KERN SB 375
LAND USE MODELING
METHODOLOGY

11/10/2022 Version 15

This Document was prepared under the supervision of the following certified engineer.

Kern Council
of Governments

Kern Council of Governments

Board of Directors

The Kern Council of Governments is the regional planning agency as well as the technical and informational resource, and rideshare administrator for the area's 11 incorporated cities and the County of Kern. Following Board direction, staff coordinates between local, state, and federal agencies to avoid overlap or duplication of programs. This intergovernmental coordination enables staff to work with many public agencies to ensure that planning and implementation of programs proceed in a coordinated manner.

Acknowledgement of existing and former staff that provided valuable input to this process:

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KERN SB 375 LAND USE MODELING METHODOLOGY

EXECUTIVE SUMMARY

Kern Council of Government's Regional Transportation Plan (RTP) is regularly updated on a four-year cycle. Public outreach efforts are conducted on a continuous basis with the oversight of the Regional Planning Advisory Committee (RPAC) and the Transportation Modeling Sub-committee (TMC). The bottom-up public involvement process employs numerous public outreach events, allowing stakeholders extensive opportunities to give valuable feedback on the goals, policies, actions and assumptions of each RTP update, including the modeling output. The RTP's environmental document analyzes the environmental impacts of the RTP and the Sustainable Communities Strategy's (SCS) which required multiple alternatives.

The Sustainable Communities and Climate Protection Act (SB 375) was passed in 2008 to reduce California's overall Greenhouse Gas (GHG) emissions. Under SB 375 Municipal Planning Organizations (MPO), like Kern COG, are required to prepare an SCS as part of the RTP. The purpose of the SCS is to reduce per capita vehicle emissions from light-duty trucks and passenger vehicles through improvements in Land Use and Transportation planning, and ultimately reducing vehicle miles traveled (VMT). One of the primary strategies required to be considered by SB 375 is the development of a more efficient land use growth pattern that reduces VMT and resulting GHG emissions. The land use model is used to consider various growth pattern scenarios in a public forum. The SCS must meet the emission reduction targets set for each MPO by California's Air Resources Board (ARB) for the years 2020 and 2035.

The per capita reduction targets for Kern Council of Governments (Kern COG), the MPO for the County of Kern, are updated every four to eight years by ARB. CARB's documentation and calculations for these targets can be found on the ARB website for Kern COG.[1] These targets were first adopted by ARB in 2010 and were updated in 2018. Minor adjustments and updates are made to the land use modeling methodology each cycle. The method used has resulted in the ultimate approval of each RTP/SCS to date by the federal, state and local reviewing agencies. This land use model analysis is one of the primary inputs into the Kern COG Public Participation Program[2] which is the only program recognized in the state 2017 RTP Guidelines as a best practice for small and medium sized MPOs.[3] The model also provides essential inputs to the regional travel model and state emissions model which are used to demonstrate that the ARB SB 375 Targets are being met by the region.

[1] California Air Resources Board, Kern COG webpage, https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/regional-plans-evaluations/kern-council

[2] Kern COG Public Information Policies & Procedures, 2019, https://www.kerncog.org/policies/

[3] California Transportation Commission, "2017 RTP Guidelines" https://catc.ca.gov/programs/transportation-planning. p. 204

MODELING DEVELOPMENT

LAND USE AND TRAVEL MODEL DEVELOPMENT

Kern COG's socio-economic data development method has evolved from spreadsheet methodologies[4] to predictive land use modeling software. The region currently uses a similar method used in the 2006 Kern COG Sustainable Blueprint visioning process, and for each subsequent RTP/SCS cycle since. The region uses the open-source, UPlan rules-based land use modeling software developed by UC Davis.[5] The software is a step above some sketch planning land use models in that it provides a priority for allocating development based on proximity to infrastructure similar to an econometric land use model that uses rent data as a primary input.

Land use model parameters, assumptions, inputs, and reference information such as General Plans are provided by Kern COG's member agencies and the public. The combined county-wide land use map developed based on this input can be found in Appendix A. The model constrains growth to areas where the land use map identifies property designated for each type of development. The Kern COG Transportation Modeling Committee and other stakeholders have provided input and oversight for the development of the modeling inputs. The land use model output is fed into the regional travel demand model which uses CitiLabs Cube software[6] used by most MPOs in California. The travel model is improved and updated regularly.[7] In recent improvement cycles the model development was part of the San Joaquin Valley Model Improvement Program (MIP). The travel model has been enhanced to include the "D's" process best practice for modeling. The D's relate to smart growth principles such as:

1. New Residential and Employment **Density**
2. Jobs and Housing **Diversity**
3. Walkable **Design**
4. **Destination** Accessibility

Sensitivity testing is performed after major changes to the model to insure continued responsiveness of the modeling results to these smart growth principles.

Output from the UPlan land use model becomes input for the travel model which then generates output for input into the emissions model. The rules-based UPlan model provides a simulated econometric distribution of growth guided by proximity to existing and planned infrastructure using a raster or grid-cell proximity analysis. Kern COG has good data on existing and planned infrastructure for this land use model, improving the accuracy of the growth forecast. Other econometric land use models use rent data to allocate growth. Kern COG tests with rent data using CubeLand software for the region showed that the rents in this simi-

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[4] Robert Ball, "Long-Range Micro-Spatial Population Forecast Modeling: Predicting Census Tract Population Using an Iterative Spreadsheet Driven Synthesis of Trend Analysis, Share Allocation, and Density-Ceiling Land Use Methods" (master's thesis, California State University, Bakersfield, 1998).

[5] UPlan Land Use Model Software, http://ice.ucdavis.edu/project/uplan .

[6] Bentley/CitiLabs Cube Travel Demand Model Software, https://www.bentley.com/en/products/brands/cube .

[7] Kern COG Travel Model Documentation, https://www.kerncog.org/model-documentation/ .

rural area were too uniform to be used to predict the location of future growth in an intuitive manner. The UPlan proximity factor to existing and planned infrastructure provided a much more detailed differential in growth attractions than those provided by the rent data for the region.

Kern COG also employs a zero-sum spreadsheet method to adjust the socio-economic output data from the land use model to over 1,200 Transportation Analysis Zones (TAZ). Kern COG is developing an adjustment step to the UPlan land use model output using the more rudimentary sketch land use model tool, Envision Tomorrow. This open source, land use sketch tool software will provide a “paint” tool that can adjust UPlan econometric based output to incorporate local agency and public input in much the same way as the post-land use model spreadsheet adjustment by TAZ. If successful it may be used to eliminate the spreadsheet adjustment step, or used in hybrid a manner.

Kern COG continues to research and provide training to staff on the latest developments in land use modeling and transportation, including the development of a population synthesizer as a first step towards implementation of a tour-based and/or activity-based travel model. A comparison of commonly used land use models is available online.[8] An overview presentation on Kern COG’s modeling methodology is also available on the Kern COG website.[9]

Land Use/Travel Model Infrastructure Induced Feedback Loop - Kern COG has also developed a land use model feedback procedure between the travel model and UPlan to capture future induced travel generated by future changes in freeway access. The process leverages the economic based attractors of changes in freeway infrastructure for various scenarios in a given future model year. The procedure simulates the changes in small-area economic attractions as new infrastructure such as an interchange is built providing more convenient local access to the faster regional network, thereby reducing travel times and increasing the attractiveness of the property in the vicinity. The new infrastructure in the land use model results in higher growth attraction close by, where in a comparison scenario without that facility growth would show less attraction at that location. This methodology more accurately captures the feedback between future network improvements in the travel model with land use changes that could be expected when a new improvement is open to traffic, such as a freeway interchange or an extension of a water main on the periphery of an urban area, providing a more transparent and intuitive land use distribution than other methods such as rent data used by land use modeling software such as CubeLand, Pecos, and UrbanSim or the UC Davis online Induced Travel Calculator. This UPlan method has the added benefit of being less complicated to develop and operate, reducing overall land use modeling costs compared to the more sophisticated models. This process is described in more detail in Kern COG’s travel model updates document[10]. The process is also described in Appendix F Land Use Model Calibration and Validation sections.

