

APPENDIX G

Houston-Galveston Area Council 2025 Regional Growth Forecast

Overview

The forecast of population and employment used for the 2025 RTP was produced by H-GAC in a two-phase process. The first phase entailed the development of county-level forecast control totals for population, households and employment. In the second phase, the growth forecast for each county was assigned to smaller levels of geography for use in modeling travel demand. These results were evaluated by H-GAC’s Forecast Committee (Figure 1) and made available for review by local elected officials and the public. Each of these steps is described in greater detail below.

County-Level Forecasts

Forecasts for each of the eight counties in the Transportation Management Area (TMA) were developed with the Regional Economic Models, Inc. (REMI) econometric forecasting tool, which is widely used by public agencies, universities and the private sector. The REMI model considers economic interactions within the region, as well as between the region and the nation.

Figure 1: H-GAC Forecast Committee

Name	Title	Organization
Curtiss Brown Jr.	Director of Community Resources	Galveston County
Larry Buehler	Business Development and Retention	Brazoria County Partnership
Perri L. D'Armond	VP of Development	Greater Fort Bend Economic Dev. Corp.
Theresa DeBose	Sr. Business Analyst	CenterPoint Energy
Jesse Hegemeier	County Engineer	Fort Bend County Engineer's Office
Steven Jennings	Executive Director	Harris County Central Technology Center
C.A. (Skip) Kasdorf III	Manager of Research	Greater Houston Partnership
Mike Kubik	Director of Communications	Chambers County
Jim Ludtke	Director Application Support/GIS	Harris County Appraisal District
Mr. Madan Mangal	Division Manager	City of Houston Planning & Development
Craig McNair	Concerned Citizen	Liberty County
Ms. Pat Miller	Director of Property Transactions	Montgomery County Appraisal District
Carol Nixon	District Director of Transportation Planning	Texas Department of Transportation
Chris Olavson	Sr. Planning Manager	Parsons, Brinckerhoff, Quade & Douglas, Inc.
Vincent L. Sanders	Sr. Transportation Systems Planner	Metropolitan Transit Authority
Vince Yokom	Executive Director	Waller County Econ Dev Partnership

Growth Scenarios

County-level totals of population, households and employment were produced using REMI for moderate and aggressive forecast scenarios. Both scenarios are based on adjustments made to the out of the box REMI model.

In the moderate scenario:

- REMI's year 2000 county level population numbers were adjusted to year 2000 Census population totals.
- REMI's year 2000 county level migration is adjusted to the year 2000 census
- An alternative set of REMI supplied growth rates were applied to a subset of industries in each county to minimize the residual error between the model and the last 10 years of historical data. This results in industry growth rates that more closely follow 1990-2000 trends.

In addition to the changes noted above, increased energy sector activity is assumed in the aggressive scenario. This increase is modeled by:

- A 25 percent linear increase in mining sector sales that begins in 2010, peaks in 2020 and is sustained through 2025.
- Corresponding increases (12 percent) in professional and other business services.

These adjustments assume likely energy sector fluctuations beyond those embedded in 1990's trend data that were not reflected in the Moderate Scenario model results. This assumption was based on the most recent (1999) forecast of world oil prices developed by the U.S. Energy Information Agency. The percentages used in the model adjustments were based on the historical average increase that occurred in the corresponding sectors during periods of peak oil prices.

Both of these scenarios appear to be reasonable futures and are within the range of other widely used forecasts for the region produced by the Texas State Data Center, the Texas Water Development Board, and the University of Houston Institute for Regional Forecasting. H-GAC selected the Aggressive Scenario for use in transportation planning, as well as its other long range planning programs.

Other Model Adjustments

Several other adjustments were made to the REMI output to enable its use with H-GAC's small area forecasting tool:

Employment – REMI reports total employment, a measure used by the U.S. Bureau of Economic Analysis. The Texas Workforce Commission and other regional agencies regularly report "non-farm wage and salary" employment based data from the U.S. Bureaus of Labor Statistics. H-GAC scales REMI output to

reflect non-farm wage and salary, rather than total employment for consistency with these other data sources.

