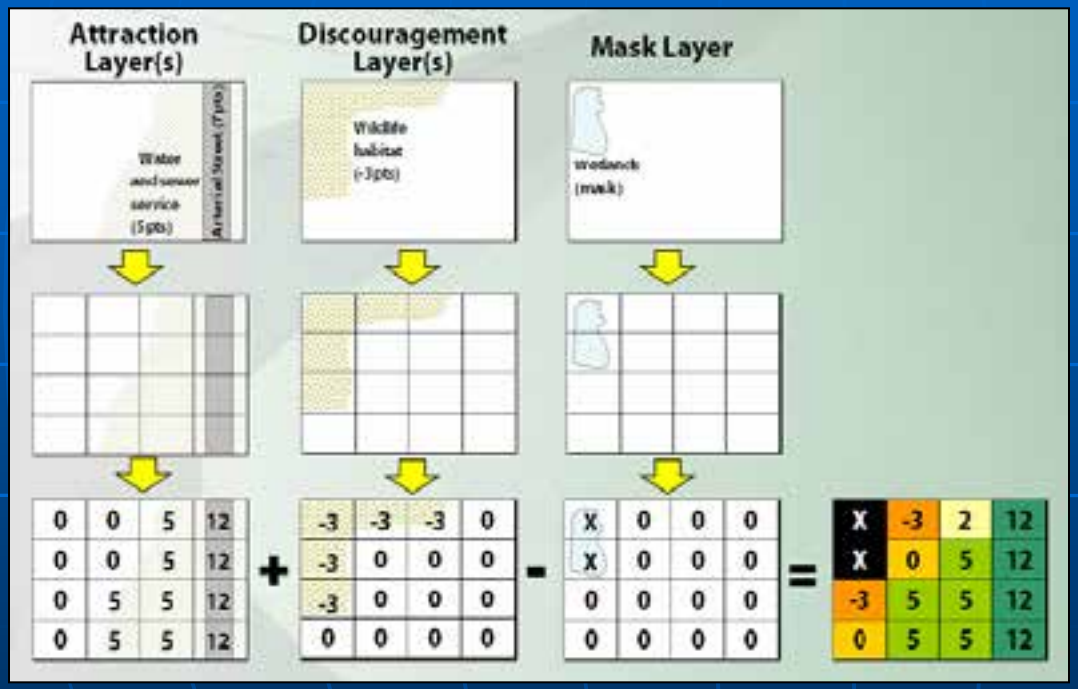
- SB 375 is a new law requiring Land Use and Transportation planning that will reduce GHG emissions-mainly from passenger vehicles
- SB 375 requires a Sustainable Communities Strategy or SCS for Regional Transportation Plans
- Public and stakeholder participation requires presenting information that is easy to understand

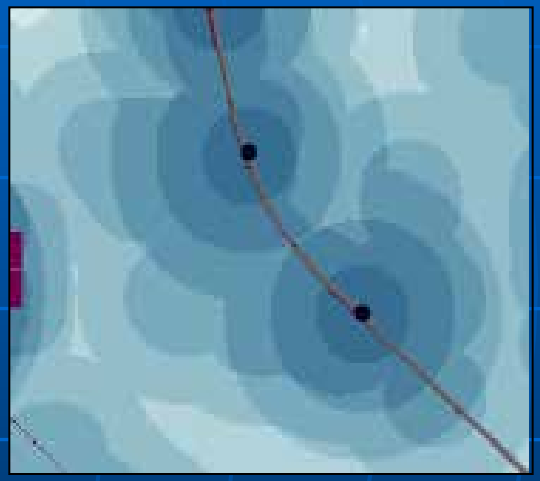
Land Use Models

- Kern COG uses Upland and Cube Land
- There are other Land Use models such as Envision, Community Viz and Urban Footprint
- SB 375 requires integration of land use and transportation models
- Performance measures and indicators are required for SCS and MAP-21
- SCS development process requires creating multiple land use scenarios

What is UPlan?

UPlan is a GIS based land use model used to analyze future urban growth.



