Land Use Modeling at ABAG

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Overview

- What and Why
- Details
- Integration
- Use
- Visualization
- Questions

What is a Land Use Model?

- Statistical relationships between three major groups of people in cities
  - Households and firms choosing locations to be near each other and other stuff
  - Developers providing space for HHs and firms
- Simulation of these relationships into the future while adjusting assumptions and/or policy levers

Why Use a Land Use Model?

- Insights: behavior of complex systems
  - e.g. place a toll on the Bay Bridge at peak periods
    - More people take BART or shift their timing (transport model)
    - Some households move to San Francisco
    - The price of housing in San Francisco rises
    - More housing gets built in San Francisco
    - Some firms leave San Francisco
    - Some firms leave the Bay Area
- Objective: rational people (decision makers, advocates, public) often disagree about the impact of policies and projects
- Comprehensive: can be applied over a large geographic region
  - Often hard to stay objective about trade-offs when every bit counts
- Guestimates: Reasonable estimate of how much might be if everything turns out the way your scenario is phrased
  - This is unlikely but still powerful
    - Eliminating scenarios that don't pan out under nice assumptions
    - Ballpark

Why Use? @ ABAG

- Ability to test modest strategies within a large, complex real estate market
  - ABAG/MTC will not be a large player in the region's land use planning any time soon/ever
  - Strategies will be on the margin
    - We are another agent in a complex system not the government at the top setting up the rules or the boundaries or even the dominant goals
    - Do these have an impact? How can we maximize this impact? Can we find synergies?

Details: Basic

- Two components
  - Location Choice: where do households and firms choose to locate? → Demand
  - Real Estate Development: can developers build buildings profitably in the locations where they are wanted under planning codes? → Supply
- Simulate all the region's future agents interacting and finding locations
- Model runs yearly

Details: HH Loc Choice

- A subset of HHs moves in a given year
- Chooses a new location based on:
  - Access to employment types
  - Access to amenity
  - Housing characteristics
  - Neighborhood characteristics
  - Price, or relative Housing Supply (from Real Estate Development model)

Details: Firm Loc Choice

- A subset of firms moves in a given year
- Chooses a new location based on:
  - Access to labor pools
  - Access to agglomeration economies
  - Access to special metropolitan locations
  - Building characteristics
  - Access to amenity
  - Price, or relative Commercial Building Supply (from Real Estate Development model)

Details: Real Estate Development

- Developers scan the metropolitan area assessing profit to be made considering:
    - Rent offered by type (Demand from Location Choice models)
    - Existing use of the land (cost to purchase and demolish/prepare)
    - Zoning limitations
    - Fees, subsidies, and property taxes
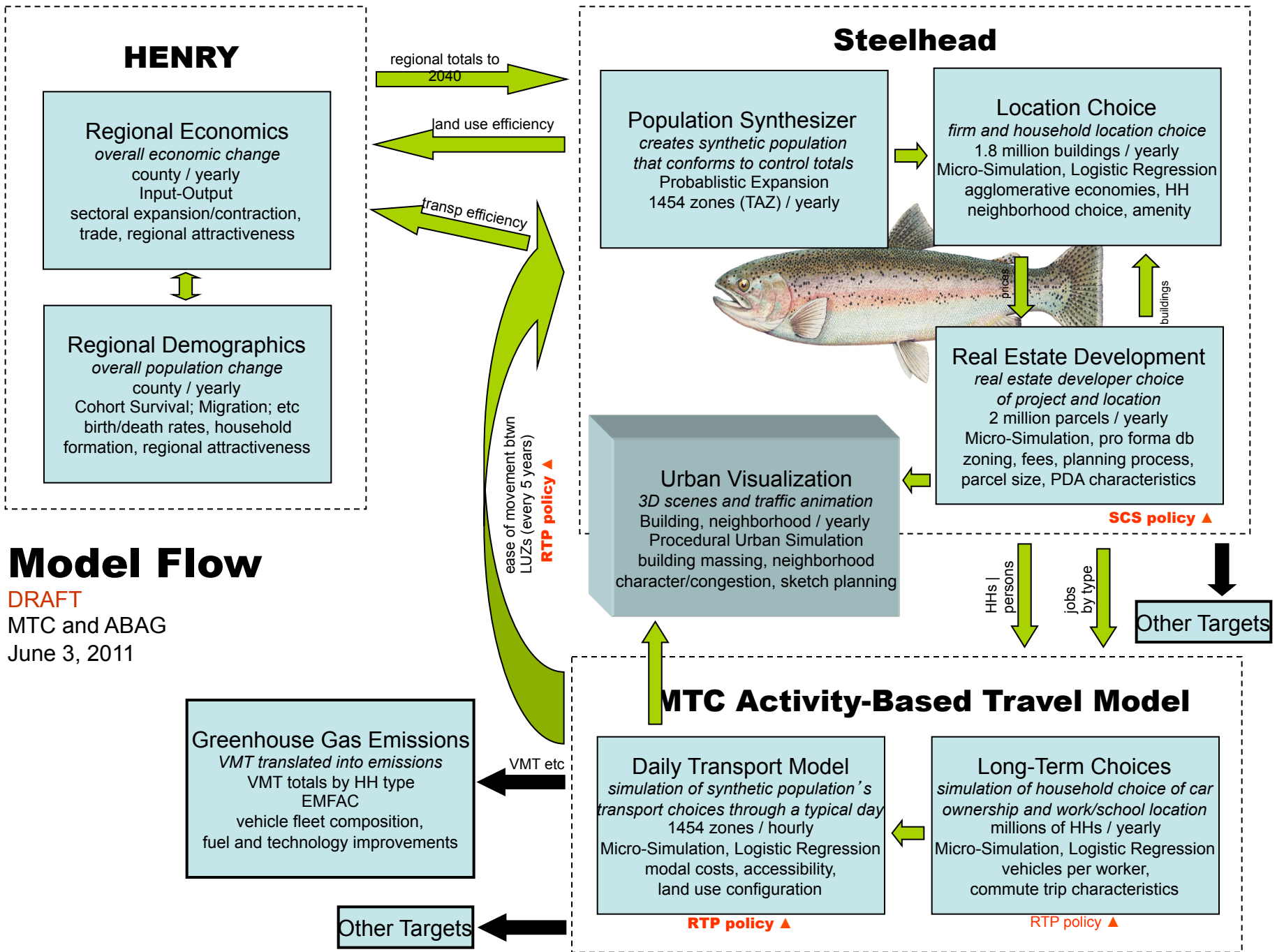   - Site level characteristics: pollution, small lot

