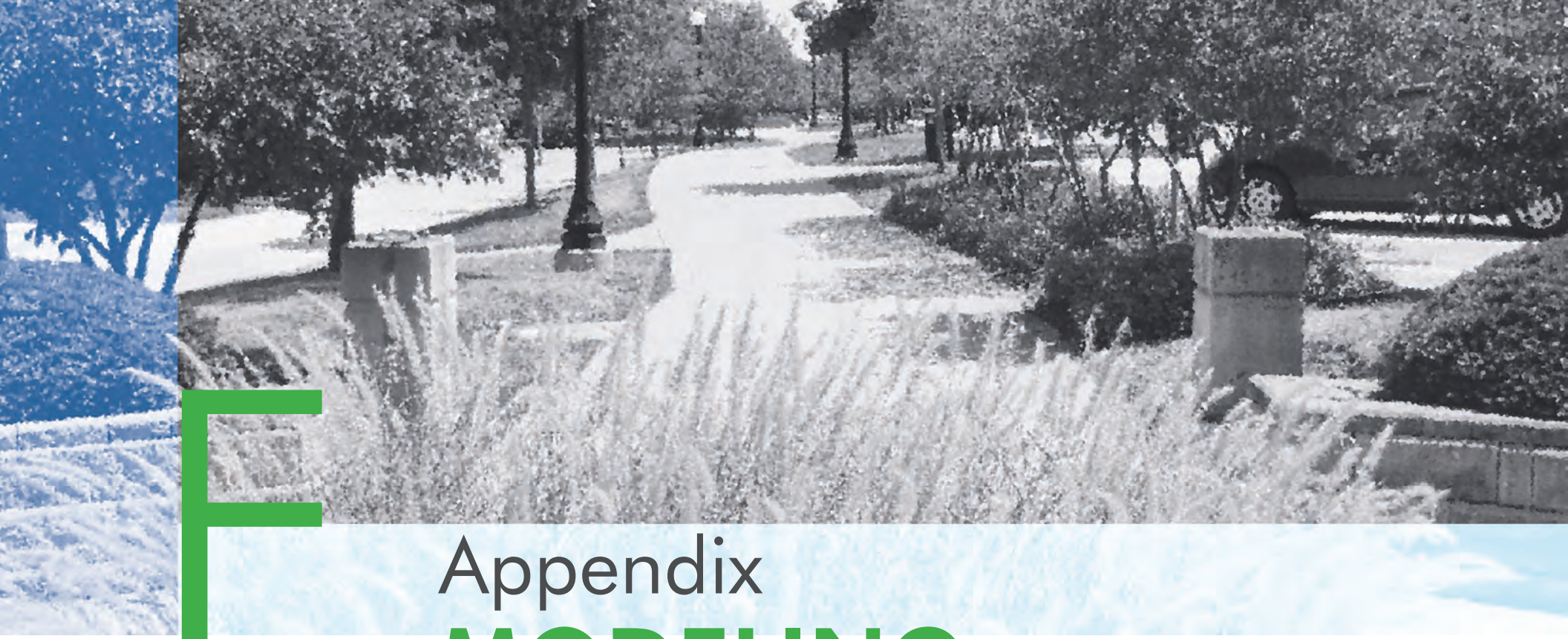


E

Appendix

MODELING FRAMEWORK

MODELING FRAMEWORK

Modeling future conditions is an important part of the LRTP process and is used to develop an understanding of the relationships between several attributes and outcomes such as the impact of the built environment on travel behavior or the relationship between travel behavior and air quality. Understanding of such relationships can then be used to inform visions, goals, and design strategies, and to predict change in future conditions in response to those visions and strategies. The transportation modeling framework can be used to answer questions such as "where are we headed?", "how can we change our trajectory?", and "how will our actions influence our future?".

The CUUATS transportation modeling framework is a set of interconnected models for Champaign County that can be used to analyze different aspects of our transportation planning process. The framework used in this LRTP has six models, each dealing with a different dimension of transportation planning issues. The representation of the modeling framework (Figure E.1) also depicts the workflow that CUUATS staff used to implement all the models.

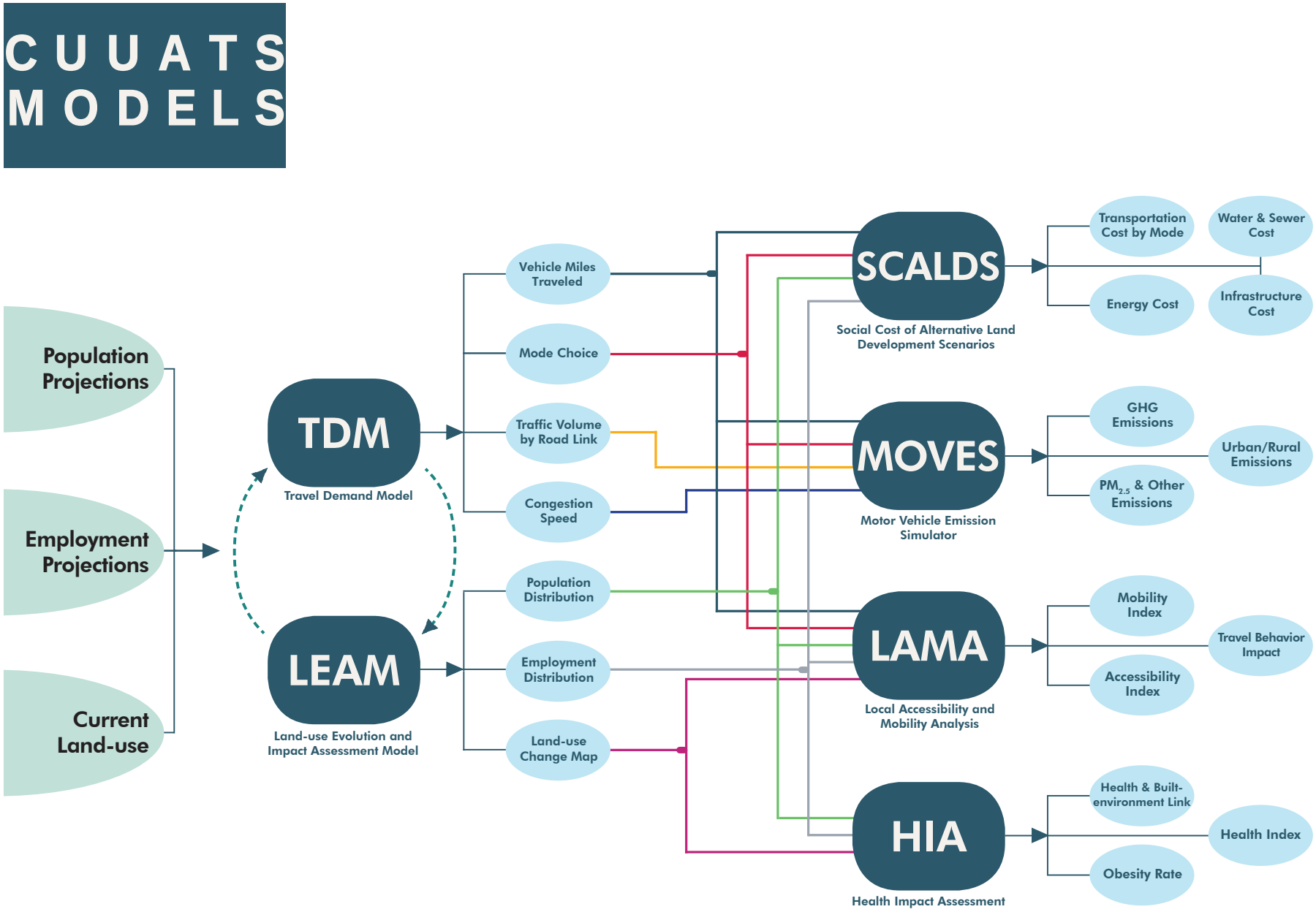
The first step in the modeling process was to develop population and employment projections for the region based on the existing conditions analysis. A comprehensive understanding of the existing conditions was also used to develop alternative scenarios that were evaluated and compared by the models. Once the projections were developed for the scenarios, the **Land use Evolution and Impact Assessment Model (LEAM)** was used to spatialize the projections, i.e. estimate locations of future developments. This was then used as an input to the **Travel Demand Model (TDM)**. The circular dashed line between LEAM and TDM signifies a close relationship between the two models.

CUUATS staff implemented LEAM and TDM iteratively every five years, so that the input of one model became the output of the other. This process ensured that the link between land use and transportation variables was appropriately addressed in the process. TDM and LEAM provided several outputs—such as vehicle miles traveled (VMT), traffic congestion, population and employment distribution—which became inputs to the other models:

- The **Social Costs of Alternative Land Development Scenarios (SCALDS)** model was used to estimate development and transportation-related social costs such as infrastructure cost, water and energy costs, travel cost, etc. These cost estimations are largely based on housing estimates from LEAM and travel behavior estimates from TDM.
- The **Motor Vehicle Emission Simulator (MOVES)** was used to estimate greenhouse gases (GHG) and other emissions from the transportation sector. TDM provided most of the inputs to MOVES such as vehicle miles traveled and speed distributions.
- The **Local Accessibility and Mobility Analysis (LAMA)** was used to evaluate accessibility and mobility across different neighborhoods in the urbanized area. The **Health Impact Assessment (HIA)** model was developed to establish a link between built environment and health. Both LAMA and HIA are currently existing conditions analyses at the neighborhood level and were not used to directly evaluate the scenarios.

The following sections of this appendix discuss in detail the methodologies and results of LEAM, MOVES, and SCALDS. Discussions on other models such as TDM, LAMA and HIA are available in other appendices.

FIGURE E.1 CUUATS MODELING FRAMEWORK



CUUATS staff developed two scenarios for the modeling process to analyze and illustrate the effectiveness of the policies and strategies outlined in the Champaign Urbana Long Range Transportation Plan 2040: Traditional Development 2040, and Sustainable Choices 2040. These scenarios were developed after an extensive existing conditions analysis to understand current transportation trends and to establish baselines for all of the transportation variables and other related variables.

Traditional Development 2040

The Traditional Development 2040 scenario is, in many ways, an extrapolation of the current trends over the planning horizon. As such, this scenario reflects no major changes in transportation policies and development patterns. Based on historical trends, the Traditional Development 2040 scenario entails development largely along the fringes of the urbanized area with future growth directed outwards from the urban core. Considering the pattern of development, the scenario also includes continued high reliance on automobiles for traveling. Overall, this scenario is characterized by low-density suburban development with limited improvements in the active transportation infrastructure.

Sustainable Choices 2040

The Sustainable Choices 2040 scenario was designed to incorporate the transportation vision defined in the LRTP 2040. This scenario was created to reflect the aspirations of the community. The vision for the scenario was based on the goals set at the federal and state levels; the planning pillars of the LRTP 2040; and the input of stakeholders and the public. The scenario emphasizes infill and redevelopment along with the objective of developing an enhanced multimodal network. It includes a high-speed rail network connecting the region to Chicago. This high-speed rail network, aligned with other supportive policies, is expected to result in growth in the downtowns of Champaign and Urbana, the University Avenue corridor, Campustown and the Research Park. The scenario also includes light industrial development along Olympian Drive. Overall, the Sustainable Choices 2040 scenario is an approximate representation of this plan's vision.

Owing to the limitations of the modeling process, not all elements of this plan are included in the scenarios, particularly those elements that do not entail any significant physical change to transportation infrastructure. Moreover, scenarios are approximations rather than accurate representations of the future and are limited by the availability and accuracy of the data. In spite of these limitations, scenarios can be useful in analyzing and comparing impacts of policies and strategies.

FIGURE E.2 TRADITIONAL DEVELOPMENT 2040 SCENARIO

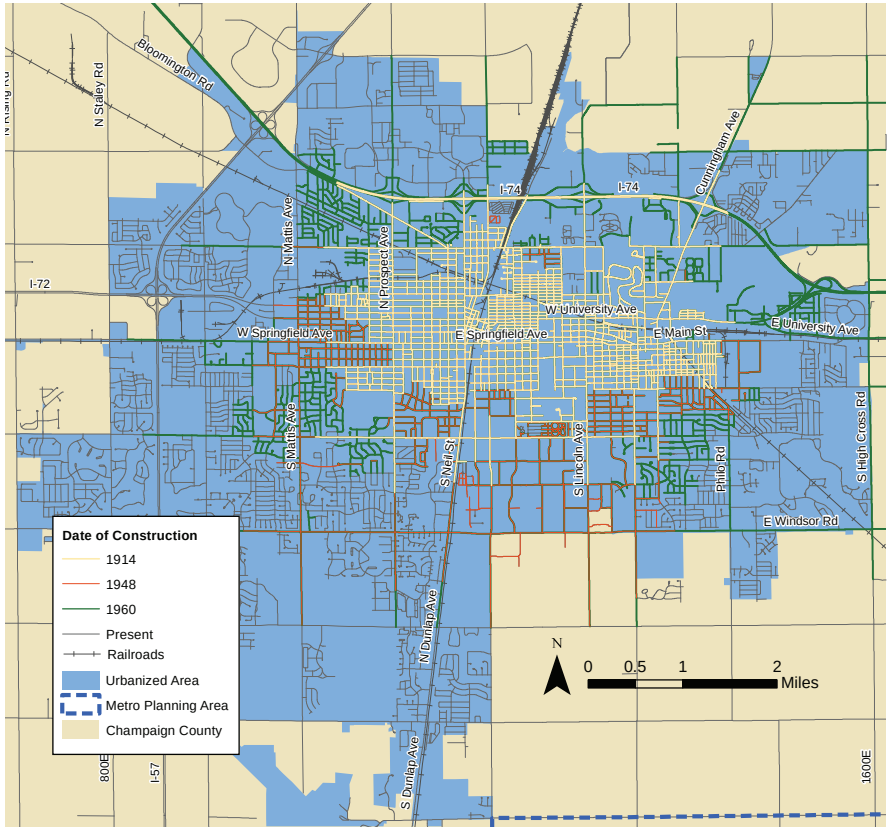
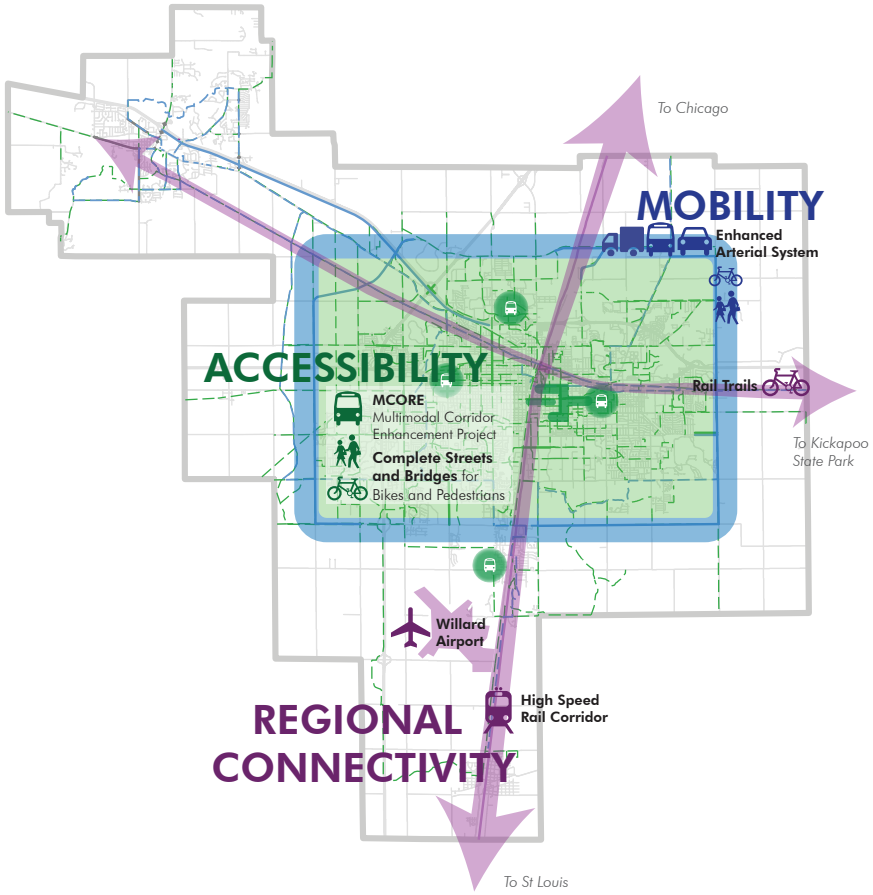


FIGURE E.3 SUSTAINABLE CHOICES 2040 SCENARIO



PROJECTIONS

The first step in the modeling process is to develop an understanding of the existing conditions, identify trends, and estimate projections for the planning horizon. These projections can then be used by other models to develop growth patterns, estimate traffic movements, and relate transportation variables to environment, health, accessibility, and mobility. CUUATS staff developed population and employment projections for Champaign County and the urbanized area for the two scenarios using specialized tools and inputs from member agencies and developers. The following sections outline the process of developing projections that was used by the staff.

Population

The main tool that was used to develop region-wide population projections was HandyAndy, developed by Dr. Andy Isserman at the University of Illinois. HandyAndy is an interregional cohort-component model that takes into account various demographic, health and migration factors to project population change over the planning horizon.

In a cohort-component analysis, the population is divided into different groups—or cohorts—by age, sex, and other attributes such as race and ethnicity. Population change calculations are done for each cohort based on factors such as births, deaths, in-migration, and out-migration. The main reason to divide the population in cohorts is that these population change factors vary across different cohorts. For instance, death rates are different for different age groups, and using a cohort component approach, each age group or cohort can be assigned a specific rate based on historical trends and other heath data. Another important feature of cohort-component analysis is the movement of people from one cohort to another. For instance, people in any age group move on to the next age group or cohort after a certain time period depending on the survival rates.

HandyAndy's methodology is described as "interregional" mainly because it uses in-migration and out-migration rates separately rather than as one net migration rate. Considering that in-migrants on one region are out-migrants of another, using separate rates ensures that changes in populations of different regions are interlinked with each other. For instance, the population change of Champaign County is sensitive to population changes in other regions when an interregional approach is used. Net migration rates, on the other hand, make population changes in a region somewhat independent of the changes in other regions. As such, an interregional approach gives a more realistic representation of migration patterns.

HandyAndy is currently formatted as a spreadsheet tool that guides the user through several calculations. The spreadsheet requires several inputs—such as historical population growth trends, birth and death rates, and migration rates—which are obtained from the Census, the Public Health District, CDC, and other sources.

HandyAndy was used to develop county-wide projections. Using those projections, CUUATS staff developed TAZ-level population projections by distributing the total population across all the TAZs primarily based on the 2010 population distribution. Moreover, some "no growth" zones were identified if there were infrastructure, environmental, or other barriers that made development unlikely in those zones over the planning horizon. The final step of the process was to get input from municipal

officials in Urbana, Champaign, Savoy and Mahomet. Officials helped with evaluation of the projections, and provided additional information on possible future developments. These additional pieces of information were used to manually adjust some of the projection numbers.

Employment

The processing of developing employment projections was similar to that used for population projections estimation. County-wide employment projections were developed using TrenDandy, a spreadsheet tool also created by Dr. Isserman. The methodology for developing employment projections is somewhat simpler, as projections are largely based on extrapolation of historical trends.

TrenDandy is a spreadsheet-based tool that allows easy integration and analysis of employment data. TrenDandy can be used with employment data from both the Standard Industrial Classification (SIC) and the North American Industry Classification System (NAICS). Historical employment data is used to estimate growth rates for different industries which are then used to estimate future employment. The main input to the spreadsheet is current employment, which was estimated using Business Analyst employment data. The data was geocoded and cross-referenced with the Champaign County Economic Development Corporation, and individual employers provided data to fill in some of the gaps.