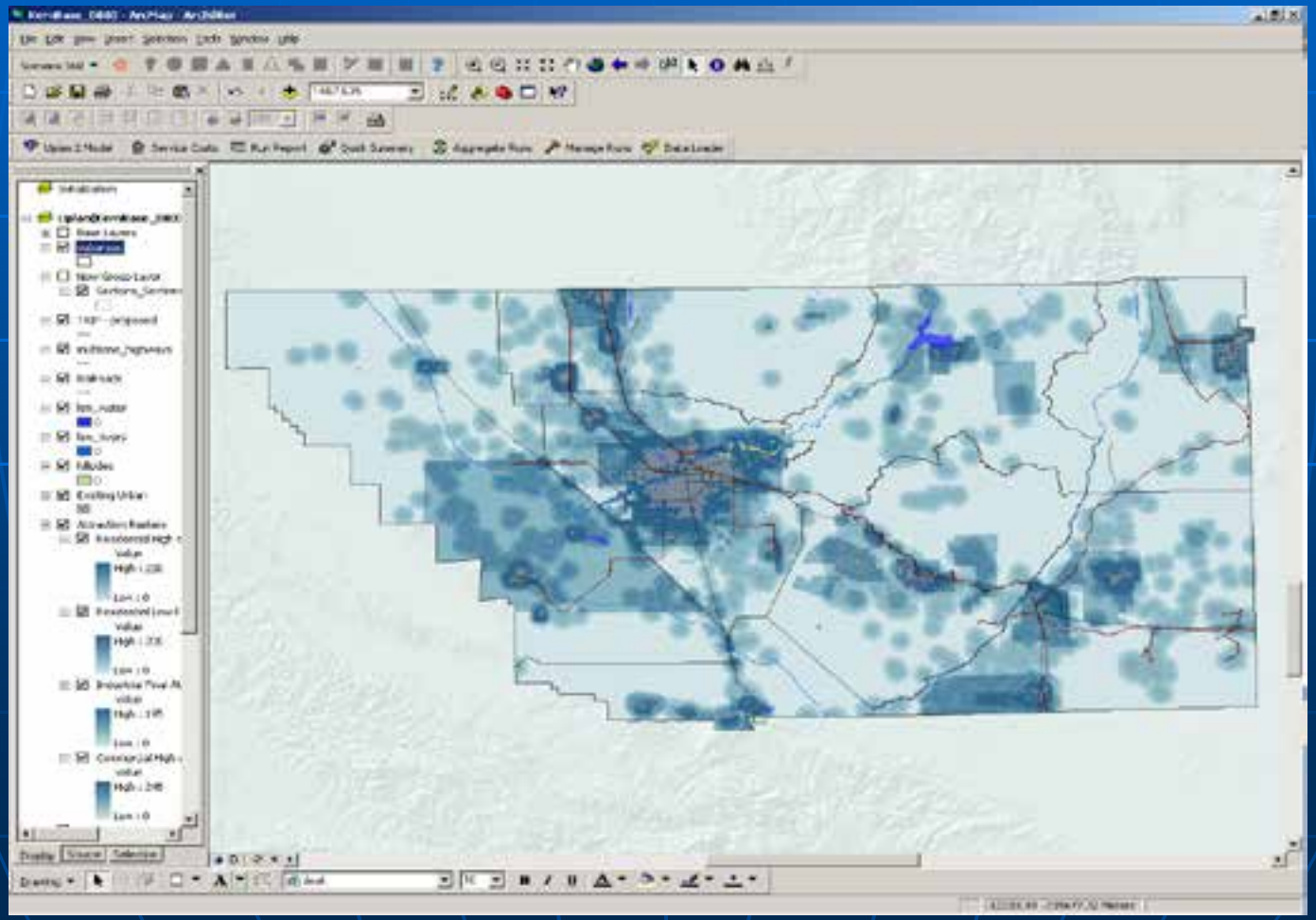


Weighted Buffers

Shape files representing general plans, specific plans, existing urban areas, infrastructure, urban cores, highway ramps, environmental, and others areas are converted to grid based rasters.

Attraction Rasters

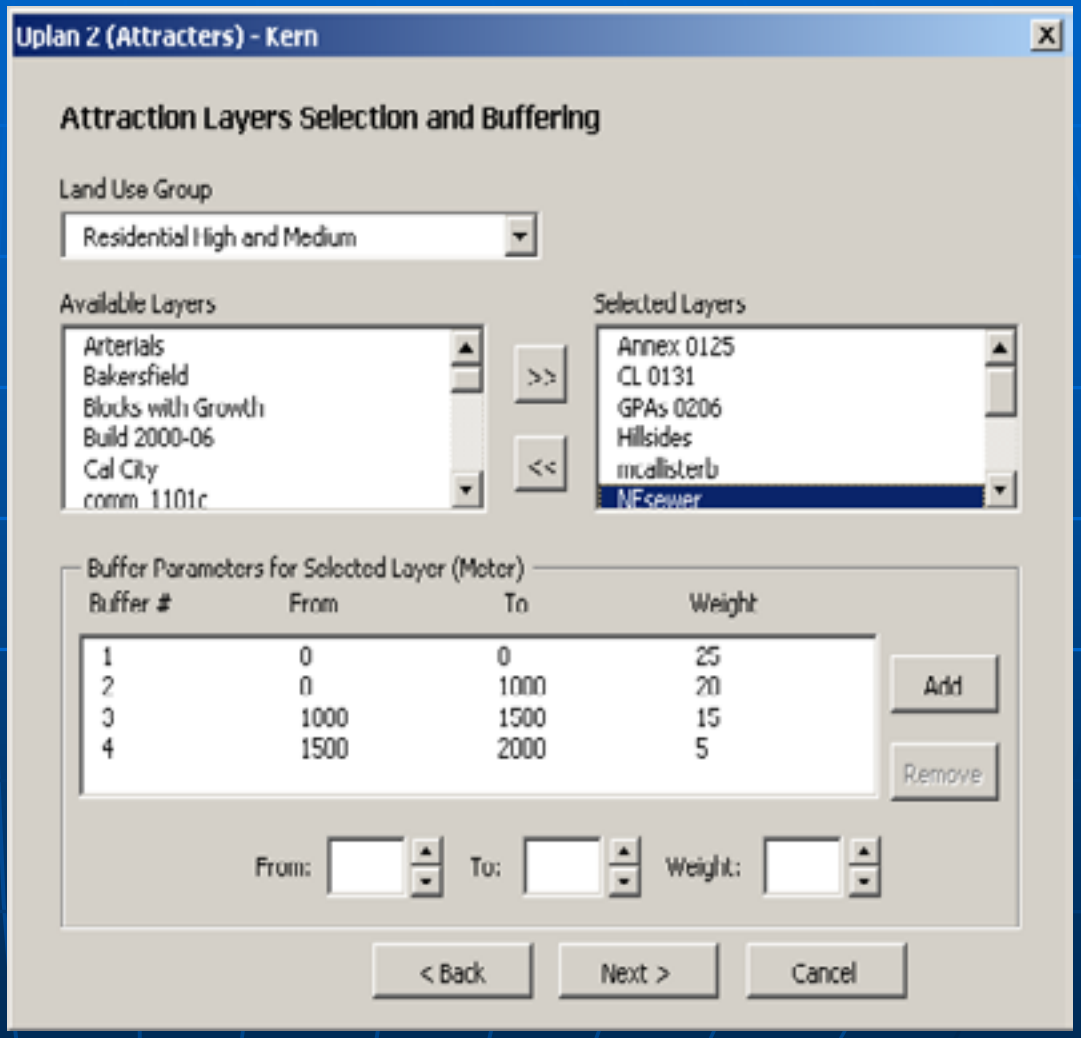
The model will create weighted Attraction Rasters that the model uses to prioritize where it allocates growth.