Details: Space

- Households and firms choose buildings that are attached to 2m parcels

- Developers assess parcels or groups of parcels to build on (split/assmembly at a cost)

- Results aggregated to 1454 TAZs that connect the model to with the travel model
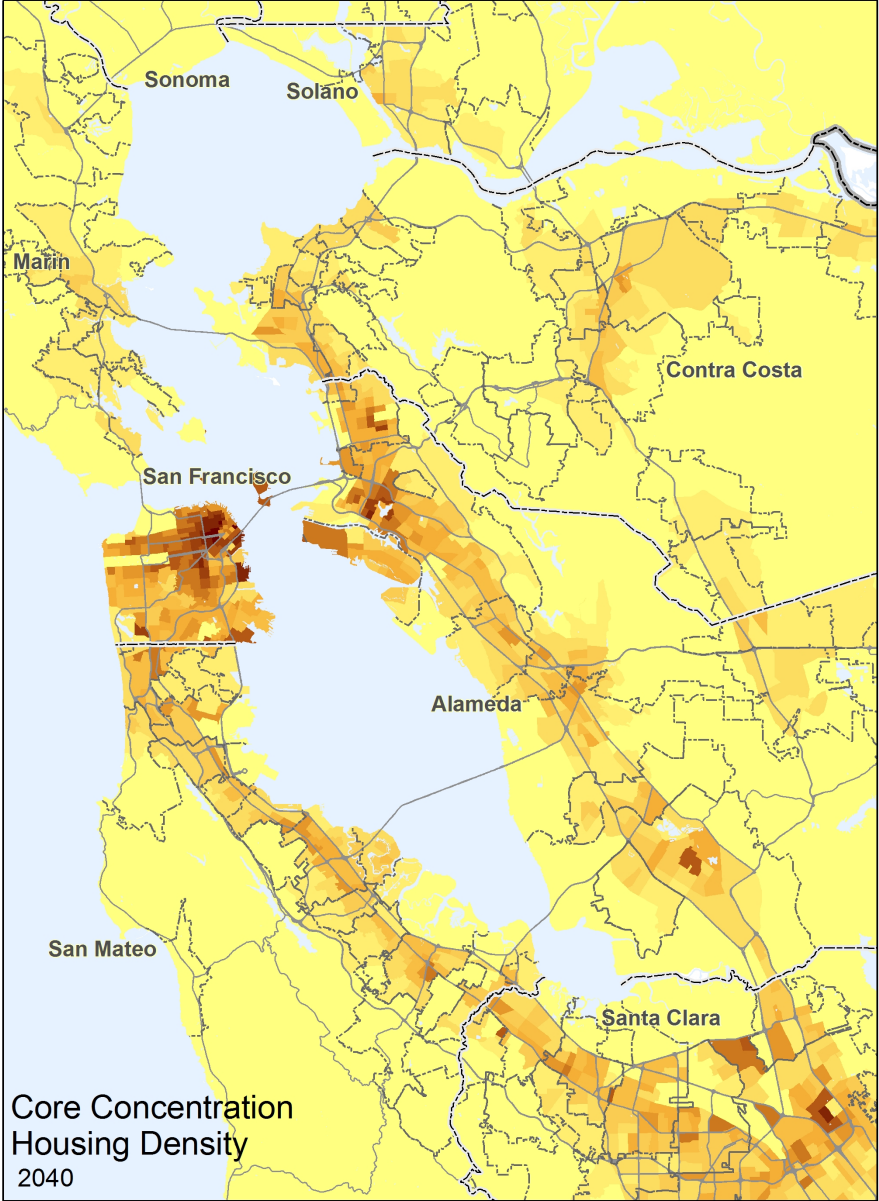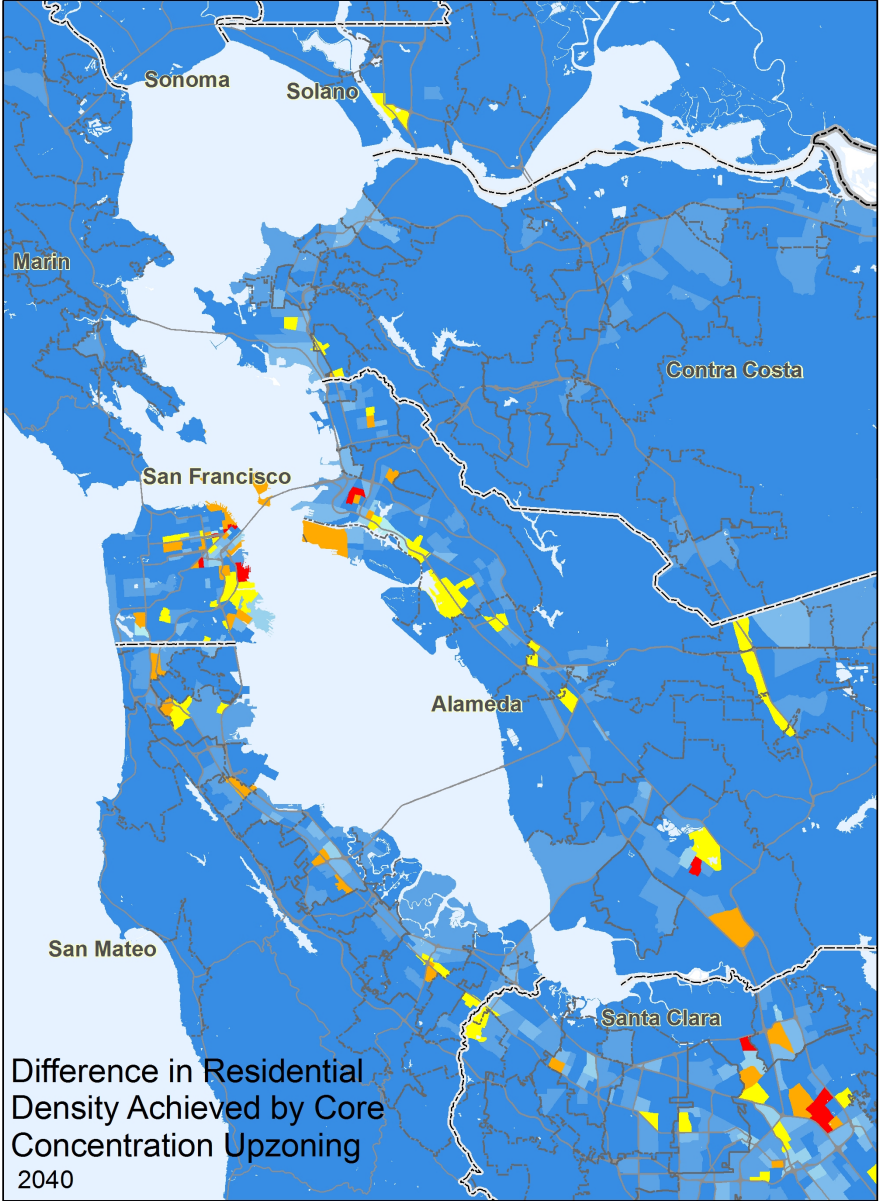
Details: Integration

