ON TO 2050 SOCIOECONOMIC FORECAST

Draft
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comment

CMAP

Contents

Introduction **2**
Part 1: 2050 Regional Socioeconomic Forecast **3**
Forecast development process 6
Overview of the regional forecasting approach 7
Population model *8*
Employment model *12*
Labor Force model *13*
Forecast scenarios *14*
Adjustment to the regional forecast *15*
Summary of reference forecast results 16
Part 2: Local Area Allocation (LAA) **19**
Introduction 19
Conceptual overview 19
Geography *22*
Base-year (2015) data *24*
Urban classification *26*
Development inventory *29*
Local Area Allocation Factors 31
Share of regional households/employment *31*
Change in household/employment share over time *32*
Infill supportiveness *33*
Disinvested/economically disconnected areas *33*
Municipal envelope *34*
Property value *34*
Auto/transit accessibility *35*
The LAA tool 35
Components *35*
Outreach 40
Determining the final factor weights 41
Results 42

Introduction

This document provides an overview of the ON TO 2050 forecasting process and results. Some high-level results will be presented here. A more complete set of data tables can be found on the CMAP Data Hub at: https://datahub.cmap.illinois.gov/dataset/2050-forecast-of-population-households-and-employment.

Socioeconomic forecasts are a required element to a Metropolitan Planning Organization's (MPO) long-range transportation plan, with a horizon year that is at least 20 years out from the plan's adoption date.[1] The results serve dual purposes. First, an understanding of forecasted population and employment trends helps shape the recommendations of ON TO 2050. Second, forecasts are used as an input to CMAP travel models for air quality conformity analyses as well as for small-area traffic projections.

The forecast has two major components: the regional socioeconomic forecast, and Local Area Allocation (LAA), which is the disaggregation of regional totals down to the local level. The process is broken into these two parts since they draw on different disciplines. The regional forecast is an exercise in demographics and macroeconomics, while the LAA requires more of a focus on transportation accessibility as well as real estate supply and constraints. The next two sections describe these processes in greater detail.

While the forecast is driven by transportation planning needs, these projections are also used by CMAP staff as well as by partner agencies, local communities, economic development organizations, and watershed planners. In acknowledgement of these diverse needs, CMAP determined that the 2050 forecast should provide more demographic and temporal detail than previous offerings. While much of this detail is limited to the regional totals, it does provide an overview of general demographic trends in northeastern Illinois forecasted over the next few decades.

[1] U.S. Government Publishing Office, *Electronic Code of Federal Regulations*, Title 23/Chapter I/Subchapter E/Part 450.324 https://www.ecfr.gov.

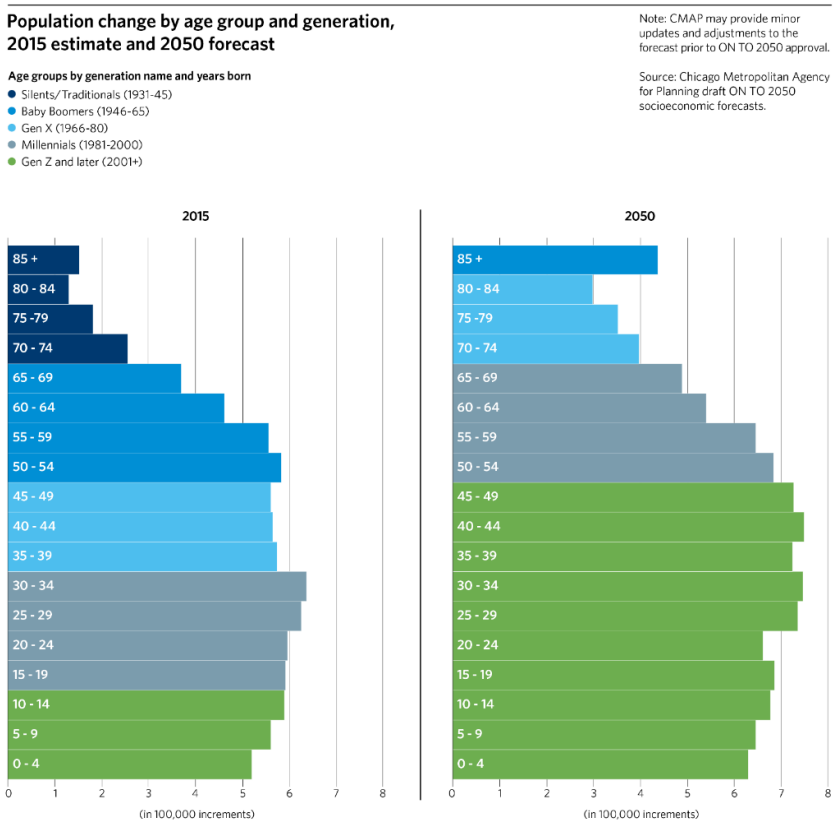
Part 1: 2050 Regional Socioeconomic Forecast

Overall, the forecast projects that the region will continue to grow. By 2050, the region will have more than 10.6 million residents compared with 8.5 million in 2015. Employment will be just below the 5 million mark, growing from 4.08 million in 2015. The region is expected to change significantly by 2050. Residents will be more diverse and will live longer. The types of jobs available will change to reflect new technology, emerging fields, and changing work patterns.

These 2050 forecasts are similar to the GO TO 2040 population and employment forecasts for the year 2040. Due to a slow recovery from the 2008 recession, the region has added employment at a slower rate than its peers. The region has also experienced very slow population growth, with recent small declines. The 2050 forecasts reflect renewed growth for the region, building on implementation of the policy and investment recommendations of the plan.

Like the rest of the nation, the region will continue to age as people live longer and delay having children to later in life. By 2050, the oldest Millennials will just be joining the senior age bracket.

Figure 1.



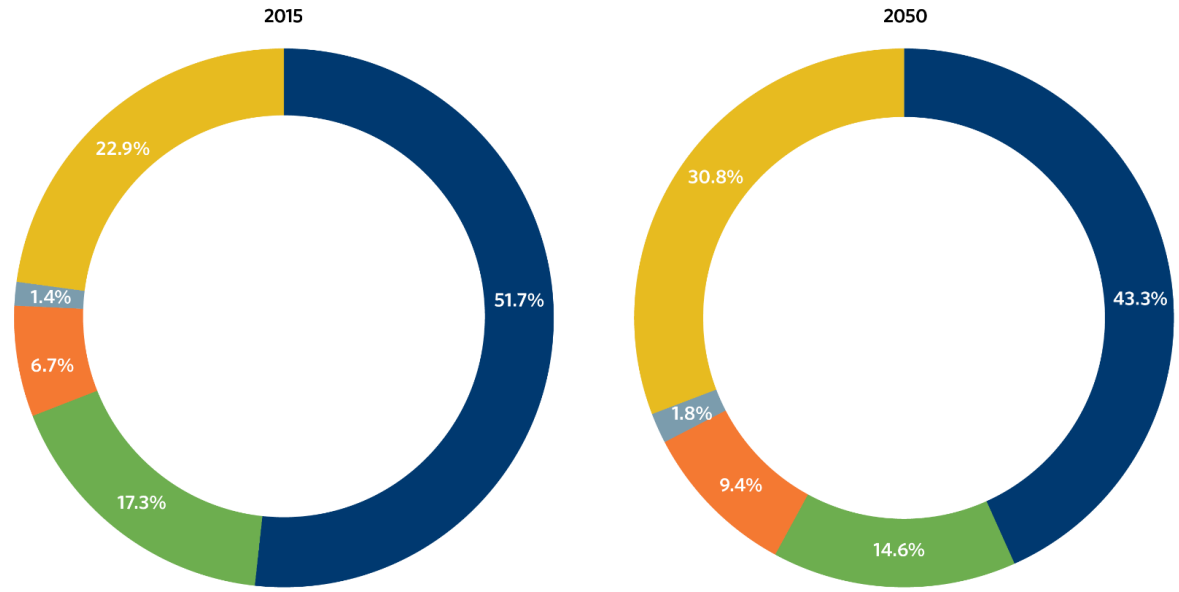
The region will also continue to diversify. Over the past decade, the region's Hispanic and Asian populations have been fueling our population growth. By 2050, the region will have an even stronger diversity of residents than today, and the majority of the region's residents will be persons of color.

Figure 2.

Proportion of population by race and ethnicity in the CMAP region, 2015 estimate and 2050 forecast

Note: CMAP may provide minor updates and adjustments to the forecast prior to ON TO 2050 approval.

Source: Chicago Metropolitan Agency for Planning draft ON TO 2050 socioeconomic forecasts.



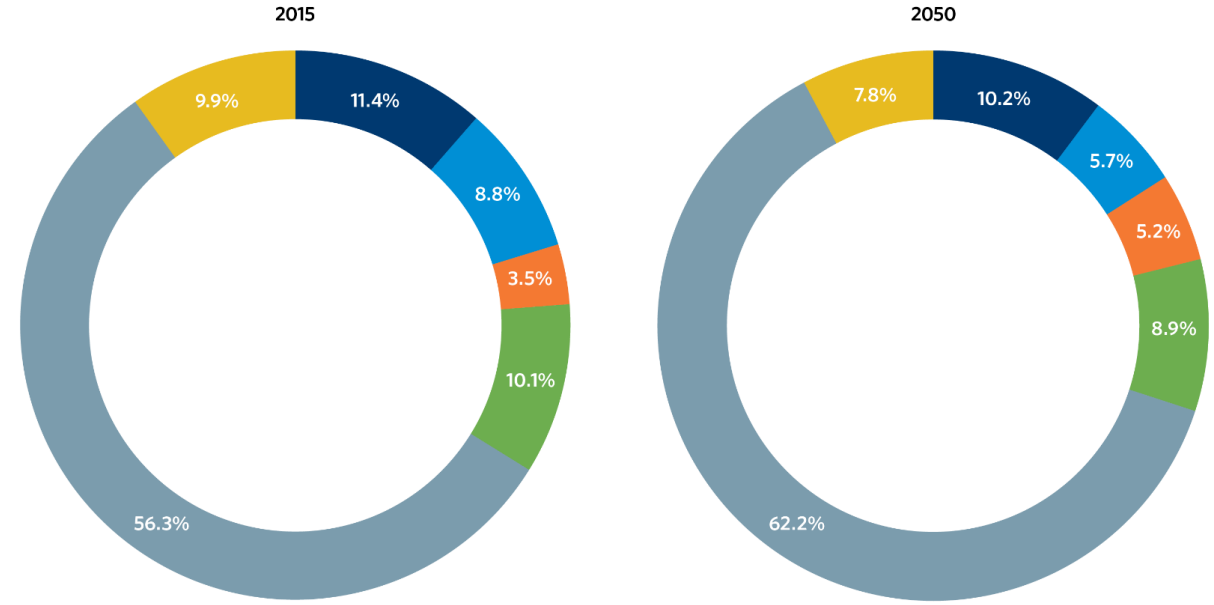
Employment is also expected to grow, with anticipated shifts in the types of jobs available. Some industries will remain strong, but need fewer workers. Others will continue to expand. By 2050, the region is forecasted to have fewer manufacturing and transportation jobs, and more jobs in service industries such as information, finance, real estate, professional/technical services, education, and health care. Read more about these changes in the Transformed Economy Alternative Future.

Figure 3.

Proportion of employment in the CMAP region by category, 2015 estimate and 2050 forecast

Note: CMAP may provide minor updates and adjustments to the forecast prior to ON TO 2050 approval. The "services" category includes a range of industries: finance, insurance, real estate, information, professional and technical services, management of companies and enterprises, administrative and waste services, healthcare and social services, educational services, arts, entertainment and recreation, accomodation and food services, and other services.

Source: Chicago Metropolitan Agency for Planning draft ON TO 2050 socioeconomic forecasts.



Forecast development process

One of the major goals in developing the ON TO 2050 socioeconomic forecast was to produce results with a finer level of demographic and temporal detail than previous CMAP forecasts. Our requirements were stated in CMAP *RFP 141, Chicago Region Socioeconomic Forecast* as follows:

> …Age/income/race characteristics and employment by sector, with interim totals (at five-year intervals) reported for all variables. In keeping with the Chicago region's status as a global economic hub, the regional forecast should take an econometric approach with subsequent demographic analysis employing cohort-component techniques to project the natural population increase (at five-year intervals), with migration serving as a function of labor demand and labor force participation assumptions.

Specific deliverables requested were:

- Households:
    - By number of persons
    - By age of householder
    - By number of workers
    - By sex by prescribed age ranges
    - By income quantiles
- Non-institutionalized group quarters population:
    - By group quarters type
    - By sex by prescribed age ranges
- Institutionalized group quarters population, by sex by prescribed age ranges
- Total population by race/ethnicity
- Employment by NAICS-2 category

During development of the regional forecast, stakeholders were kept informed of the process through presentations to CMAP working committees in September and October 2015 (introduction) and to working committees and the CMAP Board in September and October 2016 (methodology and final results).