As in the case of population projections, TAZ-level employment projections were estimated using county-wide employment projections obtained from TrenDandy. The final employment projections were estimated by making some adjustments based on the inputs provided by municipal officials.

The population and employment projections for the two scenarios are shown in Figures E.4 and E.5. The procedure for developing projections for the two scenarios was mostly similar. The Sustainable Choices 2040 scenario includes many elements of the vision outlined in this LRTP which, to some extent, explains the difference in projections for the two scenarios. For instance, in the case of the Sustainable Choices 2040 scenario, additional growth was predicted in and around the downtowns due to the construction of a high speed rail network and other supportive policies. Similarly, additional employment growth was predicted in the Research Park and near Olympian Dr. As such, both population and employment are expected to be higher in the Sustainable Choices 2040 scenario.

However, it is impossible to incorporate all elements of the LRTP vision in the scenarios. For instance, not all policies and plans involve changes in transportation infrastructure.

Detailed population and employment projections by Traffic Analysis Zone (TAZ) are included at the end of this appendix.

FIGURE E.4 TOTAL POPULATION PROJECTIONS

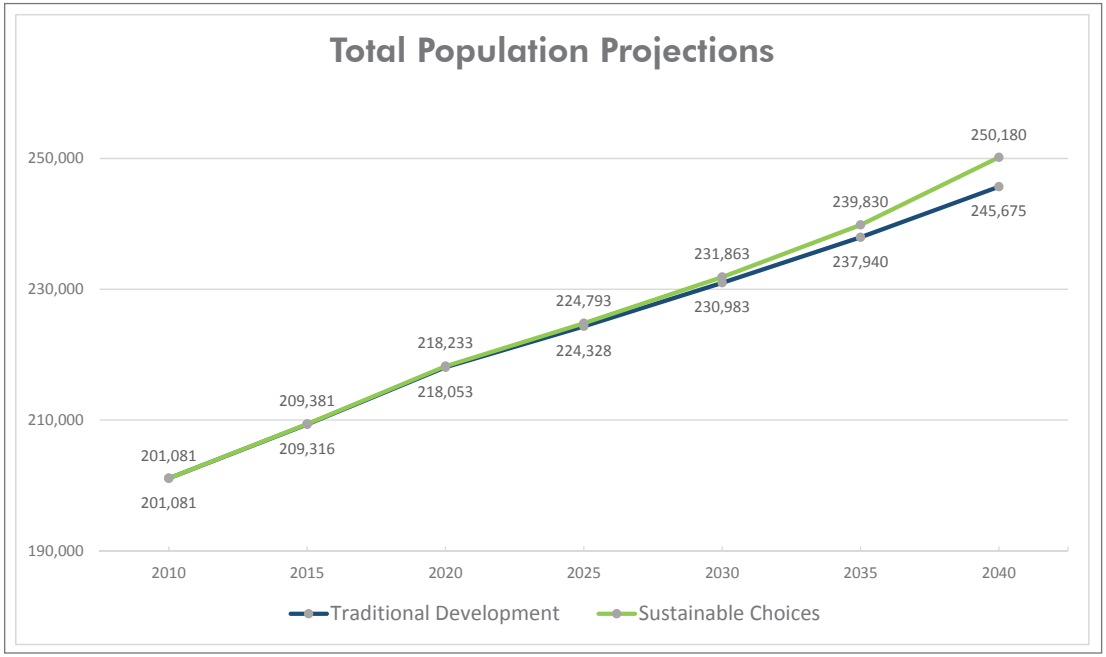
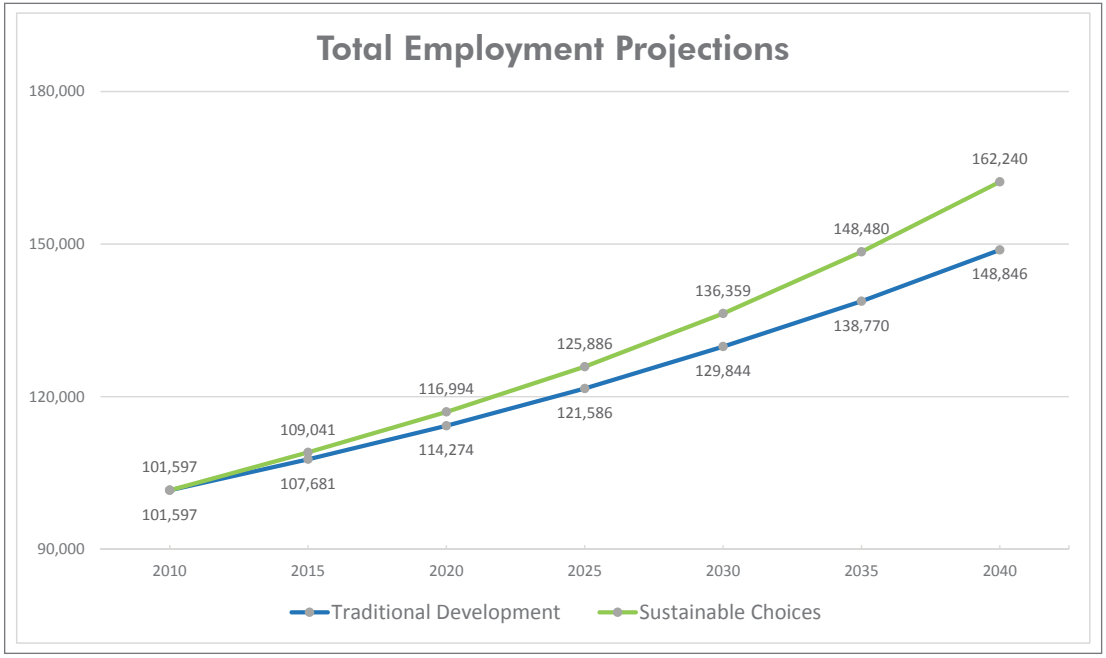


FIGURE E.5 TOTAL EMPLOYMENT PROJECTIONS



LAND USE EVOLUTION AND IMPACT ASSESSMENT MODEL

The Land use Evolution and Impact Assessment Model (LEAM) is a collection of interconnected models that predict changes in land use over a planning horizon based on a wide array of inputs. The primary objective of LEAM is to predict the spatial distribution of future growth by estimating the probability of development happening at any location within the planning area. LEAM was developed at the University of Illinois at Urbana-Champaign and was employed by CUUATS to analyze and predict land use changes from the present to 2040 for the two planning scenarios.

Based on the provided inputs such as population and employment projections, LEAM is able to simulate changes in land use with time. As such, LEAM is used to spatialize the projections in order to find out where additional residents and businesses are going to be located over the planning horizon.

LEAM in the Modeling Framework

In the modeling framework, LEAM serves as a starting point in the evaluation of any scenario because it converts characteristics of scenarios into to spatial datasets that are used by other models. LEAM works closely with the TDM, as outputs of the TDM serves as inputs for LEAM and vice versa. The TDM needs reliable estimates of the locations of households and businesses in order to calculate trip productions and trip distribution. Similarly, LEAM requires information on the changes in the transportation network and congestion levels to predict the locations of new developments. In order to account for this interdependency, LEAM and the TDM are implemented iteratively for every five years over the planning horizon. Such a process ensures that the link between land use and transportation is appropriately addressed in the planning process.

In the modeling framework, LEAM is also closely integrated with SCALDS. Development and growth patterns, as predicted by LEAM, serve as inputs to SCALDS, which then estimates social costs for alternative development scenarios. For instance, SCALDS relies on LEAM-based estimates of households living in different types of housing units, such as single-family or multi-family units, to estimate household energy and water costs. Other models in the modeling framework are indirectly connected to LEAM through the TDM.

LEAM Input

LEAM relies on a broad array of inputs related to projections and growth patterns to predict changes in land use. Apart from population and employment projections, users can specify other inputs that serve as “drivers” of growth in the region. These additional inputs are geared towards offering users more control over the spatial distribution of growth. For instance, known projects or future developments can be included in the modeling process so that their impact is reflected in the final results.

Projections

Projections are used to specify population and employment at a given point in time and are used by LEAM to estimate and balance predictions regarding land use change. The user can specify multiple projections to get more control over the final results. Each projection needs to have an associated density map that specifies future population and employment

density. This map informs LEAM of the amount of development that a cell can sustain. As such, there are three dimensions that have to be defined for any input projection: spatial extent or zone, time frame, and density. LEAM classifies projections into four categories: regional, sub-regional, redevelopment, and vacancy.

Regional Projections

These projections are made for the entire region that is being modeled, in this case, Champaign County. Figures E.4 and E.5 show the county-wide population and employment projections that were used to model growth in the two scenarios. As discussed in the section explaining the projections, the Sustainable Choices 2040 scenario was predicted to have higher population and employment than those predicted for the Traditional Development 2040 scenario. The projections are provided for five-year increments through 2040. This allows LEAM to produce growth results for intermediate years, which can be used in the TDM to model travel demand.

Sub-regional Projections

Sub-regional projections are projections for certain zones within the region. For instance, any planned or known developments can be incorporated into the model using sub-regional projections. Figure E.6 maps all of the growth zones that were used to model growth in the two scenarios. These growth zone delineations were based on the feedback from local municipalities. Projections were developed for each growth zone in conjunction with a development timeline.

The Traditional Development 2040 scenario has only those growth zones that reflect developments that have already been planned or proposed. The Sustainable Choices 2040 scenario includes additional growth zones as a result of projects—such as high-speed rail and others—included in this scenario. Growth within the urban core and industrial development along Olympian Dr. are the major additions in the Sustainable Choices 2040 scenario.

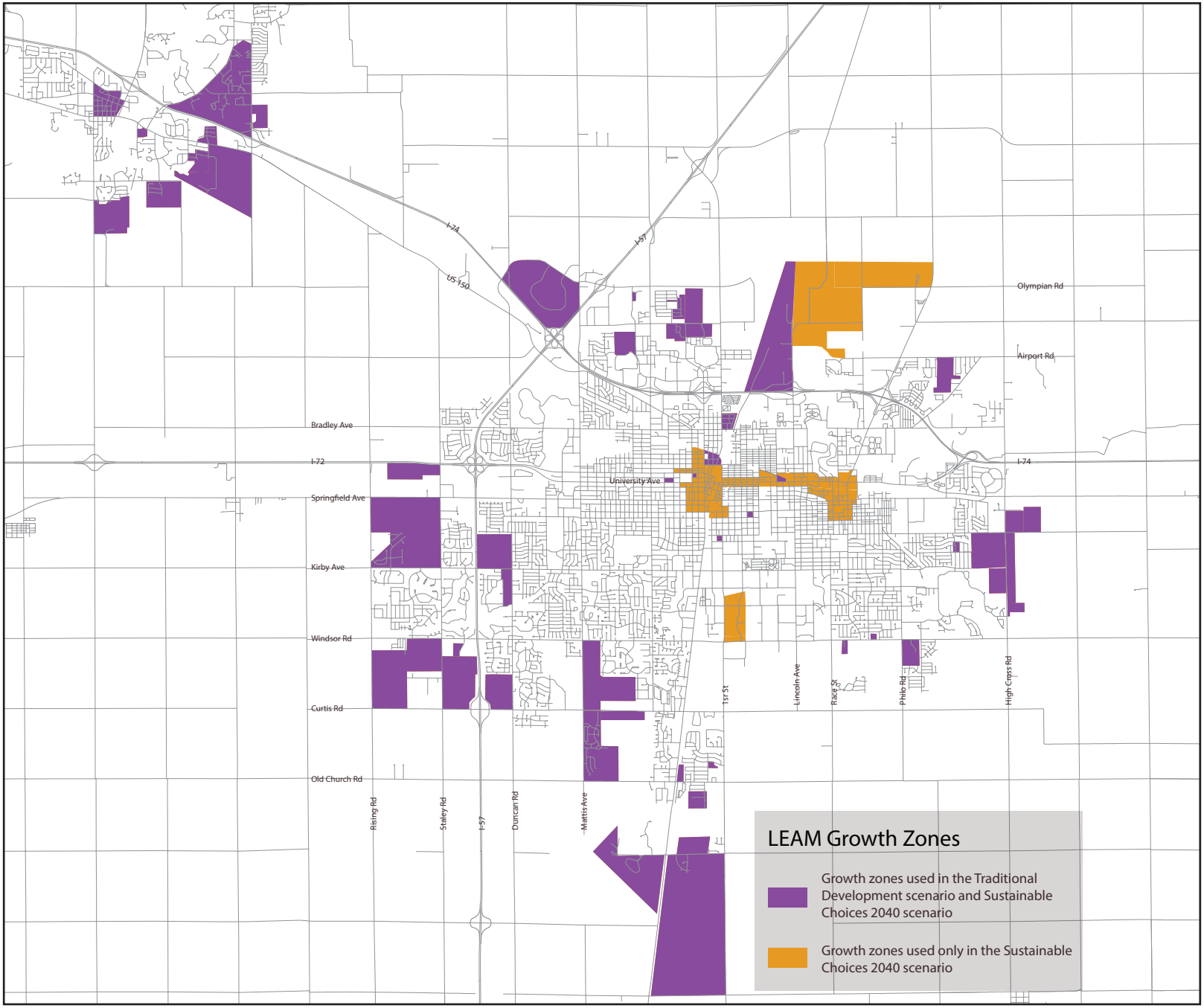
Redevelopment projections

Redevelopment projections can be used to plan future developments in locations that are already developed. By default, LEAM locates new developments in areas that are currently undeveloped, and hence, redevelopment projects have to be defined explicitly. This allows LEAM to predict land use changes in already developed parcels within the urbanized area. The Sustainable Choices 2040 scenario includes redevelopment zones that reflect infill and redevelopment growth near the downtowns and along the corridor connecting the downtowns.

Vacancy projections

Vacancy projections can be used to model expectations of long-term vacancy in certain zones. These projections allow the model to reduce the population or employment of certain cells over time.

FIGURE E.6 LEAM GROWTH ZONES



Drivers

While projections usually control the amount of development, drivers control the spatial distribution of development. LEAM uses drivers to develop probability maps that guide the location of development for different time periods. LEAM allows users to define several different types of drivers, which can help to "localize" the model and improve the reliability of the final results. All of the drivers defined by the user are essentially spatial layers that are combined by LEAM to estimate the probability of a particular type of development happening at any location during a given time period. Below are some of the drivers that can be defined by the user to guide spatial distribution of future developments.

Initial Land Use Map

The initial land use map serves as a starting point for the modeling process. It is usually a raster file with pixel value denoting the specific National Land Cover Database (NLCD) code associated with each cell. LEAM uses existing land use maps to identify the locations of residential, industrial, commercial, and other zones so that the future development predictions are compatible with the current land use. Land use maps also reveal other information, such as location of parks and institutions that can influence growth patterns. Figure E.7 shows the initial land use map, which was same for both scenarios.

Population and Employment Centers

These are usually point locations within the region that are considered regional "attractors" of growth. LEAM also takes into account population and number of employees for population and employment centers, which are used as weights when estimating the development probabilities. Generally, proximity to existing population and employment centers increases the probability of attracting future developments. Figure E.8 maps locations of the businesses in the area symbolized based on the number of employees. The maps also includes population centers, which are mapped as points corresponding to all of the municipalities.

Transportation Network

The transportation network is used to define the regional road network. LEAM requires each road segment to have two attributes associated with it: functional classification of the segment, and congested speed as predicted by the TDM. The transportation network is used by LEAM to estimate proximity and travel time to spatial features such as services, population centers, and employment centers.

No Growth Maps

No growth maps are used to designate certain areas that are not expected to be developed over the planning horizon. Figure E.9 maps all the no-growth zones that were included as part of the LEAM model. No-growth zones can be used to include parks, right-of-ways, and other parcels of land that are not going to be developed such as Willard Airport and the South Farms.

Special Drivers

Special drivers can be used to include more variables in the process and exert higher degree of control of the modeling results. Factors such as zoning regulations, tax rates, and annexation patterns can be accounted for in the model depending on the availability of reliable datasets.

Once all the drivers have been defined, multiple drivers are combined to form a driver set. Each driver set has an effective year associated with it, and users can define multiple driver sets for one scenario to simulate changing factors of growth in the region.