Running a Model

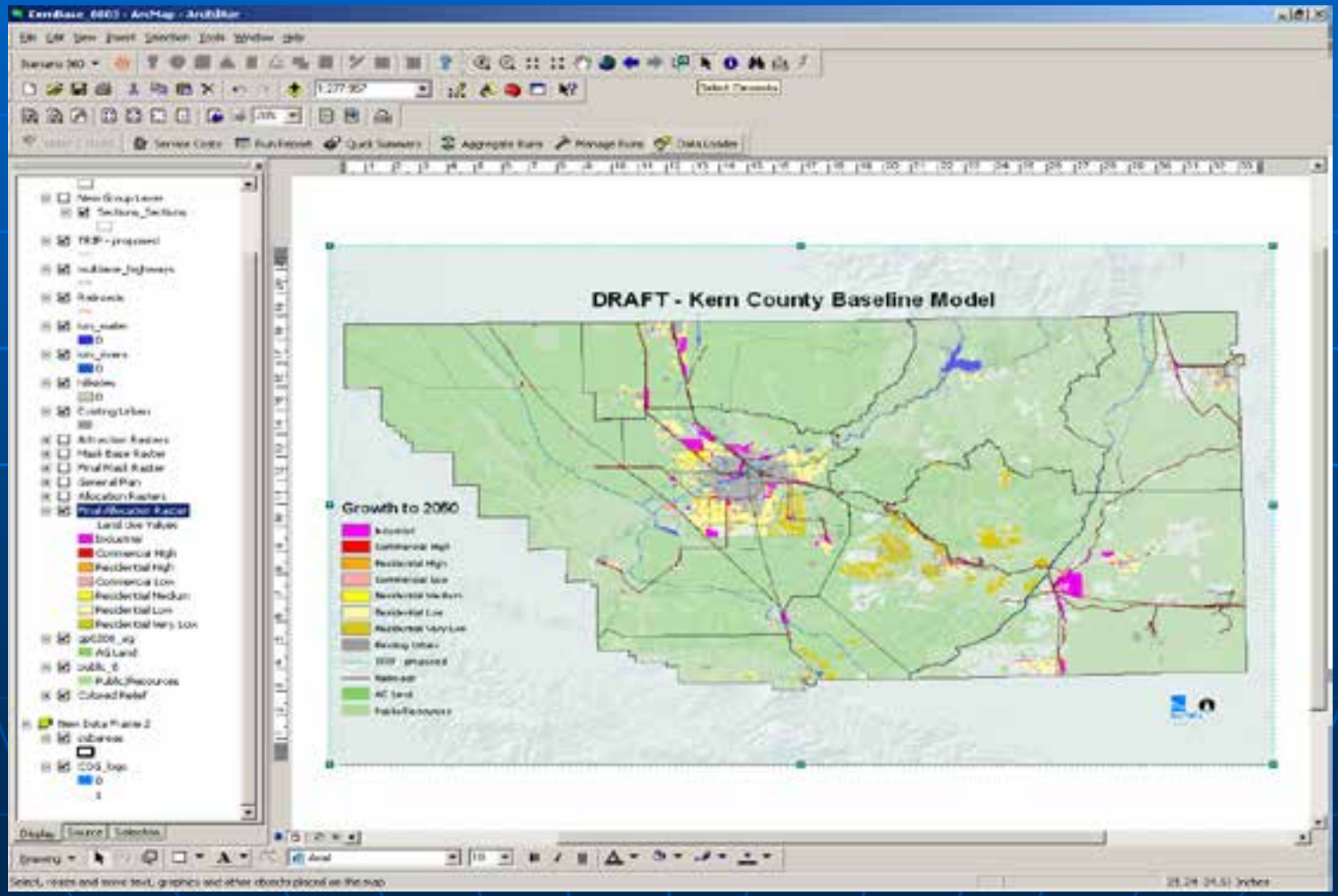
In addition to the rasters you will need parameters like: population distribution among sub-areas, housing densities (DU's/acre), buffer distances for attractions, and employment ratios.

UPlan has a wizard that allows you to input those parameters when you wish to run a model.