Peer Review Process - Kern COG maintains the UPlan/MIP modeling platform development using a consultant-based peer review process. Travel model is developed and validated by one consultant and peer reviewed by a second independent consultant and possibly re-validated by the second consultant. In

[8] National Academies of Sciences, Engineering, and Medicine, “Integrated Transportation and Land Use Models” (Washington, DC: The National Academies Press, 2018) https://doi.org/10.17226/25194 .

[9] Kern Modeling 101, https://www.kerncog.org/wp-content/uploads/2018/03/Modeling-101-Presentation.pdf .

[10] Summary of Updates to the Kern COG VMIP-3 Travel Demand Model, https://www.kerncog.org/wp-content/uploads/2022/03/VMIP-3_Model_Updates.pdf .

addition, Kern COG consults regularly our peer MPOs in the San Joaquin Valley, member agency traffic engineers, stakeholders, and ARB modeling staff as part of the SCS development process via the RPAC and Transportation Modeling Sub Committee. Comments received during the peer reviews are incorporated into the next model update as appropriate on a 4-year cycle.

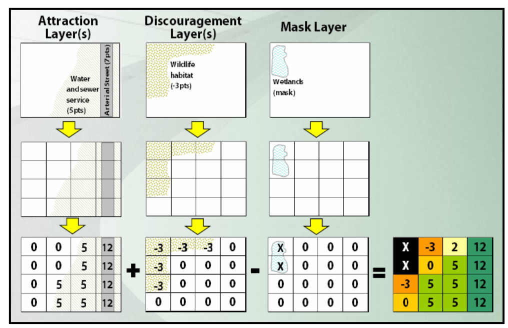
The completed land use and travel model is used to develop growth pattern scenarios and alternatives required for public participation procedure, the environmental documents, and the regular development and adoption of the Sustainable Communities Strategy and, if necessary, Alternative Planning Strategy.

HOW UPLAN MODEL ALLOCATES NEW GROWTH

UPLAN'S OBJECTIVES AND USES

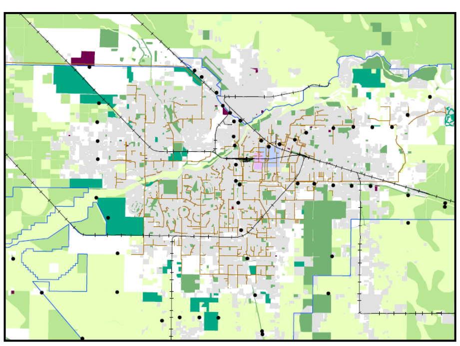
This urban growth model uses simple demographics forecasts and user inputs to project the needed space for each land use type. Projected land uses are assigned based on the attractiveness of locations to a particular land use, unsuitable locations for any development, and a local jurisdiction's general plan that determines where specific types of development are permitted. To consolidate the different general plan land use designations used by Kern's local jurisdictions, UPlan uses a set of predetermined land use designations. The conversions for each local jurisdiction's land use types can be found in Appendix G.

CELLS



The UPlan functions by dividing land into "cells", not parcels or TAZs. These cells are equal in size and can only contain one type of future planned growth, although hybrid types can be created to consolidate other types, such as the "Mixed Use" type, showing both residential and commercial growth. Kern's model has 50 by 50 meter cells.

ATTRACTIONS



An attraction could be any number of things that would promote future growth in that particular region, such as availability of electricity, water, sewer, and road infrastructure. Attractions can also be non-physical, such as political boundaries or tax incentives. An attraction will draw the allocation of growth to it, in other words, cells with attractions will have growth allocated to them before cells without attractors. See Appendix B for draft county-wide land use input layers map.

DISCOURAGEMENTS

A discouragement is the opposite of an attraction; an undesirable feature of a place where future development may take place, such as sandy soil. A discouragement does not prevent growth, although it will stop allocation of it until all other areas of that type are allocated. A discouragement represents an area that lacks desirable attributes and makes future development more costly.

Kern's Land Use Model uses discouragements layers in hilly terrain where changes in elevation make development more difficult.

WEIGHTING

Weighting is how UPlan balances attractions and discouragements, as well as how the user can determine how much an attractor will encourage growth and how much a discouragement will repel it. These weight values act much like variable rents but with a greater level of resolution.

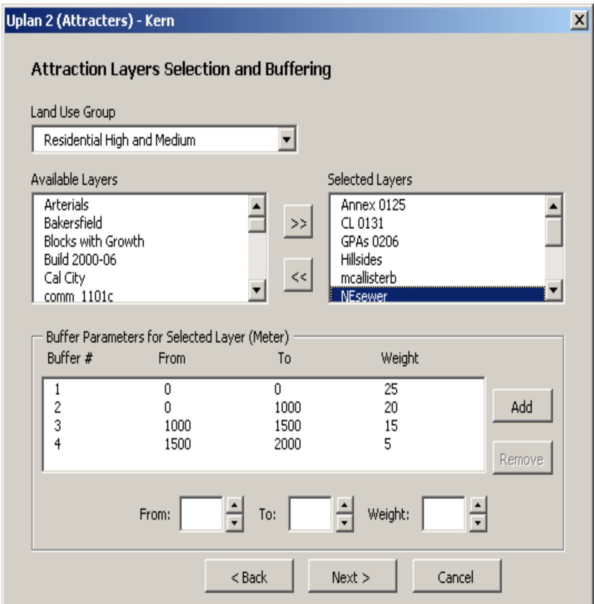
For example, if a cell has both an attractor and a discouragement, the values of them can be thought as positive and negative values, respectively. If the cell has an attractor with a weight of ten and a discourager with a weight of five, the total value of the cell will be 10 – 5 = 5, so the cell will still have an attractive value to it. A cell with multiple attractors such as a water main, transit hub, and a known redevelopment project will have an even higher value. Weighting values are relative and difficult to tie to real world data. Validation of the values requires a visual review of the output using maps to ensure intuitive results. Adjustments are made to weighting values based on public/stakeholder input.

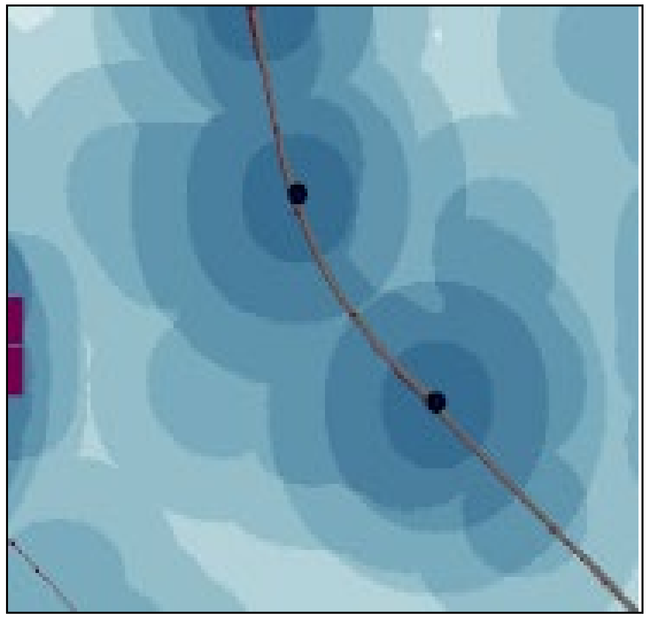
0	0	5	12
0	0	5	12
0	5	5	12
0	5	5	12

An example of how this weighting can help identify a more efficient land use pattern is an analysis using proximity to the more attractive aspects of new transportation infrastructure such has a high-quality transit hub or new freeway interchange on a beltway corridor. The proximity to a new interchange can attract growth further out because of reduced travel times created by access to less congested routes on the periphery of the urban area. This tool allows development of varied growth pattern scenarios to analyze in the travel demand model to compare changes in VMT between a beltway scenario and a high-quality transit hub scenario. The method can also be used to test the prioritization of these transportation expenditures by updating the growth pattern to match the planned projects in the travel model network for a given future year.