- Cities exist so people and firms can get near each other
  - Near is satisfying and profitable but also costly and frustrating → different degrees of near for different people/companies
  - "access" back in the choice slides
- TAZs are linked together by the Travel Model's network = the ease of moving between different parts of the metropolis
- This ease changes with congestion and new facilities → changes on the travel side change land use distributions
- Similarly, land use related to transport investments are now dynamic and inform the Travel Model every 5 years
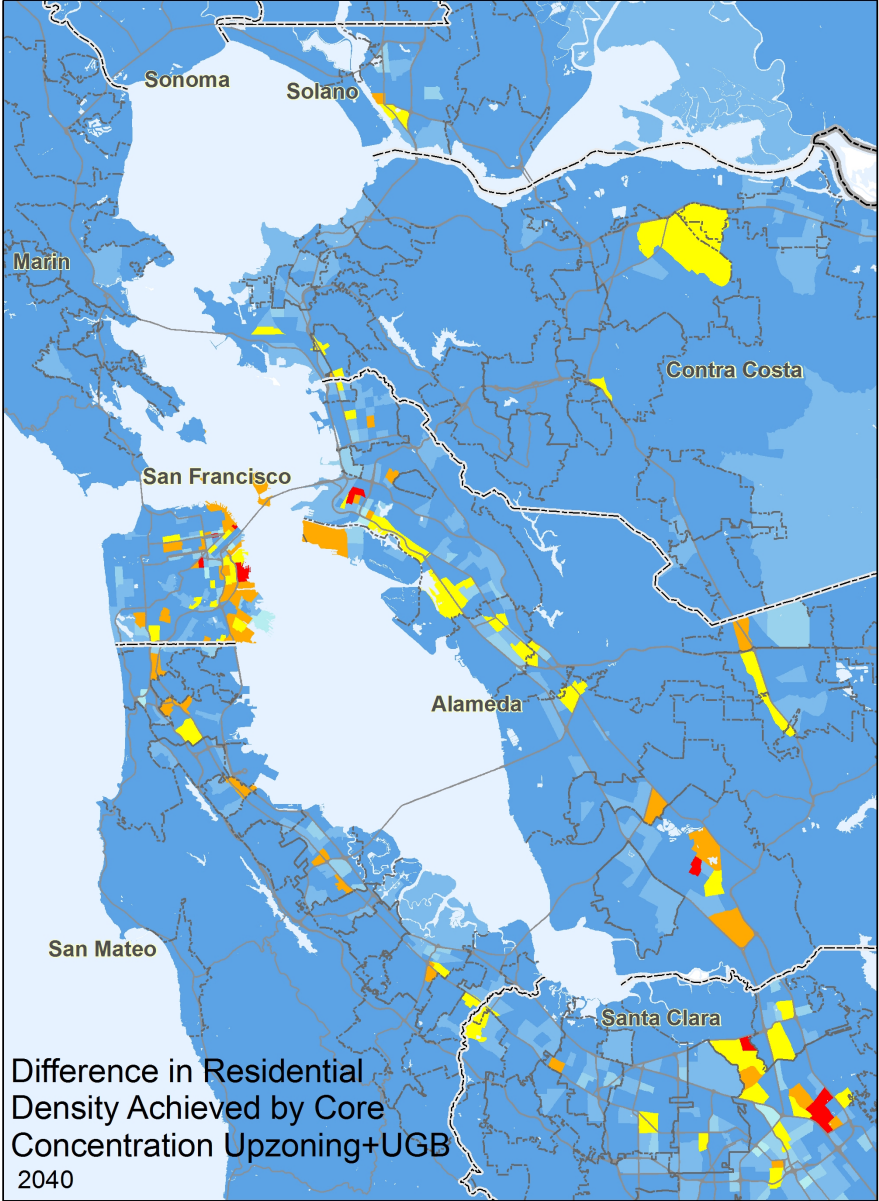
HENRY

Regional Economics
overall economic change
county / yearly
Input-Output
sectoral expansion/contraction,
trade, regional attractiveness

Regional Demographics
overall population change
county / yearly
Cohort Survival; Migration; etc
birth/death rates, household
formation, regional attractiveness

regional totals to 2040

land use efficiency

transp efficiency

ease of movement btwn LUZs (every 5 years) **RTP policy ▲**

Steelhead

Population Synthesizer
*creates synthetic population
that conforms to control totals*
Probablistic Expansion
1454 zones (TAZ) / yearly