FIGURE E.7 BASE LAND USE MAP

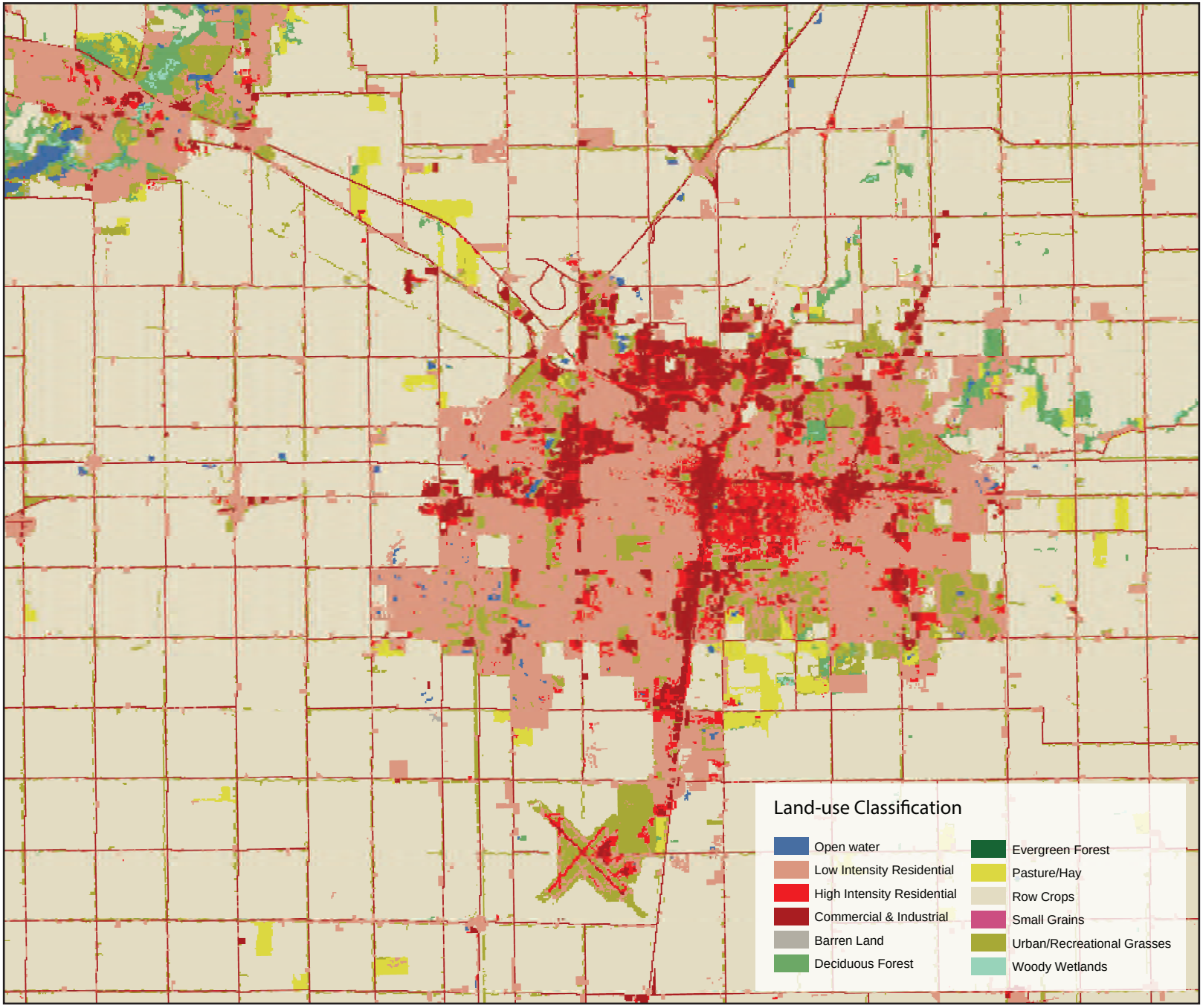


FIGURE E.8 BUSINESS LOCATIONS

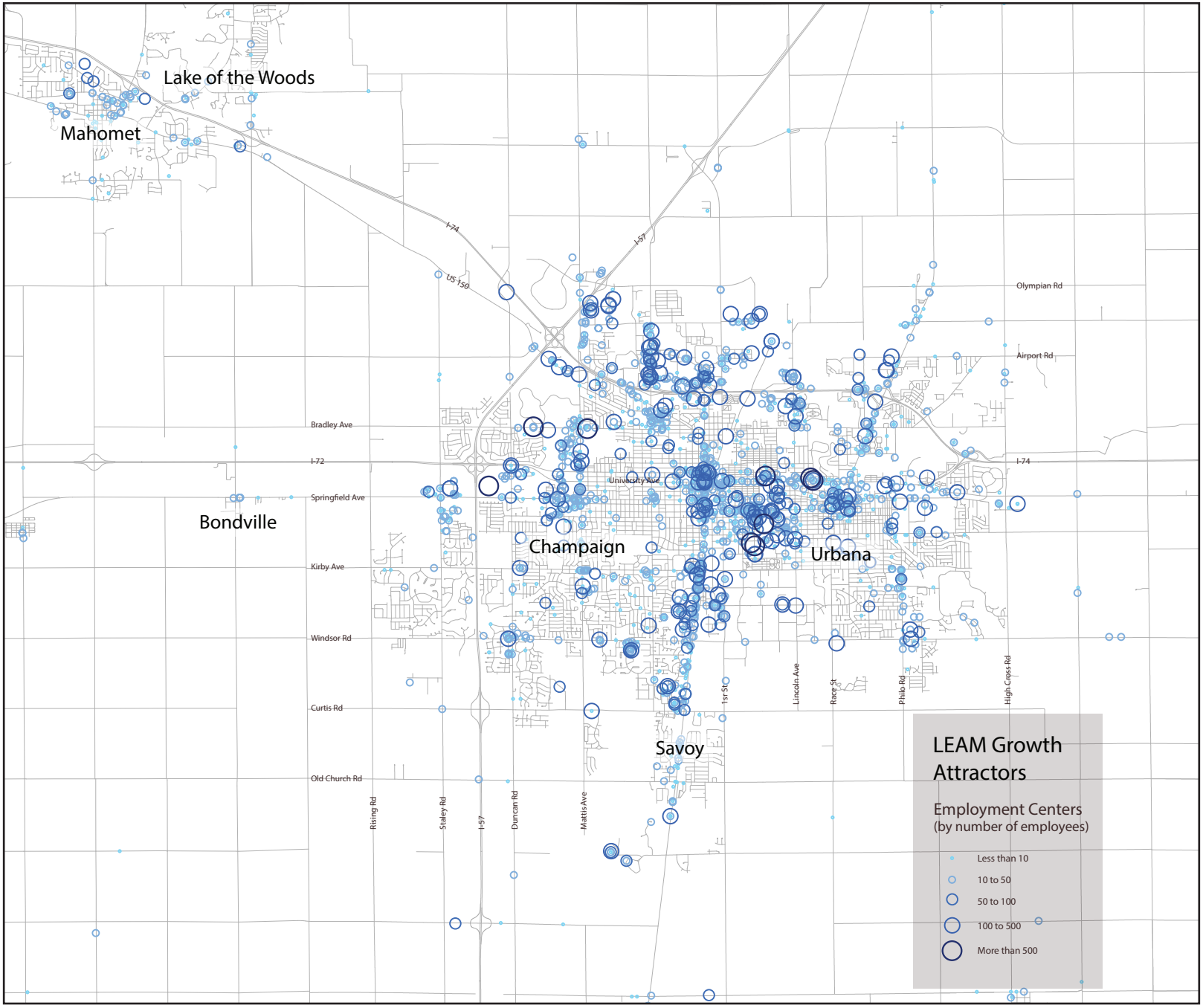
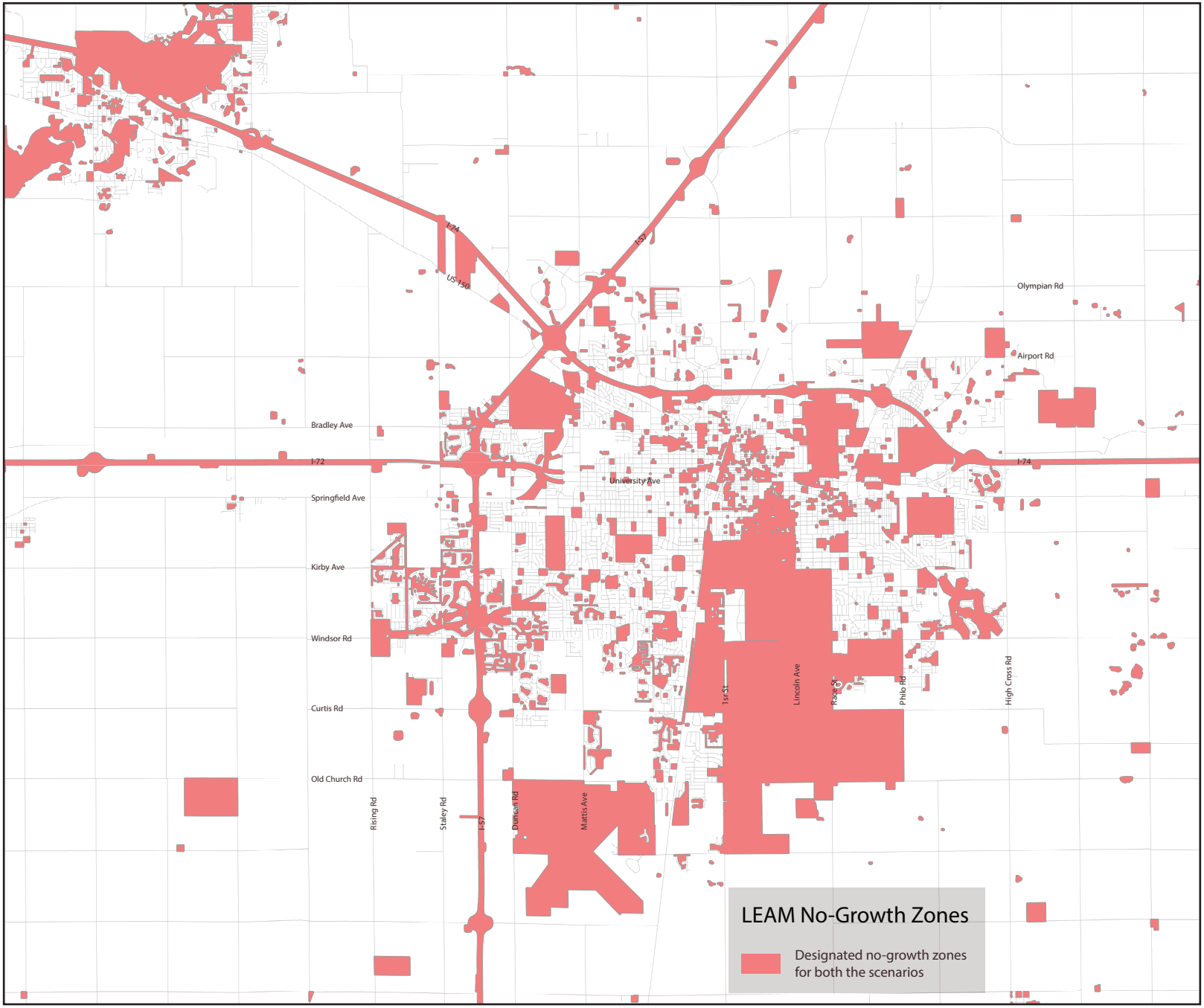


FIGURE E.9 NO-GROWTH ZONES



LEAM Methodology

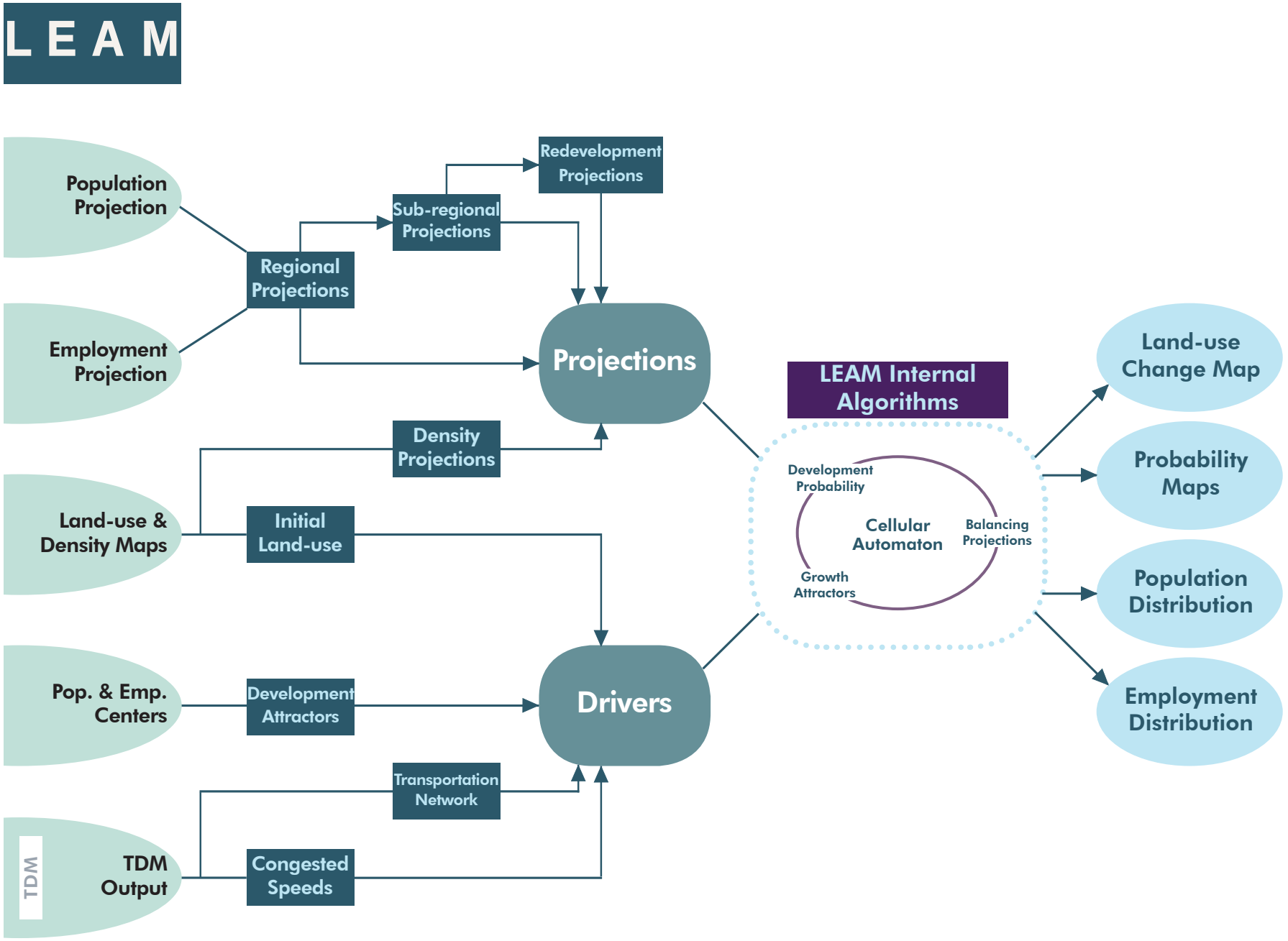
Currently, CUUATS uses a web portal where inputs for different scenarios are uploaded and processed. The LEAM web interface allows user to develop scenarios by uploading different components of the scenario. Once the scenario is completely defined, the processing begins automatically, and the results are posted in the same section as the defined scenario.

LEAM is a cellular automaton model whereby the planning area is divided into a discrete number of cells. Each cell has a state assigned to it, such as agricultural or developed. Moreover, each cell has certain attributes such as population and employment. The state of the cell, together with the attributes, is used to define the spatial distribution of land use. The raster created by LEAM has a very high (30 meter by 30 meter) resolution, which allows LEAM to analyze and capture spatial variations within traffic analysis zones (TAZs).

The most important part of the process is the development of probability maps, which depend on a cell's current state, the state of its neighbors, and the spatial input provided by the user in the form of drivers. Drivers are defined for a specific period of time and include spatial data describing population centers, employment centers, the transportation network, land use, no growth areas, etc. As such, drivers of growth are used to estimate the probability of development occurring at a particular location. For instance, proximity to existing population and employment centers increases the probability of development. The transportation network and the current and future traffic conditions also play an important role since proximity is based largely on travel time on the road network. Since each driver has a time period associated with it, the driver becomes activated only when growth within that particular time period is being modeled. Since CUUATS used LEAM and the TDM iteratively, CUUATS used different transportation network drivers for different time periods so that LEAM could take into account changes in the transportation network and the traffic conditions when modeling land use changes.

The process starts with a grid representing the initial state of the cells. Then the model runs a series of iterations whereby cells change states and attributes based on the inputs provided by the user. Inputs such as growth drivers are used to develop probability maps which represent the likelihood of cells changing states during any iteration. A small part of the process is randomized to produce results that are stochastic in nature. Projections are used to control the quantity and the rate of change for the entire region and the different sub-regions. LEAM uses internal feedback mechanisms to ensure that accumulated changes match the overall projections for the region. For instance, apart from region-wide projections, the user can define sub-region or effective area projections. LEAM ensures that the final output reflects both the regional and the sub-regional projections provided by the user.

FIGURE E.10 LAND USE EVOLUTION AND IMPACT ASSESSMENT MODEL



LEAM Output

Since LEAM uses a cellular automation process, its outputs are mostly raster maps that have the same 30-meter resolution that LEAM uses for the analysis. The resolution of the raster images is high enough that their results can be aggregated easily at different scales. Most of the output from LEAM relates to the predicted location and quantity of future residential and business developments. Following is the list of outputs obtained from LEAM.

Change map

The change map provides the final land use state of all cells that changed states during the modeling process. For instance, a cell that changed states from agricultural to residential would be coded as residential in the change map. Land use codes are based on the National Land Cover Database (NLCD) classification system. If a cell is coded as zero in the change map, that cell retained its original state over the planning horizon.

Population per cell

The population per cell raster file shows the final the population change for every cell in the planning area. The value of the cell indicates the predicted change in population of the cell over the planning horizon. The quantity of change is largely based on population density maps.

Employment per cell

The employment per cell raster file shows the final employment change for every cell in the planning area. As in the case of population change, LEAM uses employment density maps to estimate the quantity of employment that can happen at a location.

Households per cell

The households per cell raster file contains the final change in the number of households for every cell in the planning area.

Change Year

The change year raster file stores the year in which a cell changed from one state to another. This map can be used to visualize the timeline for new developments. For instance, change maps can be used to predict which undeveloped parcels are likely to be developed sooner given the existing land use.

Probability Maps

During each iteration, LEAM calculates the probability of land use change for each cell in the study area. Probability maps depend largely on the growth drivers, the current state of the cell, and the state of the surrounding cells.

Sanity Check

Since the user defines multiple projections as the input, there is a possibility that certain projections are incompatible with each other. Alternatively, in the case of sub-regional projections, it may not be possible to accommodate the projected development given that the maximum development that might happen in any sub-region is constrained by the available area and the density of development. As such, the model would not be able to meet all the constraints set by the projections. In that case, before running the model, LEAM provides a sanity check report that points out if there are any errors or inconsistencies in the projections.

Most of the outputs from LEAM are raster files that can be imported and symbolized in ArcMap. Raster output easily can be aggregated at different geographic scales for further analysis. For instance, LEAM can be customized to aggregate population and employment growth by TAZ, which can be used in the TDM. Figures E.11 and E.12 show the growth maps for the two scenarios. As expected, LEAM predicts most of the new development to happen along the fringes of the urbanized area for both scenarios. Since most of the growth drivers are the same in both scenarios, the pattern of growth along the fringes is similar in both cases.

The growth patterns for the two scenarios are very similar, as many of the growth drivers are the same across the scenarios. LEAM predicts that most of the new development will occur along the fringes of the urbanized area near major roadways.

In the case of the Traditional Development 2040 scenario, growth is predicted to happen almost exclusively outside the current urbanized area. The scenario does not have any infill development or redevelopment projects, and pushes all the growth outwards from the urban core.

In accordance to the defined growth zones, LEAM predicts the Sustainable Choices 2040 scenario to have high growth near the downtowns and along University Avenue, connecting the downtowns of Champaign and Urbana. Also, as expected, the predicted density of developments in these zones is much higher than those observed in developments along the urban fringe. The Sustainable Choices 2040 scenario is also predicted to have high employment growth near Olympian Dr. In addition, predicted employment growth near the Research Park is also higher in the case of the Sustainable Choices 2040 scenario.