Overview of the regional forecasting approach

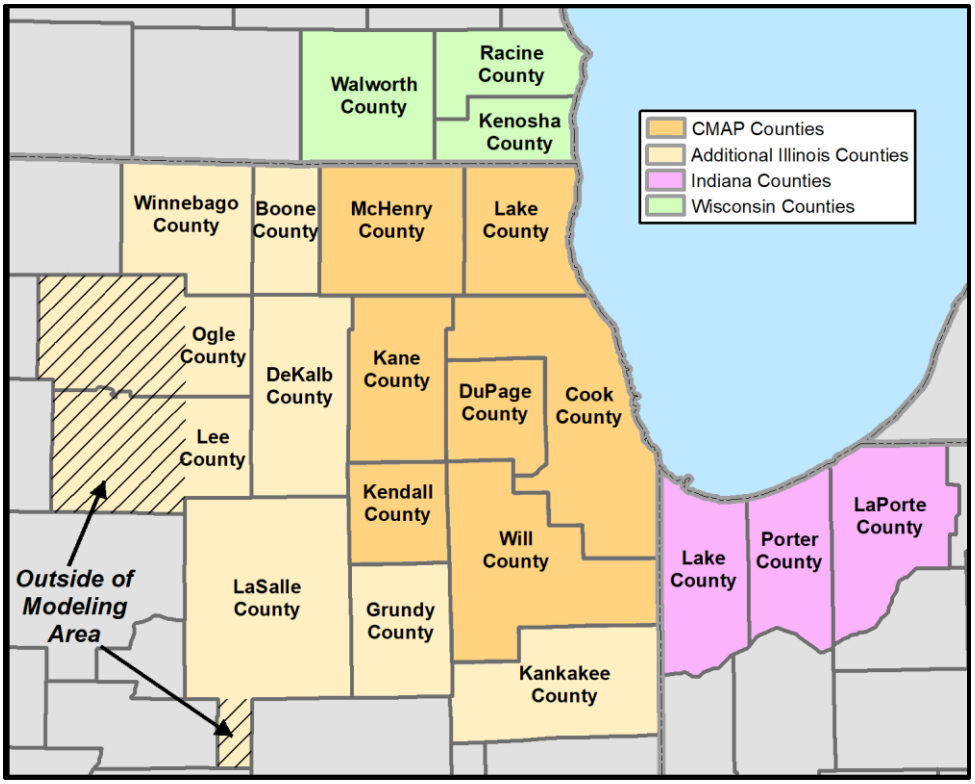
In January of 2016, CMAP selected the firm Louis Berger to develop the ON TO 2050 socioeconomic forecast. An overview of the Berger approach will be presented here; for a more in-depth exploration of their methodology please see the *Chicago Region Socioeconomic Forecast: Final Report*, available on the CMAP Data Hub.

The forecast was developed using an economic-demographic model to link the two primary socioeconomic components: regional employment and population. These two components were modeled separately and subsequently linked through a labor-induced migration adjustment to balance labor supply (population) and demand (employment). These efforts produced a baseline forecast; scenarios were then developed based on selected GO TO 2040 plan recommendations, from which a final, "reference" scenario was selected as the official ON TO 2050 regional forecast.

Much of the data used to inform the population and employment models are derived from state- and county-level sources. The models described below work at the county level to accommodate these data, with resulting county-level projections as output. As a regional planning agency, CMAP recognizes the importance of inter-county dependencies, and that it is unreasonable to expect counties to grow in isolation of one another. Additionally, analyses such as these do not account for a county's capacity (or lack thereof) for additional growth. As this is a regional forecasting exercise, all county-level outputs from both models were summed into regional totals for the Regional Forecast; sub-regional (county, township, travel model zone) totals were generated through the LAA exercise, described in Part 2 of this document.

Finally, while the regional forecast was developed specifically for the seven-county CMAP region, the consultants were asked to provide projections for a wider, 21-county area (**Figure 4**) that coincides with the area modeled by CMAP's travel demand models. The broader area was requested so that CMAP models could reference a forecast produced with consistent methodology. Results for areas outside of the seven-county CMAP region are used solely as travel model inputs and are not considered part of the official ON TO 2050 forecast, and will not be reported here.

Figure 4. Twenty-one- county modeling area



Population model

The Population model is based on a cohort-component approach which relies on existing data on births, deaths, and migration. As described in the *Final Report:*[2]

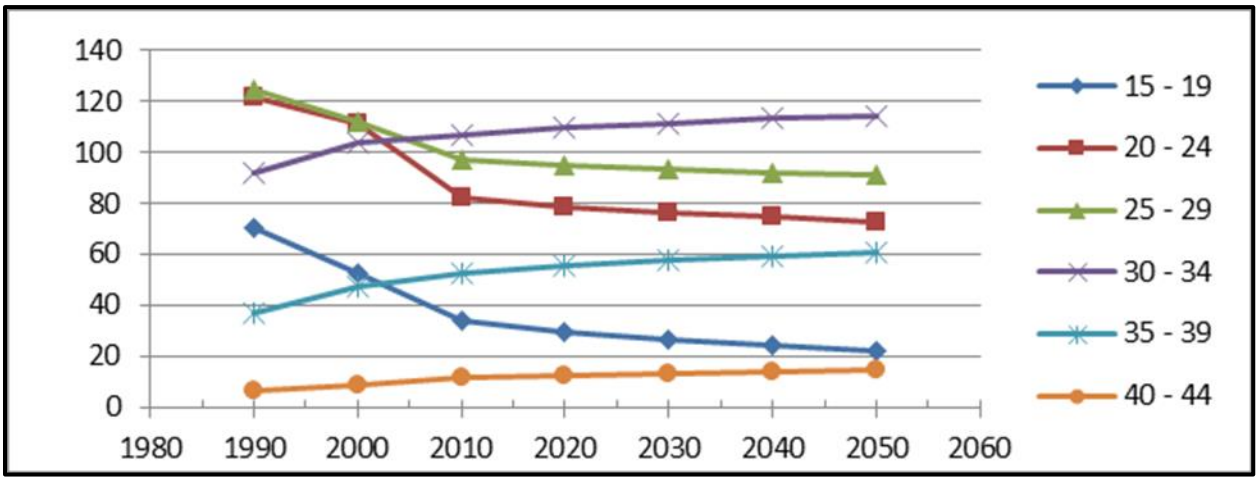
> The base year population is stratified by sex into 18 age cohorts. Fertility rates (by age group) are applied to the female population of child bearing age groups to generate an

[2] Louis Berger Group, *Chicago Region Socioeconomic Forecast, Final Report* (2016). https://datahub.cmap.illinois.gov/dataset/2050-forecast-of-population-households-and-employment/resource/a812de2f-d465-47f2-87df-0427e81da2cf

estimate of births during each five-year interval of the 2050 projection horizon. Similarly, survival rates are also applied to each age group to generate estimates of the survived population in each successive five year time increment. The estimated volume of net migration (both in and out migration) is added to the survived population based on historically observed age specific patterns of migration.

Birth and death data were obtained from the Illinois Department of Public Health, Indiana State Department of Health, and Wisconsin Department of Health Services, to develop fertility and mortality rates necessary to inform the cohort-component model. Data on births were used to calculate fertility rates for the years 1990-2010, grouping them into six age cohorts (in five year ranges from ages 15-19 through 40-44). Historic rates showed two distinct trends: fertility rates for the under-30 cohorts showed a marked decrease, while all age 30 and above cohorts showed moderate increases. These trends were carried forward into the forecast years using a logarithmic trend projection, which allows for a gradual slowing of trends in acknowledgement of the uncertainty of these trends carrying forwards into the future. **Figure 5** (below) depicts the historic (1990-2010) and projected fertility rates by age cohort, reported as live births per 1,000 females.

Figure 5. Forecast region age-specific fertility rates (historic and forecast)

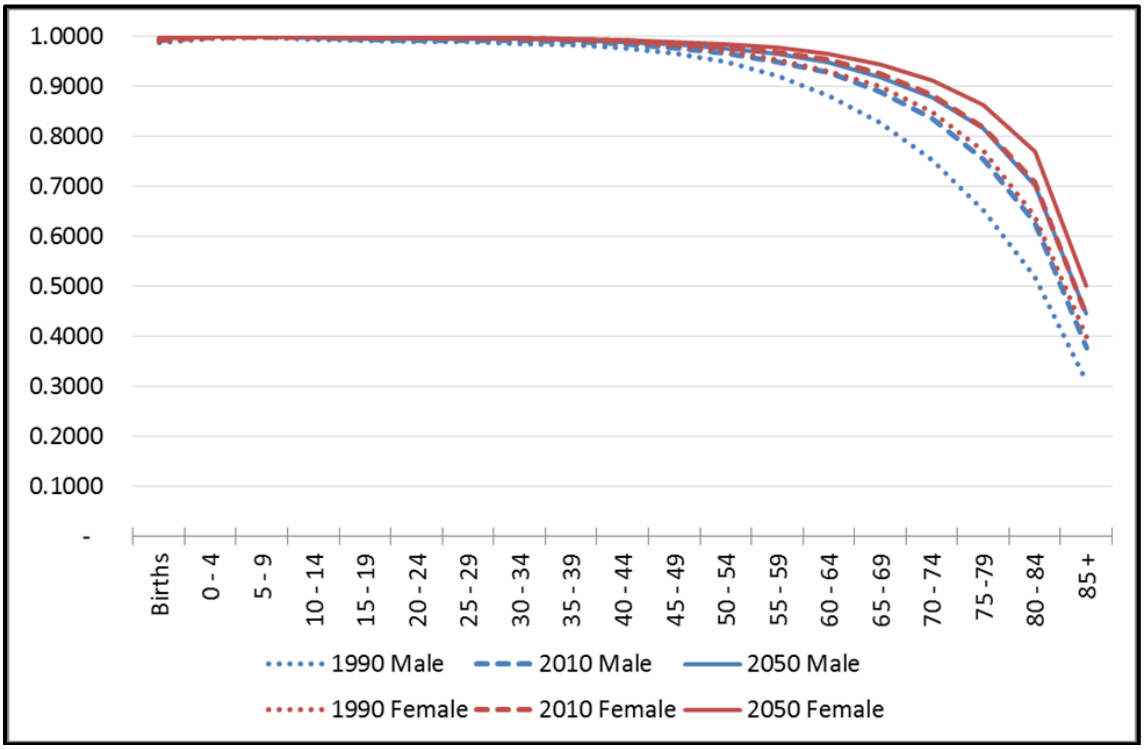


Source: Louis Berger Group, Chicago Region Socioeconomic Forecast Final Report, 2016.

Similarly, death data from the state health departments were used to calculate age-specific death rates for the 1990-2010 period. These rates were used to generate age-specific survival rates representing the percentage of persons of a certain age who are expected to survive to the following year. Mortality rates, as expected, fell over this period, translating into a greater likelihood of each age cohort to survive into the next time period. Survival rates are expected to continue to increase over the forecast period due to continued advances in medical technology;

future survival rates used in the cohort-component model are based on projected changes in survival rates out to 2050, published in Social Security Administration life tables.[3]

Figure 6. Forecast region survival rates

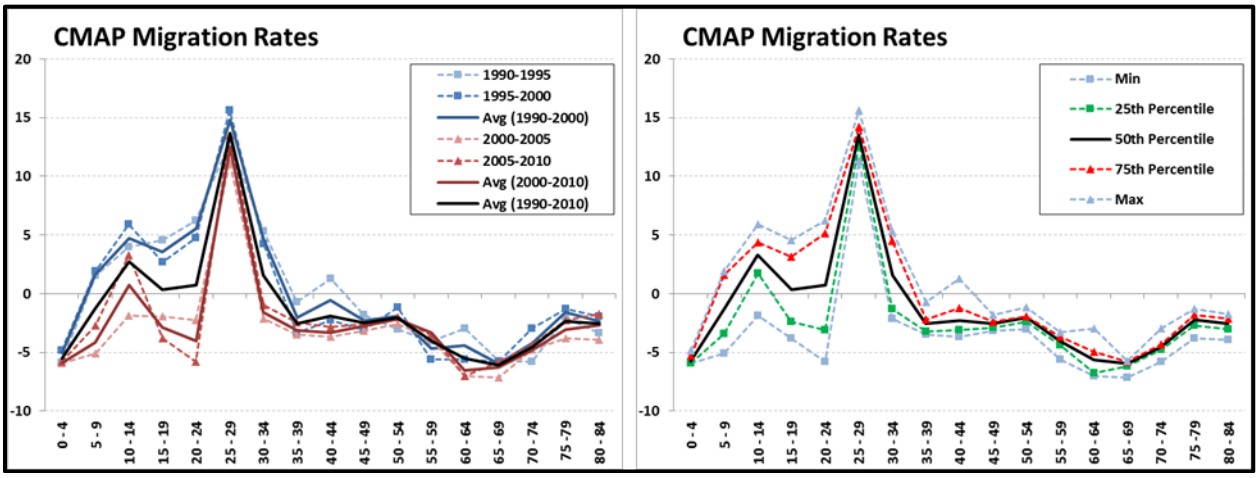


Source: Louis Berger Group, Chicago Region Socioeconomic Forecast Final Report, 2016.

As with births and deaths, projected migration rates are derived from historic rates. Unlike births and deaths, migration rates tend to fluctuate in response to local economic conditions as well as larger national (and global) trends and events. Migration rates also vary by age. Thus, it is unrealistic to attempt to identify a trend in migration and extrapolate it out to the forecast horizon. Instead, the consultant team obtained six decades' worth of county-level migration data from the Applied Population Laboratory (APL) at the University of Wisconsin, and determined the 50th-percentile rate for each age cohort in the APL data to apply as the age-specific migration rate through the duration of the forecast period.

[3] Felicitie C. Bell and Michael L. Miller. *Actuarial Study No. 120: Life Tables for the United States Social Security Area, 1900-2100* (2005). https://www.ssa.gov/oact/NOTES/as120/TOC.html.

Figure 7. Migration rates in the CMAP region, by data source (left) and percentile (right)



Source: Louis Berger Group, Chicago Region Socioeconomic Forecast Final Report, 2016.

Additional household population variables

Total Households

The forecast team relied on Census Public Use Microdata Sample (PUMS) and 2010 Decennial data to develop age-specific household-headship rates. These rates were applied to each age cohort for each forecast year to determine the number of households headed by someone in that cohort. The summed total of households by all cohorts yielded the total number of households for each forecast year.

Age of Householder

CMAP's travel models require aggregated age-of-householder information, breaking out total number of households into three groups based on householder's age range: Under 25, Age 35-64, and Age 65 and above. As the household calculations (described above) are based on household headship by age cohort, this variable was generated by summing the various head-of-household age cohorts into the required age ranges.