BUFFERS

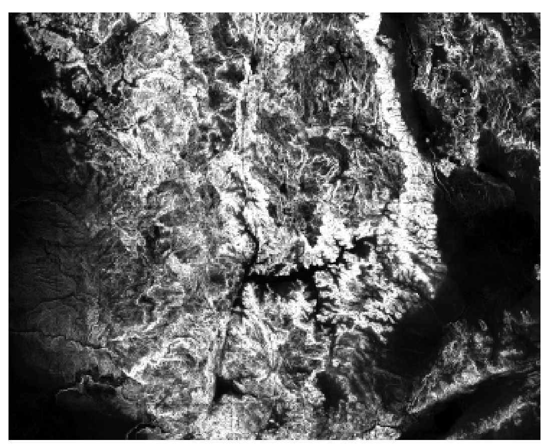
Attractions or discouragements may be surrounded by a user-defined sphere of coordinates or ‘buffer’. The user decides the number and width of the buffers. The highest attraction or discouragement values are given to buffers that have the greatest proximity to the feature. A buffer could be used in the situation of a freeway interchange and commercial growth. Clearly, businesses will wish to be closest to the freeway in order to obtain more customers, so areas closest the freeway should be modeled with the highest attraction value, with areas further away slowly decreasing in value relative to the distance from the freeway. Below is an example of the input parameters for a buffer along with an image showing the accumulated buffers the model will use as the attraction for each land use type. See Appendix C for draft county-wide map showing the buffering layer produced from the UPlan.





MASKS

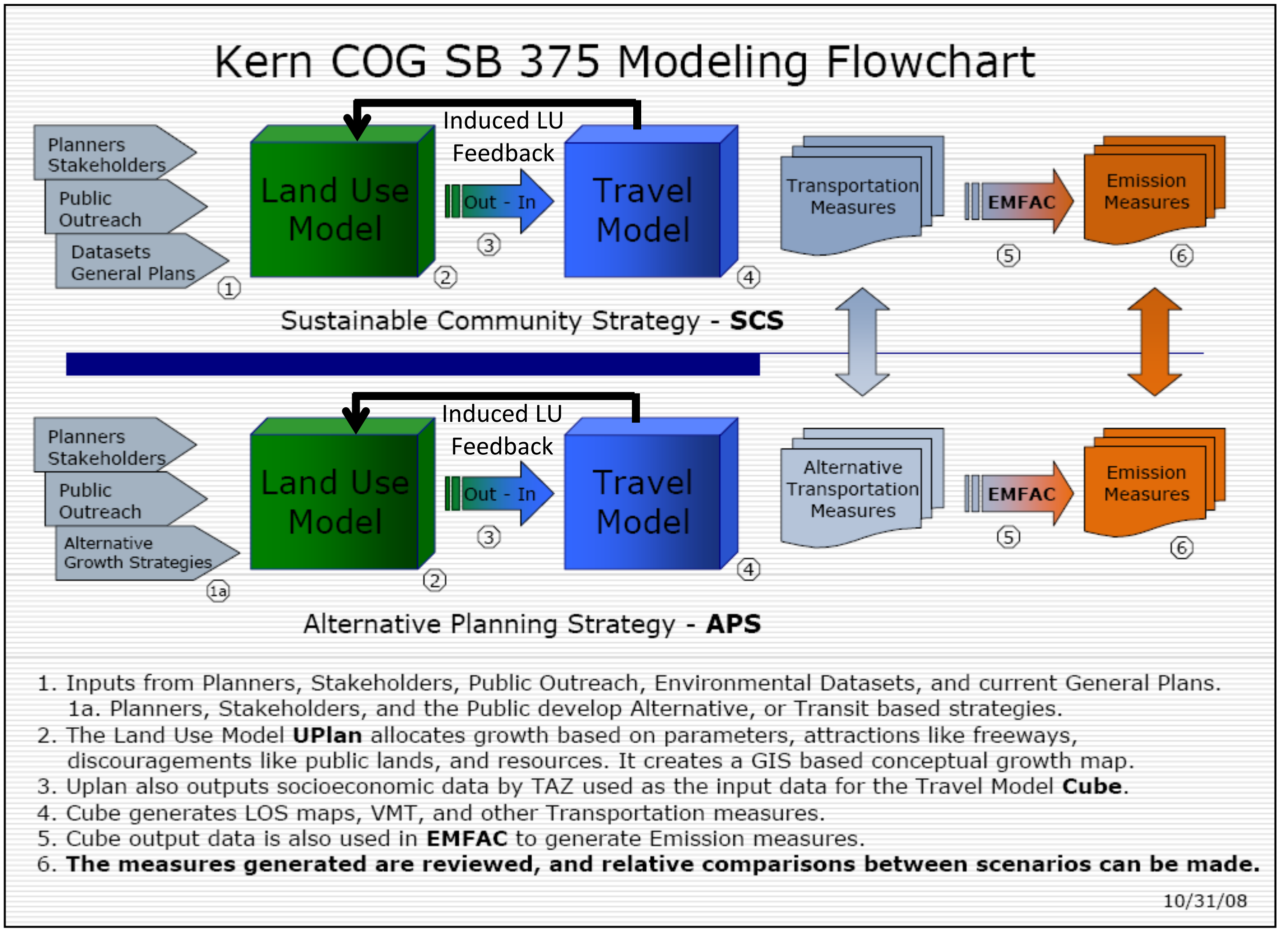
A mask is effectively an infinite discouragement, preventing all growth in that particular cell, even if all other cells have been assigned growth and unassigned growth still remains. A good candidate for a mask in UPlan would be lakes or cliffs where growth would be (by today’s economic and technological standards) improbable. At right is a mask based on slope. Kern COG uses a mask in some scenarios to prevent growth in existing developed areas. Holes are then cut out of the existing developed areas to allow infill growth in those areas to simulate redevelopment around an existing or future transit hub.



RULES BASED MODEL - BASIC RULES UPLAN OPERATES BY

- People take up space.
- People live in groups known as Households.
- Different household types take up different amounts of space.
- Some portion of each household is employed.
- Different forms of employment require different amounts of space.
- Each residential type has attributes that attract or discourage growth.
- Each employment type has attributes that attract or discourage growth.
- Some things block all growth (i.e. a lake).
- The general plan can be used determine where future growth will occur and what type it will be.
- Growth will happen in the areas with the most attractions first, then the next most attractive, then the third most attractive, and so on.