FIGURE E.11 TRADITIONAL DEVELOPMENT 2040 SCENARIO LAND USE

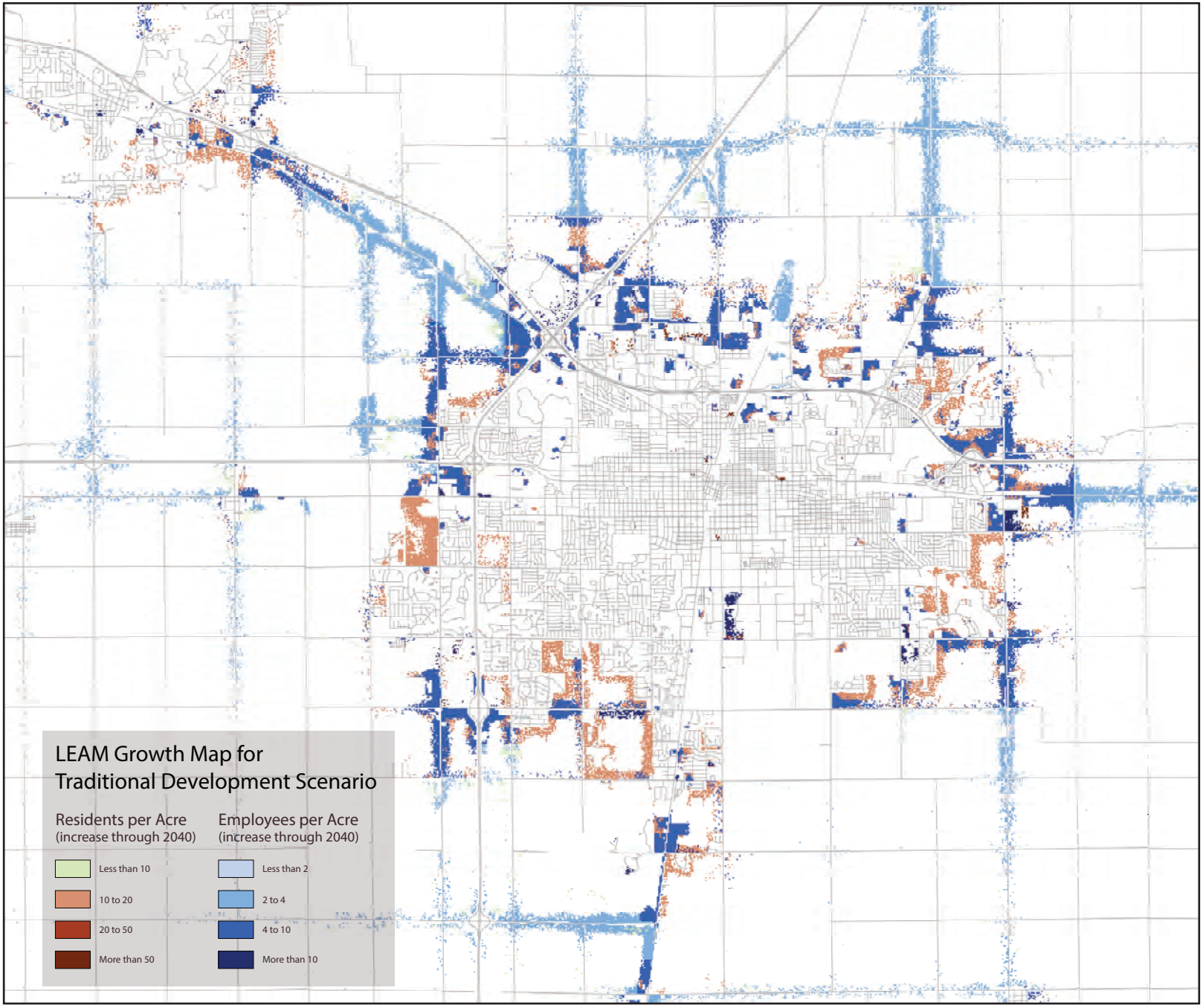
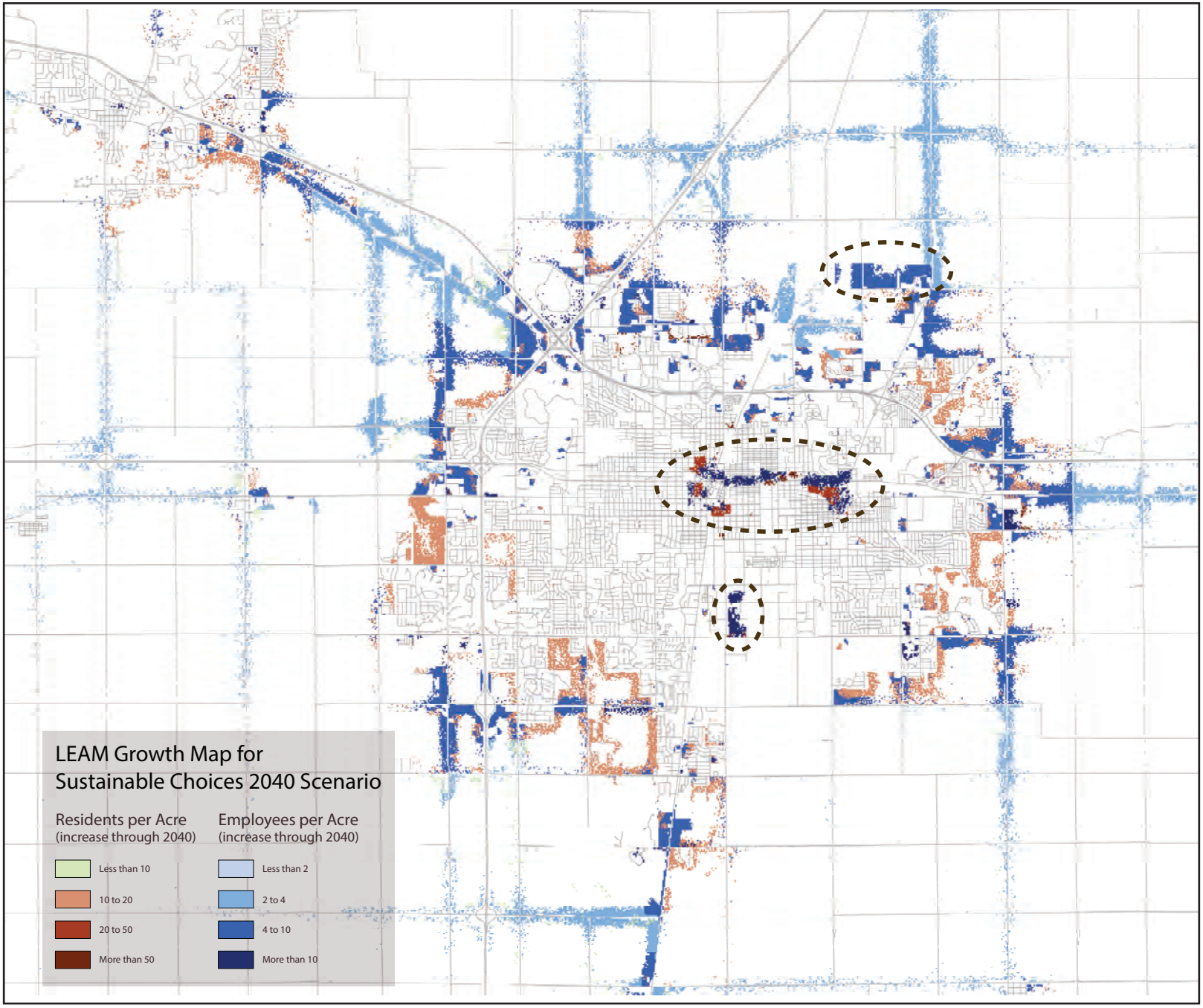


FIGURE E.12 SUSTAINABLE CHOICES 2040 SCENARIO LAND USE



MOTOR VEHICLE EMISSIONS SIMULATOR

The Motor Vehicle Emission Simulator (MOVES) is a model developed by the U.S. Environmental Protection Agency (EPA) that can estimate emissions of a wide range of pollutants from mobile sources. MOVES is the most comprehensive tool available that can be used to estimate greenhouse gas (GHG) and other emissions from the transportation sector. Emission processes and rates were developed by EPA based on analysis of numerous emissions tests and studies.

MOVES is used to model emissions from different scenarios and to answer various "what if" questions, such as "what will be the total GHG emissions in the future if certain transportation policies are implemented?". To answer such questions, MOVES takes into account a broad array of inputs such as vehicle miles traveled (VMT), vehicle types, road types, fuel compositions, local weather conditions, and so on. Based on the inputs, the model performs a series of calculations that simulate the vehicle emission processes and provides results in the form of total emissions or emission rates for a given location over a given time period. MOVES is used by state and local transportation planning organizations (MPOs) to keep track of levels of emissions and pollutants. CUUATS uses MOVES to analyze the impact of future land use and transportation decisions on regional emissions and air quality.

MOVES in the Modeling Framework

In the CUUATS modeling framework, MOVES provides the crucial link between transportation and the environment. The TDM, along with LEAM, serves as the primary source of inputs to MOVES. Using these inputs, MOVES is able to quantify the total amount of emissions for different scenarios. Since MOVES estimates emissions from motor vehicles, the most important input is VMT estimates, which are based on the output from the TDM. In the modeling framework, MOVES potentially can be linked to the Health Impact Assessment model, since its output can be used to predict changes in air quality. Overall, MOVES provides an environmental and air quality dimension to the transportation modeling framework.

MOVES Input

In order to predict vehicle emissions reasonably, MOVES requires a very detailed set of inputs. MOVES also relies on a comprehensive internal database, which provides most of the generic and some localized inputs. Users provide inputs for their particular area of analysis, which serves to localize the modeling process. MOVES has default databases created for all counties in the U.S., which can be used as an input in cases where more accurate local data are not available. The following sections discuss some of the major inputs that were used for the modeling process.

Scale

Scale, in MOVES terminology, indicates the geographic scale of analysis. For the LRTP 2040, this scale was set as Champaign County. MOVES selects the default database based on the scale of analysis. For instance, MOVES' internal database has default data specifically for Champaign County, which is used in the modeling process. There is an option to define a custom scale that can be used to evaluate emissions at a different geographic scale, such as the Champaign-Urbana urbanized area.

Time Span

The time span parameter can be used to specify the time period for the analysis. For the Baseline 2010 scenario, this was set to the total annual emissions for 2010. For the Traditional Development and Sustainable Choices 2040 scenarios, calculations were done for the year 2040.

Vehicle Type/Fuel Combinations

The vehicle type/fuel combination option allows users to model emissions from various combinations of vehicle type and fuels such as gasoline passenger cars, diesel buses, electric cars, and so on. MOVES has built-in functions to simulate emission processes for different combinations of vehicle types and fuels. The same standard combinations of gasoline and diesel fuel vehicles were used in both scenarios to allow easy comparison of emissions between the scenarios.

Meteorology

The meteorology parameter includes temperature and humidity data for each hour for a typical day of every month. MOVES has a 30-year average for Champaign County, which was used for the analysis. The meteorology data were kept the same for the 2010 and 2040 scenarios because not enough information was available to model changing weather patterns due to global warming over the time horizon.

Source Type Population

The source type population option is used to specify the total count of vehicles of different types that exist in the study area for the given time period. Vehicle registration data obtained from Illinois Secretary of State were used to estimate the population of different types of vehicles in 2010. The vehicle population in 2040 was estimated using an appropriate growth rate over the time period.

Age Distribution

Apart from vehicle count, MOVES also takes into account the age of vehicles for each vehicle type. These data were also estimated using vehicle registration data. The vehicle age distribution was kept constant over the years.

Vehicle Type VMT

The vehicle type VMT option is used to specify the annual VMT by type of vehicle for the study period. In addition to the total annual VMT values, there are fractions for months, days, and hours used to estimate the fraction of the total VMT that occurs during specific months, days, and hours. For instance, the month fraction for June would be used to estimate fraction of total VMT that occurs during that month. The TDM was used to estimate total VMT on all road links in Champaign County, which represented Annual Average Weekday Vehicle Miles Traveled (AADVMT). The annualized VMT was estimated using a spreadsheet tool provided by EPA that estimates annual VMT from AADVMT using default month, day and hour fractions. EPA also provides default vehicle type fractions, which were used to divide the total VMT by vehicle type.

Road Type Distribution

Road type distribution refers to the proportion of VMT across different road types. MOVES classifies road links into four types: rural restricted, rural unrestricted, urban restricted, and urban unrestricted. The VMT for each road link in Champaign County was obtained from the TDM, which also includes a detailed classification of road types. Output from the TDM was reclassified to match MOVES road type categories, and VMT was aggregated for different road types to get the final distribution of VMT by road type. MOVES requires road type distributions for each vehicle type, but since the TDM output does not include that level of detail, the same road type distribution was assumed for all vehicle types. The proportion of VMT in the urbanized area was higher for the Sustainable Choices 2040 scenario compared to the Traditional Development 2040 scenario, a pattern also reflected in the emissions estimates for rural and urbanized area (discussed later).

Speed Distribution

The speed distribution option is used for specifying the average speed on different road types during each hour of a typical weekend and weekday. The TDM gives the average congested speed for each road link in Champaign County. These speeds are categorized into sixteen "speed bins" as defined by MOVES. The final input that MOVES requires is the average speed fraction, which is the fraction of driving time spent in each speed bin. This fraction is estimated using Vehicle Hours Traveled (VHT) data also provided by the TDM.

Ramp Fraction

MOVES has a separate function to estimate emissions on freeway ramps and thus requires the user to provide input specific to ramps. The ramp fraction is the fraction of time spent on ramps in case of urban/rural restricted road types. The TDM provided the data regarding VHT on different road types including the ramps. The ramp fraction was estimated as the fraction of VHT on ramps out of the total VHT on freeways.

MOVES Methodology

MOVES is a JAVA-based model that uses MySQL relational databases for performing calculations and storing the data. MOVES has a GUI built in JAVA, which interacts with MySQL Server, which stores the default database along with user inputs and execution files. The final output is also stored in the MySQL server.

MOVES' calculations of final emissions are based on internally defined emission models that take into account geography, time span, source types, and emission processes. Geography and time span are largely user-defined, and users can take advantage of a comprehensive default database that is available for different geographies and years. This database includes many of the inputs outlined in the previous section.

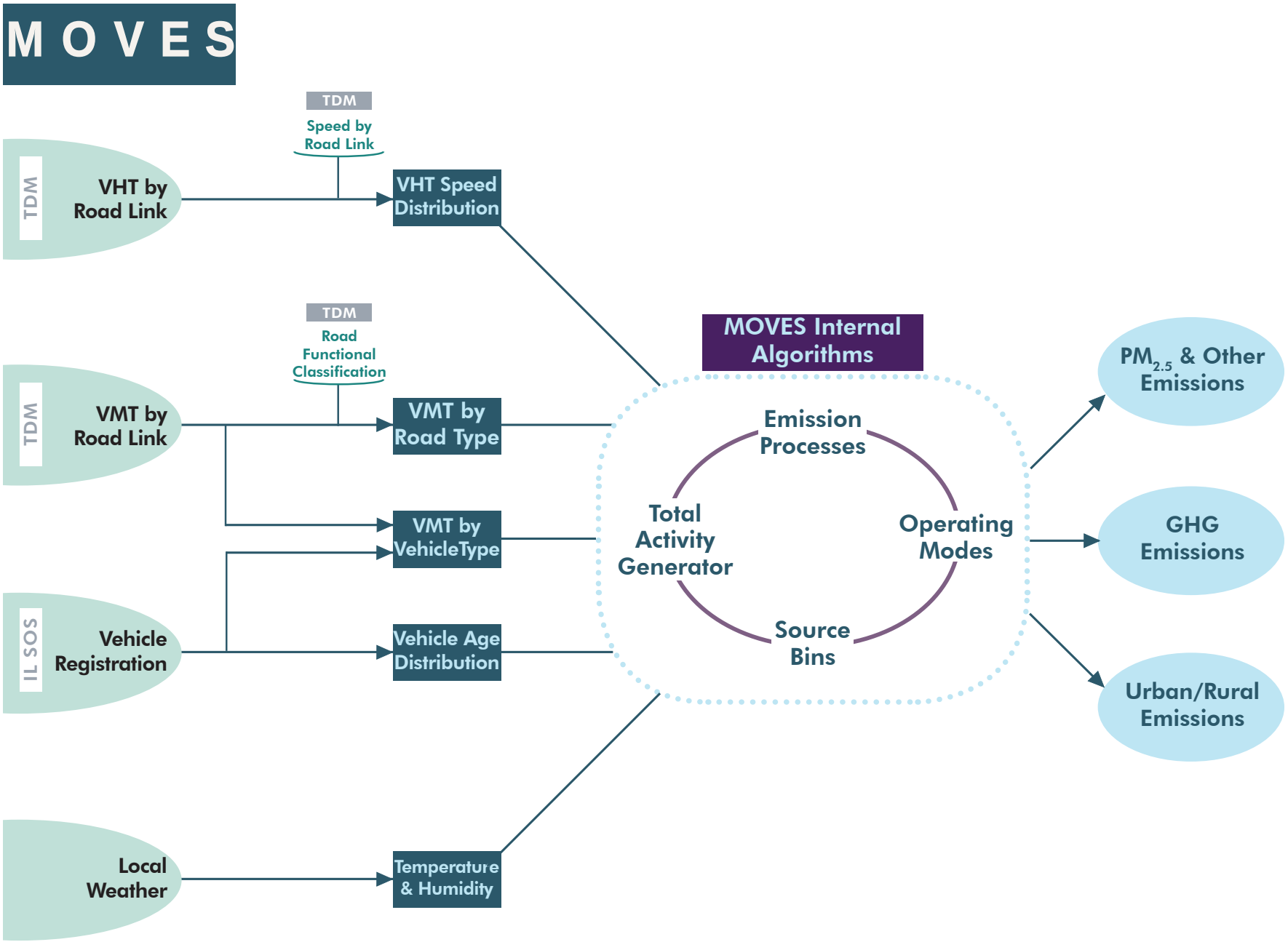
MOVES' internal emission calculators consider the type of source as the specific combination of vehicle type and fuel type. Based on the input provided by the user, MOVES defines "source bins," with each bin having unique fuel consumption and emissions patterns associated with it. This ensures that varying emission rates are used in calculations reflecting the variability of types of vehicles and types of fuels.

Another important consideration in emission calculations is identifying different emission processes. Depending on the specific pollutants being modeled, MOVES is able to estimate emissions from several processes, such as running exhaust, start exhaust, extended idle, brake wear, and so on. Emissions generated through each of these emission processes are based on the "total activity" associated with the process. For instance, emissions from running exhaust are based on total amount of running hours for vehicles. Similarly, emissions from start exhaust are based on the total number of starts in the given time period. MOVES has internal algorithms such as the "Total Activity Generator" that are able to estimate total activity for all emissions processes based on the input provided by the user.

Additionally, MOVES also considers "operating modes" as another dimension to estimating total emissions. Total activity for some processes are further divided into different operating modes. For instance, emissions from running exhaust are further classified into different operating modes, which represent vehicle speeds. As such, estimates for emissions would vary depending on the average speed of vehicles.

As such, MOVES uses a comprehensive set of algorithms to estimate emissions from vehicles. Complementing input provided by the user with internal databases, MOVES is able to categorize activity based on several functional and operational classifications, and separately estimate emissions for each category to give an accurate picture of total emissions. Moreover, functions used by MOVES to estimate emissions are based on several studies on emissions processes. As such, MOVES is an accurate and reliable tool for estimating emissions from motor vehicles.

FIGURE E.13 MOTOR VEHICLE EMISSIONS SIMULATOR



MOVES Output

The final output from MOVES is stored in a form of a MySQL database that contains a series of tables containing additional details such as error logs and other metadata. Emissions data are stored in the "movesoutput" table that list emissions for different combinations of hours, days, months, emission processes, fuel type, source type, road type, pollutant type, and so on. MOVES can also provide data regarding emission rates, such as rate per vehicle if the calculation type is set to emission rates instead of inventory when running the model.

The raw output from MOVES is very detailed and requires aggregation across several parameters. MOVES output tables use codes and ids for all the categories, and as such, access to MOVES default database is also required to get text descriptions of all the codes. The aggregation process can be done using different tools such as MySQL Workbench, Microsoft Access, R, and other database management tools. CUUATS used an R script to aggregate the data to produce the final output tables.

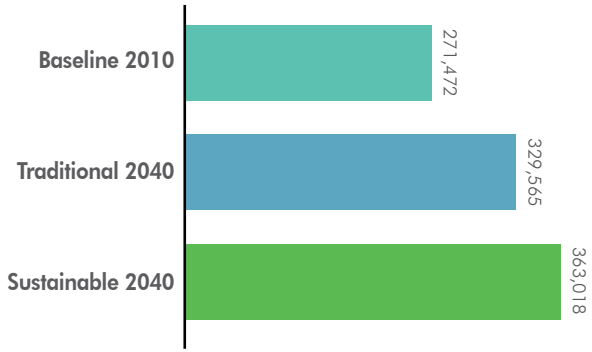
After running MOVES for Champaign County, the model predicted that the total amount of emissions would generally increase over the planning horizon for both scenarios. Both scenarios entail an increase in both population and employment, and, as such, an overall increase in emissions is an expected outcome of increased economic activity. The Sustainable Choices 2040 scenario has higher aggregate amount of emissions, but per capita emissions are lower than that of the Traditional Development 2040 scenario. It should also be noted that greenhouse gas (GHG) emissions per employment for Sustainable Choices 2040 scenario is noticeable lower than for the Traditional Development 2040 scenario. As such, the Sustainable Choices 2040 scenario leads to higher growth of population and employment while keeping per capita emissions low. This can be partially attributed to the predicted mode shift to actives modes of transportation in the Sustainable Choices 2040 scenario reducing, the growth in VMT.

Another interesting aspect of the emissions results is their spatial distribution. Though MOVES predicts emissions at the county-wide level, it is possible to distinguish roughly between urban and rural emissions. The Sustainable Choices 2040 scenario leads to higher growth of economic activities within the urbanized area which is somewhat reflected in the emission trends. Compared to the Traditional Development 2040 scenario, the Sustainable Choices 2040 scenario has higher urban emissions but lower rural emissions.