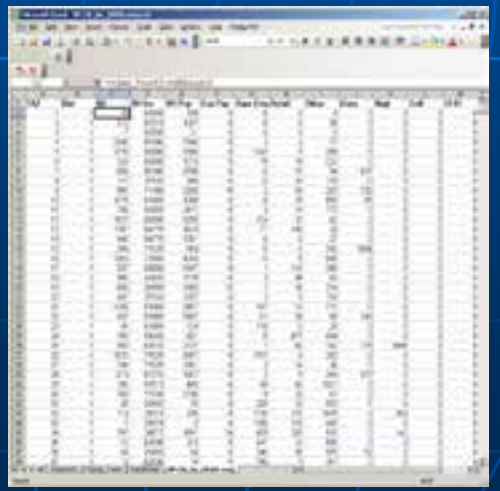
Final Allocation Raster

Once the model is completed the Final Allocation Raster is created. This raster displays the growth in seven different land use types.

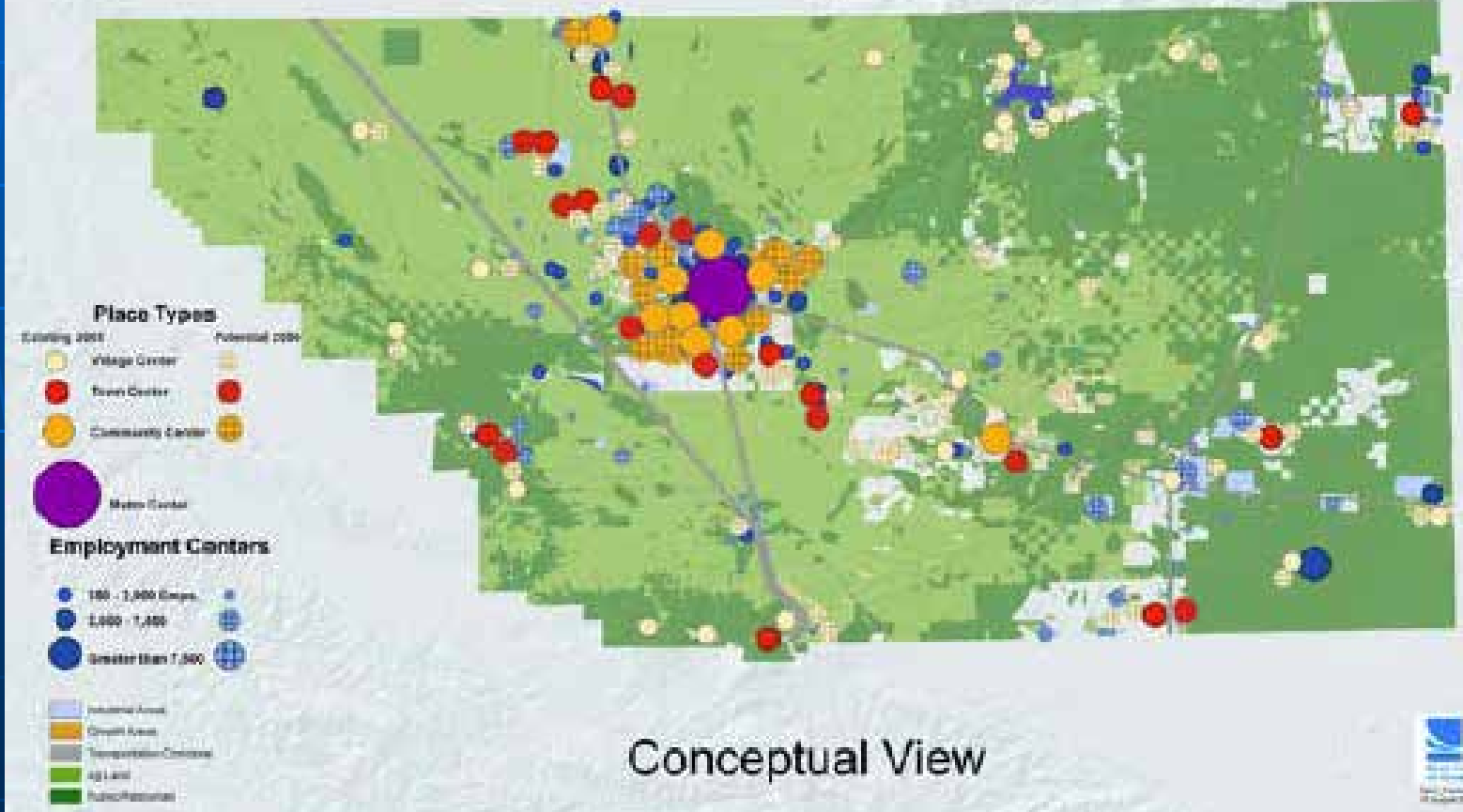


UPlan Model Results

- Using GIS the Uplan results are used to create maps, illustrations, and presentations
- Uplan also creates a spreadsheet containing socio-economic data by TAZ that is used as an input for Transportation model