KERN COG METHODOLOGY

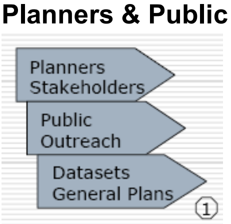


LAND USE MODEL METHOD

KERN COG SB375 MODEL

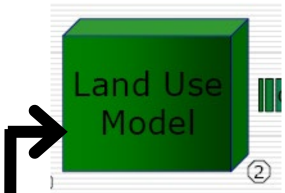
- Developed from Blueprint Processed modeling
- Based on GIS-based UPlan land use model
- Existing Cube transportation model
- Updated MIP transportation model

Planners & Public Information



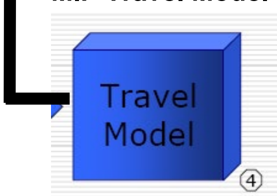
The planners provide information about their forecasts and predictions using the spreadsheet model, public agencies provide general plans, and private stakeholders provide information on forthcoming developments. A public outreach program is also conducted to better predict public opinion on future growth. This information is compiled and put into a matrix for the UPlan Land Use inputs.

UPlan Land Use Model



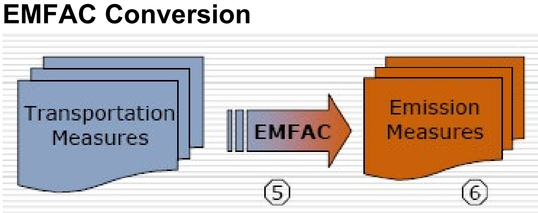
The UPlan model, as described earlier, takes this public and agency input and predicts where new growth will be allocated for each incremental period of growth between future forecast years. Information generated from the UPlan is adjusted with a manual spreadsheet process and/or land use sketch modeling tool and then input into the MIP Travel Model at the TAZ level. The arrow indicates how changes in infrastructure related land use attractions, that are included in the travel model network scenario, result in a land use feedback loop that takes into account induced travel from this future transportation infrastructure.

MIP Travel Model



The MIP Travel model then takes this information and calculates VMT (Vehicle Miles Traveled); this provides input for the ARB maintained **EM**ission **FAC**tors (EMFAC).

EMFAC Conversion



EMFAC takes the transportation measure output from the MIP model and calculates the carbon emissions produced from each planning scenario/alternative. ARB is requiring that we continue to use EMFAC2014 to improve comparibility with the prior RTP/SCS. ARB provides a special protocol for running EMFAC when demonstrating SB 375 target emissions reduction.

Kern COG's land use model calibration and validation documentation is provided in Appendix F which provides further details on the calibration and validation analysis performed for the 2022 RTP/SCS. Additional analysis for the feedback between the Travel Model and Land Use model along with the ability to capture Long Term Induced VMT is provided in the Travel Model Documentation (see page 5, footnote 10).

CREATING SCENARIOS

TECHNICAL TOOLS

Existing Models

- Land Use Model (UPlan)
- Trip-based travel demand model (Cube/MIP)
- Emissions model (ARB's EMFAC Model)

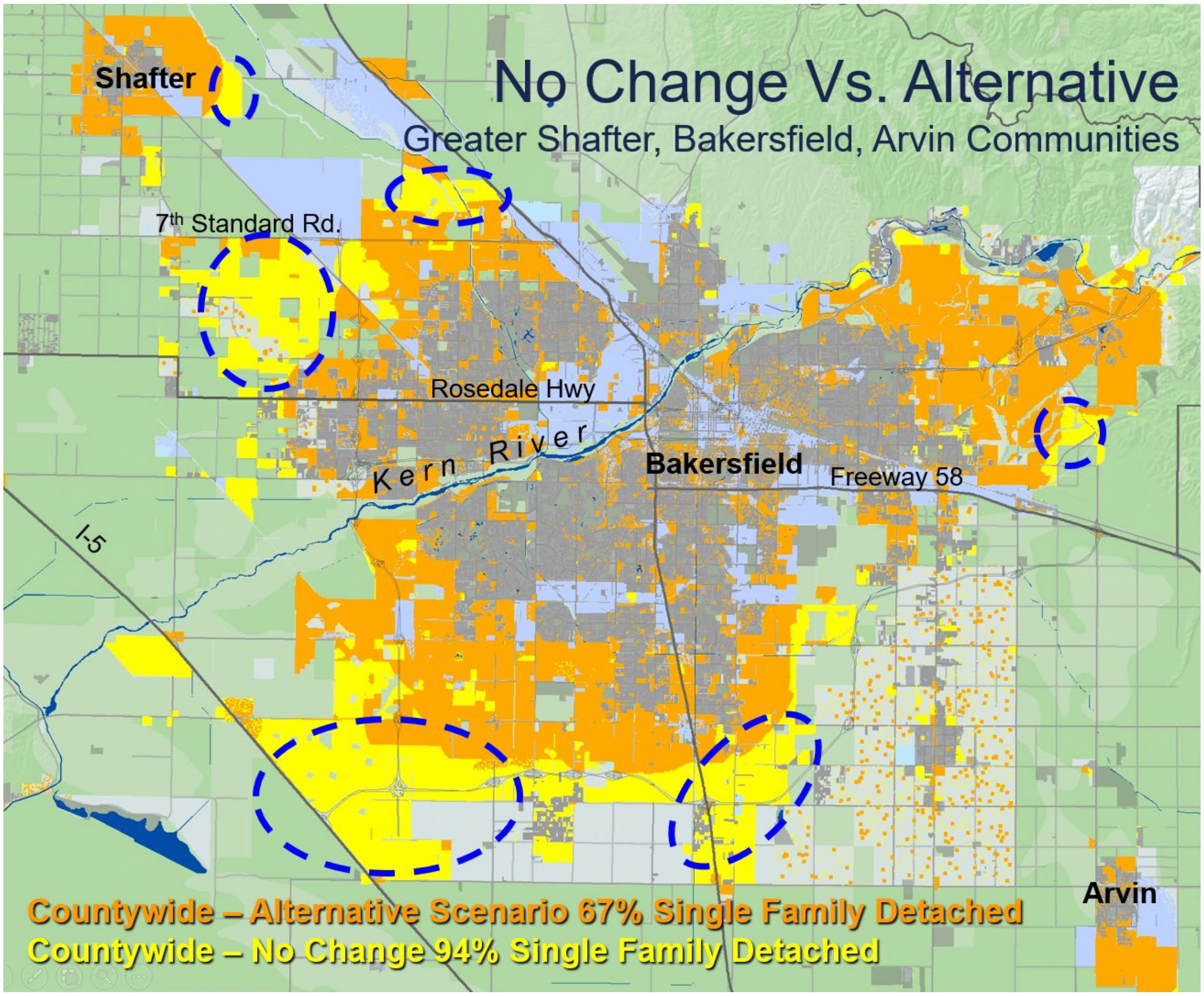
New Model Development

- Envision Tomorrow
- Population synthesizer tool
- Tour or Activity Based Model

HISTORIC TRENDS – BUSINESS AS USUAL – NO CHANGE – OLD PLAN SCENARIO

Past trends are the input parameters that result in future growth patterns for what is "business as usual" or a "no change" scenario alternative using historic growth rates and "old plan" policies. With each RTP cycle, the old plan baseline future growth pattern has changed, becoming more compact with greater infill in existing developed areas (gray areas on the map). The map below depicts the 2006 Blueprint future growth pattern by 2050 (orange areas), The pre-blueprint no change scenario shows peripheral growth extending all the way to I-5 (yellow areas). The blue dashed locations indicate roughly the amount of area not required for development by 2050. This analysis combined with the housing reset in 2008 resulted in a curtailment of general plan amendment requests on the periphery of the Metropolitan Bakersfield urban area. It is important to note that any model results greater than 5 years in the future are subject to trend bifurcations and are nearly impossible to predict accurately. Consequently, the growth locations and amounts will differ greatly from what actually happens. The best way to control for this is to update long range forecasts on a regular 4-5 year schedule. Commercial/Industrial designated property growth (light blue areas) were masked out because the results were not intuitive to local planners and difficult to validate. Since the Blueprint, the growth pattern modeling horizon year is about 24 years of growth rather than the nearly 50 years of growth shown below and includes employment areas.