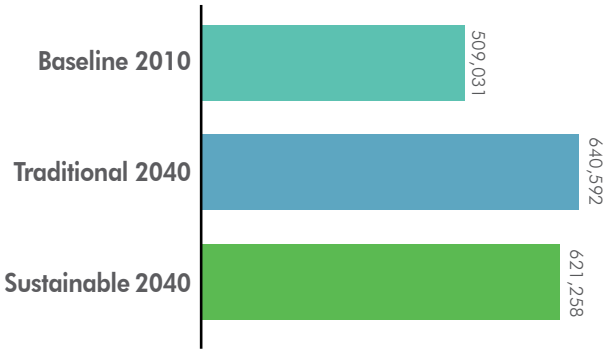
Overall, the difference in emissions between the two scenarios is not very significant, which means that the Sustainable Choices 2040 scenario can achieve higher growth without increasing emissions significantly. Aggregate emissions would rise in both scenarios, as both population and employment would increase over the next 25 years. The Sustainable Choices 2040 scenario would lead to lower per capita emissions as a larger percentage of growth would happen within the urban core compared to that in the traditional development scenario.

FIGURE E.14 MOVES OUTPUT

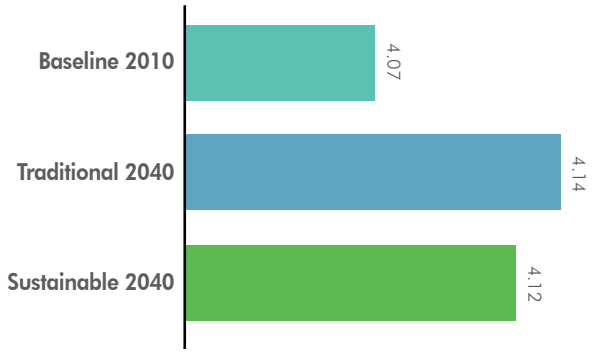
Urban CO_2 Equivalent (U.S. ton)



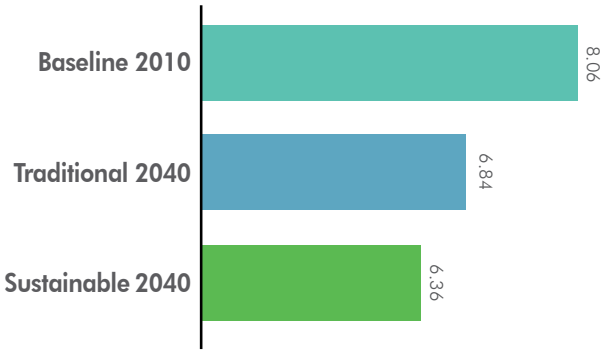
Rural CO_2 Equivalent (U.S. ton)



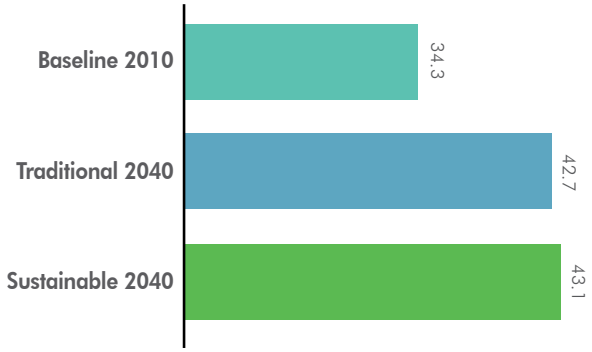
Per Resident CO_2 Equivalent (U.S. ton)



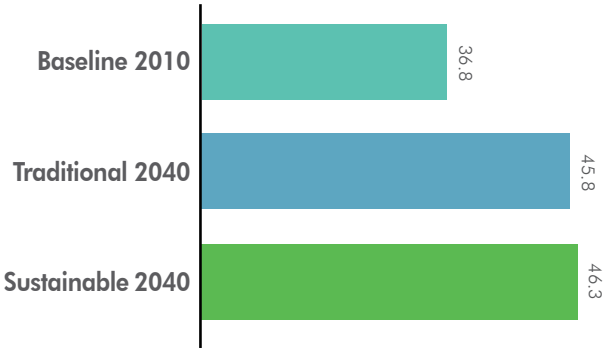
Per Employment CO_2 Equivalent (U.S. ton)



$PM_{2.5}$ (U.S. ton)



PM_{10} (U.S. ton)



SOCIAL COST OF ALTERNATIVE LAND DEVELOPMENT SCENARIOS

Social Cost of Alternative Land Development Scenarios (SCALDS) is a social cost estimator model that was released by the Federal Highway Administration (FHWA) in 1998. While the FHWA has not released any updates to the model since then, CUUATS staff has updated the model periodically using local data for Champaign County to develop reliable estimates of social costs associated with different planning scenarios.

SCALDS is used to estimate direct and indirect costs of different development scenarios. SCALDS considers direct costs such as cost of land development, construction, labor, and utilities. More importantly, SCALDS also considers indirect costs or cost of externalities such as air pollution due to driving. SCALDS can be used to estimate the following components of scenario costs:

- Transportation costs
- Water and sewer cost
- Storm-water system cost
- Energy cost (non-transportation)
- Infrastructure cost (streets and utilities)

SCALDS in Modeling the Framework

SCALDS is an important piece of the CUUATS integrated modeling framework, as it addresses important development considerations such as infrastructure and energy costs, which are not accounted for in other models of the framework. SCALDS adds a social cost dimension to the modeling framework and works closely with LEAM and the TDM to broaden our understanding of impacts of different scenarios and plans.

SCALDS Input

SCALDS provides estimates for a wide array of costs. As such, it requires detailed inputs related to different aspects of the scenarios such as projections, housing mix, and land use. Apart from details of the specific scenario being modeled, SCALDS also requires localized inputs related to costs and trends, which help calibrate the model to better reflect local costs and impacts. Inputs to SCALDS can be categorized in two broad groups: calibration or localization input, and scenario input.

Localization Input

Localization inputs reflect local costs of development and services. These have to be updated when newer estimates become available. Most of the localization inputs remain constant across scenarios, which allows for easy comparison of the impacts of scenarios. Some transportation-related localization inputs, such as mode share, do change across scenarios to reflect the change in travel behavior as a result of transportation policies and plans. Major localization inputs that are required to develop reliable social cost estimates include:

Transportation

- Average mode share
- Average trip production rates
- Average length of trips
- User costs such as gasoline, insurance, registration, repairs, and parking
- Government costs such as highway maintenance, transit operating costs, security services, etc.
- Societal costs such as air pollution, waste, noise, accidents, etc.
- Cost of time
- Adjustments for peak and non-peak time travel

Water, Sewer and Storm-water system costs

- Water and sewer demand per person for different types of residential land uses
- Water and sewer demand per sq. ft. for non-residential land uses
- Average annual cost for water, sewage and storm water system usage for a typical single-family dwelling unit

Energy costs

- Annual energy use per household for different types of land uses
- Average cost of energy

Infrastructure costs

- Average cost of developing street infrastructure per units for different types of land uses
- Average per unit cost of developing utilities infrastructure for different land uses

Scenario Input

Population projections

The scenario input includes aggregate county-wide population projections for the scenario being modeled (Figure E.4).

Employment projections

SCALDS estimates employment by industry from the county-wide employment projections (Figure E.5).

Household projections

SCALDS requires detailed projections on number of households by different type of housing units ranging from low-density single-family unit to high-rise multi-family apartments. While SCALDS has default proportions to divide the aggregate household estimates into different housing unit categories, it is recommended to develop detailed household estimates separately for each scenario to accurately capture the differences in development patterns.

CUUATS uses output, from LEAM to estimate household projections. LEAM gives the location and density of future developments which, can be used to develop reliable estimates of single-family and multi-family housing units for different scenarios. Figure E.16 shows the housing units estimates, which were based on results from LEAM, for the two scenarios included in the LRTP 2040. The Sustainable Choices 2040 scenario was predicted to have high growth and redevelopment near the downtowns, and hence the scenario has a higher percentage of multi-family units. In the Traditional Development scenario, on the other hand, as much as 90 percent of the new households are predicted to live in single-family units.

SCALDS Methodology

SCALDS is a spreadsheet model with the same basic layout same as that developed by the FHWA. The spreadsheet layout has several interconnected sheets that calculate different components of the cost based on the inputs provided for the scenarios. The advantage of having the model in a spreadsheet format is that the assumptions and data used for calibration can be easily viewed and updated as and when required.

Transportation

The first step in estimating transportation cost is to estimate the total number of daily trips produced in the region, which is obtained by multiplying the number of households by the average household trip production rate. The trips are then divided among different modes of travel using the mode choice estimates. Person miles traveled (PMT) for each mode is estimated by multiplying average trip lengths by the number of trips. PMT for different modes is them multiplied by the average cost per mile for each mode to get total transportation cost. SCALDS has separate cost estimates for peak and off-peak travel for each mode of transportation. Finally, all of the costs for all of the modes are combined to get one estimate of the total transportation cost for a scenario.

Water, Sewer and Storm-water system

Demand for these services is estimated based on the type of household. As such, the projections for the number of households are broken down into different categories using observed housing mix in the region. Localized estimates for water and sewer demand for each type of housing are then used to estimate total residential water and sewer demand. A similar process is followed to estimate non-residential demand where employment projections are divided between different industrial classifications. The average demand for each type of non-residential use is then used to calculate non-residential water and sewer usage costs.

Energy

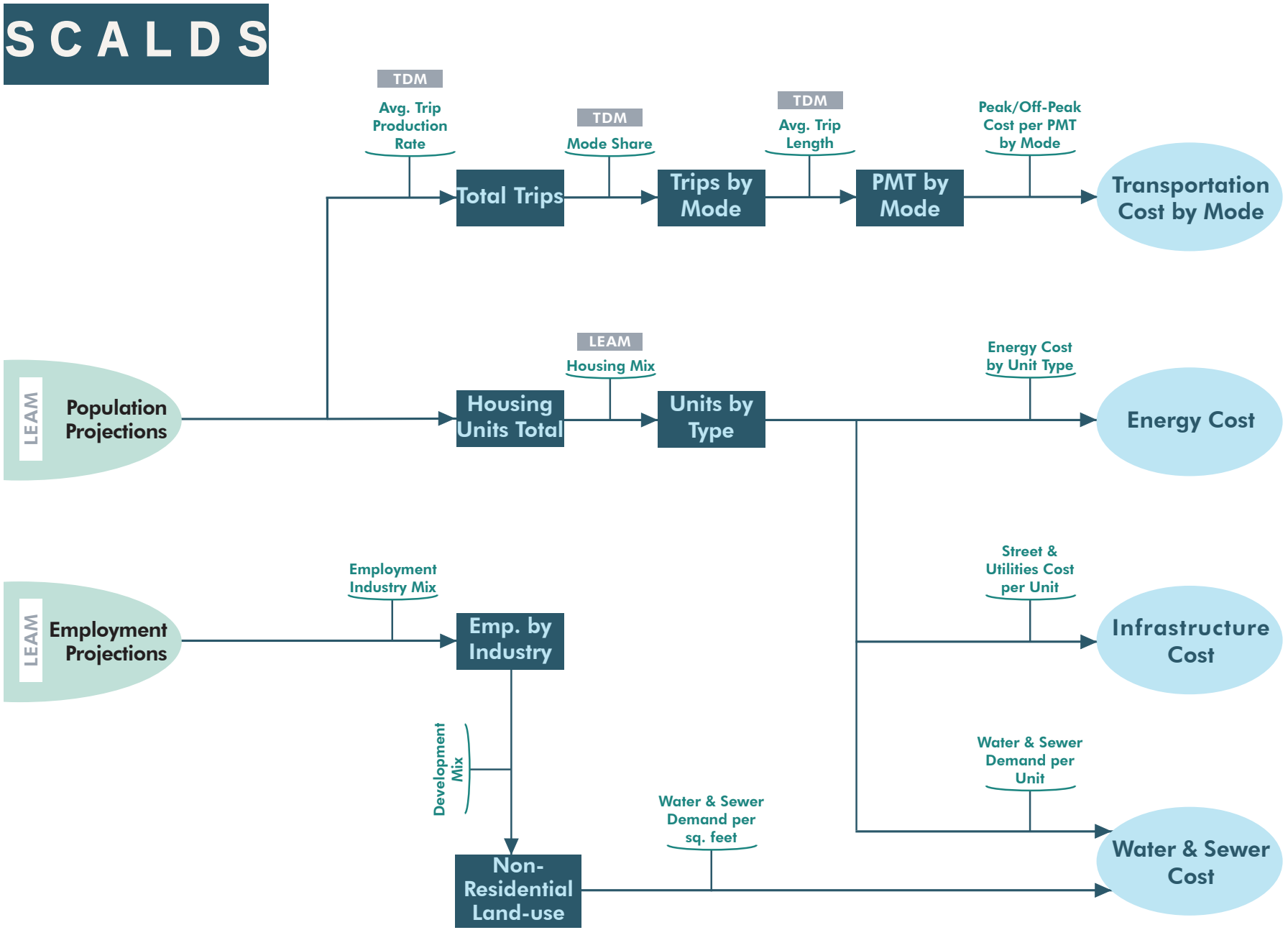
Energy cost estimates are based on local data on the average annual energy use of different types of households. These estimates are multiplied by the number of households associated with each category to get the total energy usage for each type of household. The total energy cost can then be estimated from the total energy by considering the average cost of energy usage.

Infrastructure

SCALDS estimates the cost of infrastructure for new developments based on the type of development. Based on housing projections, the number of new housing units are estimated for fixed intervals of time, such as 2020 to 2025, which are then used to estimate the infrastructure cost for new developments. Infrastructure costs are divided into two categories: streets and utilities. SCALDS uses local estimates for the infrastructure costs of street and utilities for different types of housing units.

Currently, SCLADS is in the form of a spreadsheet, so it requires input data about scenarios to be pasted as tables on specific cells of the spreadsheet. SCALDS then automatically updates the results for social costs in the output summary sheets. Before running the model for a scenario, the model has to be calibrated appropriately by updating all of the localization inputs with the most recent data. Input tables for projections can be prepared manually and pasted into the input sheet of the model. CUUATS has worked with the LeamGroup to add a SCALDS extension to LEAM, which automatically prepares the inputs table for SCALDS as part of the output of LEAM.

FIGURE E.15 SOCIAL COST OF ALTERNATIVE LAND DEVELOPMENT SCENARIOS



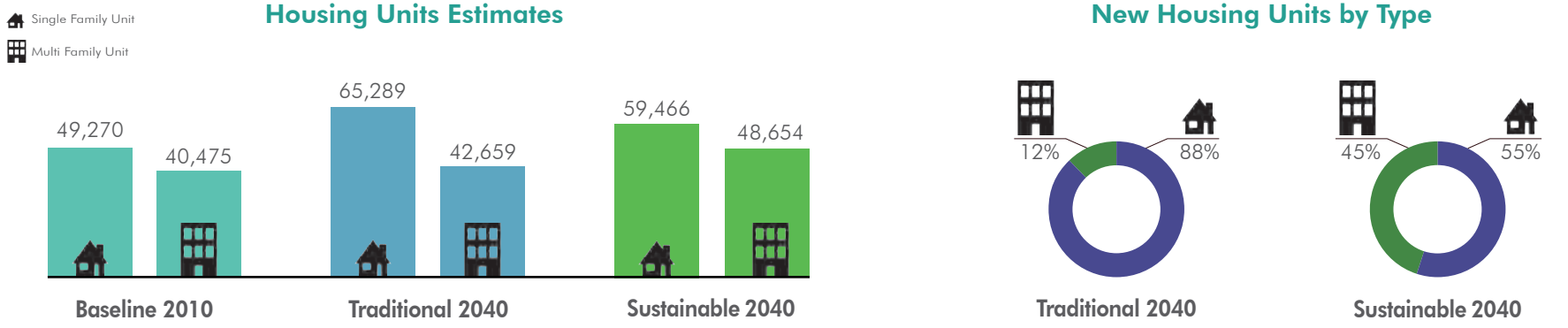
SCALDS Output

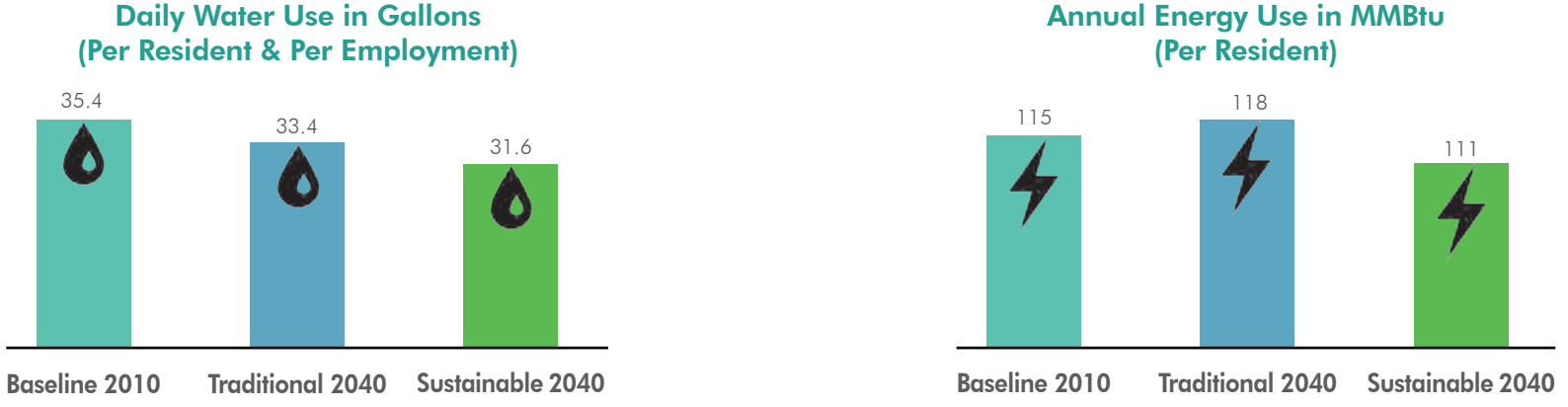
SCALDS provides as outputs cost estimates for every five years over the planning horizon. Cost estimates for different categories are broken down into subcategories to present a detailed overview of the social costs. For instance, transportation cost estimates are broken down by mode of transportation. SCALDS output tables can be used directly for reporting the results, and there is no need for any post-processing of the output. In the current version of the model, cost estimates do not account for inflation or any social discount rate. As such, cost estimates are directly proportional to quantity of services used over the planning horizon. For instance, energy costs is simply a product of the estimated total energy use and the current energy price.

SCALDS predicts the Sustainable Choices 2040 scenario to have significantly lower infrastructure in spite of having more population and employment. This is primarily due to the fact that the scenario is estimated to have a significantly higher proportion of multi-family units, which have lower per unit infrastructure cost. Similarly, per capita water and energy usage are estimated to be lower in the Sustainable Choices 2040 scenario. Moreover, the Sustainable Choices 2040 scenario can achieve lower per capita water and energy costs compared to the current estimates even as the region grows and adds more people and jobs. Even though the difference in values may seem small, over time large savings are expected in the Sustainable Choices 2040 scenario.

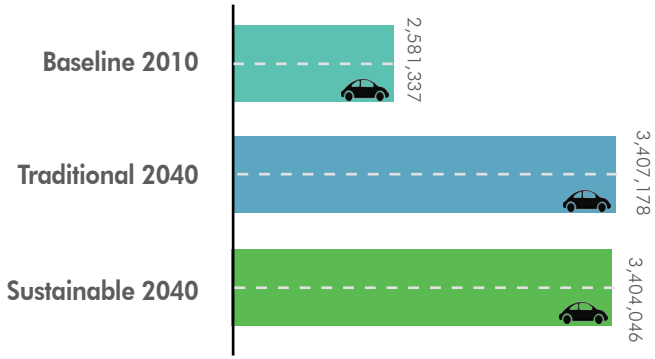
Transportation costs estimates reflect a noticeable mode shift to active modes of transportation in the Sustainable Choices 2040 scenario. Both scenarios are expected to have higher aggregate personal miles traveled (PMT), as transportation activity is predicted to increase with increases in population and employment. In the case of the Traditional Development 2040 scenario, almost 97 percent of the increase in PMT is due to an increase in driving miles. While driving miles is expected to remain high in Sustainable Choices 2040 scenario, the scenario is estimated to have much higher PMT by active modes of transportation, especially public transit and walking. In fact, transit PMT is estimated to be more than 30 percent higher for the Sustainable Choices 2040 scenario than for the Traditional Development 2040 scenario.