Households and Population – REMI reports both total and household population but does not generate a household count. H-GAC used age- and race-specific household headship rates to convert REMI's reported household population to total households. The headship rates are derived by determining the number of household heads in a specific age-race category as reported by the 2000 census.

Small Area Forecasts

In order to assign the growth to smaller sub-county areas, H-GAC utilized the UrbanSim model developed by Urban Simulation Project at the University of Washington. UrbanSim is a leading-edge tool that attempts to replicate the interaction of population and job growth with the land development process. Using the county-level forecasts as the “demand” factors, UrbanSim places growth in specific locations based on their “attractiveness” for development. Attractiveness is determined by factors such as land availability and cost, existing land uses, household characteristics, employment patterns and access to the transportation system. A full description of the model is available at www.urbansim.org.

The primary geographic unit of analysis used in the small area forecast is the Regional Analysis Zone (“RAZ”). The TMA contains 199 RAZs, which are further subdivided into 2,634 Transportation Analysis Zones (TAZ). Population and employment data at the TAZ level is then used to forecast travel demand.

The following is a brief description of the steps that were taken to localize and calibrate the model.

Year 2000 Initial Conditions

In the model, the region is represented by a grid consisting of roughly 250,000 1000 x 1000 foot grid “cells” (a geographic equivalency file, external to the model, is used to move from the “grid cell” level model output to TAZ and RAZ level summary reports). Information about land use, building areas, households, and jobs, are associated with each grid cell. Three basic datasets were used to describe initial conditions in the H-GAC region:

- **Land Use** – A combination of appraisal records and satellite imagery was used to determine the total building area and land-use mix within each grid cell. Based on this mix, each grid cell was classified into 1 of 25 predominant development types. These are shown in Figure 2.

Figure 2: UrbanSim Predominant Development Types

Residential Land Uses	
Residential 1	1 to 10 Units
Residential 2	11 to 40 Units
Residential 3	41 to 80 Units
Residential 4	81 to 140 Units
Residential 5	141 to 200 Units
Residential 6	201 to 300 Units
Residential 7	301 to 600 Units
Residential 8	Over 600 Units
Mixed Land Uses	
Mix 9	1 to 80 Residential with 6,000 to 40,000 sq ft Commercial
Mix 10	81 to 300 Residential with 25,000 to 40,000 sq ft Commercial
Mix 11	81 to 300 Residential with 40,001 to 100,000 sq ft Commercial
Mix 12	81 to 300 Residential with 100,001 to 300,000 sq ft Commercial
Mix 13	81 to 300 Residential with Over 300,000 sq ft Commercial
Mix 14	Over 300 Residential with 40,001 to 80,000 sq ft Commercial
Mix 15	Over 300 Residential with 80,001 to 240,000 sq ft Commercial
Mix 16	Over 300 Residential with Over 240,000 sq ft Commercial
Commercial Land Uses	
Commercial 17	40,000 to 250,000 sq ft
Commercial 18	250,001 to 1,000,000 sq ft
Commercial 19	Over 1,000,000 sq ft
Industrial Land Uses	
Industrial 20	40,000 to 250,000 sq ft
Industrial 21	250,001 to 1,000,000 sq ft
Industrial 22	Over 1,000,000 sq ft
Institutional Land Uses	
Government 23	Universities, Medical Facilities, Prisons, Govt Buildings
Vacant Land	
Vacant 24	Open Space
Other Land	
Other 25	Parks, Airports, Water, Lowlands, Heavily Industrialized

- **Employment** – Number and types of jobs were assigned to each grid cell using data generated from a proprietary record-level database. Employment was classified into one of the following seven categories based on Standard Industrial Classifications (SIC):
 - Durable Goods
 - Non-Durable Goods
 - Mining
 - Construction/Transportation-Utilities
 - Finance-Insurance-Real Estate/Services/Agriculture
 - Retail-Wholesale Trade
 - Government/Medical/Education

This data was then reassembled into the 6 employment categories used in H-GAC's travel demand model:

- Office
- Industrial
- Government
- Medical
- Education
- Retail

Employment was scaled to match the REMI regional control totals. Additionally, a TAZ level control was used to ensure that TAZ level employment corresponded to the levels H-GAC's transportation modeling group uses to calibrate its regional transportation model.