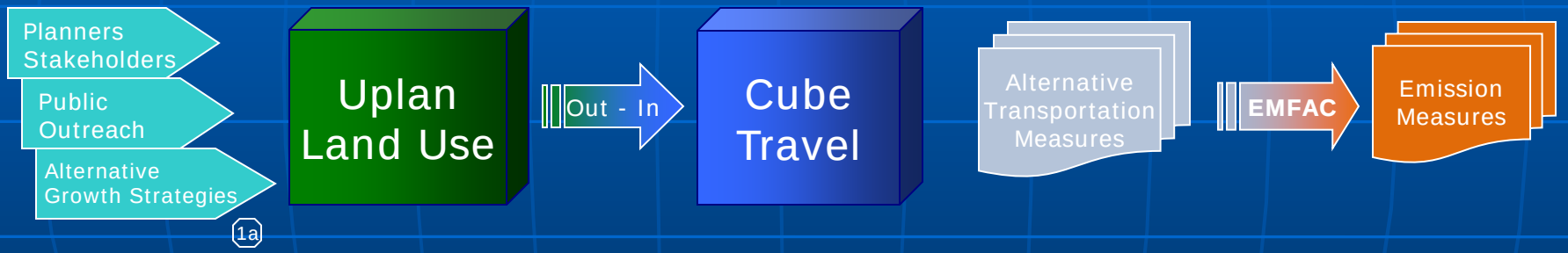


Kern Blueprint - Alternative Scenario 2050



Uplan Modeling Flowchart

Sustainable Community Strategy - **SCS**



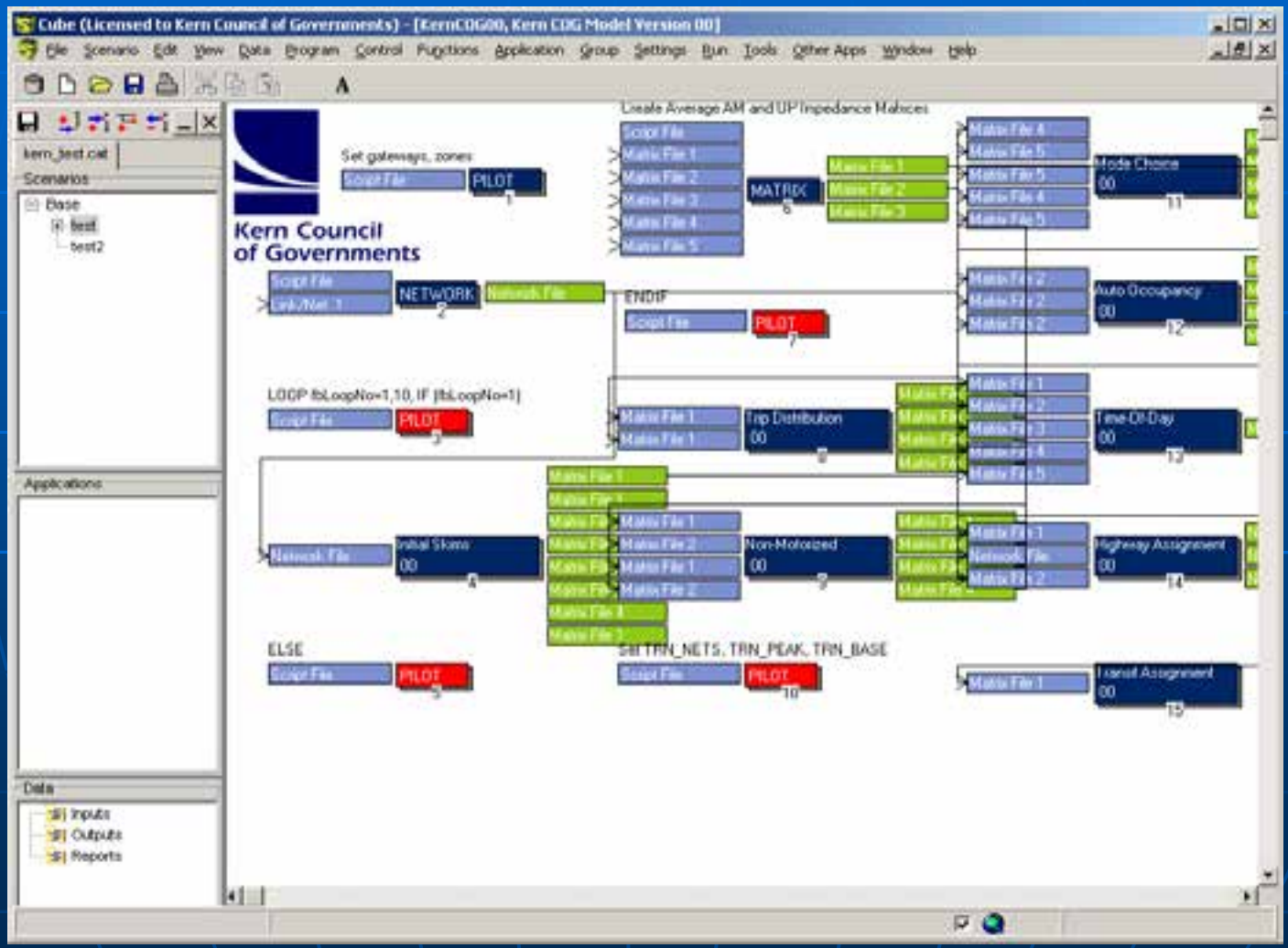
Alternative Planning Strategy - **APS**

1. Inputs from Planners, Stakeholders, Public Outreach, Environmental Datasets, and current General Plans.
   1a. Planners, Stakeholders, and the Public develop Alternative, or Transit based strategies.
2. The Land Use Model **UPlan** allocates growth based on parameters, attractions like freeways, discouragements like public lands, and resources. It creates a GIS based conceptual growth map.
3. Uplan also outputs socioeconomic data by TAZ used as the input data for the Travel Model **Cube**.
4. Cube generates LOS maps, VMT, and other Transportation measures.
5. Cube output data is also used in **EMFAC** to generate Emission measures.
6. **The measures generated are reviewed, and relative comparisons between scenarios can be made.**