FIGURE E.16 SCALDS OUTPUT

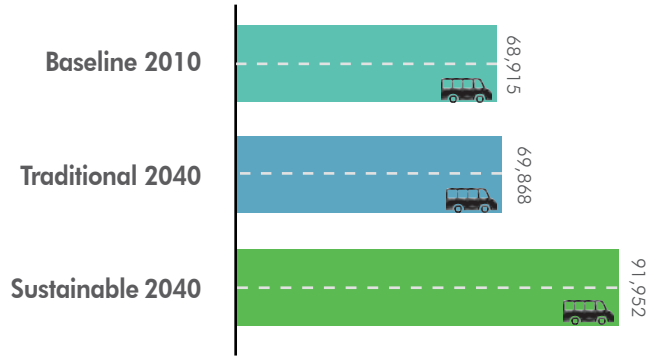




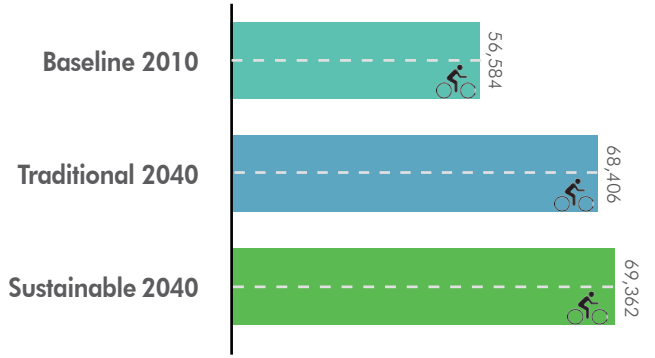
Driving Personal Miles Traveled Estimates



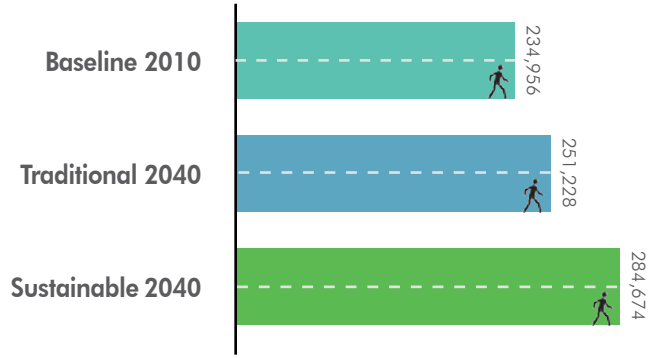
Transit Personal Miles Traveled Estimates



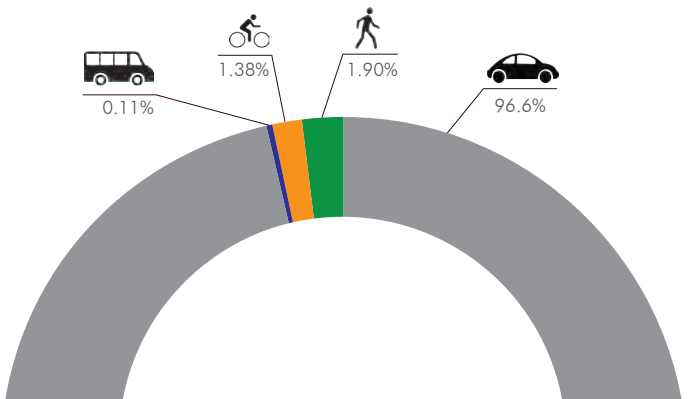
Biking Personal Miles Traveled Estimates



Walking Personal Miles Traveled Estimates



Increase in Personal Travel Miles by Mode
Traditional Development 2010-2040



Increase in Personal Travel Miles by Mode
Sustainable Choices 2010-2040

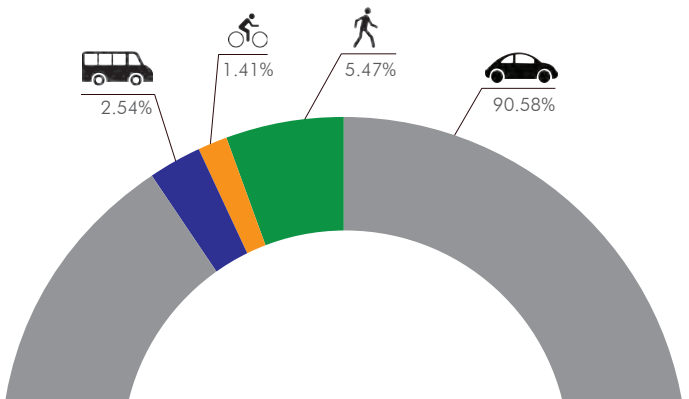


FIGURE E.17 TDM OUTPUT

TABLE E.1 POPULATION PROJECTIONS BY TRAFFIC ANALYSIS ZONE (TAZ)

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
1	2	132	4	50	132	132	132	132	132	P: Downtown.	1
2	124	134	124	127	130	134	134	134	134	P:	2
3	134	82	73	75	79	82	82	82	82	P:	3
4	20	26	75	75	75	75	75	75	75		4
5	8	65	41	50	60	65	65	65	65	P:	5
6	99	119	79	90	105	119	119	119	119	P:	6
7	396	432	390	401	415	432	432	432	432	P: Downtown	7
8	27	17	146	170	200	200	200	200	200	P: Increased 2015 by 30, increased 2020 by 50, kept steady in susequent years. Downtown; 'Urban neighborhood, development north of downtown starting before 2020'	8
9	1,036	1,085	1,036	1,186	1,255	1,255	1,255	1,255	1,255	P: Added 150 in 2015, and 169 in each subsequent year. Downtown, 'Eden supportive living facility (Church and State) under development right now with 150 units, bump population by 2015' (Eden growth was incorrectly calculated here rather than TAZ 1)	9
10	484	437	362	380	410	437	437	437	437	P:	10
11	1,205	1,227	1,152	1,183	1,205	1,227	1,227	1,227	1,227	P:	11
12	894	866	851	859	865	873	873	873	873	P:	12
13	607	698	715	715	715	715	715	715	715	P:	13
14	633	642	640	642	642	642	642	642	642	P:	14
15	1,446	1,516	1,490	1,500	1,516	1,516	1,516	1,516	1,516	P:	15
16	541	533	640	640	640	640	640	640	640	P:	16
17	1,595	1,707	1,623	1,657	1,680	1,707	1,707	1,707	1,707	P:	17
18	3	2	2	2	2	2	2	2	2	P:	18
19	1,165	1,149	1,206	1,206	1,206	1,206	1,206	1,206	1,206	P:	19
20	6	5	0	3	5	5	5	5	5	P: No foreseeable growth. School district has some interest for high school here but it would need work - best to leave it without population. Champaign is doing TIF study there - if not school, maybe multi use in the future.	20
21	6	0	0	0	0	0	0	0	0	P:	21
22	976	1,232	1,222	1,232	1,232	1,232	1,232	1,232	1,232	P:	22
23	404	409	433	433	433	433	433	433	433	P:	23
24	1,475	1,531	1,554	1,554	1,554	1,554	1,554	1,554	1,554	P:	24
25	894	767	760	767	767	767	767	767	767	P:	25
26	264	227	213	218	227	227	227	227	227	P:	26
27	1,322	1,218	998	1,060	1,130	1,218	1,218	1,218	1,218	P:	27
28	1,171	1,172	1,261	1,261	1,261	1,261	1,261	1,261	1,261	P:	28
29	884	845	1,042	1,042	1,069	1,069	1,069	1,069	1,069	P: Added 50 in 2020 and 50 more in 2025. 'Bristol Place redevelopment 2020 target, some increased density, not huge, about 50 more units, similar to lakeside terrace in Urbana'	29
30	491	461	464	464	464	464	464	464	464	P:	30

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
31	497	474	581	581	581	581	581	581	581	P:	31
32	1,088	1,193	1,328	1,328	1,328	1,328	1,328	1,328	1,328	P:	32
33	2,584	2,614	2,653	2,653	2,653	2,653	2,653	2,653	2,653	P:	33
34	1,459	1,361	1,368	1,378	1,390	1,403	1,404	1,404	1,404	P:	34
35	273	230	192	200	210	220	230	240	250	P:	35
36	644	651	546	566	586	606	626	644	644	P:	36
37	1,038	1,236	1,151	1,213	1,280	1,326	1,371	1,436	1,501	P:	37
38	1,176	897	752	792	836	866	897	938	981	P:	38
39	856	923	653	703	758	814	870	928	990	P:	39
40	546	481	476	481	488	488	488	488	489	P:	40
41	975	1,116	1,209	1,272	1,345	1,395	1,441	1,500	1,576	P:	41
42	210	768	1,638	1,725	1,822	1,882	1,952	2,032	2,136	P: Development behind Philo strip mall currently under development + room for future expansion	42
43	824	634	729	729	729	729	735	735	735	P: Added 300 in 2015, 300 more in 2020, (added 600 each year after). University and Wright - developer interested in putting in student apartments within 2 years, 500 units(ch)/600 beds(ur), average 2 bedrooms, August 2015 occupancy.	43
44	23	22	40	42	44	46	48	50	53	P: IL Terminal expansion (look for market study on this), residential dev, increase growth	44
45	1,164	1,026	1,332	1,400	1,481	1,530	1,587	1,660	1,737	P:	45
46	1,730	1,937	2,000	2,105	2,224	2,300	2,383	2,483	2,607	P:	46
47	255	237	0	0	0	0	0	0	0	P: University	47
48	1,021	1,085	1,443	1,443	1,443	1,443	1,443	1,443	1,443	P: University	48
49	1,042	773	1,016	1,016	1,042	1,042	1,042	1,042	1,042	P: University	49
50	2,226	0	0	0	0	0	0	0	0	P: University	50
51	975	951	1,431	1,431	1,431	1,431	1,431	1,431	1,431	P: University	51
52	754	717	1,294	1,294	1,294	1,294	1,294	1,294	1,294	P:	52
53	174	209	205	205	209	209	209	209	209	P:	53
54	1,711	1,872	2,068	2,258	2,258	2,258	2,258	2,258	2,258	P: Added 190 in 2015 and held # steady through 2040 - no obvious additional room for growth there. '1st and armory reconstruction - higher density.' (To be completed in 2013, 72 units/194 beds with 2, 3, and 4 bedrooms - Wells and Wells Construction website)'	54
55	1,581	1,436	2,104	2,104	2,104	2,104	2,104	2,104	2,104	P:	55
56	1,080	1,211	1,311	1,587	1,621	1,621	1,621	1,621	1,621	P: Added 276 in 2015 and to each year after, (120x2.3=276). 'residential unit going up now with 120 units, occupancy by 2015'	56
57	1,708	3,161	3,703	3,748	3,798	3,799	3,800	3,801	3,802	P: University. There could be some remodeling happening but not sure if it would increase density at all. No additional growth projected beyond the model.	57

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
58	0	0	0	0	0	0	0	0	0	P:	58
59	15	5	7	200	468	468	468	468	469	P: Added 460 in 2020 and each year after. University. 'Adding some residential, 200 units by 2020 (Fox)'	59
60	0	0	0	0	0	0	0	0	0	P:	60
61	267	292	151	200	292	292	292	292	292	P: 'Some residential growth with Fox dev'	61
62	7	8	111	111	111	111	111	111	111	P:	62
63	0	0	16	16	16	16	16	16	16	P:	63
64	621	1,144	1,272	1,330	1,415	1,505	1,616	1,800	1,959	P: Added 100 is 2030 and 300 in 2040. There is a big similar lot next door that could double the existing capacity. 'Eventual expansion of Baytown, add some more by 2030 (currently 354 apartments)'	64
65	0	150	911	1,275	1,613	1,690	1,761	1,800	1,863	P: Increased by 300 in 2015, 600 in 2020, and 675 in 2030 and 2040. 'Hunter's Pond apartments built 300 units in the last few years, people will fill them eventually. Room to grow. A lot of apartment units have gone in between 2010 and 2015, the population should be increased. Interstate to Market will be extended soon. Firestation move from Bradley to Market St to Shadowood.'	65
			79	379	679	717	754	754	754		
66	0	116	131	137	145	150	155	160	171	P:	66
67	180	746	1,081	1,081	1,081	1,081	1,081	1,081	1,081	P:	67
68	1,587	1,464	1,394	1,470	1,551	1,650	1,761	1,930	2,217	P: Increased pop by 100 in 2030 and 400 in 2040, if the area "pops" there is enough land to double the existing pop. 'under 160 acres, could pop any day, mostly single family, a little commercial by 2020/30'	68
69	2,650	2,412	2,405	2,425	2,466	2,467	2,468	2,468	2,469	P:	69
70	1,659	1,590	1,569	1,580	1,609	1,609	1,610	1,610	1,611	P:	70
71	865	889	821	843	865	877	889	889	889	P:	71
72	1,005	1,064	1,010	1,062	1,123	1,175	1,204	1,340	1,516	P: Added 200 in 2040, small portion of TAZ available for development: 'could see some development when 68 develops - same family owns land in both places (less in 72). 2020-2030, all the infrastructure is in place.'	72
73	806	714	654	672	692	714	714	714	714	P:	73
74	715	606	621	628	637	637	637	637	638	P:	74
75	895	996	743	800	860	920	996	996	996	P:	75
76	2,595	2,686	2,574	2,600	2,628	2,659	2,686	2,686	2,686	P:	76
77	901	1,963	2,451	2,580	2,726	2,826	2,921	3,050	3,195	P: numbers look fine, there is room for growth	77
78	691	692	658	672	692	692	692	692	692	P:	78
79	1,642	1,555	1,777	1,777	1,777	1,777	1,777	1,777	1,777	P:	79
80	714	1,010	1,103	1,103	1,103	1,103	1,103	1,103	1,103	P:	80

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
81	646	586	582	588	597	597	597	597	598	P:	81
82	1,083	1,011	924	960	1,011	1,011	1,011	1,011	1,011	P:	82
83	654	646	610	627	646	646	646	646	646	P:	83
84	698	689	693	693	693	693	693	693	693	P:	84
85	561	497	495	500	508	508	508	508	508	P:	85
86	1,121	1,027	1,006	1,015	1,032	1,032	1,032	1,032	1,033	P:	86
87	980	889	826	846	866	889	889	889	889	P:	87
88	913	890	870	880	892	892	893	893	893	P:	88
89	760	665	676	682	693	693	694	694	694	P:	89
90	826	1,130	848	900	950	1,000	1,060	1,130	1,130	P:	90
91	878	971	873	900	925	950	971	971	971	P:	91
92	828	1,095	1,204	1,510	1,839	2,100	2,435	2,500	2,570	P: Added 1,000 residents by 2030, (300 in 2015, 500 in 2020, 1000 in 2030 and 2040)	92
93	857	786	732	753	774	786	786	786	786	P:	93
94	919	898	838	858	878	898	898	898	898	P:	94
95	370	263	231	242	253	263	273	283	293	P:	95
96	1,572	1,737	1,671	1,700	1,737	1,737	1,737	1,737	1,737	P:	96
97	1,067	1,260	3,378	3,560	3,756	3,880	4,025	4,250	4,404	P:	97
98	838	563	635	640	650	660	670	680	690	P:	98
99	1,110	968	875	900	930	968	1,000	1,050	1,110	P: (see 43 for nearby development)	99
100	392	396	340	355	378	390	405	425	443	P:	100
101	0	660	1,628	1,715	1,811	1,880	1,941	2,050	2,122	P: (Vacancy issue - Census unit over count in Capstone Condos)	101
102	855	625	1,400	1,710	2,020	2,030	2,040	2,050	2,060	P: "No room for growth, per se, but redevelopment and infill promoted in king park neighborhood in future land use maps" Pop increased dramatically to account for One South, which is comparable to One North in TAZ 201.	102
103	516	478	526	554	584	600	627	650	686	P:	103
104	182	270	484	484	484	484	484	484	484	P:	104
105	1,211	936	1,045	1,055	1,065	1,072	1,072	1,072	1,073	P:	105
106	69	65	27	37	47	57	65	65	65	P:	106
107	2,342	1,563	1,031	1,100	1,200	1,310	1,430	1,563	1,563	P: University. Orchard downs redev - future increased density?	107
108	1,166	1,065	992	1,024	1,065	1,065	1,065	1,065	1,065	P:	108
109	490	403	470	495	523	540	559	580	614	P: Eventual expansion of Clark Lindsey Villas (+32 villas)	109
110	1,611	1,430	1,620	1,734	1,900	2,000	2,100	2,300	2,500	P: Increased 2020, 2030, and 2040 by a few hundred. 'Sommerset development - zoned for expansion (double what is there currently)'	110
111	1,215	1,106	1,209	1,209	1,209	1,209	1,209	1,209	1,209	P:	111
112	736	701	651	675	701	701	701	701	701	P: Future land use map identifies this as nature preserve and rural residential	112
113	696	966	1,070	1,120	1,170	1,220	1,275	1,330	1,396	P:	113

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
114	325	370	400	400	400	420	420	435	450	P: Reduced population (RM) and estimated growth - room for jail or nursing home expansion.	114
115	1,772	1,512	1,615	1,615	1,615	1,615	1,615	1,615	1,615	P:	115
116	1,596	1,630	1,667	1,667	1,667	1,667	1,667	1,667	1,667	P:	116
117	2,418	3,089	3,848	3,872	3,900	4,100	4,350	4,550	4,800	P: 41 single family plots (approximately 86 people) still undeveloped south of rainbow ridge, + huge plot on corner of Washington and High Cross zoned for single family (RM - 900 total build out, Rita says include all by 2040), redevelopment of townhomes south of Washington near Philo. (previous 2040 # "way too high" during the initial meeting in August so I decreased growth to just 100 between 2010 and 2040, edited after receiving additional comments from Robert Meyers 11/7/13).	117
118	1,523	1,591	1,464	1,484	1,504	1,530	1,560	1,591	1,591	P:	118
119	1,630	1,459	1,401	1,475	1,558	1,600	1,670	1,750	1,826	P: Old swim club has plans to redevelop into 48 town homes over next couple of years. Church on corner of Philo and Windsor likely to sell soon.	119
120	513	104	547	585	608	650	700	757	840	P: Stone Creek, not 100% occupied yet, plus 170 du sf homes with Menards development by 2040 (Engstrom email 12/16), added 50 in 2030, 50 in 2035, 70 in 2040.	120
121	625	761	880	920	950	1,000	1,048	1,100	1,147	P: Red dev not fully occupied + room for future dev	121
122	84	110	156	156	156	156	156	156	156	P:	122
123	7	22	48	51	453	1,200	1,957	2,500	3,457	P: Added 400 in 2020, 1500 more in 2030 and 1,500 more in 2040 (assuming it will fill to about same level as TAZ 137). 'Jacob's landing - all infrastructure is in place, by 20 it will start filling out, 30 and 40 should fill. Trails at Abby Fields same situation and time line, infratructure is in place and its ready for construction. Lo owns this property.'	123
124	522	474	432	462	620	700	764	810	863	P: Added 100 in 2020, 250 in 2030 and 300 in 2040. 'This number looks good, but there could be another small single family or multi family developement here before 2020.'	124
125	49	44	39	41	43	44	46	48	50	P:	125
126	146	50	21	23	25	29	35	44	54	P:	126
127	341	1,422	1,321	1,365	1,422	1,422	1,422	1,422	1,422	P:	127
128	63	53	58	61	64	64	64	64	64	P:	128
129	90	132	93	100	108	112	120	132	132	P: Room for future Sommerset expansion (perhaps not before 2040, still a lot of room for infill growth in TAZ 110 to the south)	129
130	710	818	775	810	845	890	930	975	1,011	P: Possible development around future Olympian Drive extension	130
131	63	56	68	72	76	78	81	86	89	P: Possible development around future Olympian Drive extension	131
132	251	217	145	157	169	173	180	210	233	P:	132
133	2	0	3	3	3	3	3	3	4	P:	133