2006 Kern Regional Blueprint – Comparison of 2050 Growth Patterns Using UPlan Software



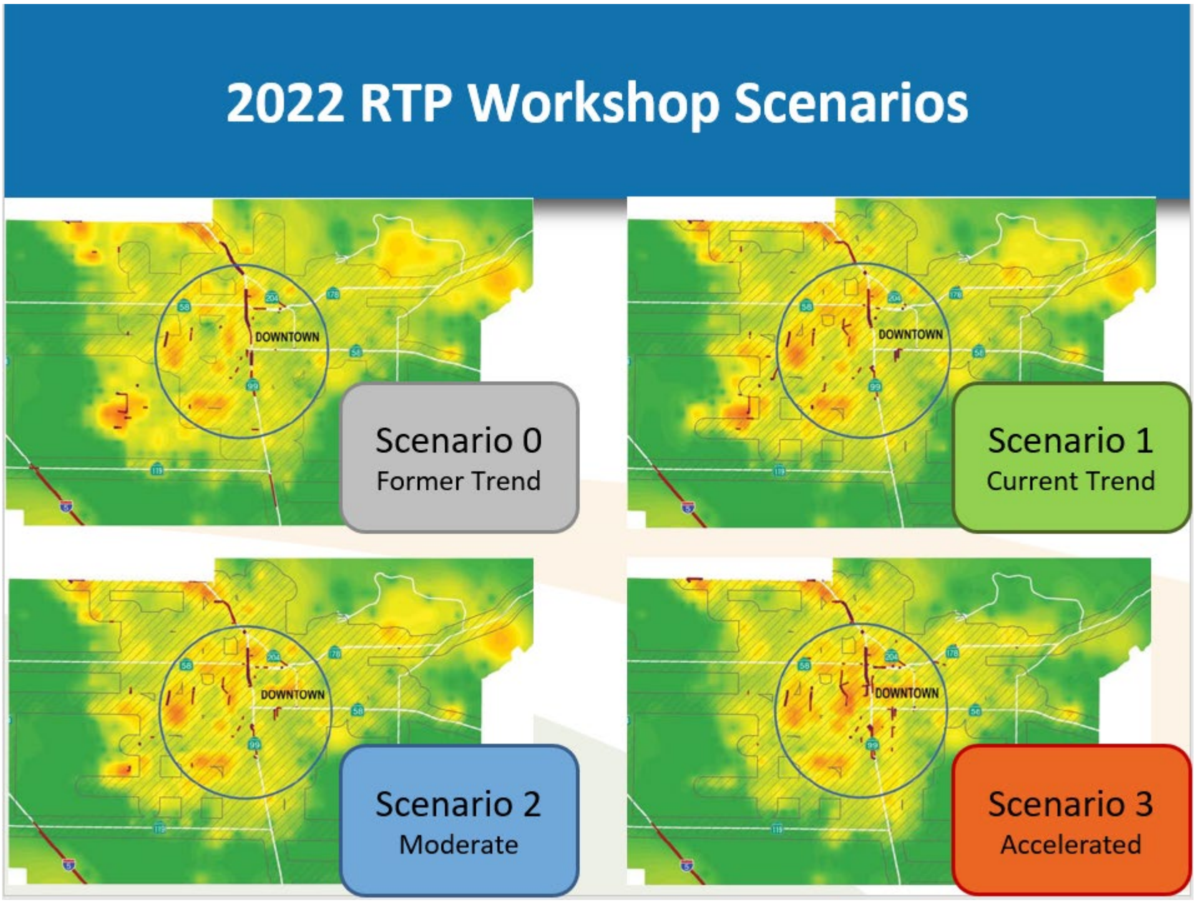
SCS SCENARIOS PROCESS

The alternative scenario is the “what if” part of the model. These scenarios are where planners can see what may happen in various hypothetical situations, which can be used to create a Sustainable Community Strategy. Scenario alternatives vary in infill/redevelopment, compactness, and infrastructure investments. Here is a description of the scenarios from the 2022 RTP/SCS public participation process. All scenarios:

- Consistent with state direction on SB 375
- Assume the same overall growth in population, households, and jobs in Kern County by 2046:
    - 1.2 million people
    - 351,000 households
    - 395,000 jobs
- Approximately two-thirds of this growth is within Metropolitan Bakersfield

- Scenarios analyze changes in Metro growth using Kern Council of Governments' land use and transportation modeling tools

PRELIMINARY SCENARIOS (2022 RTP/SCS)



To avoid inferring a false level of specificity in the land use modeling results, Kern COG creates a "fuzzy" map or heat map using ESRI ArcGIS software from the land use output. This helps ensure that the model is not seen to be picking which parcels will be developed and which will not based on a given scenario. The model is run countywide, but 2/3rds of the population and urban growth activity is in Metropolitan Bakersfield, so we focus on this growth in the metro public outreach process. The strategies in outlying rural disadvantaged areas are different (van pools, economic development, etc.) so we customize the outreach process for each community, focusing on the strategies that are most relevant for that community. For the Metro Bakersfield workshops, here are the scenarios as reviewed in the 2022 public outreach process.

Scenario 0 "Former Trends"

This scenario is shown for information purposes only, to show how previous growth and development patterns prior to the SCS impacted the region. Scenario with land development and transportation investment choices of past decades out to 2046. Assumes historic trends in peripheral growth in the metropolitan area.

- Transportation investments favor roadway infrastructure.
- Modest investment in walk and bike strategies.
- Lacks major service improvements to transit.
- Investment focused on capacity and safety improvements including a South Urban Corridor by 2046.
- Maintenance underfunded by 22%.
- Minor revitalization of Downtown assumed.

Scenario 1 "Current Trend"

Investment plan maintains current level of investment on highways and non-highway projects. Assumes growth/housing choice patterns similar to current trends.

- Investment focused on maintenance and more transit-, bike-, and walk-friendly communities.
- Improved connectivity between modes of travel.
- Provides safer roads and more streamlined goods movement.
- Modest change in demand for more transit-, bike-, and walk-friendly housing choices closer to jobs and shopping.
- Postpones South Beltway.

Scenario 2 "Moderate"

With Investment plan similar to 2018 RTP/SCS. Assumes revitalization of Downtown and of vacant and underused areas to support the broader transportation choices.

- Increased investment in non-highway projects.
- Moderate increase in demand for more transit-, bike-, and walk-friendly housing choices closer to jobs and shopping.

Scenario 3 "Accelerated"

Accelerates investment shift from highways to transit, bike, and walk infrastructure over the current trend. Expands and accelerates revitalization to areas with increased transit service.