Adults/Children in Households

The cohort-component model works with five-year age cohorts (e.g. 5-9, 10-14, and so on up to age 85+). For the most part, these variables required only a simple summation of relevant age cohorts into total adults and children. However, since the travel model considers "adult" to be anyone aged 16 or over, it was necessary to split out the age 15-19 cohort so that the 15-year-olds would be summed with total children and the remainder summed with total adults. Decennial Census data from 2010 were used to calculate the proportion of 15-year-olds out of the total (aged 15 and above) household population to add to the age 0-14 cohorts to estimate total children in households; the remainder of the age 15-19 cohort was added to the age 20 and over group to estimate total adults in households. The calculated 2010 ratio was applied to this cohort for all forecast years as well.

Household Income

The forecast team utilized household income projections from Woods & Poole Economics. Woods & Poole reports historic and projected number of households by 11 income ranges (in 2009 dollars) on a per-county basis. The final variable, as required by the travel model, is a median household income for the broader the 21-county modeling region, along with 25th and 75th percentile values for each forecast year. Values were generated by calculating Woods & Poole shares of the total for each income range for four subregions within the modeling area (CMAP, other Illinois counties in the modeling area, Indiana counties, and Wisconsin counties); assigning those shares to the modeled household control totals for modeled shares; and then establishing a cumulative percentage to arrive at median and 25th/75th percentile values.

Additional regional forecast variables

Group Quarters Population

All population modeling described up to this point addressed only the region's population living in households. To arrive at a total population figure, projections must also account for group quarters populations, both institutionalized (residents of skilled nursing facilities, prisons, etc.) and non-institutionalized (college dormitories, military quarters). Totals for these populations change over time not through demographic trends, but through the construction of new facilities and the repurposing of old facilities. An analysis of 1990-2010 Census data showed that group quarters population tends to track with household population. To produce age and sex specific profiles of projected group quarters populations, the 2010 share of each age and sex cohort by institutional and non-institutional has been applied to the control total for each forecast year.

Race and Ethnicity

Race and ethnicity projections were developed for the entire (not just household) population for the following groups: White Non-Hispanic, Black Non-Hispanic, Asian Non-Hispanic, Other Non-Hispanic, and Hispanic. Rather than employ race-specific cohort-component methods, the Berger team used Decennial and Intercensal Census data for the 2000-10 period to chart recent trends. As with the trends in fertility rates, the team used a partial logarithmic approach to strike a balance between the more aggressive trends that have been documented in recent years and the inherent uncertainty about the direction of future growth.

Employment model

In a departure from previous efforts, the ON TO 2050 forecast breaks employment out into 20 sectors based on the North American Industry Classification System (NAICS) two-digit sector scheme (see **Table 5** under Results for the complete list). CMAP requested this higher level of detail to provide insight into how nationwide trends in certain sectors (e.g. Manufacturing or Retail) were expected to play out in the region; additionally these totals serve as the controls for CMAP's Activity-Based Model for more sophisticated travel modeling.

The process began with a benchmarking activity to define employment sectors and to develop a historical employment series for all sectors at the national, state, and county level from the year 1990 through 2014 (the latest year for which data were available). Estimating employment is never as straightforward as population for a number of reasons, including: counting multiple-job holders, whether or not to include part-time workers; and whether or not to include groups such as self-employed, domestic workers, and farm workers.

The team compiled benchmark employment at the national level using the Bureau of Labor Statistics (BLS) Current Employment Statistics for payroll employment, the Census Bureau's American Community Survey (ACS) for self-employment, and the Current Population Survey (a joint Census/BLS survey) for agricultural and private household workers. At the state level the data were compiled from the BLS' Quarterly Census of Employment and Wages (QCEW), supplemented by data from their State and Metro Area Employment program for certain sectors which are not covered fully by QCEW. County-level benchmarks were derived from QCEW, where each county/industry combination was allocated a share of the state benchmark total.

Baseline employment forecasts relied on a composite approach incorporating two third-party sources: county-level payroll employment forecasts from Moody's Analytics, and national employment projections published by the BLS. This leverages strengths of each source, as Moody's focuses on the national economy, while demographic and workforce trends inform the BLS model to a greater extent. The Berger team standardized the two datasets to account for differing sector definitions and end-years.

This process resulted in two projections: total employment and wage & salary employment. Total employment serves as a driver of the Labor Force Model (described below); wage & salary employment is required for CMAP's travel demand models. Results can be found at the end of this section.

Labor Force model

The population and employment models described above operate independent of one another. An additional step is necessary to reconcile labor demand (employment) with labor supply (workers, a subset of the total population); if the rate of employment growth outpaces the number of workers available to fill those positions (through natural increase and in-migration calculated in the cohort-component model), then additional people are expected to move into the region as labor-induced migration.

Developing a labor-induced migration adjustment involved first estimating current labor force participation rates (by age and sex) and estimating the changes to those rates in future years ("labor force" includes both employed persons and those who are unemployed but actively seeking work). Base-year participation rates were derived from Census PUMS data for 2010 and 2014, with projected changes in participation rates based on published BLS reports. As the

BLS projections extended only to 2024, those figures were held constant for all subsequent years.

Labor demand was based on employment projections for Basic industries, which exclude "local-serving" industries that are unlikely to impact migration patterns. Excluded local-serving sectors were: Retail (NAICS 44-45); Arts, Entertainment and Recreation (71); Accommodation and Food Services (72); and Other (81). The Basic employment total was adjusted to account for multiple job-holders (factored at 4.9 percent based on Current Population Survey data) to arrive at total Basic labor demand.

In addition to the migration adjustment, the Labor Force model was used to estimate the number of workers living in households, a required variable in CMAP travel models. These figures were generated by applying age/sex-specific labor force participation rates to the appropriate cohorts to estimate the total projected labor force; these were subsequently adjusted to account for unemployment, using Congressional Budget Office projections of national unemployment rates for future-year unemployment assumptions.

Forecast scenarios

The processes outlined above produced a baseline forecast independent of planning considerations. As a part of regional forecast development, alternate scenarios were developed that assumed implementation of certain GO TO 2040 recommendations. The team chose two topic areas to develop scenarios around: Transportation and Human Capital.

Transportation scenario:
CMAP staff employed Transportation Economic Development Impact System (TREDIS) modeling to estimate job impacts by industry assuming the following transportation improvements:

- Construction of all major capital projects identified in CMAP's GO TO 2040 Plan Update
- A package of arterial improvements
- Increase in transit ridership

TREDIS-estimated job impacts by sector for each forecast year were added to baseline sector employment projections.

Human capital scenario:
This scenario builds on the GO TO 2040 recommendation "Improve education and workforce development." The Project Team reviewed several studies that estimate the impact that educational attainment has on employment and identified a 2004 study published in the *Journal*

of Urban Economics[4] that estimates the connection between educational attainment and job growth by industry sector. As described in the *Final Report*[5]:

> Adjustments were applied to baseline employment growth rates in a lagged fashion (7-year based on Simon) using separate elasticities for "skilled" industries, "unskilled" industries, and declining industries (based on groupings in Simon). Increases in the level of educational of attainment (bachelor's degree) correspond with goals established and provided by CMAP.

Reference (transportation + human capital) scenario:
A third scenario combines the results of the Transportation and Human Capital scenarios. This is what was selected by CMAP staff to serve as the ON TO 2050 Reference Scenario.

Note: while the scenarios described above explicitly impact employment projections, population is nonetheless affected through a revised labor-induced migration adjustment.

Table 1. Comparison of baseline and reference scenarios

	2010	2050 Baseline	2050 Reference
Total Population (including Group Quarters)	8,431,386	10,552,391	10,826,002
Total Households	3,088,156	4,136,942	4,243,067
Wage & Salary Employment	3,689,872	4,841,319	4,999,618

Source: Louis Berger Group, Chicago Region Socioeconomic Forecast Final Report, 2016.

Adjustment to the regional forecast

Shortly after completion of the forecast in November 2016, it was determined that the Forecast Team should revise projections to incorporate estimates from the Census Bureau's 2015 Vintage Population Estimates. This was necessary to account for slower-than-expected growth subsequent to the 2008 Recession. Census estimates for the CMAP region for 2015 were more than 149,000 persons lower than the Forecast Team's 2015 projection. This was accomplished by incorporating the 2015 estimates into the cohort-component model, while retaining the fertility, mortality, and migration rates used in the original model. Employment, which was based on more recent (2014) data, did not require an adjustment. These adjustments are outlined in the *Final Report Addendum*,[6] available on the CMAP Data Hub.

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[4] Curtis J. Simon, 2004, "Industrial reallocation across US cities, 1977-1997," *Journal of Urban Economics* 56: 119-143.

[5] Louis Berger Group, *Chicago Region Socioeconomic Forecast, Final Report* (2016). https://datahub.cmap.illinois.gov/dataset/2050-forecast-of-population-households-and-employment/resource/a812de2f-d465-47f2-87df-0427e81da2cf.

[6] Louis Berger Group, *Chicago Region Socioeconomic Forecast: Revised Forecast, Final Report Addendum* (2017). https://datahub.cmap.illinois.gov/dataset/2050-forecast-of-population-households-and-employment/resource/0055322c-3582-43ea-b895-5b6053f0aae0.

Summary of reference forecast results

All results below are for the aggregate, seven-county CMAP region. For sub-regional results please refer to the Local Allocation section of this report. Microsoft Excel versions of all tables can be found on the CMAP Data Hub.[7]

Regional population

Reported in ten-year intervals for space considerations. A five-year interval version is available on the CMAP Data Hub.

Table 2. ON TO 2050 Reference scenario, total population 2015-50

Total Population	2015	2020	2030	2040	2050
Total Population	8,524,670	8,970,201	9,635,885	10,249,300	10,826,002
Non-Hispanic White	4,409,492	4,514,076	4,604,403	4,662,469	4,686,245
Non-Hispanic Black	1,478,899	1,521,508	1,559,490	1,577,265	1,585,047
Non-Hispanic Asian	566,926	637,458	765,505	893,516	1,022,728
Non-Hispanic Other	120,999	132,674	153,669	175,034	196,704
Hispanic	1,948,355	2,164,485	2,552,817	2,941,015	3,335,278
Percent of Total	**2015**	**2020**	**2030**	**2040**	**2050**
Non-Hispanic White	51.7%	50.3%	47.8%	45.5%	43.3%
Non-Hispanic Black	17.3%	17.0%	16.2%	15.4%	14.6%
Non-Hispanic Asian	6.7%	7.1%	7.9%	8.7%	9.4%
Non-Hispanic Other	1.4%	1.5%	1.6%	1.7%	1.8%
Hispanic	22.9%	24.1%	26.5%	28.7%	30.8%

Source: Louis Berger Group, Chicago Region Socioeconomic Forecast, Final Report Addendum, 2017.

[7] CMAP Data Hub: https://datahub.cmap.illinois.gov/dataset/2050-forecast-of-population-households-and-employment/resource/a812de2f-d465-47f2-87df-0427e81da2cf.

Table 3. ON TO 2050 Reference scenario, household/group quarters population 2010-50

Household Population	2015	2020	2030	2040	2050
Total Households	3,179,661	3,391,549	3,730,695	4,000,305	4,243,067
Total Population in HHs	8,385,120	8,816,348	9,466,470	10,058,765	10,615,707
Average Household Size	2.64	2.60	2.54	2.51	2.50
Group Quarters Population	2015	2020	2030	2040	2050
Non-Institutional	71,156	79,576	87,044	97,503	107,639
Institutional	68,394	74,277	82,371	93,032	102,655

Source: Louis Berger Group, Chicago Region Socioeconomic Forecast, Final Report Addendum, 2017

Regional employment

Table 4. Regional share of employment by major industrial group, 2015 and 2050

Group	Industrial Group	2015 Total	2015 Share	2050 Total	2050 Share
G	Government	465,905	11%	511,681	10%
M	Manufacturing	359,882	9%	284,879	6%
R	Retail	410,117	10%	445,876	9%
S	Services	2,295,121	56%	3,110,683	62%
T	Trans./Comm./Utilities	403,200	10%	387,708	8%
O	Other	144,333	4%	258,790	5%

Source: Louis Berger Group, Chicago Region Socioeconomic Forecast Final Report, 2016.

Table 5. ON TO 2050 Reference scenario, wage and salary employment by sector, 2015-50

Group	Industry	NAICS	2015	2020	2030	2040	2050
O	Agriculture, Forestry, Fishing and Hunting	11	3,045	3,293	3,423	3,601	3,872
O	Mining	21	1,250	1,310	1,376	1,444	1,467
T	Utilities	22	11,378	11,883	11,670	11,433	10,892
O	Construction	23	140,038	158,045	174,559	204,460	253,451
M	Manufacturing	31 - 33	359,882	356,208	323,977	302,637	284,879
T	Wholesale Trade	42	208,718	212,068	215,545	217,721	213,170
R	Retail Trade	44 - 45	410,117	411,778	415,471	425,685	445,876
T	Transportation and Warehousing	48 - 49	183,104	179,461	174,412	169,496	163,645
S	Information	51	74,670	77,544	79,008	80,852	82,078
S	Finance and Insurance	52	217,964	225,396	240,776	261,198	276,601
S	Real Estate & Rental & Leasing	53	59,901	60,822	58,547	56,856	58,186
S	Professional, Scientific and Technical Services	54	320,183	347,735	370,046	401,436	449,883
S	Management of Companies & Enterprises	55	81,443	83,676	80,689	79,035	76,704
S	Administrative/Waste Svc	56	335,626	384,426	466,582	563,037	655,796
S	Educational Services	61	129,833	131,618	127,580	124,881	116,740
S	Health Care and Social Assistance	62	497,838	527,822	570,562	607,356	640,133
S	Arts, Entertainment, and Recreation	71	62,845	65,705	66,543	66,439	65,502
S	Accommodation and Food Services	72	336,561	364,810	401,122	443,479	496,200
S	Other Services (exc. Public Administration)	81	178,257	183,484	185,371	188,537	192,860
G	Public Administration *	92	465,905	473,383	489,656	500,442	511,681
Total Wage & Salary Employment			4,078,558	4,260,468	4,456,914	4,710,024	4,999,618

Source: Louis Berger Group, Chicago Region Socioeconomic Forecast Final Report, 2016.