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
134	26	20	22	22	23	24	25	26	27	P:	134
135	300	226	160	190	236	270	298	315	342	P: Increased 50 in 2020, 100 in 2030 and 2040. 'There will be more residential development and population growth by 2020/30/40, infrastructure is already in place'	135
136	4	9	6	6	7	7	7	8	10	P:	136
137	15	764	2,668	2,768	2,900	3,040	3,179	3,320	3,478	P:	137
138	8	4	314	330	349	400	474	510	559	P: Increased by 100 in 2030 and 150 in 2040.'NW Curtis Interchange, sewer extension will likely happen by 2040, some development by 2030, more by 2040; add more growth'	138
139	101	777	1,748	1,770	1,800	1,835	1,871	1,871	1,871	P: Decreased growth, maintained 2010 number for 2015 and moved 2020 number to 2030 and 2040. 'only a few hundred units available here, growth too high in 2040'	139
140	4	4	455	475	495	518	540	565	593	P:	140
141	0	0	0	0	0	0	0	0	0	P:	141
142	52	104	96	99	102	105	108	112	119	P:	142
143	106	102	122	128	134	140	146	152	159	P:	143
144	78	17	61	62	64	67	69	72	75	P:	144
145	0	0	0	0	0	0	100	200	300	P: Added 100 in 2030 and 200 in 2040 in anticipation of Menards residential development plans.	145
146	23	20	23	24	26	27	28	60	130	P: Added 100 in 2040. 'Menards will eventually development land - residential and commercial'	146
147	53	48	38	40	42	43	45	48	51	P:	147
148	630	637	741	778	815	855	890	925	967	P:	148
149	736	817	867	907	947	990	1,035	1,080	1,131	P:	149
150	4	14	70	265	743	746	749	752	756	P: Added 190 in 2015, 475 more (665 total) in 2020, added 665 to each subsequent year	150
151	58	50	59	62	65	68	71	75	77	P:	151
152	559	597	1,120	1,170	1,225	1,280	1,340	1,400	1,460	P:	152
153	455	466	453	473	493	515	540	565	590	P:	153
154	26	39	46	47	49	50	52	55	58	P:	154
155	25	22	40	42	44	46	48	50	53	P:	155
156	12	9	8	9	9	9	9	10	11	P:	156
157	16	14	8	9	9	9	10	12	14	P:	157
158	29	33	38	39	40	41	43	45	47	P:	158
159	80	70	64	66	68	70	73	76	79	P:	159
160	3	3	3	3	3	3	3	3	4	P:	160
161	1	0	0	0	0	0	0	0	0	P:	161
162	32	45	56	58	60	62	64	67	70	P:	162
163	15	18	11	12	13	13	13	16	19	P:	163
164	11	27	47	48	50	52	54	56	59	P:	164
165	26	30	27	27	28	30	31	32	33	P:	165

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
166	37	45	40	41	42	44	46	48	50	P:	166
167	27	27	27	28	29	30	31	32	33	P:	167
168	3	4	15	16	16	16	17	18	19	P:	168
169	22	2	14	15	15	15	16	17	18	P:	169
170	10	16	2	2	2	40	100	200	300	P:Added 100 in 2030 and 300 in 2040 in anticipation of Clearview residential.	170
171	0	35	0	0	0	0	0	0	0	P:	171
172	9	10	6	7	7	7	7	9	11	P:	172
173	8	5	8	9	9	9	9	10	11	P:	173
174	0	0	0	0	0	0	0	0	0	P:	174
175	11	96	1,060	1,110	1,160	1,210	1,264	1,320	1,382	P:	175
176	3	2	1,118	1,170	1,220	1,275	1,335	1,500	1,458	P:	176
177	5	14	2	2	2	2	6	8	10	P:	177
178	3	6	3	3	3	3	4	5	6	P: SW Curtis Interchange, sewer extension will likely happen by 2040, some development by 2030, more by 2040; not adding growth to this quadrant keeping in mind that this will probably be the 3rd or 4th quadrant to go	178
179	3	6	0	0	0	0	0	0	0		179
180	14	13	11	11	13	13	13	13	13	P:	180
181	66	54	49	50	52	54	54	60	66	P:	181
182	75	65	58	61	64	68	70	73	76	P:	182
183	16	83	76	78	81	84	87	90	94	P:	183
184	146	119	103	110	119	119	119	119	119	P:	184
185	24	26	49	50	52	54	56	58	61	P:	185
186	10	5	5	5	5	5	6	6	6	P:	186
187	0	0	0	0	0	0	0	0	0	P:	187
188	12	7	8	9	9	9	9	9	9	P:	188
189	5	0	0	0	0	0	0	0	0	P:	189
190	2	1	4	4	4	4	5	5	5	P:	190
191	24	70	84	88	92	96	100	104	109	P:	191
192	17	6	11	12	12	12	13	13	14	P:	192
193	0	0	0	0	0	0	0	0	0	P:	193
194	0	2	1	1	1	1	1	1	1	P:	194
195	9	13	8	9	9	9	10	12	14	P:	195
196	10	350	734	770	816	910	1,175	1,400	1,557	P: Added 150 in 2030 and 300 in 2040. NE Curtis Interchange, sewer extension will likely happen by 2040 - a developer already owns this and this quadrant will probably be the first to get underway, a little by 2020, more by 2040. South of Robeson Meadows West, more growth after 2020 before 2040.	196

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
197	6	3	5	5	5	5	6	6	106	P: Added 100 in 2040. SE Curtis Interchange, sewer extension will likely happen by 2040 - this quadrant will probably be the 3rd or 4th to get underway.	197
198	383	525	520	525	525	525	525	525	525	P:	198
199	0	446	468	468	468	468	468	468	468	P:	199
200	0	5	4	4	20	40	80	100	200	P: Added 15 in 2020, 94 in 2030 and 293 in 2040 since the high school is now there. Future residential plans as part of the Atkins group Clearview development that has medical and office space in TAZ 170. Mostly single family (various lot sizes) with a small portion of townhomes and condos. Clearview residential development probably won't go until TAZ 170 is full or at least well underway.	200
201	0	16	0	10	16	16	16	16	16	P:	201
202	144	0	284	294	308	323	338	354	371	P:	202
203	0	0	46	92	92	92	92	92	92	P: Doubled 2010 population for 2015 and held consistent through 2040. 'Waters Edge apartments here, double population that is there right now, but no more residential there, the rest is zoned commercial.'	203
204	14	17	5	5	6	6	6	6	6	P:	204
205	6	6	939	1,005	1,144	1,250	1,420	1,560	1,724	P: Added 100 in 2020, 300 in 2030, and 500 in 2040. 'Increase in pop, new home construction has started back up there, bump up growth a little bit.'	205
206	10	9	6	7	7	7	7	7	7	P:	206
207	582	635	661	661	661	661	661	661	661	P:	207
208	3,627	3,230	3,346	3,386	3,432	3,432	3,433	3,434	3,435	P:	208
209	1,385	1,108	1,057	1,080	1,108	1,108	1,108	1,108	1,108	P:	209
210	984	891	944	950	968	968	969	969	969	P:	210
211	1,506	1,637	1,648	1,838	1,838	1,838	1,838	1,838	1,838	P: Added 190 in 2015 and held # steady through 2040 - no obvious additional room for growth there. '1st and armory reconstruction - higher density.' (To be completed in 2013, 72 units/194 beds with 2, 3, and 4 bedrooms - Wells and Wells Construction website)'	211
212	1,138	1,238	1,531	1,531	1,531	1,531	1,531	1,531	1,531	P: University.	212
213	657	499	765	765	765	765	765	765	765	P: University.	213
214	1,626	1,365	1,347	1,360	1,381	1,381	1,382	1,382	1,383	P: University.	214
215	852	773	656	674	700	730	773	773	773	P:	215
216	220	230	226	230	230	230	230	230	230	P:	216
217	726	660	663	670	680	690	700	700	700	P:	217
218	9	2	790	1,021	1,228	1,260	1,292	1,338	1,380	P: Added 175 by 2015, 175 more in 2020, added 350 to each subsequent year	218

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
219	0	0	51	205	356	420	560	800	1,067	P: Added 150 people in 2015, 300 in 2020, 500 in 2030, and 1,000 in 2040	219
220	0	0	0	0	0	0	0	0	0	P:	220
221	0	0	0	0	0	0	0	0	0	P: University.	221
222	1,710	1,688	1,811	1,811	1,811	1,811	1,811	1,811	1,811	P:	222
223	445	413	384	394	404	413	424	434	445	P:	223
224	318	289	332	348	363	380	396	413	433	P:	224
225	186	222	204	209	217	223	232	242	253	P:	225
226	995	1,262	1,421	1,470	1,521	1,570	1,625	1,695	1,771	P:	226
227	40	34	32	33	34	35	36	38	40	P:	227
228	101	85	63	66	69	72	75	82	91	P:	228
229	218	210	190	195	203	208	216	225	237	P:	229
230	219	207	228	237	246	255	264	274	284	P:	230
231	524	517	505	520	535	555	575	600	629	P:	231
232	701	700	751	775	806	830	855	892	937	P:	232
233	555	545	520	540	560	583	603	625	648	P:	233
234	381	427	420	435	450	465	480	500	524	P:	234
235	501	413	395	410	425	440	455	470	491	P:	235
236	14	18	11	12	13	13	13	13	15	P:	236
237	172	149	181	190	199	208	217	226	236	P:	237
238	109	131	122	126	130	134	139	145	152	P:	238
239	12	13	7	8	8	8	8	9	10	P:	239
240	340	292	311	320	332	343	354	370	388	P:	240
241	729	813	911	945	980	1,005	1,037	1,085	1,135	P:	241
242	657	727	816	841	866	900	930	970	1,017	P:	242
243	427	414	422	434	448	462	481	500	527	P:	243
244	257	302	284	292	302	312	324	339	354	P:	244
245	90	101	100	104	108	112	116	120	124	P:	245
246	211	164	177	183	190	195	201	210	220	P:	246
247	107	147	203	210	217	225	232	240	253	P:	247
248	438	420	322	348	370	385	405	425	451	P:	248
249	367	361	382	402	422	440	459	479	498	P:	249
250	331	324	274	290	306	320	331	331	331	P:	250
251	1,230	1,147	1,514	1,560	1,606	1,650	1,720	1,800	1,887	P:	251
252	39	47	65	68	73	75	78	81	85	P:	252
253	245	290	303	310	321	340	350	362	378	P:	253
254	635	1,529	2,539	2,539	2,539	2,539	2,539	2,539	2,539	P:	254
255	324	376	389	405	415	428	443	455	484	P:	255
256	365	398	309	340	370	398	398	398	398	P:	256

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
257	195	476	1,579	1,800	2,076	2,455	2,677	2,923	3,169	P: Conway Farm + Plotner = 131 houses/351 people, + Tarter (future). Additional input from Gary Laforge regarding Country Ridge, Whisper Meadows, and Prairie Fields(?) = additional 150 in 2015, 400 in 2020, 718 in 2025, 879 in 2030, 1040 in 2035, 1201 in 2040.	257
258	1,070	962	924	950	975	1,000	1,052	1,100	1,151	P:	258
259	437	393	382	394	405	420	435	450	476	P:	259
260	587	602	542	570	602	602	602	602	602	P:	260
261	542	621	468	490	515	540	570	615	665	P:	261
262	172	210	381	395	410	420	434	452	475	P:	262
263	418	405	475	475	475	475	475	475	475	P:	263
264	1,122	1,362	1,498	1,510	1,510	1,510	1,510	1,510	1,510	P: Added 11 in 2015 (4 houses) and kept numbers consistent (rather than losing population as "rural" area - should be "urban")	264
265	489	555	511	525	545	560	580	605	636	P:	265
266	28	433	796	879	980	1,000	1,041	1,080	1,126	P: Added 27 in 2015 and 135 in 2020 and each year after	266
267	167	192	183	188	194	194	194	194	194	P: Reduced by and 35 in 2040 and kept consistent from 2020 - 2040	267
268	539	477	526	520	513	507	500	490	480	P: Decreased population to make room for more retail, down to 500 in 2030 and down to 480 in 2040	268
269	1,216	1,336	1,105	1,210	1,336	1,350	1,366	1,366	1,366	P: Increased population by 30 in 2030 and 2040	269
270	871	1,022	1,221	1,255	1,296	1,340	1,390	1,450	1,521	P:	270
271	722	997	1,295	1,340	1,386	1,430	1,474	1,540	1,614	P:	271
272	1,115	1,238	1,471	1,495	1,520	1,542	1,566	1,588	1,613	P: Increased 3% in previous population numbers starting in 2015	272
273	148	120	130	134	138	142	148	154	162	P:	273
274	150	190	347	357	368	380	395	411	432	P:	274
275	917	1,260	1,953	2,040	2,100	2,160	2,223	2,320	2,433	P:	275
276	425	433	401	412	426	440	457	477	500	P:	276
277	304	291	320	330	342	352	365	380	398	P:	277
278	1,083	980	935	960	992	1,022	1,065	1,115	1,165	P:	278
279	259	0	0	0	0	0	0	0	0	P:	279
280	4,094	1,398	1,669	1,660	1,650	1,640	1,630	1,620	1,610	P:	280
281	281	91	82	82	82	82	82	82	82	P:	281
282	3,138	1,552	1,763	1,763	1,753	1,743	1,733	1,723	1,713	P:	282
283	663	697	601	607	614	621	628	635	642	P:	283
284	211	206	284	284	284	284	284	284	284	P:	284
285	806	900	1,080	1,115	1,150	1,190	1,230	1,280	1,346	P:	285
286	306	309	231	245	260	275	290	305	309	P:	286
287	656	642	644	644	644	644	644	644	644	P:	287
288	1,831	1,503	1,467	1,506	1,566	1,636	1,706	1,766	1,828	P:	288

TAZ	Pop 1990	Pop 2000	Pop 2010	Pop 2015	Pop 2020	Pop 2025	Pop 2030	Pop 2035	Pop 2040	Population Notes	TAZ
289	1,436	1,344	1,476	1,516	1,556	1,610	1,679	1,750	1,839	P:	**289**
290	1,002	846	598	630	660	690	720	750	785	P:	**290**
291	536	479	395	410	425	445	465	488	514	P:	**291**
292	228	278	408	418	430	445	462	480	500	P:	**292**
293	449	383	406	416	430	445	460	475	490	P:	**293**
294	1,581	1,654	1,456	1,550	1,560	1,600	1,650	1,720	1,800	P:	**294**
295	828	775	638	658	678	703	728	753	775	P:	**295**
296	634	610	907	930	962	1,000	1,040	1,080	1,130	P:	**296**
297	679	731	686	706	727	750	780	810	854	P:	**297**
298	1,169	1,177	1,110	1,150	1,190	1,235	1,280	1,330	1,383	P:	**298**
299	1,314	1,246	1,387	1,430	1,472	1,520	1,579	1,650	1,728	P:	**299**
300	926	856	704	735	765	800	835	875	918	P:	**300**
301	581	680	628	648	668	690	715	740	782	P:	**301**
302	275	289	287	288	289	289	289	289	289	P:	**302**
303	994	1,080	947	970	1,005	1,045	1,085	1,130	1,180	P:	**303**
304	237	223	270	275	282	290	300	315	337	P:	**304**
305	323	1,733	278	290	302	315	330	345	360	P:	**305**
306	191	175	160	165	170	176	182	190	200	P:	**306**
307	1,605	1,410	1,236	1,236	1,236	1,236	1,236	1,236	1,236	P: Changed projections numbers to remain consistent since 2010. 'Trailer park, no growth projected.'	**307**

TABLE E.2 EMPLOYMENT PROJECTIONS BY TRAFFIC ANALYSIS ZONE (TAZ)

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
1	1,086	1,189	1,305	1,434	1,577	1,736	1,914	E: Downtown - Added 200 between 2020 and 2040. 'increase employment growth'	1
2	1,042	1,134	1,235	1,348	1,474	1,614	1,770	E:	2
3	916	964	1,015	1,071	1,132	1,199	1,273	E:	3
4	566	576	597	633	676	719	773	E: Downtown - Added 100 between 2020 and 2040. 'increase employment growth'	4
5	408	432	458	486	518	552	590	E: Increase in employment due to terminal expansion (no details, no increase)	5
6	369	372	373	378	386	394	404	E:	6
7	1,515	1,591	1,670	1,770	1,884	2,014	2,161	E: Downtown	7
8	1,144	1,185	1,228	1,276	1,327	1,383	1,443	E: Increased employment by moving growth forward 5 years starting in 2020 (moving 2025 growth to 2020 etc.). Downtown - 'increase employment growth'	8
9	472	504	539	578	621	669	723	E: Increased 2015 by 70 and 5 additional each (5)year after. Downtown - 'increase employment growth; New hotel (Neil and Church) with 60+ employees, could spur additional growth.'	9
10	449	502	561	627	701	784	877	E:	10
11	330	357	386	419	455	494	539	E:	11
12	252	280	311	347	386	430	479	E:	12
13	671	688	705	726	749	775	802	E:	13
14	703	741	783	829	880	936	998	E:	14
15	2,296	2,408	2,529	2,661	2,805	2,961	3,132	E:	15
16	1,666	1,782	1,910	2,050	2,205	2,376	2,564	E:	16
17	1,475	1,580	1,695	1,823	1,964	2,121	2,295	E:	17
18	1,697	1,752	1,813	1,880	1,955	2,038	2,130	E: Plastipak 400 (EDC says 810)	18
19	377	413	453	499	550	607	670	E:	19
20	430	442	454	467	481	495	510	E:	20
21	893	921	951	982	1,017	1,053	1,093	E:	21
22	1,056	1,086	1,117	1,152	1,190	1,230	1,275	E:	22
23	178	184	191	198	206	214	224	E:	23
24	656	708	765	829	899	978	1,065	E:	24
25	1,732	1,816	1,905	2,000	2,100	2,206	2,319	E: Kraft 1,300	25
26	255	266	279	293	308	324	342	E:	26
27	102	110	119	128	139	151	164	E:	27
28	1,217	1,266	1,318	1,379	1,447	1,521	1,603	E: Patterson 400	28
29								E:	29

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
30	26	28	30	32	35	37	41	E:	30
31	839	884	934	989	1,049	1,116	1,190	E:	31
32	817	877	943	1,015	1,094	1,180	1,275	E:	32
33	120	129	139	150	161	175	189	E:	33
34	395	396	395	400	406	415	425	E:	34
35	1,095	1,145	1,198	1,254	1,315	1,379	1,448	E: CUMTD manually added (328)	35
36	1,177	1,186	1,194	1,205	1,218	1,233	1,249	E: Flex-N-Gate (EDC=460, BA=200) + Guardian West 425	36
37	266	280	296	314	332	353	375	E:	37
38	522	546	572	600	631	665	702	E:	38
39	4,680	5,245	5,880	6,592	7,391	8,288	9,295	E:	39
40	805	826	850	875	903	934	968	E: 'Other' employment increased by 460 in 2010 to account for Solo Cup (0 employment listed in BA data), Re-projected based on previous CAGR through 2040 (RM).	40
41	337	351	367	385	404	425	449	E:	41
42	807	870	939	1,016	1,101	1,195	1,300	E: Plots available for community development along Philo and around Meijer. 'Retail' employment increased by 250 in 2010 to account for Meijer which had 0 employees listed in BA, (RM). Re-projected retail employment with previous CAGR.	42
43	1,368	1,527	1,705	1,905	2,130	2,382	2,665	E: Provena	43
44	224	230	236	243	250	258	265	E:	44
45	263	278	294	312	331	352	374	E: IL Terminal expansion, incl. office space, increase employment growth	45
46	58	62	67	72	78	84	91	E:	46
47	1,295	1,448	1,619	1,811	2,026	2,268	2,538	E: University: Added 600 in 2010, Beckman, computer engineering bldgs, labs etc (see university tab for recalculated CAGR)	47
48	234	245	258	271	286	303	321	E: University: Added 70 in 2010 for Public safety office (see university tab for recalculated CAGR)	48
49	312	337	364	394	427	464	505	E: University. Added 600 in 2010 loomis lab, superconductivity, computation, (see University tab for recalculated CAGR)	49
50	162	175	190	206	224	244	266	E: University: Added 1,000 in 2010 for engineering quad (see University tab for recalculated CAGR)	50
51	1,062	1,089	1,118	1,149	1,181	1,215	1,252	E: University: Added 300 in 2010 for prof arts, computation, vivarium (see University tab for recalculated CAGR)	51
52	405	431	460	491	527	566	610	E: University	52
53	147	150	153	156	159	163	166	E: University	53