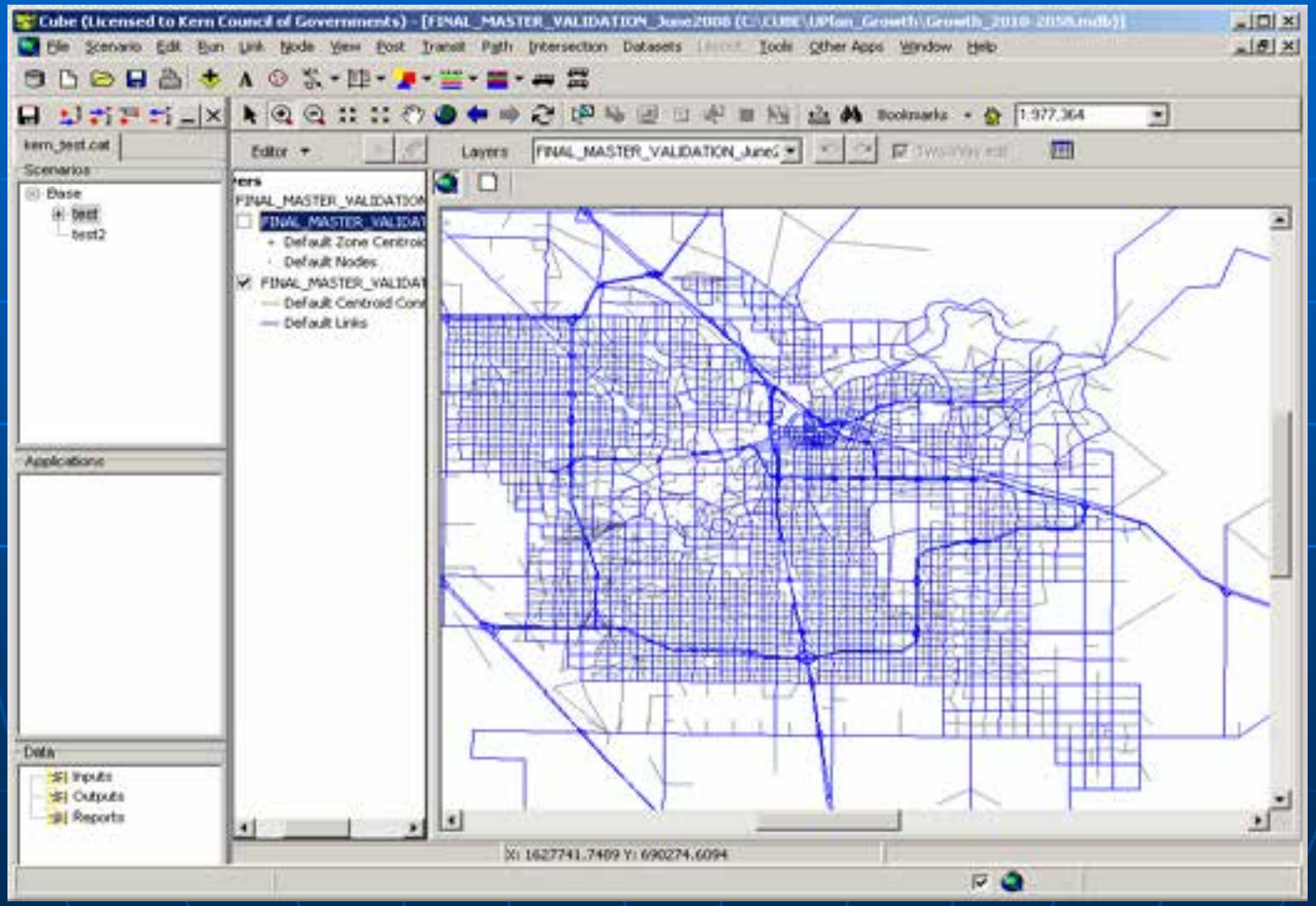
What is Cube?

- Cube is a suite of transportation models developed by Citilabs
- The latest versions of Cube includes the ESRI ArcMap engine
- Transportation model run outputs are stored in a geodatabase
- Cube Land is an economic based land use model that runs interactively with the Cube Voyage transportation model.