Location Choice
firm and household location choice
1.8 million buildings / yearly
Micro-Simulation, Logistic Regression
agglomerative economies, HH
neighborhood choice, amenity

prices

buildings

Real Estate Development
*real estate developer choice
of project and location*
2 million parcels / yearly
Micro-Simulation, pro forma db
zoning, fees, planning process,
parcel size, PDA characteristics

SCS policy ▲

Urban Visualization
3D scenes and traffic animation
Building, neighborhood / yearly
Procedural Urban Simulation
building massing, neighborhood
character/congestion, sketch planning

Model Flow

DRAFT
MTC and ABAG
June 3, 2011

Greenhouse Gas Emissions
VMT translated into emissions
VMT totals by HH type
EMFAC
vehicle fleet composition,
fuel and technology improvements

VMT etc

HHs | persons

jobs by type

Other Targets

MTC Activity-Based Travel Model

Daily Transport Model
*simulation of synthetic population's
transport choices through a typical day*
1454 zones / hourly
Micro-Simulation, Logistic Regression
modal costs, accessibility,
land use configuration

RTP policy ▲

Long-Term Choices
*simulation of household choice of car
ownership and work/school location*
millions of HHs / yearly
Micro-Simulation, Logistic Regression
vehicles per worker,
commute trip characteristics

RTP policy ▲

Other Targets

Core Concentration
Housing Density
2040

Sonoma
Solano
Marin
Contra Costa
San Francisco
Alameda
San Mateo
Santa Clara

Difference in Residential
Density Achieved by Core
Concentration Upzoning
2040

Difference in Residential
Density Achieved by Core
Concentration Upzoning+UGB
2040

Visualization

- Most efforts end with the maps and tables
- We're lucky to be working on moving this into something more interactive with Paul Waddell at UC Berkeley
- Here I'll show some early outputs
- Procedural Modeling: structures are semi-randomly generated
  - Some details supplied from underlying Steelhead results (building type, stories, square feet, age, quality)