*** NOTE: Public Administration includes all public-sector employees regardless of occupation (i.e. public school employees and municipal sanitation workers).**

Part 2: Local Area Allocation (LAA)

Introduction

The second major component of the forecasting process is the disaggregation of the regional forecast to the local level. This is necessary to produce the socioeconomic inputs required by CMAP's travel models for conformity analysis; the results are also shared with transportation planners and consultants for project analyses, and to county and local governments for long-range planning purposes.

In addition to serving as travel model inputs, CMAP's small-area forecasts are intended to represent how implementation of ON TO 2050 priorities play out at the local level: market influences such as property value and highway accessibility are balanced by factors that promote infill development and reinvestment in economically-disconnected communities.

To achieve this, CMAP issued *RFP 149, Socioeconomic Forecast: Subregional Allocation Solution* in January 2016 to engage a consultant that could expeditiously develop an approach to disaggregation of regional forecast (control) totals. CMAP selected Louis Berger for this exercise; the company had developed a similar tool for the New York Metropolitan Transportation Council at a more aggregate level, and it was Berger's task to scale this to the finer-grained subzone modeling geography employed by CMAP.

Conceptual overview

The ON TO 2050 local allocation of forecasted growth is intended to be an articulation of the comprehensive plan's policies and goals. The plan outlines broad priorities for where growth occurs (e.g. infill, disinvested communities), emphasizes the benefits of and need to invest in areas with access to transportation infrastructure, and points to a set of policy options that support plan goals. In addition, market factors will clearly affect where and how development occurs through 2050. The forecast balances these various considerations.

While the principal focus of the tool is to provide localized estimates of projected households and employment, CMAP requested that the tool provide a number of additional variables to help satisfy the requirements of CMAP's travel demand model. Required output variables for the travel model were:

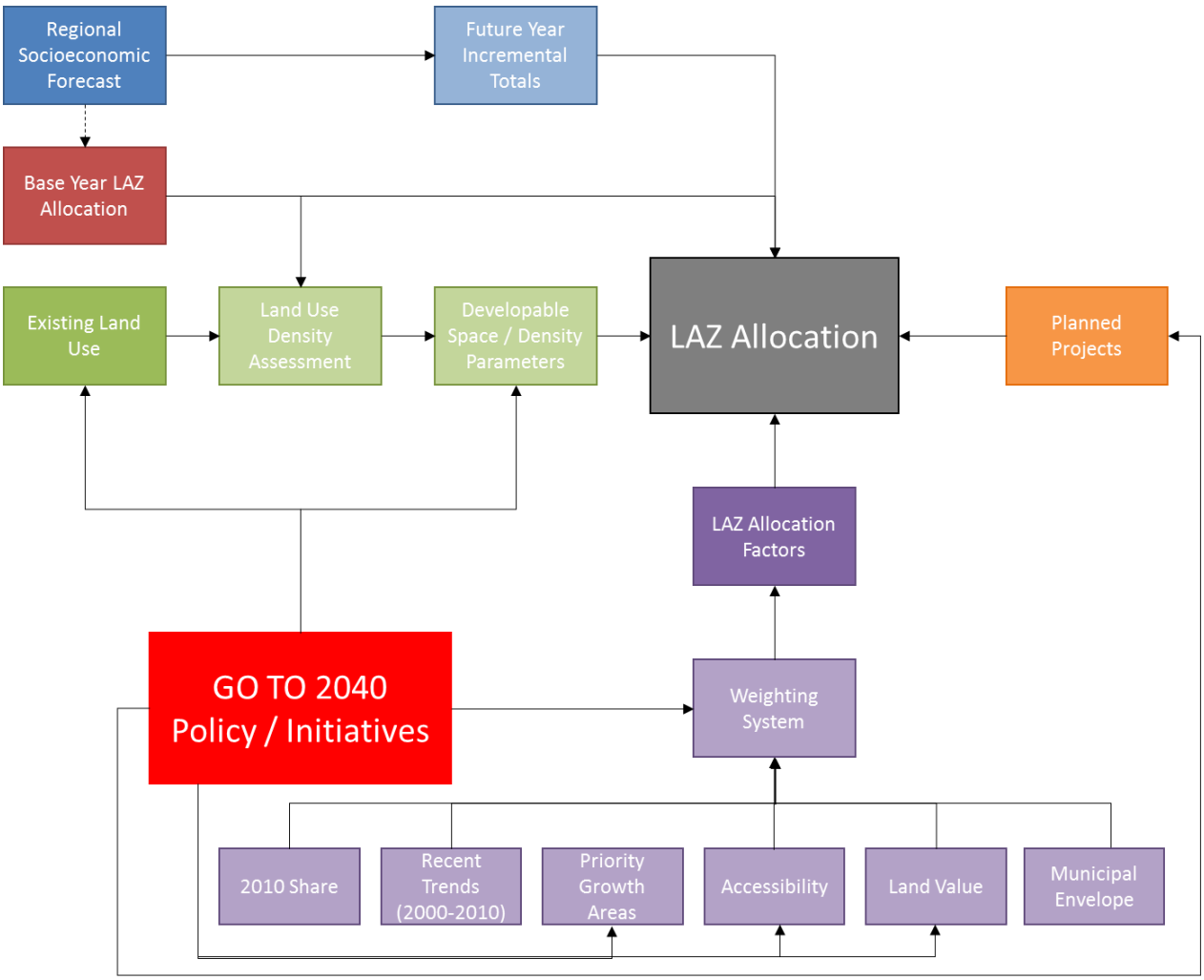
- Households
- Population Living in Households
- Adults (aged 16+) in Households
- Children (under 16) in Households
- Workers in Households
- Household Income

- Number of Householders by Age Group (Under 35, 35 – 64, Over 64)
- Total Employment
- Employment by NAICS-2 Sector

The following text, from documentation provided by Louis Berger, describes the framework for the LAA tool:

> As illustrated in **Figure 8,** the Louis Berger team's subregional allocation model framework consists of seven broadly distinct components that ultimately feed into the zonal allocation process as briefly described below.

Figure 8. LAA tool framework



- **Regional socioeconomic forecast and future year incremental totals.** The CMAP regional level forecasts, developed by the Louis Berger Team, form the basis for the down allocation to the Local Allocation Zone (LAZ) level [*see Geography section below*],

and provide the control totals (or controlling values in the case of variables such as average household income) that guide and define LAZ characteristics. The forecasts of population, households, and employment will be used to generate incremental region-level control totals to be successively added to the base year LAZ allocation.

- **Base year LAZ allocation.** The base year LAZ allocation is developed by CMAP using census data on population, households, and housing units, together with ES-202 employment data from Illinois Department of Employment Security (IDES). The 2015 base year LAZ allocation forms the starting point of the subregional model and is modified through incremental adjustments dictated by the overall regional growth, local constraints on development density and developable space, and local measures of settlement attraction.

- **Existing land use, land use density, and developable space.** Data on existing land use was compiled and used to determine existing residential, commercial, restricted and vacant space in each LAZ. Existing vacant space forms the basis for accommodating future growth, while the base year allocation of population and employment together with existing land use designations, was used to estimate existing land use densities, and to subsequently determine the urban classifications of each LAZ.

  In addition to the vacant space determinations, the redevelopment potential of existing residential and commercial space was used to estimate the potential for additional developable space accruing to higher densities of future development.

  As part of their High Quality Natural Areas initiative, CMAP also developed a GIS layer delineating areas that cannot be used to support future development. This layer was incorporated into the model to provide constraints that limit the development potential of affected LAZs.

- **Planned projects.** CMAP's Northeastern Illinois Development Database (NDD) contains geocoded information of known housing or commercial development projects. The NDD was used to partially inform the spatial allocation of housing and employment in the near-term.

- **Zonal allocation factors.** The attractiveness of each LAZ, across multiple dimensions of desirability (as indicated at the bottom portion of **Figure 8**), was combined into a single factor based on the application of regional weights that rate the relative importance of each dimension of desirability.

- **GO TO 2040 and ON TO 2050 recommendations.** The GO TO 2040 policy recommendations play a direct role in determining the anticipated land use

characteristics while also possibly influencing the allocation factors used to drive the actual subregional allocation down to the LAZ level.

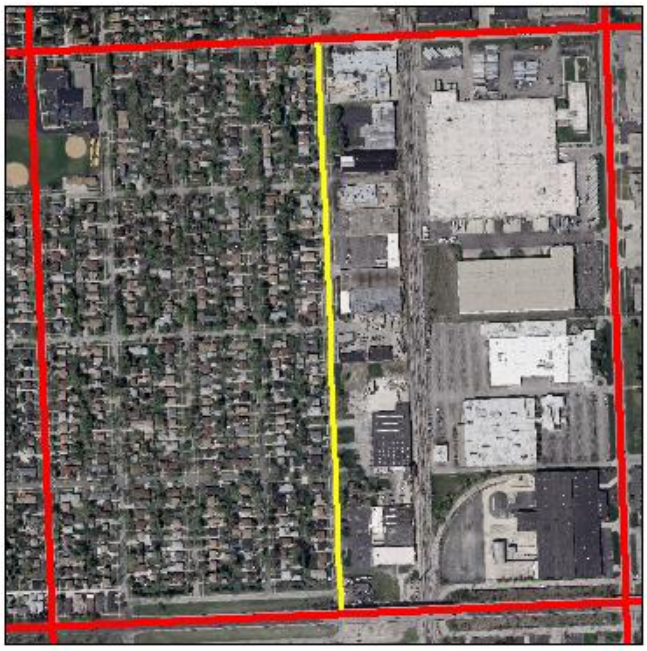
- **LAZ allocation.** Starting with the base year LAZ allocation of all household and employment variables, the allocation tool allocates future incremental growth of both household and employment variables, with due consideration of the aforementioned factors: developable area constraints, anticipated location and scale of planned projects, and allocation factors representing the desirability of each zone. **Figure 8** provides a high-level overview of the LAZ allocation processes for households and employment as they are executed within the subregional allocation model.

  The fitting of incremental households and employment in the allocation process is conducted through up to four steps of allocation iterations that utilize developable space through each successive round. The rate at which developable space is consumed will be determined by each LAZ's urban classification and corresponding allowable development density as previously described.

Geography

The basic unit of geography for this exercise is the Local Allocation Zone, or LAZ. These are CMAP travel model subzones subdivided by 2010 municipal boundaries. This was done to allow for more nuanced growth within subzones, since communities that share a subzone may have markedly different characteristics (see **Figure 9** below). This also allows for more meaningful summaries of data at the municipal level for those who use forecast data for purposes other than travel modeling. An example of the need to subdivide subzones for municipal tabulation purposes can be seen below, where two towns share a subzone but have very different characteristics.

Figure 9. CMAP subzone (red) divided into two LAZs (yellow line)

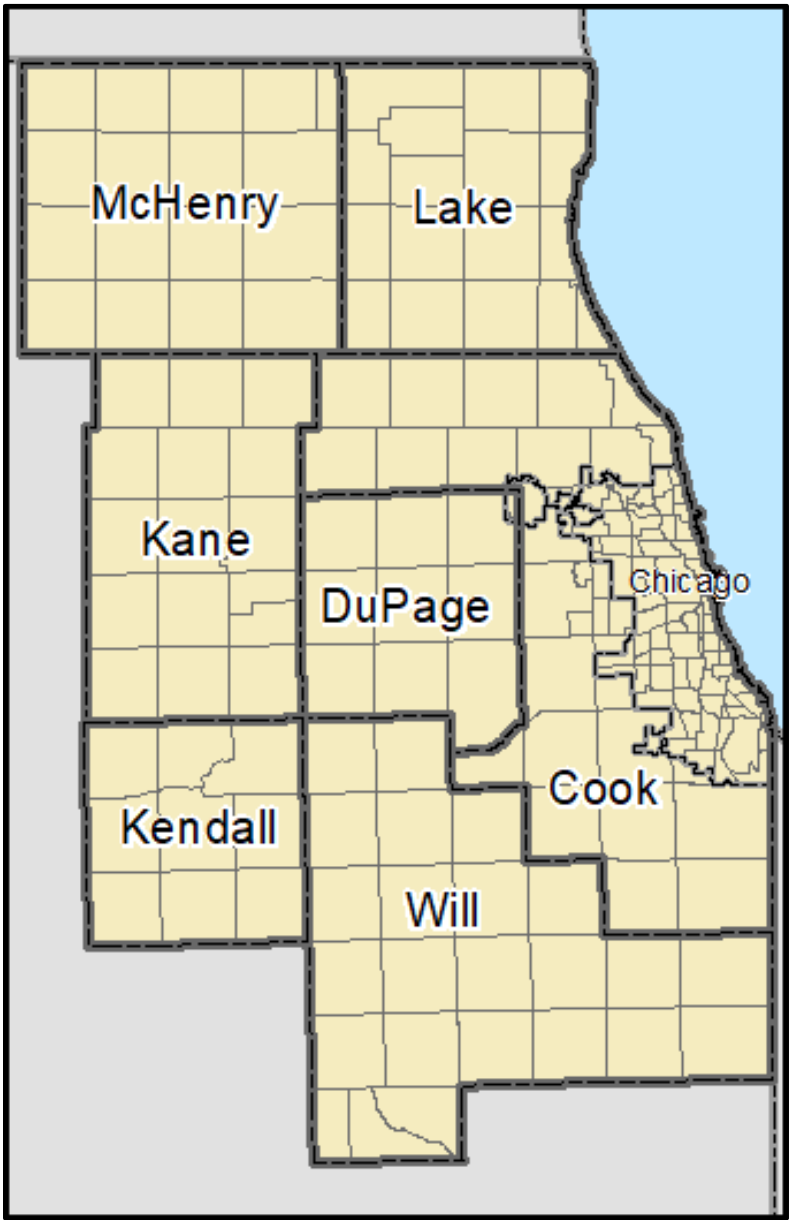


Note: The Village of Westchester is on the left, the Village of Broadview on the right.