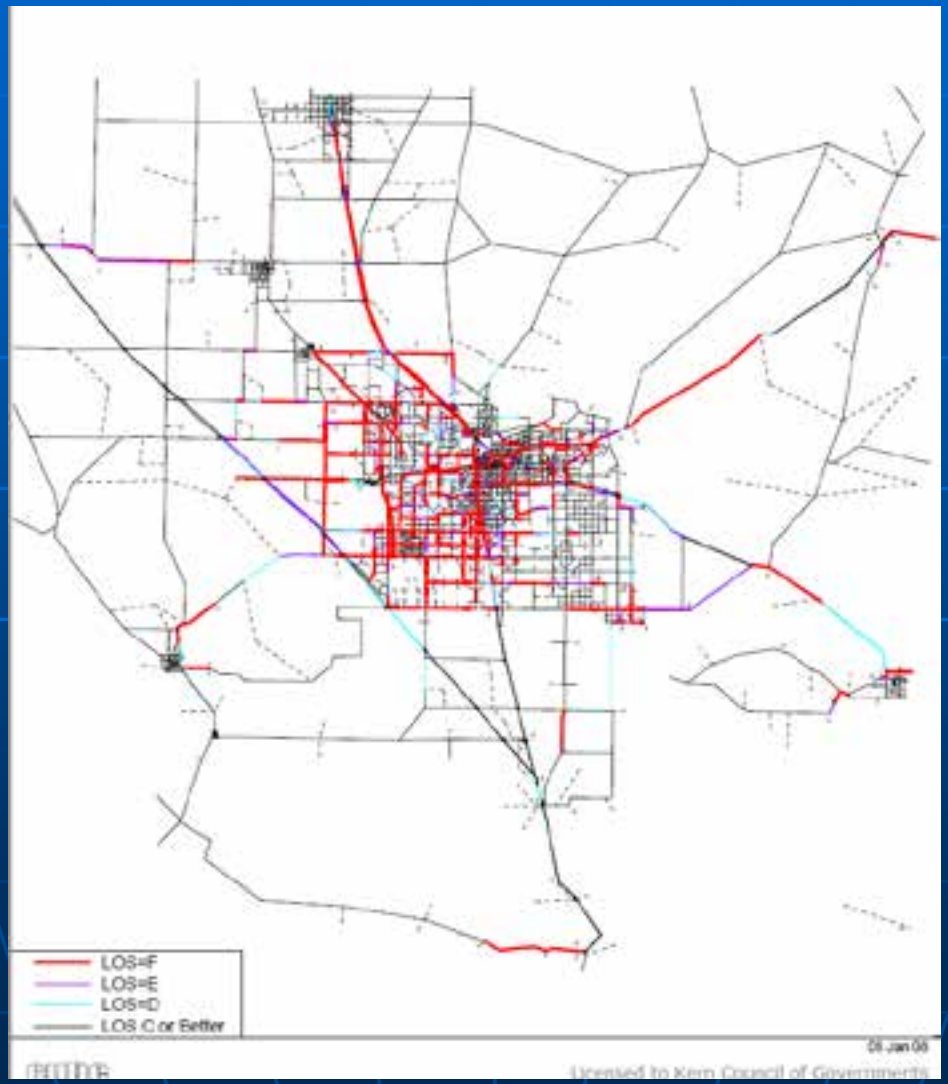
Cube Transportation Model



Cube GIS Interface



Model Output - Level of Service



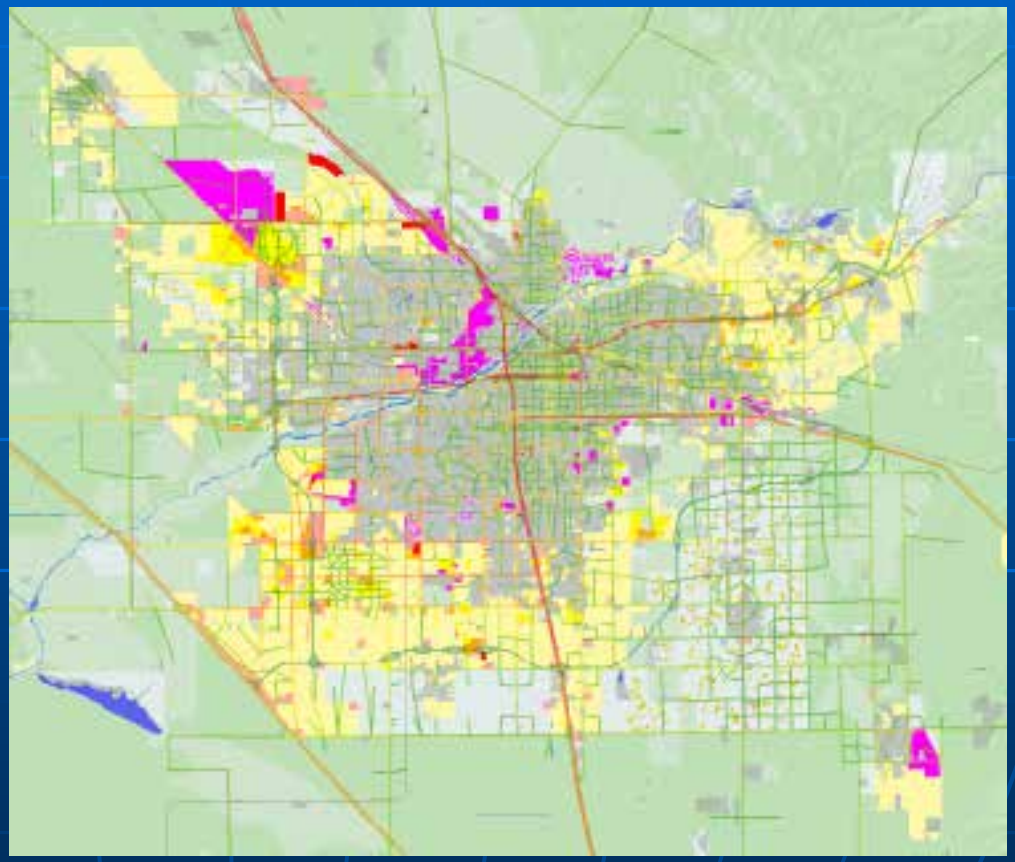
Model Output as Shapefiles

Land Use

- Existing - 2010
- Households
- Employment

Transportation

- Road Network
- Level of Service



Metro Bakersfield 2035 Growth Projection

Levels of Land Use Analysis

Zoning / land use class

- Describes what activities and structures can legally occur on land

Buildings & land

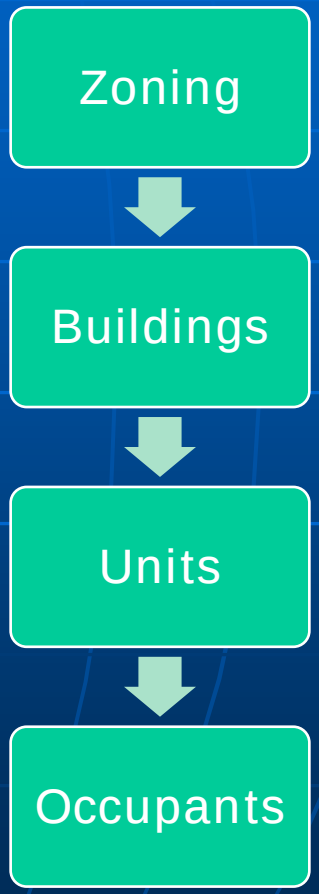