Procedural Buildings

Procedural Buildings
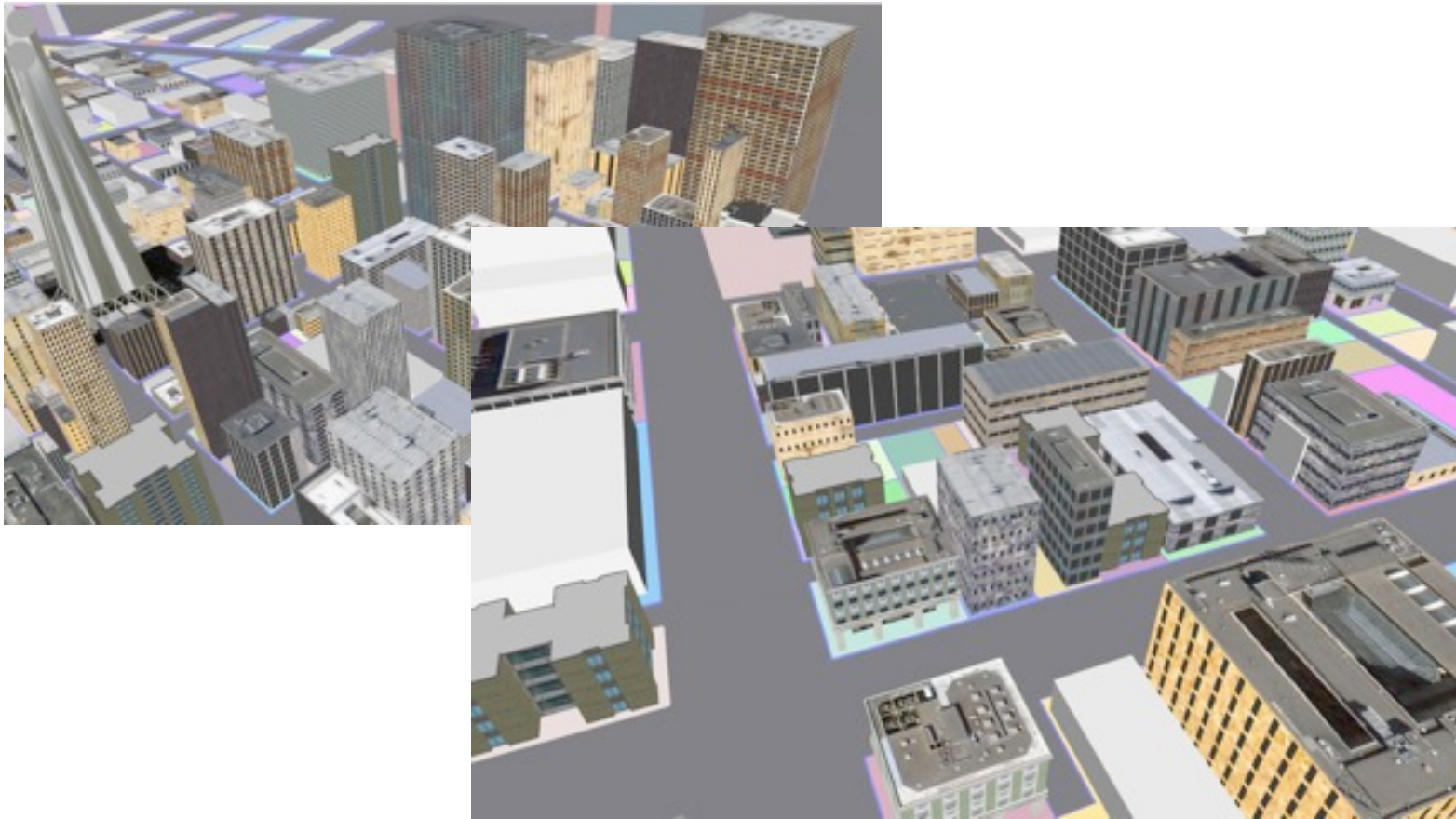
OF Office