Within the seven CMAP counties there are a total of 16,443 travel model subzones; the splitting of subzones for municipal (or unincorporated) identification resulted in a total of 21,977 LAZs.

An additional geography used for data aggregation and summary reporting is the "MCDCCA," a combination of Census Minor Civil Divisions (MCDs, also known as political townships), and the 77 Chicago Community Areas (CCAs). This geography is especially useful in providing sub-county breakdowns of socioeconomic data, as well as aggregating localized data that lack precise coordinates. **Figure 10** (below) depicts MCDCCA geography within the seven counties; suburban MCD outlines follow established political township boundaries except in northeast Lake County, where Zion and Benton Townships are merged and their border with Newport Township generalized to maintain consistency.

Figure 10. MCDCCA geography: Minor Civil Divisions (Townships) and Chicago Community Areas



Base-year (2015) data

Both the Regional Forecast and the LAA used the year 2015 as a base to take advantage of more up-to-date data resources. Localized household estimates were based on the Census Bureau's Population Estimates Program (2015). The Census Estimates data were disaggregated to the parcel level (with CMAP's 2013 Land Use Inventory as the base), using data from the American Community Survey (2011 – 2015), CoStar, NDD, and county assessor data to provide parcel-level estimates. These estimates were then summarized to LAZ to provide the Housing Unit, Household, and Population in Households 2015 inputs.

Employment figures are based on BLS county-level estimates by industry, which were disaggregated to the local level using establishment-level Unemployment Insurance (ES-202) data obtained under special agreement with IDES. IDES establishment locations with industry classification (2-digit NAICS) and number of workers were geocoded, with substantial clean-up necessary to break out single-address "headquarters" locations that represented multiple locations. These establishment-level totals are then factored upwards to meet BLS estimates for each county/NAICS-2 combination. Employment by NAICS-2 was then summed at the LAZ level to serve as the 2015 employment inputs.

After initial inspection of 2015 employment distribution, staff determined that additional refinement was necessary for both base-year and forecast totals to properly account for workers in the NAICS 561320 category (Temporary Help Services). Similar to the "headquarters" issue described above, temp workers in the ES-202 data are represented at the location of the temp agency office, and not the actual assignment locations for these workers. As the primary purpose of the forecast is to support the travel demand model, any effort to improve local employment estimates strengthens the overall model. This reallocation effort was informed by a 2015 report by the U.S. Department of Commerce, *Temporary Help Workers in the U.S. Labor Market*,[8] which identified temp workers by occupation; and the BLS' *Industry-Occupation Matrices* to break out occupation totals by (NAICS-2) sector.[9] The end result was a subtraction of the NAICS-561320 total from the NAICS 56 (Administrative and Support) sector and a reallocation of that total into the sectors where they were more likely to be working (for example, one-quarter of all temporary workers can be found in the Transportation and Material Moving occupations). For the base year employment, this reallocation appeared as an adjustment of the NAICS-2 control totals by county. For forecast years, it serves as a revised control at the regional level. These adjusted totals were developed to improve on travel model output, and are not reflected in any regional forecast documentation.

Along with providing the foundation for the population estimates, the 2013 Land Use Inventory was used to estimate amount of developable acreage per LAZ (vacant and agricultural lands) as well as areas that are off-limits to development (such as open space, updated to reflect county conservation acquisitions through 2015). Additional development constraints where identified through research performed for the development of the ON TO 2050 Conservation Areas Layer. This layer was overlaid with existing vacant and agricultural land, with the amount of developable acreage for those areas lowered based on the priority rating.

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[8] U.S. Department of Commerce, Economics and Statistics Administration. *Temporary Help Workers in the U.S. Labor Market* (2015) http://www.esa.gov/reports/temporary-help-workers-us-labor-market

[9] U.S. Department of Labor, Bureau of Labor Statistics. *Industry-Occupation Matrix Data, by Occupation*. https://www.bls.gov/emp/ep_table_108.htm

Table 6. Conservation rating

Description	Reduction
Regional Conservation Priorities: includes wetlands, 100-year floodplains, unprotected Illinois Natural Areas Inventory (INAI) sites, oaks, prairies, and savannas. Also included are 200-foot buffers around wetlands, INAI sites, prairies, savannas, and oak stands of greater than 10 acres. Also included are 200-foot buffers around surface water, protected open space, and current and programmed trails included in the Regional Greenways and Trails Plan.	100%
Local Conservation Priorities: environmental resource areas identified in Kane, McHenry, and Lake County green infrastructure plans that were not captured in the Regional Conservation Priorities analysis.	60%
Conservation Opportunities: include non-oak forest patches greater than 50 acres that were identified in the regional analysis but not included as environmental resource areas in county green infrastructure plans. Because forest patches are important resource areas, they are included as conservation opportunities, but based on the review of other green infrastructure mapping projects, it appeared to be appropriate to consider them in a different category than the regional conservation priorities.	40%

Additional development constraints were added in the form of "blocks," where individual LAZ were flagged as unavailable for additional households or employment. This was employed for practical (not policy) considerations: a LAZ which is entirely industrial but has additional capacity due to existing (industrial) vacant property or through a redevelopment bonus should not necessarily receive a household allocation. In such an instance, the LAZ would have a "household block" assigned to it, meaning that the LAZ can receive additional employment allocation, but not households. In some instances, a land use might under most circumstances support additional density with certain exceptions: at O'Hare, for example, some LAZ are entirely taken up by runway space and need to be taken off the table for any sort of allocation; in this instance these LAZ have both household and employment blocks assigned.

Urban classification

The Urban Classification is intended to provide a consistent characterization of urban type across the region. Based on existing development densities and patterns, it categorizes all LAZ in the region as one of the following: Central Business District, Dense Urban, Urban, Suburban, Low-Density Suburban, and Rural; all categories except CBD and Rural also contain a "with business" modifier to distinguish those that have a stronger non-residential presence. There are ten categories in all (see **Table 7**).

These classifications serve as a guide to future growth, establishing densities for both new development and redevelopment, and providing a "ceiling" to prevent zones from being assigned growth beyond a contextually-appropriate level. The Urban Classification is not a guarantee that the zone will develop out to that density; zonal attractiveness and accessibility are the main drivers of growth. Some areas, such as those near transit stations or on planned

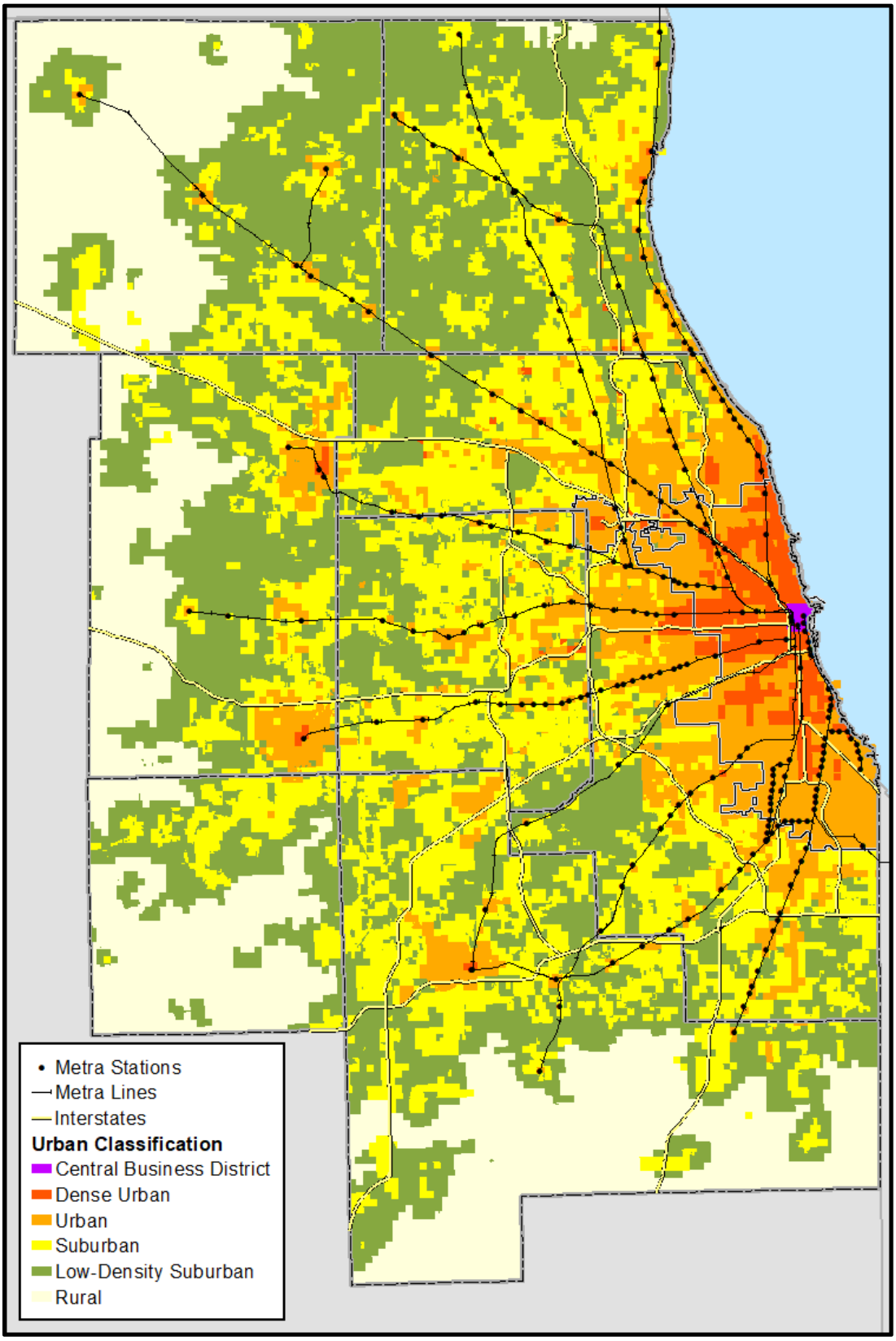
Pace Arterial Rapid Transit routes, were assigned a higher level of Urban Classification to allow for densities that would support ON TO 2050 priorities.

Classifications were derived by calculating the density of existing population and employment over the amount of residential and non-residential developed area within each LAZ; modifications were made for areas with higher access to transit (based on CMAP's Transit Availability Index), and areas outside of the 2010 Census Urbanized Area that had no development were re-classified to Rural. LAZ with a high employment-to-population ratio were assigned the "with business" modifier.

Table 7. Urban classification definitions

Urban Classification	How Defined	Example
Chicago Central Business District (CBD)	Downtown Chicago, bounded by: Chicago Avenue, Halsted Street, Roosevelt Road, and Lake Michigan.	
Dense Urban	Population + employment density > 40,000/sq. mi OR Transit Availability Score = 5	Logan Square (Chicago)
Dense Urban with Business	Population + employment density > 40,000/sq. mi OR Transit Availability Score = 5 AND population-to-employment < 5:1	Near West Side (Chicago)
Urban	Population + employment density > 20,000/sq. mi OR Transit Availability Score = 4 OR within Chicago	Joliet (outside of downtown)
Urban with Business	Active Pop/Emp density > 20,000/sq. mi OR Transit Availability Score = 4 OR within Chicago AND population-to-employment < 3:1	Downtown Waukegan
Suburban	Population + employment density > 5,000/sq. mi OR Transit Availability Score = 3 OR Capacity Zone = Inner Ring Suburb	Naperville (outside of downtown)
Suburban with Business	Population + employment density > 5,000/sq. mi OR Transit Availability Score = 3 OR Capacity Zone = Inner Ring Suburb AND population-to-employment < 3:1	Bolingbrook industrial corridor
Low-Density Suburban	Not defined above or in Rural	Campton Hills
Low-Density Suburban with Business	Not defined above or in Rural AND population-to-employment < 3:1	Unincorporated Crete Township
Rural	Based on a buffered 2010 Urbanized Area, with exceptions for LAZs identified as incorporated (including post-2010 annexations)	

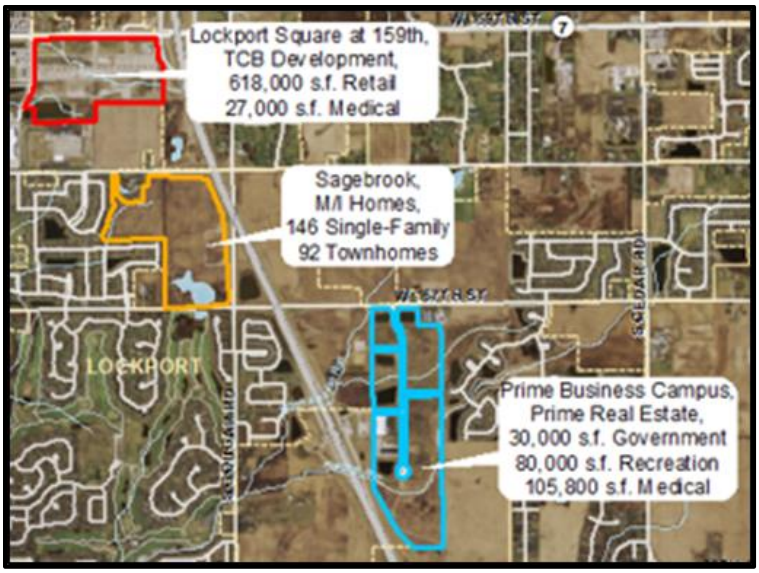
Figure 11. Map of urban classifications



Development inventory

CMAP maintains a region-wide database of proposed developments and tracks projects through completion. CMAP's NDD, which tracks proposed developments through completion, was used to account for near-term "pipeline" projects. For this exercise we are including all properties listed as under construction or committed (meaning there is a high degree of certainty that the project will move forward). On the residential side, the reported number of units becomes a part of the household allocation (after factoring for vacancy assumptions). Non-residential developments are reported by building square footage, which are converted to estimates of employment based on development type.