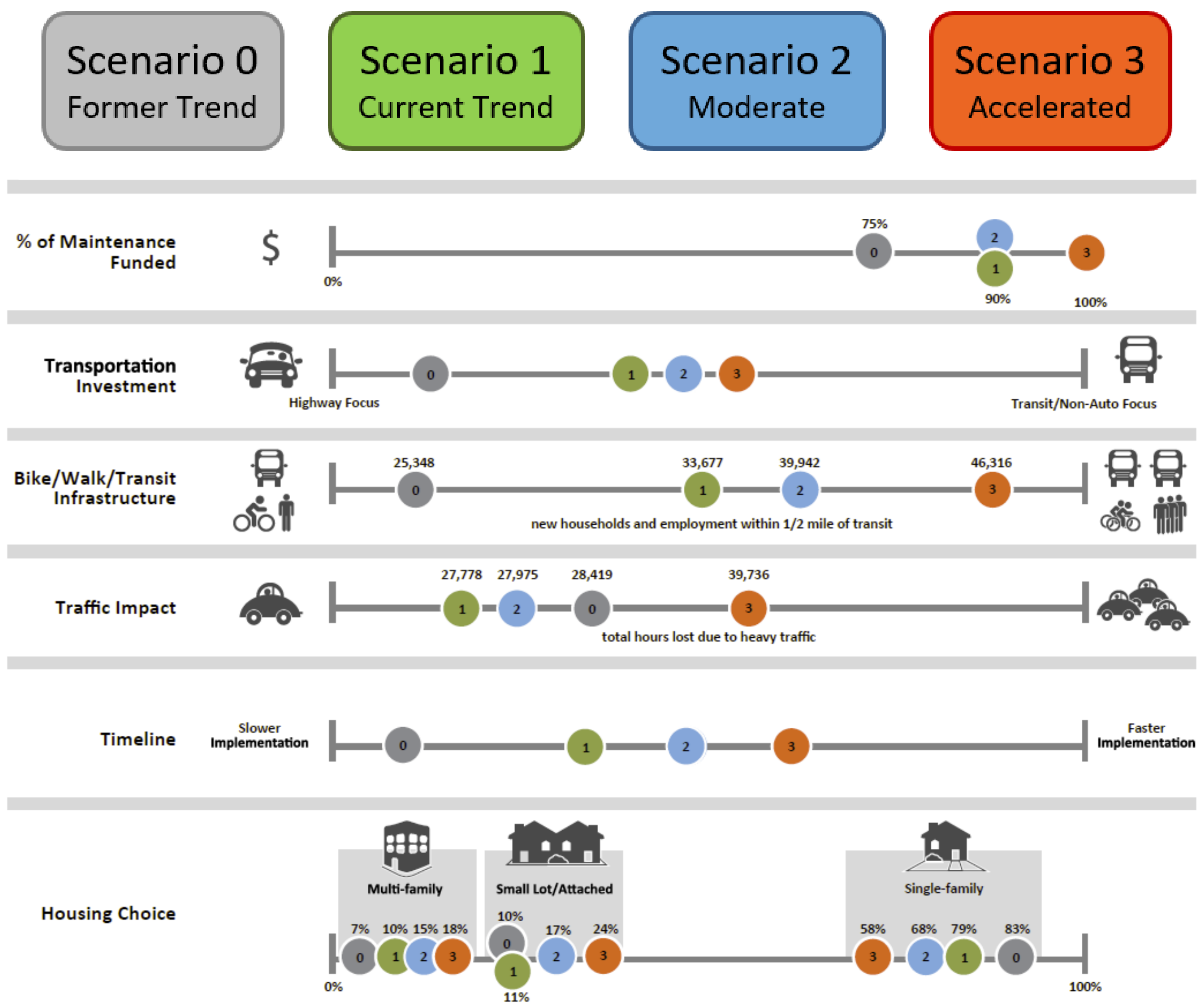
- Major shift in demand for more transit-, bike-, and walk-friendly housing choices closer to jobs and shopping.
- Requires new investment in infrastructure and revitalization with an expedited time frame.

Preferred Alternative "Hybrid"

In past couple of RTP/SCS cycles Kern COG has used the averaged public voting on the four scenarios to craft a hybrid alternative that reflected public input. In the first two SCS cycles public input fell on an alternative about halfway between the medium and high scenarios. For example, in 2018 the average score was ~3.4 or 40% of the way between the medium and high scenarios. The Hybrid alternative had density and infill levels that was 40% of the way between the medium and high scenarios shown during the public outreach process. It is important to note that the preferred alternative does not preclude a higher or lower alternative. The ultimate decision is dependent on market demand and local government implementation. The key is to revisit the scenarios and modeling on a regular 4-5 year basis to account for changes in trends and assumptions.

SCS SCENARIO COMPARISON GRAPHICS FOR PUBLIC REVIEW

Below are scenario comparison graphics used in the public workshops to help describe the scenarios before voting. Some of the performance measures are from the land use model, some from the travel model and some from the emissions model.



All scenarios assume same overall growth in population, households, and jobs.	Local Infrastructure Costs[1]	Water Use[2]	Energy Independence[3]	Vehicle Miles Traveled (VMT) & Fuel Consumption[4]
SCENARIO 3 Accelerated - Investment plan accelerates shift from highways to non-highway projects over current trend. Accelerates revitalization in downtown and areas with increased transportation choices: transit, bike, pedestrian facilities, etc.	$1.98 billion	921 million gallons	3,169 billion Btu	9.79 billion VMT; 315.8 million gallons
SCENARIO 2 Moderate Increase - Investment plan similar to current 2018 RTP/SCS. Expands increased investment in non-highway projects. Assumes revitalization in downtown and revitalization of vacant and underused areas.	$2.04 billion	958 million gallons	3,309 billion Btu	10.11 billion VMT; 319.8 million gallons
SCENARIO 1 Current Trend - Investment plan maintains current levels of investment on highways and non-highway projects. Assumes growth/housing choice patterns similar to current trends.	$2.07 billion	1,005 million gallons	3,494 billion Btu	10.15 billion VMT; 321.5 million gallons
SCENARIO 0 Former Trend (Pre-SCS) - Investment plan based on highway focused trends prior to the first SCS in 2014. Assumes outward growth patterns and impacts.	$2.1 billion	1,132 million gallons	3,561 billion Btu	10.26 billion VMT; 326 million gallons

All scenarios assume same overall growth in population, households, and jobs.	Public Health Cost[5]	Household Transportation Costs[6]	Automobile Air Emissions[7]	Land Consumption[8]
SCENARIO 3 Accelerated - Investment plan accelerates shift from highways to non-highway projects over current trend. Accelerates revitalization in downtown and areas with increased transportation choices: transit, bike, pedestrian facilities, etc.	$631 thousand	$21,783	7.98 tons NOx 14.3 lbs CO_2 per capita	13.7 sq. miles
SCENARIO 2 Moderate Increase - Investment plan similar to current 2018 RTP/SCS. Expands increased investment in non-highway projects. Assumes revitalization in downtown and revitalization of vacant and underused areas.	$652 thousand	$22,481	8.26 tons NOx 14.5 lbs CO_2 per capita	14.8 sq. miles
SCENARIO 1 Current Trend - Investment plan maintains current levels of investment on highways and non-highway projects. Assumes growth/housing choice patterns similar to current trends.	$654 thousand	$22,565	8.3 tons NOx 14.58 lbs CO_2 per capita	16.2 sq. miles
SCENARIO 0 Former Trend (Pre-SCS) - Investment plan based on highway focused trends prior to the first SCS in 2014. Assumes outward growth patterns and impacts.	$682 million	$22,821	8.4 tons NOx 14.78 lbs CO_2 per capita	18.7 sq. miles

ASSUMPTIONS

DATA

Current Base Year – Horizon Years (2035, 2046)

Census

Population

Employment

Existing Land Use

Existing Zoning

General Plans

Additional Blueprint Projects

Base Year Transportation Inventories

Baseline Transportation Inventories

MATRIXES (SPREADSHEET BASED WORKSHEETS)

Population Matrix

6 Population/Housing Categories – (Consolidated from county and cities individual general plans)

- Very High Density Residential
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Very Low Density Residential
- Rural Residential

Demographic Reference Information:

- Population – Kern Adopted Population Growth Tables
- People per household
- Future population
- Employees per household