- **Households** – Records representing individual households were also distributed to the grid cell level. Census block group data was used to assign household size and income characteristics to these households. Household data were scaled to match the Census Block Group and REMI regional controls.

Post Year 2000 Household and Employment Location Choice

The net growth of households and jobs for each county must then be placed in grid cells within the county. UrbanSim bases this assignment on a statistical model that identifies the preference of particular household and job types for particular types of locations. This choice matrix is described below:

Household Attributes	Location Characteristics
Household Income (4 levels)	Home access to employment by transit or auto
	Proximity of other homes (4 income categories)
Employment Attributes	Location Characteristics
Sector (7 categories)	Proximity to other jobs (7 categories)
	Proximity to commercial, retail, or mixed use development types
	Proximity to arterials and highways
	Work access to employment
	Work access to population
	Travel time to CBD
	Distance to airport

Mathematically, these choices are represented by two multinomial logit models – one for housing choice and another for employment location choice.

Land Development

As previously stated, year 2000 land use for each grid cell was classified into 1 of 25 development types. This initial classification represents enough residential and employment land uses to accommodate all year 2000 households and jobs. UrbanSim then evaluates the likelihood of various types of land transitions that may occur, including development of vacant land and transition of developed land to higher intensity uses. Possible transitions are shown below.

- vacant to low-density residential
- vacant to residential
- vacant to mixed
- vacant to commercial/government
- vacant to industrial
- low-density residential to residential
- residential to dense-residential
- density-residential to mixed-use
- mixed-use to commercial
- commercial to high-density commercial/institutional

Some grid cells (e.g., those representing highly industrialized areas along the ship channel, wastewater treatment plants, landfills, environmentally sensitive areas) were not allowed to transition into new uses. The land development model was tested using a representation of 1990 land use as baseline data. This test model was run through the year

2000 and calibrated to reproduce as closely as possible the year 2000 data for land development type, households and jobs.

Anticipated Development Events

The model allows users to incorporate development events that override normal model dynamics. Unless this is done carefully, inputting a large number of these event random events can result in an artificial development bust that negatively affects model results. However, there are a number of large Houston area developments planned between 2000 and 2005 that can, with a reasonable level of certainty, be expected to occur. After reviewing sample output, H-GAC observed that the model's dynamics tended to accurately reflect employment and housing growth in the areas in which these events were expected to occur. Because of this, H-GAC took a conservative approach to including such announced projects as development events that would override normal model dynamics.

To a limited degree, an exception was made for the Houston Central Business District (CBD). The CBD represents the region's most intense use of urban land, and the sample of 1990-2000 events for which downtown development intensified even further was extremely small. With this constraint in mind H-GAC added additional downtown commercial building square footage (development events) based on 1985-1995 building trends. For downtown residential units, a dataset from the Downtown Houston Association was used to ensure that housing units actually constructed between 2000 and 2003 were added as future development event for years 2001-2003.

Travel Matrices

H-GAC transportation modeling group provided matrices that measure the costs of traveling from each zone (TAZ) in the region to every other zone. As the travel network changes (i.e. roadway improvements added, congestion levels change), the values in this matrix will change. For the purposes of the forecast, a matrix representing year 2000 conditions was used for years 2000-2007. The travel matrix for year 2007 was used for all years after 2007.

Review Process

After the baseline data was established, H-GAC tested the model's ability to reproduce historical 1990-2000 growth patterns for selected areas and made calibrations accordingly. Once this process was completed, preliminary results were produced for review by H-GAC's Forecast Committee. After review and revision, the forecast was then made available for review by all local governments in the TMA, as well as the general public. The 2025 Regional Growth Forecast was adopted by H-GAC's Board of Directors on May 20, 2003.

Conclusions

This forecast was the first produced by H-GAC using REMI and UrbanSim. While these models are more data- and labor-intensive than previously used methodologies, they appear to be more representative of the true dynamics of a metropolitan economy and the resulting growth

patterns. UrbanSim, in particular, appears to have successfully captured both the trends of continued strong suburban growth and reinvestment in the central city.

H-GAC will produce regular updates of the forecast as new information is available on significant transportation projects, major residential and commercial developments, or any new constraints on future land use. These updates will be posted on H-GAC's Web site, www.h-gac.com.