Figure 12. NDD example: Lockport



Since NDD is a dynamic dataset that is continually updated, the developments selected from the database were based on a snapshot from early November 2017, so it will not reflect information on projects which entered the pipeline after that. Extensive clean-up of the data was necessary to ensure that developments that were already completed, with representations of households or employment in our 2015 base data, were excluded from this set. Also, due to the gradual nature in which many residential subdivisions are completed, we made sure to net out the existing housing unit counts from our 2015 parcel-based housing inventory from the overall unit count for the development. Projects that were near completion were assigned to the 2020 allocation; residential subdivision properties which build out more slowly had a portion of the total held back to the 2025 allocation.

Since the Residential developments are tracked by the number of units, there is a fairly direct relationship between the number of added housing units and the forecast number of occupied households by imposing assumed vacancy rates on the housing unit total. Assignment of household population to new housing units is guided by prevailing household size for the township or Chicago Community Area that the development is located in. Commercial and

Industrial developments, which are tracked by size (in square feet), require an interim step to convert building area into employment based; data compiled by the U.S. Green Building Council[10] was used to develop the conversion factors. These employment estimates were then loaded directly into the LAZ for the allocation year (e.g. 2020, 2025) that the development is expected to be completed.

Table 8. Estimated per-worker space requirements by development type

Development Type	Sq. Feet per Worker
Office, Urban (Urban Classifications A - E)	243
Office, Suburban (Urban Classifications F - J)	300
Commercial (including Retail)	530
Manufacturing/General Industrial	495
Institutional	965
Warehouse/Distribution	1,448

Source: Louis Berger summary of U.S. Green Building Council data: *Building Area per Employee by Business Type* (2008)

Table 9. Summary of residential units and non-residential square footage assigned between 2015 and 2025 from NDD

	Residential (units)	Commercial (sq. ft.)	Office (sq. ft.)	Institutional (sq. ft.)	Manufacturing (sq. ft.)	Warehouse/ Distribution (sq. ft.)
Chicago	32,763	5,032,816	8,693,706	4,473,905	1,224,799	4,002,955
Sub. Cook	10,597	2,334,385	1,075,017	1,417,540	1,100,473	6,113,238
DuPage	5,064	461,425	548,218	918,631	1,434,418	5,020,191
Kane	5,360	331,914	232,131	708,626	845,575	6,949,870
Kendall	9,585	40,732	-	20,500	-	-
Lake	5,238	1,489,953	76,500	1,668,280	-	2,374,031
McHenry	6,871	51,459	-	570,593	743,600	141,047
Will	12,201	1,012,969	21,250	688,997	1,908,983	26,710,035
Region	**87,679**	**10,755,653**	**10,646,821**	**10,467,072**	**7,257,847**	**51,311,368**

Source: CMAP summary of Northeastern Illinois Development Database data, November 2017

[10] U.S. Green Building Council, *Building Area per Employee by Business Type* (2008). https://www.usgbc.org/Docs/Archive/General/Docs4111.pdf

In addition, certain anticipated developments that are not yet in NDD were included in our pipeline assumptions.

Table 10. Non-NDD development assumptions

Project	Impacted Years	Ultimate Employment
Old Chicago Main Post Office	2020, 2025, 2030	8,219
Obama Presidential Center	2025	400
Crete Intermodal & associated warehousing	2025, 2030, 2035, 2040	2,964
South Suburban Airport	2030, 2035, 2040	6,272

Local Area Allocation Factors

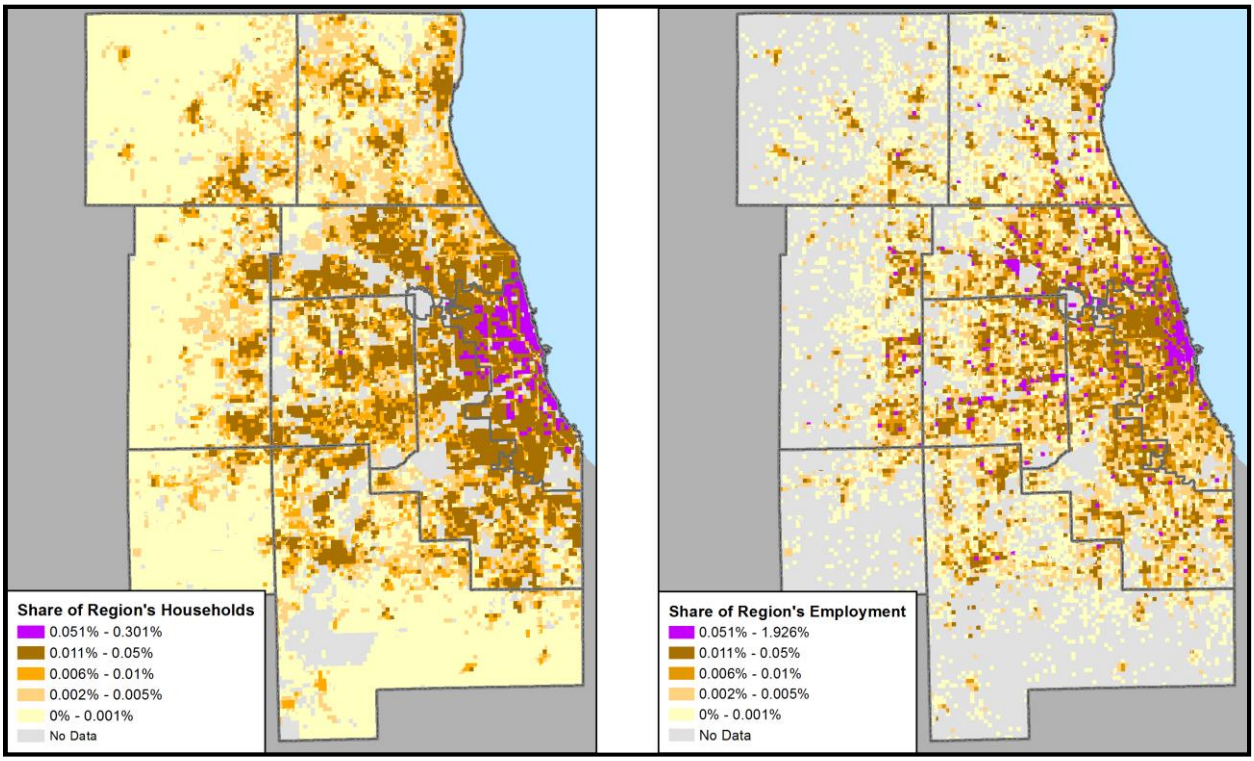
There are a total of eight market- and policy-based factors that control the allocation of population and employment. In the tool, each LAZ has scores representing its potential support of each of these factors. Factors are given weights to reflect priorities, and unique combinations of weights (the eight must sum up to 100 percent) constitute a scenario. Population and employment are allocated in separate steps, and can have different combinations of weights.

As for the factors themselves, CMAP and the consultant reviewed best practices from prior Local Allocation processes and assessed what data might best represent GO TO 2040 and ON TO 2050 transportation, land use, and environment, and economic priorities. Staff also considered feedback from stakeholders that the GO TO 2040 allocation did not appropriately reflect existing conditions and local constraints. Finally, the team also sought to identify factors that could mirror market activity. The final data sources were also evaluated for availability and reliability at the LAZ scale.

Share of regional households/employment

This factor emphasizes the importance of reinvesting in existing developed areas and incorporating existing densities. Developed areas would be more likely to receive additional residents and employees, and already-dense areas would receive higher amounts (within the prescribed limits of those areas' Urban Classifications). CMAP used localized 2015 estimates developed in-house to have an up-to-date post-recession distribution of population and employment. The score for each LAZ represents its share of the overall region total. The source for these figures are the Base-Year (2015) population and employment totals cited in Part 1 of this report (see **Figure 13**).

Figure 13. LAZ-level share of households and employment, 2015

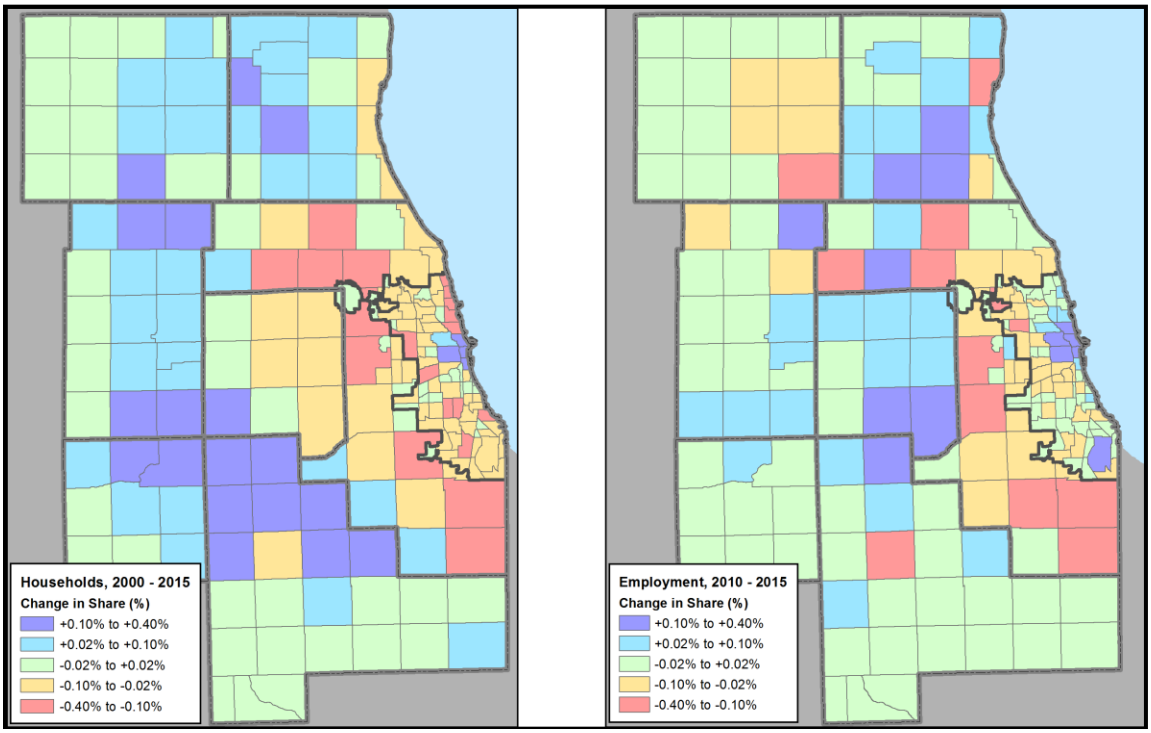


Change in household/employment share over time

This factor builds on the market exhibited by recent growth trends. Prioritizing this factor would emphasize new residents and employment in growing parts of the region. Again, to reduce for the impact of the recession, the 2000-15 period was used to measure household change; a similar measure for employment could not be developed over that period, so a 2010-15 range was used to take advantage of better consistency in data quality between those years.

Additionally, to mitigate the potential for geocoding errors generating false positives (i.e. results suggesting a change where no actual change occurred), the change-over-time data were aggregated to the MCDCCA geography, with the change-in-share value applied to all LAZ resident within each township or community area (see **Figure 14**).

Figure 14. Change in share of households and employment by MCDCCA



Infill supportiveness

CMAP has classified the region into areas with high, moderate, and low potential for infill. This analysis also incorporates land cover, employment, road network, and population data, as well as areas that municipalities have indicated as a priority for reinvestment via comprehensive, corridor, Transit-oriented development (TOD), or similar plans. Prioritizing this factor would emphasize reinvestment in existing communities as well as less-developed areas with municipal plans in place.

The data is based on research conducted for CMAP's ON TO 2050 Infill and TOD Snapshot Report,[11] with each LAZ classified as highly-, partially-, or minimally-infill supportive (see **Figure 15**).