OF12

OF11

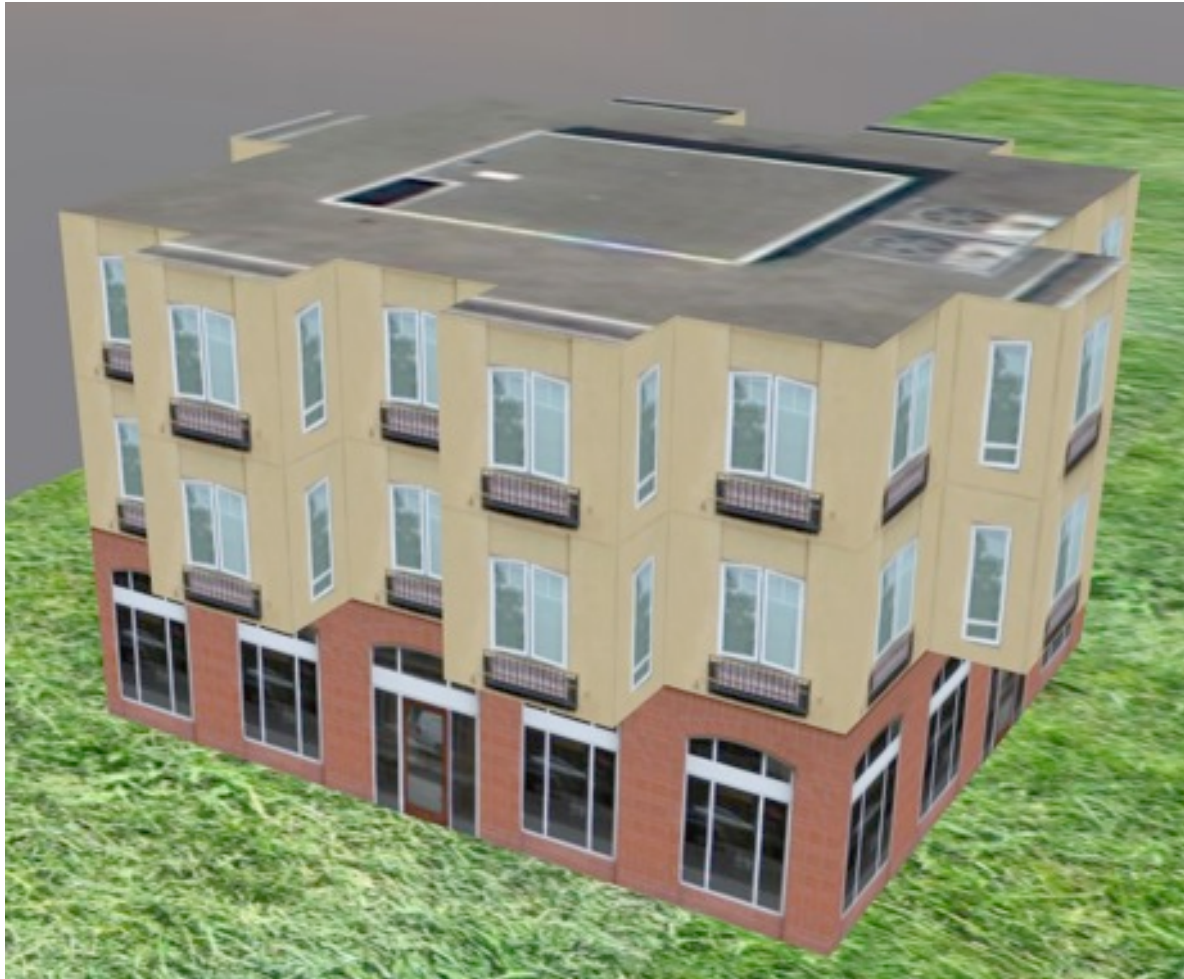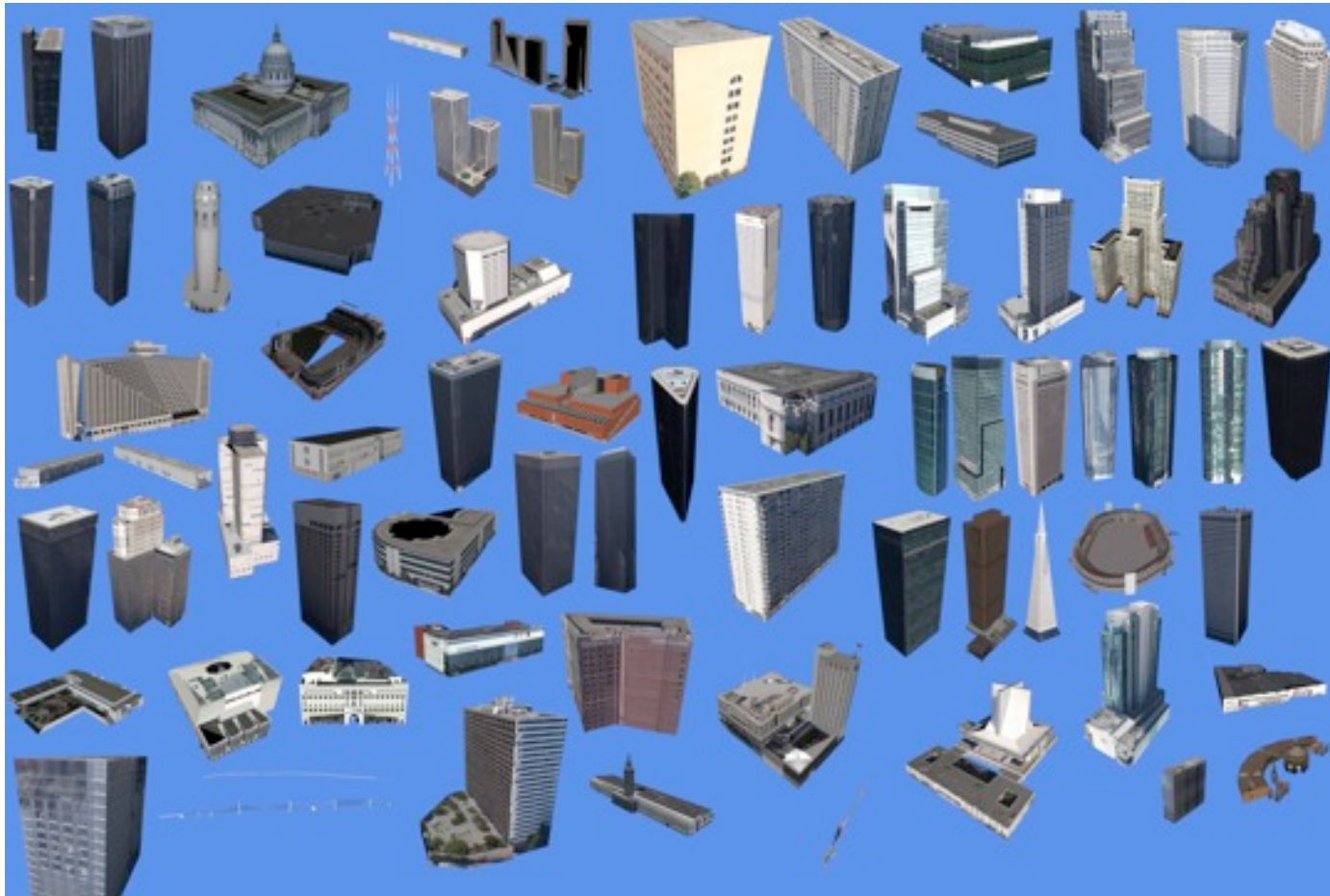OF31