Employment Matrix

3 Employment Categories – (See previous definition on population categories)

- Retail
- Office
- Industrial

GEOGRAPHIC PARAMETERS

SUB-REGIONAL VMT MONITORING

Report upon completion and approval of RTP/SCS every 4 years

SUBAREAS

Subarea #1 – Greater Taft/Maricopa – Major cities include Taft & Maricopa

Subarea #2 – Greater McFarland

Subarea #3 – Greater Wasco

Subarea #4 – Greater Tehachapi

Subarea #5 – Greater Metropolitan Bakersfield – Cities include Bakersfield & Arvin

Subarea #6 – Greater California City – Communities include Cal City, Mojave, & Rosamond

Subarea #7 – Greater Kern River Valley- Communities include Lake Isabella and Kernville

Subarea #8 – Greater Ridgecrest – Communities include Ridgecrest & Inyokern

Subarea #9 – Greater Frazier Park

Subarea #10 – Greater Shafter

Subarea #11 – Greater Arvin

Subarea #12 – Greater Delano

LAYERS

TAZ – Traffic Analysis Zones

Subareas – Consolidation of TAZs that the model uses

Extent – Kern County Lines

Cities & County General Plans

Slope – (sometimes as a mask)

Attractors

Discourages – (such as hills)

Masks – (such as existing urban)

MODEL OUTPUTS

Final Allocation (All land use types)

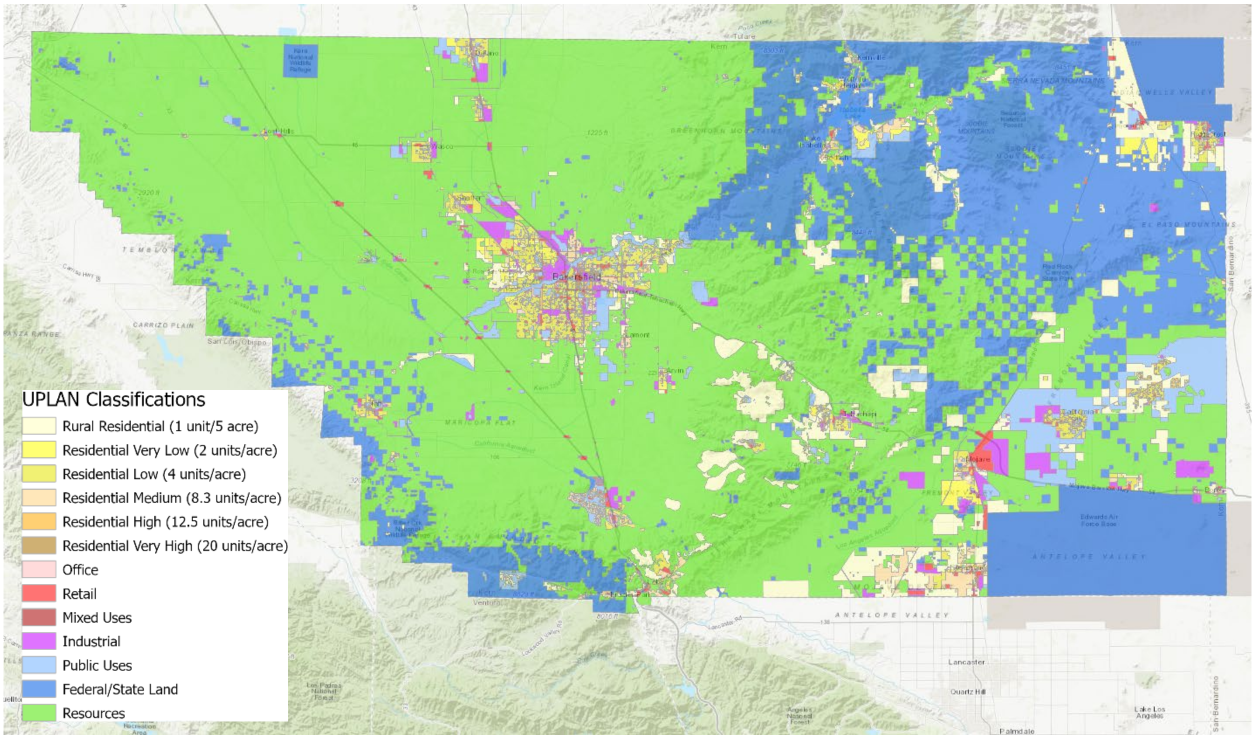
Final Attraction Layer

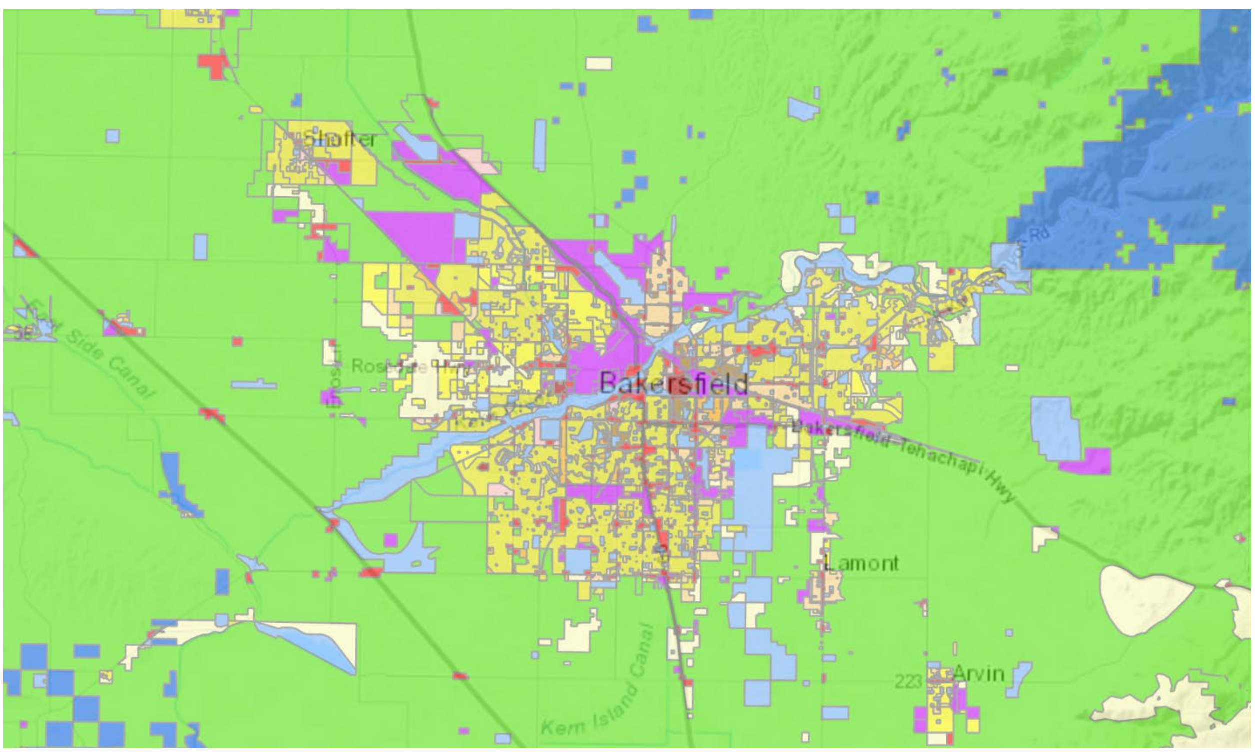
Datasets output (spreadsheet.dbf)

- Allocation Stats
- Land Consumption (See Appendix F)
- Results by TAZ
- TAZ export to socio-economic spreadsheet (used for travel model)