Disinvested/economically disconnected areas

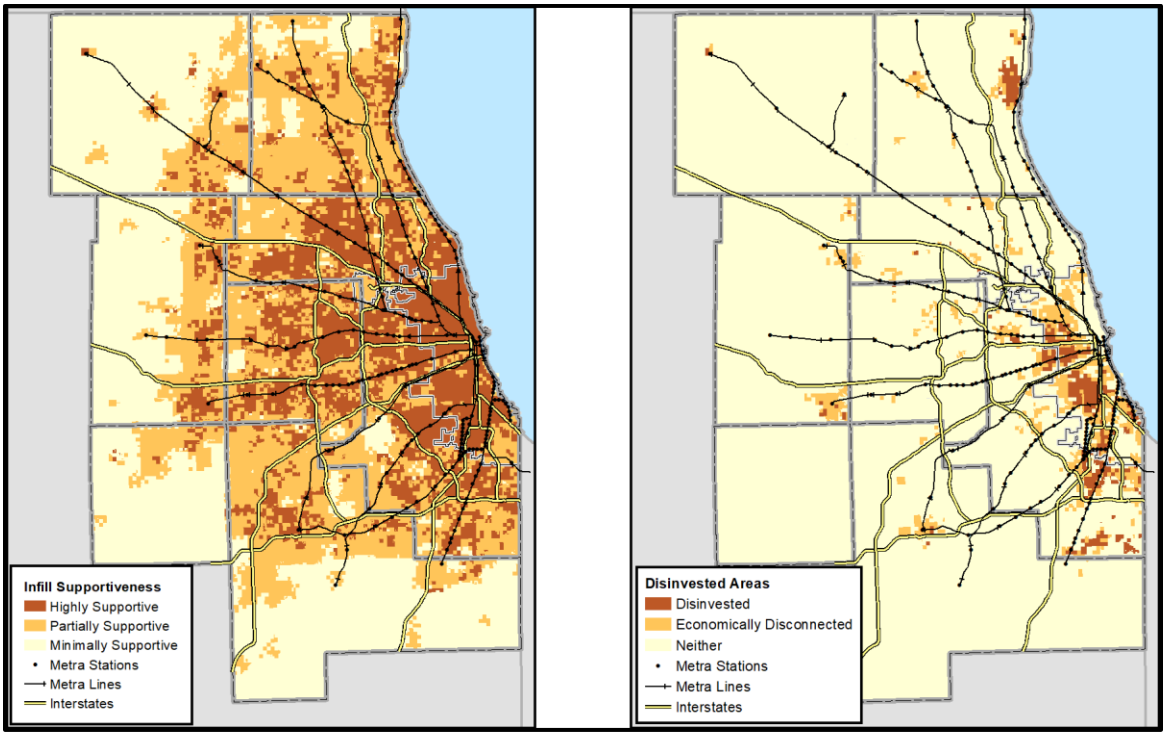
Disinvested areas are defined as mature areas which have experienced a combination of population decline, low property values, and high rates of vacancy in residential, commercial and/or industrial property. Economically disconnected areas (EDAs) contain concentrations of

[11] Chicago Metropolitan Agency for Planning, *ON TO 2050 Snapshot Report: Infill and TOD* (2017). http://www.cmap.illinois.gov/documents/10180/0/Infill+and+TOD+Snapshot+Report.pdf/4273b7d1-0a16-4c2f-a93e-dce1c2a472fd.

low-income households with either a minority or limited English proficiency population. ON TO 2050 places a priority on renewed public and private investment in these communities.

Staff used property value, vacancy, and employment data to identify disinvested areas; assignment of EDAs was based on research in support of the Inclusive Growth[12] strategy paper. Given the difference in the level of severity between these two categories (EDAs may be at risk for becoming disinvested areas but currently aren't experiencing the loss in population or jobs), LAZ classed as disinvested were weighted more heavily than EDAs (see **Figure 15**).

Figure 15. Infill-supportiveness (left) and disinvested/economically disconnected areas (right)



Municipal envelope

This factor uses the 2010 municipal boundaries, plus some adjacent area, to allocate growth. GO TO 2040 had a target for 75 percent of new non-residential square footage and 60 percent of new residential units to occur within the 2010 municipal envelope. Prioritizing this factor would emphasize growth in existing incorporated areas.

Property value

This factor serves as an indicator of market potential. Property value depends on many factors, including transportation accessibility, recent development trends, agglomeration, tax rates, and existing densities. At base, higher property values indicate higher market demand for an area.

[12] Chicago Metropolitan Agency for Planning, *ON TO 2050 Strategy Paper: Inclusive Growth* (2017) http://www.cmap.illinois.gov/documents/10180/515753/Inclusive+Growth+strategy+paper.pdf/0f01488d-7da2-4f64-9e6a-264bb4abe537.

Prioritizing this factor means that land with higher value will receive higher proportions of new residents and population. The population allocation was based on median residential property value, while the employment allocation is based on median commercial and industrial property value. Tax Year 2014 (the latest available) property assessment data was used for this factor.

Auto/transit accessibility

This factor measures the time required to commute to work from various parts of the region. Prioritizing this factor emphasizes growth in areas with good transportation and employment access. Auto and transit accessibility are based on the average generalized cost calculations estimating the average time it takes to travel from one Traffic Analysis Zone (TAZ) to all other TAZs in the region, weighted by population (for the household allocation) and employment (for the employment allocation.

For the highway accessibility measures, all TAZs within the CMAP travel demand model were used; for transit accessibility, only those TAZs that have walk access to transit were included for consideration with the transit accessibility factor.

In practice, the travel model and LAA tool were run in iterative stages to ensure that improved accessibility does not influence development patterns until after projects are completed. To accommodate this connection, both the LAA tool and the travel demand model had to be run in five-year increments, following these steps:

- Highway and transit accessibility figures for year T are loaded into the LAA tool;
- The tool is run, and LAZ-level socioeconomic results for the year T+5 are passed back to the travel model;
- The travel model is run for the year T+5, generating new accessibility calculations that incorporate the T+5 population/employment distribution as well as new transportation projects completed in the T-to-T+5 period.
- Highway/transit accessibility figures for year T+5 are generated and loaded into the LAA tool for the next iteration.

The LAA tool

Components

The LAA tool itself is an Excel-binary (.xlsb) spreadsheet containing base-year capacity calculations, forecast control totals, NDD inputs, and other resources to perform the allocation calculations. Each major component is described below:

<u>LAZ base year 2015</u>

Base-year data at the LAZ level for all required household and employment variables.

Control totals

Forecasted regional totals for all required household and employment variables in five-year increments from 2010 to 2050.

Development inventory

This is the worksheet that converts NDD development information into anticipated housing units and employment by LAZ. Housing unit amounts were drawn straight from NDD; employment estimates required an additional step of converting square footage (by development type) to total employees listed in **Table 8** above.

Allocation factor calculations

The factor calculations sheet is the heart of the tool; in this worksheet are all of the figures and calculations needed to generate the individual LAZ distributions for each factor, including the Urban Classification and attendant redevelopment assumptions, amount of developable space, household and employment "blocks," all base year variables, the variables that support the factor calculations, and the weighted average of factors used to determine the LAZ's ultimate allocation.

Urban Classification

This worksheet uses existing household and employment densities to determine the upper limits of each LAZ's growth based on their Urban Classification. These limits take into account overall residential density (sum of housing units divided by total residential land area) and employment density (sum of employment divided by total developed non-residential land area) for each Urban Classification type.

Allocation factors

Unique combinations of factor weights are input in this tab to create scenarios. Weights for the population and employment allocations can be different to reflect differing priorities for each type, as well as to correct for biases which would skew the distribution in unintended ways. Factors must sum to 100 percent. **Figure 16** shows the factor input table with the weights that were ultimately used for the final local allocation exercise. A discussion of the final set of factor weights can be found in later in this report.

Figure 16. Factor weight input screen

Population								
2015 Hholds Share	2000-2015 Housing Change Share	Infill	Disinvestment	Auto Access	Transit Access	Res Land Value	Muni Envelope	Total
8.0%	3.0%	25.0%	3.0%	10.0%	21.0%	5.0%	25.0%	100%
Employment								
2015 Employment Share	2010-2015 Emp Change Share	Infill	Disinvestment	Auto Access	Transit Access	Com Land Value	Muni Envelope	Total
3.0%	1.0%	20.0%	1.0%	25.0%	15.0%	15.0%	20.0%	100%

Redevelopment assumptions by Urban Classification

While upper limits on density are established in the Urban Classification worksheet based on existing densities, the tool allows for the inclusion of redevelopment assumptions at higher densities. This is accomplished through a "control" tab which allows the user to increase the density for future household and employment allocations through unique combinations of Urban Classification and existing land use type (Residential, Commercial/Industrial, and Vacant).

Household size calibration

Since the LAA tool explicitly allocates households to match regional controls, additional steps are required to ensure that household population variables at the LAZ level: a) sum to regional control totals; b) are in line with existing household size characteristics of the LAZ's surrounding area; and c) observe the overall trend of decreasing household size over the forecast period.

This was achieved by applying Township/Community Area (MCDCCA) rates of adults and children in households from the previous forecast year to the amount of new households allocated in the current forecast year to create an "estimated" number of adults and children; this total was summed and divided into the "actual" (control) number of adults and children in the current forecast year to scale the adult/child totals to match the regional control.

Vacancy rates

The tool accounts for total housing units (households plus vacant housing units); since Urban Classification density calculations are based on the number of housing units per acre, it was necessary to build in assumptions on vacancy rates, as 100 percent occupancy is highly unlikely. The Louis Berger team evaluated historic vacancy rates and determined that base-year vacancy was still above the historic (pre-Recession) trend and established target vacancy rates based on year 2000 vacancy rates. These adjusted vacancy rates were used to calculate the housing backlog, or the amount of existing housing units per county that could be used to absorb household increases without consuming additional developable space.

Employment allocation control

This worksheet was developed to address employment losses in LAZs that host industries expected to decline over the forecast period. While overall employment is projected to increase, certain sectors, such as Manufacturing (NAICS 31-33) and Transportation & Warehousing (NAICS 48-49) are expected to experience losses due to the long term impacts of new technology and supply chain shifts. The Employment Allocation Control sheet allows LAZ-level losses in these sectors to be offset by new employment in kindred sectors that have a tendency to co-locate with those industries. The purpose of this step is not to provide one-for-one job replacement (no more than 50 percent of any employment loss was replaced in this manner); it was designed to ensure that areas that have concentrations of declining sectors do

not simply "empty out," but instead experience reinvestment by sectors who could most effectively make use of the space. The O'Hare area, which has lost substantive employment in manufacturing since 2000, while still maintaining somewhat healthy vacancy rates, offers an example of how this occurs in the region.

Allocation calculations

The tool contains a worksheet for each forecast year out to the forecast horizon, providing the allocation for that particular year. It includes all socioeconomic variables from the previous forecast year, all new housing units and employment assigned through NDD, and remaining capacity. Calculations for a given year work in this manner for each LAZ:

1. The amount of remaining developable space is multiplied by the employment density assumption for the LAZ's Urban Classification to provide total remaining employment capacity.
2. Any new employment derived from the Development Inventory data is assigned to the LAZs for that forecast year, and overall remaining employment capacity reduced by that amount.
3. The weighted factor score is adjusted to reflect that LAZ's percentage of summed factor scores for all LAZ which still have capacity.
4. The factors are applied to the employment control total (new employment over the five-year period) to assign new employment. Through this exercise, some LAZ will reach capacity, leaving un-assigned (round 1 residual) employment.
5. A second-round allocation repeats Step 4 to assign the round 1 residual employment. Again, some LAZ reach capacity, leaving a small residual.
6. A third-round allocation assigns the residual employment (a very small number at this point) across all LAZ with capacity based on each LAZ's share of total remaining capacity.

Following this last step, the household allocation begins, based on remaining developable space (which includes subtracting space allotted for new employment above). Steps for household allocation are identical to the steps for employment.

Summary

A Summary tab provides totals at the county and MCD/CCA level, reporting Households, Population in Households, and Total Employment for each forecast year, allowing for quick review of results and comparison with other scenarios.

After the LAA tool has been run, a VBA macro script is run to generate a new Excel file with output variables for all forecast years at the LAZ level, along with worksheets providing county

and MCDCCA-level summaries, and a metadata sheet which lists all factor weights used for that run.

Outreach

CMAP held two workshops during the LAA phase to introduce the tool and process to stakeholders and to review initial results. Invitees included members of all CMAP working committees, and land use and transportation planning staff from the counties and the City of Chicago.

The first workshop was held on November 18, 2016, which included a presentation of the LAA tool and concepts by the Louis Berger team. Attendees were seated at tables with CMAP staff serving as facilitators to gather feedback on Urban Classification designation as well as to discuss and prioritize allocation factors. Twenty-two persons attended, including representatives of county planning and transportation departments, the RTA, and planning liaisons for numerous Councils of Mayors. Urban Classification feedback ranged from large-scale conceptual topics to the re-assignment of Urban Classification designation for specific areas. After a discussion of the various allocation factors, tables were asked to rank allocation factors in order of preference:

Table 11. Factor ranking at November 2016 workshop, average across all tables

Factor	Avg. Score	Rank
2015 Share Households/Employment	3.0	1
Transportation Access (highway + transit)	3.0	1
Infill	3.3	3
Recent Household/Employment Change	3.8	4
Disinvested Areas	4.3	5
Muni Envelope	5.3	6
Property Value	5.3	6

The second workshop was conducted twice, on February 24 and March 3, 2017. After reviewing the concepts introduced in the November workshop, attendees had an opportunity to see a simplified version of the tool (running a single, 35-year allocation) and develop scenarios based on unique combinations of factor weights for a better understanding of how the prioritization of certain factors affected results. This workshop also afforded the opportunity to begin to "dial in" the factor weights to develop a finalized scenario.

On March 16, 2017, CMAP staff shared for comment preliminary county-level 2050 projections with county planning staff and planning liaisons. Feedback, particularly from Lake and DuPage counties regarding population, and from Will County concerning employment, was used to reassign Urban Classifications for certain areas, and determine final factor weights for a March 2017 run of the LAA tool. This preliminary forecast was used as the source for Regionally-Significant Project (RSP) analysis.

Determining the final factor weights

Through March 2017, staff were working with a beta version of the tool which provided allocation results only for the year 2050. Subsequent to the submission of results LAA results for RSP analysis, the consultant delivered the final version of the tool capable of performing the allocation at the required five-year intervals. The five-year version of the tool allowed for more nuanced change—the amount of residual households and employment (described above in the Allocation Calculations section) was significantly smaller for each year, meaning more of the allocation was based on factor weights, resulting in more compact growth patterns over time.

The November workshop provided guidance on factor prioritization and served as a starting point for developing the final weights used in the LAA (see **Table 11** above). A series of initial runs were generated to analyze results when converting these priorities to factor weights that add up to 100 percent. Results of early tests were used to validate (and at times alter) Urban Classification designations for specific LAZ, as well as to determine reasonable redevelopment assumptions by Urban Classification type. Resulting (final) redevelopment bonus values are found in **Table 12**. Bonus values were kept low in the dense urban core to prevent assignment to the region's highly accessible and high value urban core beyond feasible densities; they are higher in the urban and suburban areas – particularly areas with strong transportation access - to promote development at higher densities than currently observed.