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
54	470	501	536	574	615	661	711	E: University: Added 400 in 2010 for physical plant, DRES, geo lab, food, copies (see University tab for recalculated CAGR)	54
55	85	89	93	98	104	110	116	E: University	55
56	1,826	1,914	2,010	2,116	2,231	2,358	2,497	E:University: Subtracted 11,000 in 2010 to distribute university employment more accurately (see University tab for recalculated CAGR)	56
57	5,586	6,088	6,644	7,263	7,949	8,712	9,558	E: University: Added 6,000 in 2010 for all faculty working in all buildings around quad and beyond in this TAZ (see University tab for recalculated CAGR)	57
58	102	108	116	124	133	143	154	E: University	58
59	1,097	1,181	1,274	1,378	1,493	1,621	1,762	E: University. Increased employment starting in 2020 to double by 2040. 'Talk of developing research park out further - just opened up 4th street for growth there. About 1,200 employees right now, that could easily double in the next 10 yrs.'	59
60	303	331	363	398	436	479	526	E: University: Added 380 in 2010 for NCSA, central receiving, mail etc (see university tab)	60
61	1,351	1,402	1,522	1,649	1,826	2,008	2,240	E:	61
62	1,418	1,560	1,717	1,893	2,088	2,306	2,548	E: Parkland 800	62
63	692	703	714	725	737	749	762	E:	63
64	419	451	486	524	567	614	666	E:	64
65	2,957	3,051	3,149	3,251	3,358	3,469	3,585	E: Added 100 in 2020 and another 100 every 10 years after. 'Mall area - lots of opportunity for infill here, even in parking lots or by reducing retention ponds. Interstate to Market will be extended soon.'	65
66	1,553	1,614	1,680	1,752	1,829	1,913	2,004	E:	66
67								E:	67
68								E: Increased by 10 in 2020, 20 in 2030 and adjusted surrounding years accordingly. under 160 acres, could pop any day, mostly single family, a little commercial by 2020/30	68
69	327	343	360	378	397	418	441	E:	69
70	574	613	656	704	758	817	883	E:	70
71	54	54	55	56	57	58	59	E:	71
72	396	407	420	434	448	464	481	E:	72
73	74	78	82	86	91	96	101	E:	73
74	76	79	81	84	87	91	95	E:	74
75	286	309	333	360	390	423	460	E:	75

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
76	96	107	120	134	150	168	187	E:	76
77	103	111	121	131	142	155	169	E:	77
78	39	43	47	51	57	62	68	E:	78
79	151	160	170	181	194	208	224	E:	79
80	244	269	297	329	364	403	447	E:	80
81	205	205	204	204	204	204	203	E:	81
82	162	170	178	188	198	210	223	E:	82
83								E:	83
84	65	68	71	75	79	83	87	E:	84
85	21	21	22	23	25	26	27	E:	85
86	52	54	56	58	61	63	66	E:	86
87	214	223	232	242	253	266	279	E:	87
88								E:	88
89	316	336	358	382	409	438	469	E:	89
90	148	165	184	205	229	255	285	E:	90
91	328	335	341	349	356	364	372	E:	91
92	851	906	965	1,030	1,102	1,180	1,266	E:	92
93	548	594	644	701	764	834	912	E:	93
94	134	145	156	169	184	200	218	E:	94
95	421	431	442	453	465	478	491	E:	95
96	84	93	104	116	129	143	159	E:	96
97	196	260	299	309	320	333	345	E: Added 55 employees from school that moved in 2012, add 30 grain elevator employees by 2020: added 55 in 2015, added 85 in 2020 and each year after that	97
98	450	461	472	488	506	527	551	E:	98
99	146	158	171	185	201	219	239	E:	99
100	8	8	8	8	8	8	8	E:	100
101	1,064	1,121	1,184	1,253	1,328	1,411	1,501	E:	101
102	165	176	189	202	218	234	253	E: Small commercial plots where future land use plan identifies opportunities for local businesses - existing projected growth sufficient.	102
103	1,136	1,186	1,240	1,300	1,365	1,437	1,515	E:	103
104								E: Fairgrounds	104
105	99	101	102	104	105	107	109	E:	105
106	320	352	388	428	472	521	575	E:	106
107	13	13	13	13	14	14	14	E: University - Orchard Downs.	107

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
108	19	19	19	20	20	20	21	E:	108
109	215	220	230	240	250	260	270	E: No employment listed for Clark Lindsey, added 201 in 'other' employment, EDC employment listed in 2010 (RM). Eventual expansion of Clark Lindsey Villas (+32 villas). Estimated growth after 2010. (BA located Clark Lindsey in TAZ 128)	109
110	61	62	62	63	64	65	67	E: Added 40 in 2030 and 80 in 2040. 'Room for additional development along Cunningham'	110
111	163	171	179	189	198	209	221	E:	111
112	163	166	170	173	176	180	183	E:	112
113	239	240	240	242	244	246	248	E: One plot left for commercial development	113
114	722	732	742	757	772	792	812	E: Significantly reduced growth based on existing employers here (government, corrections), (RM). No change by 2015, +60 2020	114
115	156	169	182	197	214	232	251	E: Room for additional light industrial dev. Loss of Birkey's farm supply (35 'other') in 2014. (RM).	115
116	126	135	145	156	167	181	195	E:	116
117	118	127	137	148	160	173	188	E: Possible growth along Philo - 13 commercial lots by 2040 (small, stripmall-ish) with Menards development (Engstrom email 12/16)	117
118	119	125	132	140	148	157	167	E:	118
119	71	79	87	96	106	117	129	E:	119
120	67	68	68	69	70	70	71	E:	120
121	250	288	326	364	402	440	480	E: RM "I see more growth in that area, 250-300 employees today and double that in 2040" I added 50 in retail, 80 in services, 10 in other, in 2010. I estimated the rate of the existing employment doubling by 2040.	121
122								E:	122
123								E: Lo owns this property. Possible relocation of Judah Christian school to this TAZ.	123
124								E:	124
125	27	27	27	27	28	28	28	E:	125
126	469	479	490	504	518	534	550	E: Airport	126
127	282	297	313	332	353	377	404	E: Added 100 in 2015 and 175 to 2020 and each year after that, Savoy CVS + Christie development	127
128	34	35	36	38	40	41	43	E:	128

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
129	84	89	94	100	106	113	121	E: Room for additional development along Cunningham	129
130	1,677	1,760	1,851	1,950	2,056	2,172	2,298	E: Industrial - room for additional development along Cunningham and a future Olympian Drive extension	130
131	1,438	1,494	1,559	1,636	1,724	1,824	1,935	E: Industrial - possible commercial develoment around future Olympian Dr - major intersection at (future) Olympian and (future) Lincoln. Removed 800 from "other" category (duplicate employment listed for supervalu) and recalculated total.	131
132	1,733	1,823	1,921	2,029	2,147	2,277	2,419	E: Apollo industrial park, growth may be more modest - each employer will bring a lot of employees. Also, improvements along Market street might bring more development/employment. Also, Olympian Drive to Lincoln will be extended by 2040 which could encourage more development as well. (additional Plastipak facilities here?)	132
133								E:	133
134	6	6	6	6	6	6	6	E:	134
135	16	16	17	17	17	17	18	E:	135
136	73	81	90	100	111	123	136	E:	136
137	72	77	83	89	96	103	111	E:	137
138	6	71	87	95	103	111	119	E: Increased by 65 in 2015 and 2020. Increased by another 20 in 2030 and 40 in 2040. YMCA moved here from TAZ 94 in 2012. 'bump up employment numbers by 2040 in conjunction with Curtis interchange development plans'	138
139	406	437	471	510	552	599	651	E:	139
140	1,521	1,566	1,613	1,663	1,715	1,771	1,830	E:	140
141	1,389	1,419	1,451	1,484	1,518	1,553	1,590	E:	141
142	6	7	7	8	8	8	9	E:	142
143	31	31	31	31	32	32	32	E:	143
144								E: good	144
145	329	341	349	362	537	542	597	E: Walmart initially listed 0 employment, added 400 based on EDC 2010, (RM). Added 200 more in 2030, 50 in 2035, 50 in 2040 for Menards and strip mall (RM). 'Lots available around WalMart, Menards will eventually develop land - 500 units (single family and multi family) + superstore + commercial'. (Add all Menards development by 2040)	145

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
146	32	114	118	122	128	134	140	E: Birkey's is currently building a new store here with plans to open in 2014 employing 85 people (RM). In addition, 'Menards will eventually develop land - residential and commercial.'	146
147								E:	147
148	249	262	277	293	312	333	357	E:	148
149	36	38	41	45	48	53	57	E:	149
150	98	105	113	121	130	139	150	E: Added 10 employees in 2015 and each year after that.	150
151	30	31	32	33	34	35	36	E:	151
152	79	80	81	83	84	86	88	E:	152
153	109	114	119	124	130	135	141	E:	153
154	87	97	107	119	132	146	162	E:	154
155								E:	155
156								E:	156
157	9	10	11	13	14	16	17	E:	157
158								E:	158
159								E:	159
160	23	25	26	28	29	31	33	E:	160
161								E:	161
162	63	65	67	69	71	73	75	E:	162
163								E:	163
164								E:	164
165	23	25	26	28	29	31	33	E:	165
166								E:	166
167								E:	167
168								E:	168
169								E: No growth added. 'possible employment growth here from Atkins 150 expansion, but no sewer yet'	169
170	0	0	40	80	160	320	640	E: Added 40 jobs in 2020 and doubled every 5 years after. 'Employment will start here in 2020, more in 30 and 40. Carle owns 100 acres - CLEARVIEW development by Atkins group with medical park and office park, at least some of the plots are available for immediate development. (Atkins group website)'	170
171	294	293	293	293	293	292	292	E: Added 50 in 2020, 100 in 2030 and another 100 in 2040. 'Atkins 150 development - most employment in this quadrant'	171
172	124	128	133	138	144	150	157	E:	172
173								E:	173

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
174								E:	174
175	23	25	27	29	31	34	37	E:	175
176								E:	176
177	785	797	810	824	839	855	871	E: Horizon Hobby 400; No additional growth added to initial projections. 'Numbers look good, but could be bumped up a bit, there is land next to the interstate that could still be developed'	177
178	29	32	36	40	44	49	54	E: Added 20 to 2040 in conjunction with Curtis interchange development plans	178
179									179
180	2	2	2	2	2	2	2	E:	180
181								E:	181
182	227	245	263	302	325	358	391	E: No growth added to initial projections. 'Numbers look good, but could be bumped up a bit, there is land next to the interstate that could still be developed. No sewer yet.'	182
183	16	16	17	17	17	17	18	E:	183
184	45	47	149	151	153	155	158	E: New Dollar General in 2013, 8 employees. Added 100 (big box store) by 2020 and each year after	184
185	59	115	200	220	239	239	239	E: Added 44 by 2015, 44 more in 2020 for factory, plus 8 other lots built out for med offices or fast food =77 more employees between 2015 and 2030. (5/5/2014)	185
186								E:	186
187								E:	187
188								E:	188
189								E:	189
190								E:	190
191								E:	191
192								E:	192
193								E:	193
194								E:	194
195								E:	195
196	136	149	164	180	197	217	238	E: Added 30 in 2030 and 40 in 2040. 'bump up employment numbers by 2040 in conjunction with development plans'	196
197	0	0	0	0	0	0	20	E: Added 20 in 2040 in conjunction with interchange development plans	197
198	394	408	423	438	454	470	488	E: Added 40 employees in 2015, 75 in 2020, and 75 in each year after that	198

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
199								E:	199
200	40	45	50	61	69	80	91	E: Limited retail as part of future residential plans. St. Thomas Moore High School is here.	200
201	997	1,044	1,093	1,146	1,202	1,262	1,325	E: Fine	201
202	347	356	365	375	384	394	405	E:	202
203	8	38	59	69	80	95	112	E: Added 30 in 2015, 50 in 2020, 70 in 2030, and 100 in 2040. 'Prospect and Lincoln - all infrastructure in place, office park/bldg 2020/30 there will be more, 4 or 5 small office buildings.'	203
204								E:	204
205	0	0	80	80	80	80	80	E:	205
206								E:	206
207	76	80	85	90	95	101	107	E:	207
208	220	237	257	278	302	328	358	E: University: Added 50 in 2010 for student housing, Nobel Hall and Flagg Hall, (see University tab)	208
209	24	25	25	25	26	26	26	E: University	209
210	106	108	110	113	115	117	120	E: University	210
211	76	77	79	81	83	85	87	E: University	211
212	358	366	374	383	394	405	418	E: University. Subtracted 30 from 'service' employment and 50 from 'other' employment after double-checking listings in this TAZ and visiting sites (RM). The Newman Center listed 0 employment, replaced the 30 initially subtracted from service to account for this.	212
213	1,110	1,173	1,242	1,318	1,402	1,495	1,597	E: University: Added 500 in 2010 for business, music, labs, spurlock, admissions (see University tab)	213
214								E: University: Added 100 in 2010 for student housing and nursing school, (see University tab)	214
215	6	7	7	7	7	8	8	E:	215
216	15	15	15	15	15	15	15	E:	216
217	19	19	19	20	20	20	21	E:	217
218	18	69	72	122	127	132	137	E: Added 50 in 2015, 50 more in 2020, and 100 in each subsequent year	218
219	143	159	227	299	422	511	578	E: Added100 in 2020, 200 in 2025, 300 in 2030, 400 in 2035, and 500 in 2040	219
220	83	84	85	86	87	88	89	E:	220

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
221	1,046	1,160	1,286	1,426	1,582	1,755	1,947	E: University: Added 1,000 in 2010 for business, art, law, huff hall, armory (see University tab)	221
222	603	641	683	730	782	840	904	E:	222
223	436	439	441	444	447	451	454	E:	223
224								E:	224
225	18	18	19	20	21	22	23	E:	225
226	200	204	208	213	220	227	234	E:	226
227								E:	227
228								E:	228
229	61	59	57	55	53	52	50	E:	229
230	62	69	76	85	94	105	116	E:	230
231	83	85	87	89	92	96	100	E:	231
232	86	90	94	99	104	109	115	E:	232
233	6	7	7	7	8	8	8	E:	233
234	77	77	77	78	79	80	81	E:	234
235	65	66	67	68	70	71	73	E:	235
236								E:	236
237	13	14	14	15	16	17	18	E:	237
238	115	110	104	100	96	92	88	E:	238
239								E:	239
240	71	72	73	75	77	80	83	E:	240
241	135	144	153	163	175	188	203	E:	241
242	123	132	143	154	166	180	194	E:	242
243	35	37	39	42	44	47	50	E:	243
244	77	80	84	88	93	98	104	E:	244
245								E:	245
246	34	34	35	36	37	39	40	E:	246
247								E:	247
248	86	93	101	109	119	130	142	E:	248
249	56	54	51	49	47	45	43	E:	249
250	119	122	125	129	133	137	142	E:	250
251	237	254	273	294	317	342	370	E:	251
252	7	8	9	10	11	12	13	E:	252
253	65	66	66	67	68	68	69	E:	253
254	114	121	129	138	147	158	169	E:	254
255	165	168	171	175	179	184	189	E:	255

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
256	190	202	214	229	246	265	286	E:	256
257	147	165	200	210	220	238	263	E: "Possibly more restaurants - around 200 employees by 2020"	257
258	145	142	138	136	133	131	129	E:	258
259	80	88	97	107	118	130	143	E:	259
260								E:	260
261	102	106	110	116	122	129	137	E:	261
262	42	44	47	50	53	56	60	E:	262
263	86	93	100	108	117	126	137	E:	263
264	108	112	116	170	208	222	236	E: Added 50 in 2025, 100 in 2030, 2035, and 2040. 'Likely to eventually see a grocery store and small strip mall here.'	264
265	60	66	72	79	87	96	106	E: Cut total in half (1/9/14)	265
266	94	96	109	110	112	118	130	E: Added 10 employees for small hotel in 2020 and each year after	266
267	337	347	358	369	382	396	411	E: Added 50 employees in 2020 and every year after	267
268	212	219	227	237	247	259	271	E:	268
269	249	260	271	286	304	323	346	E: Decreased by 385 in 2010 and recalculated growth based on previous CAGR - BA listed school superintendent's office as employing 400, confirmed with office that they have only 15 employees. Individual school employment already accounted for in their respective TAZs.	269
270	161	172	150	150	150	150	150	E: Reduced by 20% in 2020 and held consistent in subsequent years which equals a 40% reduction in 2040 employment from previous numbers	270
271	94	140	160	182	211	238	270	E: Doubled growth previously projected from for 2040, increase starting in 2015	271
272	222	240	259	280	303	329	357	E:	272
273								E:	273
274	39	43	48	54	61	68	76	E:	274
275	92	97	102	107	113	119	126	E:	275
276	28	31	33	35	38	40	43	E:	276
277	74	79	85	91	98	105	114	E:	277
278	229	234	239	246	254	263	274	E:	278
279	64	64	64	63	63	63	62	E:	279
280	487	523	562	607	657	713	775	E:	280
281	200	201	202	203	204	205	207	E:	281
282	51	53	56	58	61	64	67	E:	282

TAZ	Emp 2010	Emp 2015	Emp 2020	Emp 2025	Emp 2030	Emp 2035	Emp 2040	Employment Notes	TAZ
283	469	485	502	521	540	560	582	E:	283
284	6	6	5	5	5	5	4	E:	284
285	104	109	114	119	126	133	140	E:	285
286	163	167	172	177	183	189	195	E:	286
287	567	623	686	755	832	918	1,013	E:	287
288	248	262	278	296	315	337	361	E:	288
289	410	440	473	509	549	593	642	E:	289
290	364	44	46	47	48	50	53	E:	290
291	108	114	122	129	138	148	158	E:	291
292	106	106	106	106	106	106	107	E:	292
293	18	19	19	19	19	19	19	E:	293
294	323	338	354	371	389	409	430	E:	294
295	98	104	110	117	125	133	143	E:	295
296	80	86	92	99	107	116	125	E:	296
297	201	205	208	213	218	225	232	E:	297
298	827	850	872	903	937	977	1,021	E:	298
299	13	14	15	17	18	20	21	E:	299
300	130	137	144	152	161	172	183	E:	300
301	53	56	59	62	66	69	73	E:	301
302	1,771	2,160	2,200	2,242	2,285	2,331	2,379	E:	302
303	87	95	105	116	128	142	157	E: Bell Sports built new plant and moved to TAZ 302 in 2010.	303
304	85	88	91	95	100	106	112	E:	304
305	34	33	31	30	29	27	26	E:	305
306	44	44	44	44	44	45	45	E:	306
307								E:	307