- Physical characteristics can also influence activities / occupants

Housing & non-residential units

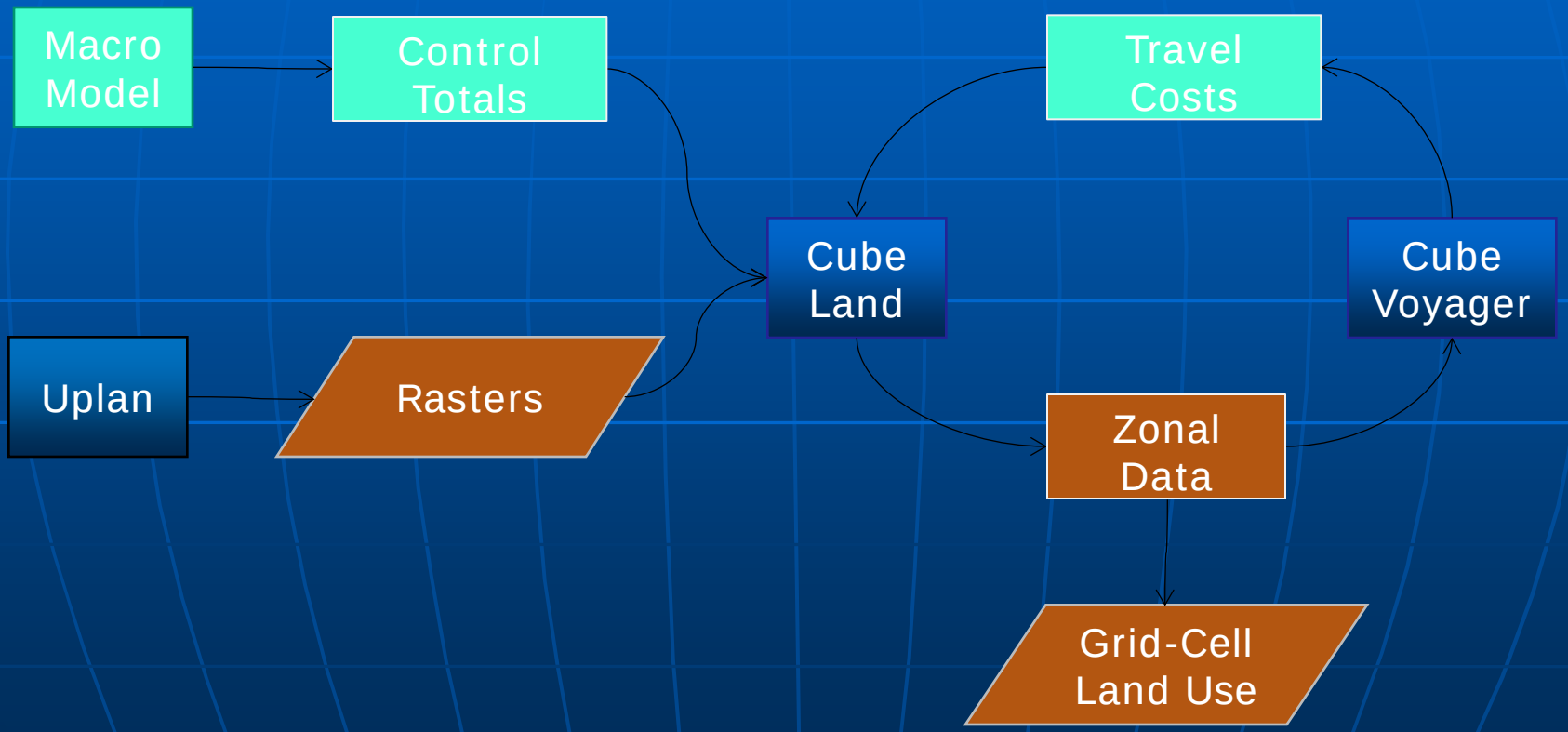
- Parcel divided into occupied spaces

Households & firms

- Occupants of real estate units
- Socio-economic characteristics



Cube Land Modeling Flowchart



Contacts

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Kern COG is planning to work with others to realize the goal of integrating Land Use and Transportation modeling in the near future.

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