Table 12. Urban Classification redevelopment assumptions

UC	UC Name	Residential	Non-Residential Developed	Vacant
A	Chicago Central Business District	5%	1%	1%
B	Dense Urban	1%	1%	1%
C	Dense Urban with Business	10%	1%	1%
D	Urban	15%	15%	15%
E	Urban with Business	15%	15%	15%
F	Suburban	10%	10%	50%
G	Suburban with Business	15%	25%	50%
H	Low-Density Suburban	5%	5%	0%
I	Low-Density Suburban with Business	5%	15%	0%
J	Rural	0%	0%	0%

The factor weights themselves went through several rounds of testing to ensure reasonable results that conform to ON TO 2050 goals. Two examples:

- While there are "with business" distinctions for certain Urban Classification categories, the tool would allocate employment equally to those Urban Classification that did not have the with-business distinction if capacity allowed for it. To compensate for this, the Commercial Land Value factor for the employment allocation was raised to ensure that

more employment was steered to those LAZ that included more commercial and industrial land.

- Factors which were represented by a small number of LAZ had an outsized influence in the allocation and had to have factors adjusted accordingly. For example, LAZ identified as Disinvested account for only 1,361, or 6 percent of the total number of LAZ in the CMAP region (by comparison 64 percent of all LAZ, representing 96.5 percent of 2015 population and 98.2 percent of 2015 employment, are listed as having high or moderate infill potential). To assign an "average" factor weight (say, 12 percent) to disinvested areas would result in a high percentage of the overall allocation being assigned to a relatively small number of LAZ.

Additionally, staff conducted sensitivity analyses using the Morris Method[13] to determine the extent of interaction among factors, and to understand how sensitive the overall results were to changes in individual factors. Results showed that there was some level of interdependence—no one factor showed an independent influence on the output. Analysis of individual factors showed that, in general, the 2015 Share, Infill, and Land Value factors had the highest sensitivity, meaning that small changes in one of these factors would have a greater effect on overall allocation than factors such as recent change in share of households or employment.

The final factor weights used for the ON TO 2050 Local Allocation are listed below.

Table 13. Factor weights used in Local Allocation

Household Allocation Factor	Weight	Employment Allocation Factor	Weight
2015 Share of Households	8%	2015 Share of Employment	3%
2000 – 15 Change in MCD/CCA Share	3%	2010 – 15 Change in MCD/CCA Share	1%
Infill Supportiveness	25%	Infill Supportiveness	20%
Disinvestment	3%	Disinvestment	1%
Automobile Accessibility	10%	Automobile Accessibility	25%
Transit Accessibility	21%	Transit Accessibility	15%
Residential Land Value	5%	Commercial/Industrial Land Value	15%
Municipal Envelope	25%	Municipal Envelope	20%

Results

Below are summarized results and maps of the ON TO 2050 Local Area Allocation process. Additional data will be made available in October 2018 on the CMAP Data Hub: https://datahub.cmap.illinois.gov/dataset/2050-forecast-of-population-households-and-employment.

[13] Morris, M. (1991). "Factorial Sampling Plans for Preliminary Computational Experiments." Technometrics, 33(2):161-174.

Table 14. Projected household population by County and City of Chicago

	2010 Census	2015 CMAP Est.	2050 Projection	2015 Region Share	2050 Region Share	2015-50 Growth
Cook	5,104,393	5,147,272	6,080,680	61.4%	57.3%	18%
DuPage	904,784	920,870	1,081,213	11.0%	10.2%	17%
Kane	508,482	524,050	780,678	6.2%	7.4%	49%
Kendall	114,528	123,147	260,868	1.5%	2.5%	112%
Lake	682,753	685,936	882,584	8.2%	8.3%	29%
McHenry	307,113	305,696	473,471	3.6%	4.5%	55%
Will	669,013	678,149	1,056,213	8.1%	9.9%	56%
TOTAL	**8,291,066**	**8,385,120**	**10,615,707**	**100.0%**	**100.0%**	**27%**
Chicago	*2,635,352*	*2,666,508*	*3,113,476*	*31.8%*	*29.3%*	*17%*
Suburban Cook	*2,469,041*	*2,480,764*	*2,967,204*	*29.6%*	*28.0%*	*20%*

Table 15. Projected households by County and City of Chicago

	2010 Census	2015 CMAP Est.	2050 Projection	2015 Region Share	2050 Region Share	2015-50 Growth	2015 HH Size	2050 HH Size
Cook	1,966,356	2,010,906	2,472,005	63.2%	58.3%	23%	2.56	2.46
DuPage	337,132	350,329	431,017	11.0%	10.2%	23%	2.63	2.51
Kane	170,479	181,339	298,212	5.7%	7.0%	64%	2.89	2.62
Kendall	38,022	41,545	102,839	1.3%	2.4%	148%	2.96	2.54
Lake	241,712	249,722	342,782	7.9%	8.1%	37%	2.75	2.57
McHenry	109,199	111,629	191,460	3.5%	4.5%	72%	2.74	2.47
Will	225,256	234,191	404,751	7.4%	9.5%	73%	2.90	2.61
TOTAL	**3,088,156**	**3,179,661**	**4,243,067**	**100.0%**	**100.0%**	**33%**	**2.64**	**2.50**
Chicago	*1,045,560*	*1,072,048*	*1,275,527*	*33.7%*	*30.1%*	*19%*	*2.49*	*2.44*
Suburban Cook	*920,796*	*938,858*	*1,196,478*	*29.5%*	*28.2%*	*27%*	*2.64*	*2.48*

Table 16. Projected wage and salary employment by County and City of Chicago

	2010	2015	2050 Projection	2015 Region Share	2050 Region Share	2015-50 Growth
Cook	2,404,649	2,591,183	3,010,214	63.4%	60.2%	16%
DuPage	528,394	615,428	708,321	15.1%	14.2%	15%
Kane	174,234	210,590	301,050	5.2%	6.0%	43%
Kendall	22,945	27,478	53,732	0.7%	1.1%	96%
Lake	289,893	338,099	416,700	8.3%	8.3%	23%
McHenry	93,582	98,153	148,123	2.4%	3.0%	51%
Will	176,176	204,622	361,477	5.0%	7.2%	77%
TOTAL	3,689,872	4,085,553	4,999,618	100.0%	100.0%	22%
Chicago	*1,211,618*	*1,353,348*	*1,543,732*	*33.1%*	*30.9%*	*14%*
Suburban Cook	*1,193,031*	*1,237,835*	*1,466,482*	*30.3%*	*29.3%*	*18%*

Figure 17. Household population density, 2015 and 2050

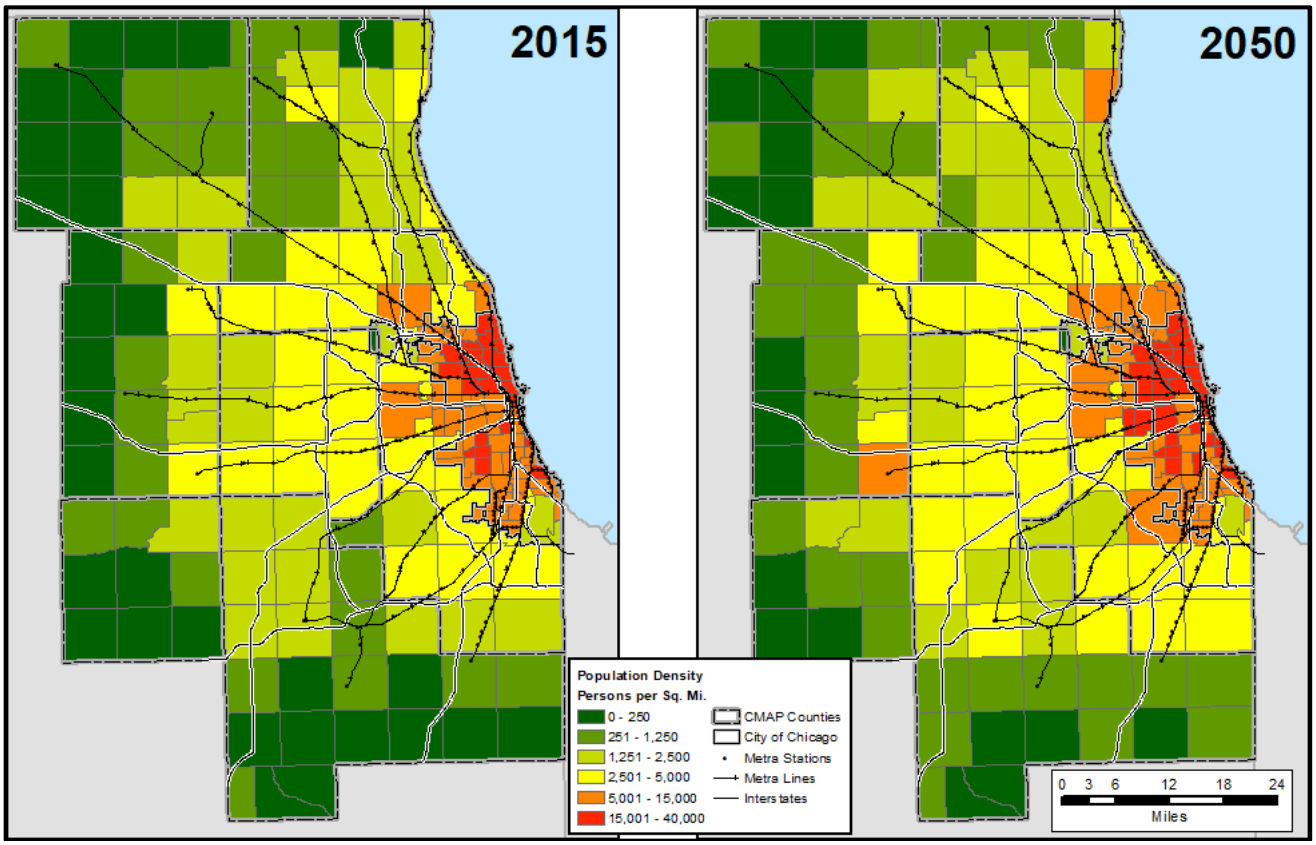
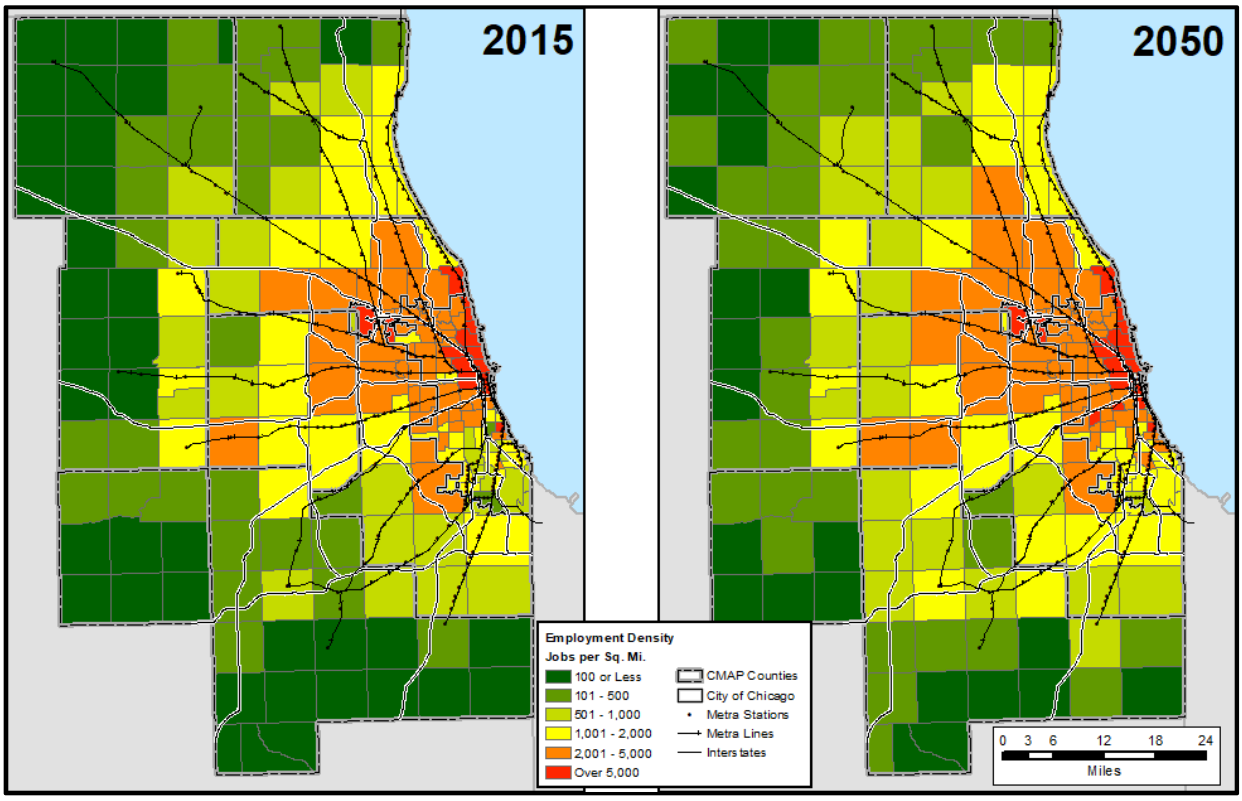


Figure 18. Employment density, 2015 and 2050



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The Chicago Metropolitan Agency for Planning (CMAP) is our region's comprehensive planning organization. The agency and its partners are developing ON TO 2050, a new comprehensive regional plan to help the seven counties and 284 communities of northeastern Illinois implement strategies that address transportation, housing, economic development, open space, the environment, and other quality-of-life issues.

ON TO 2050 is scheduled for adoption in October 2018.

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