OF (older)

IL Light Industrial
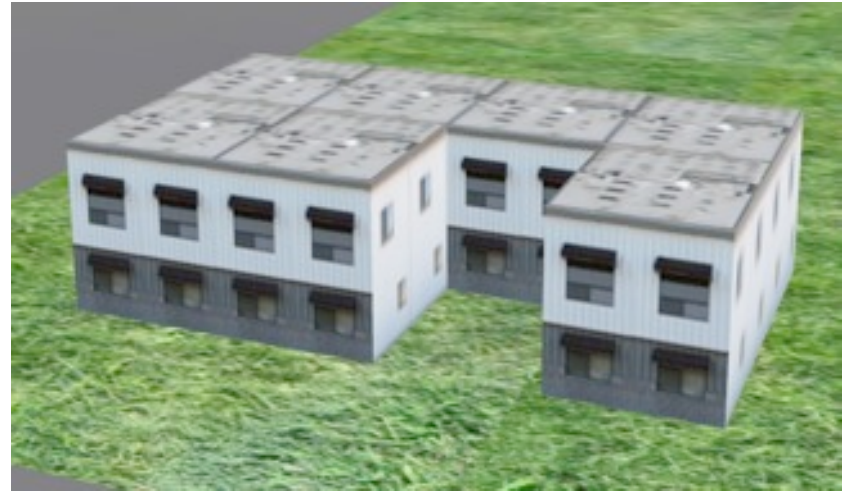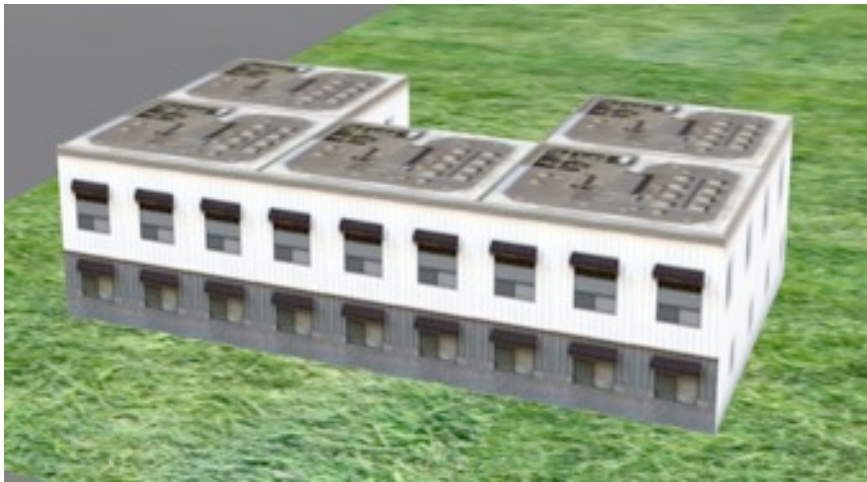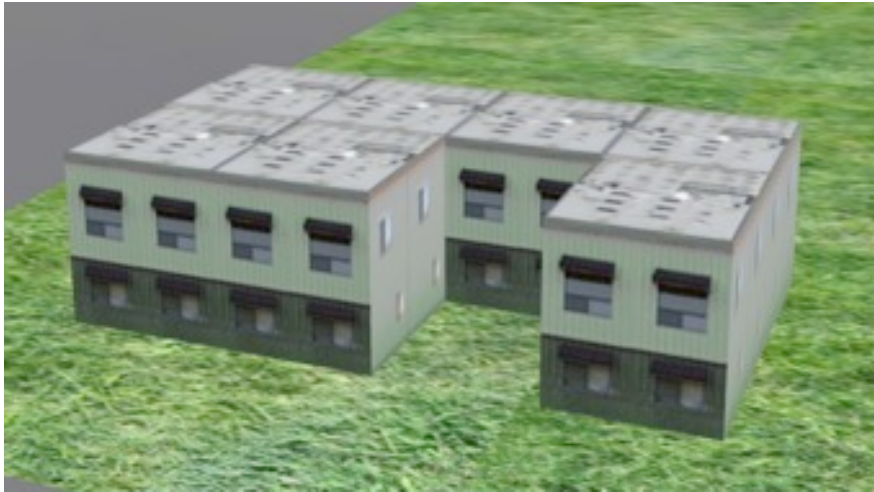
RB Big-box Retail

MR Residential-focus Mixed

MR13

Landmarks

Procedural Vegetation

Vehicles

Vehicles

Questions?