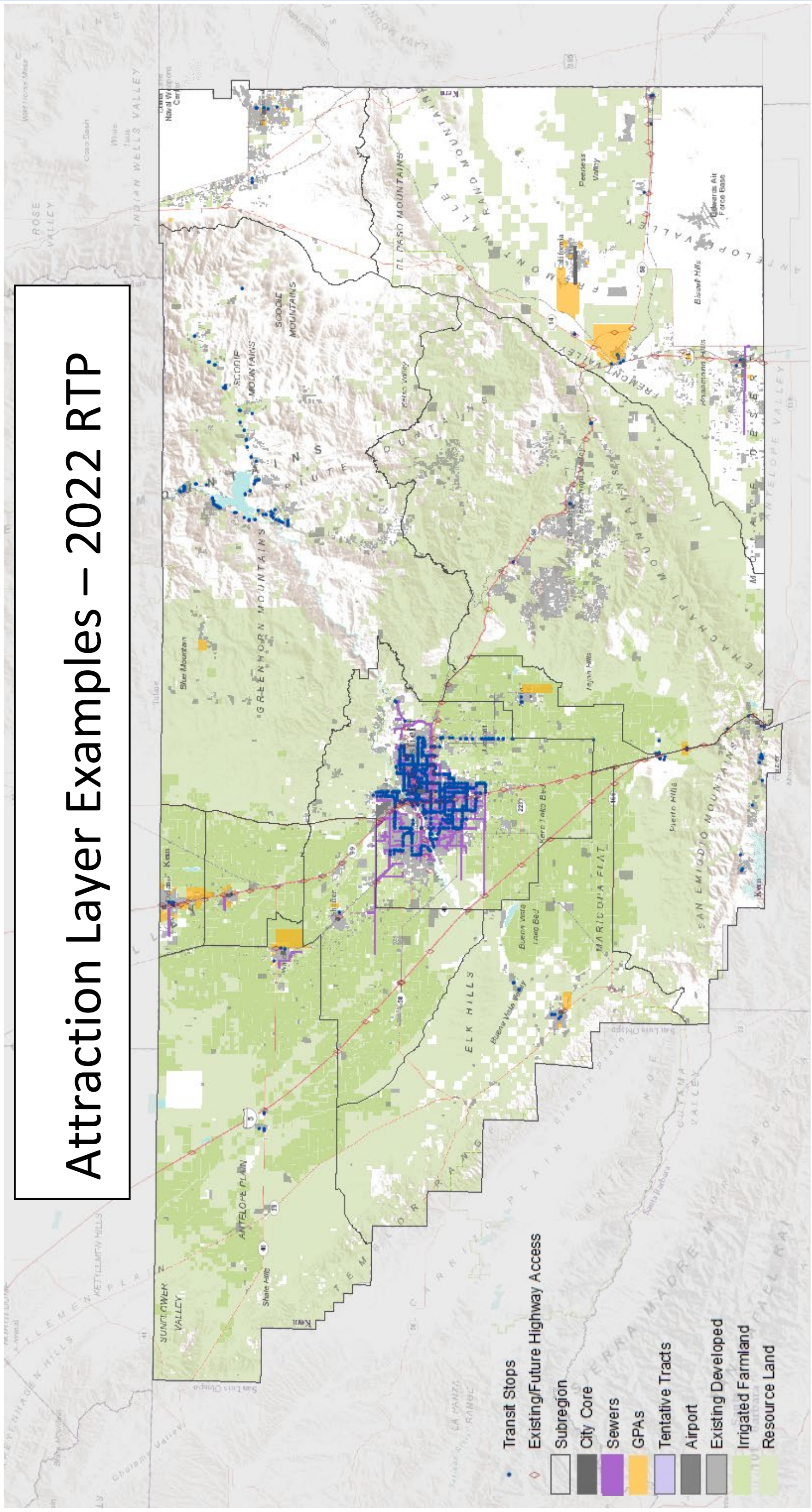
TECHNICAL APPENDIX

APPENDIX A – COMBINED LAND USE MAP

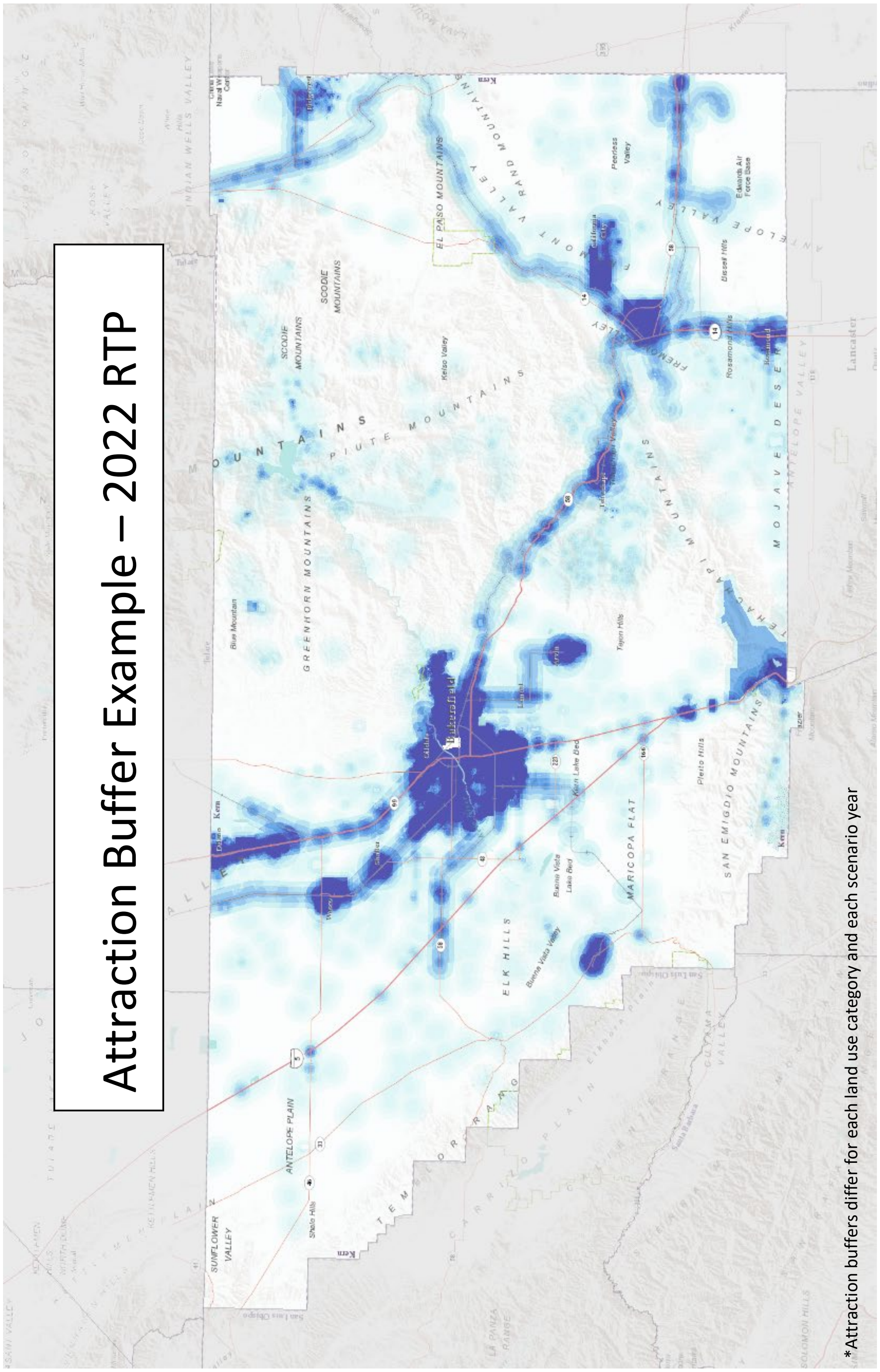




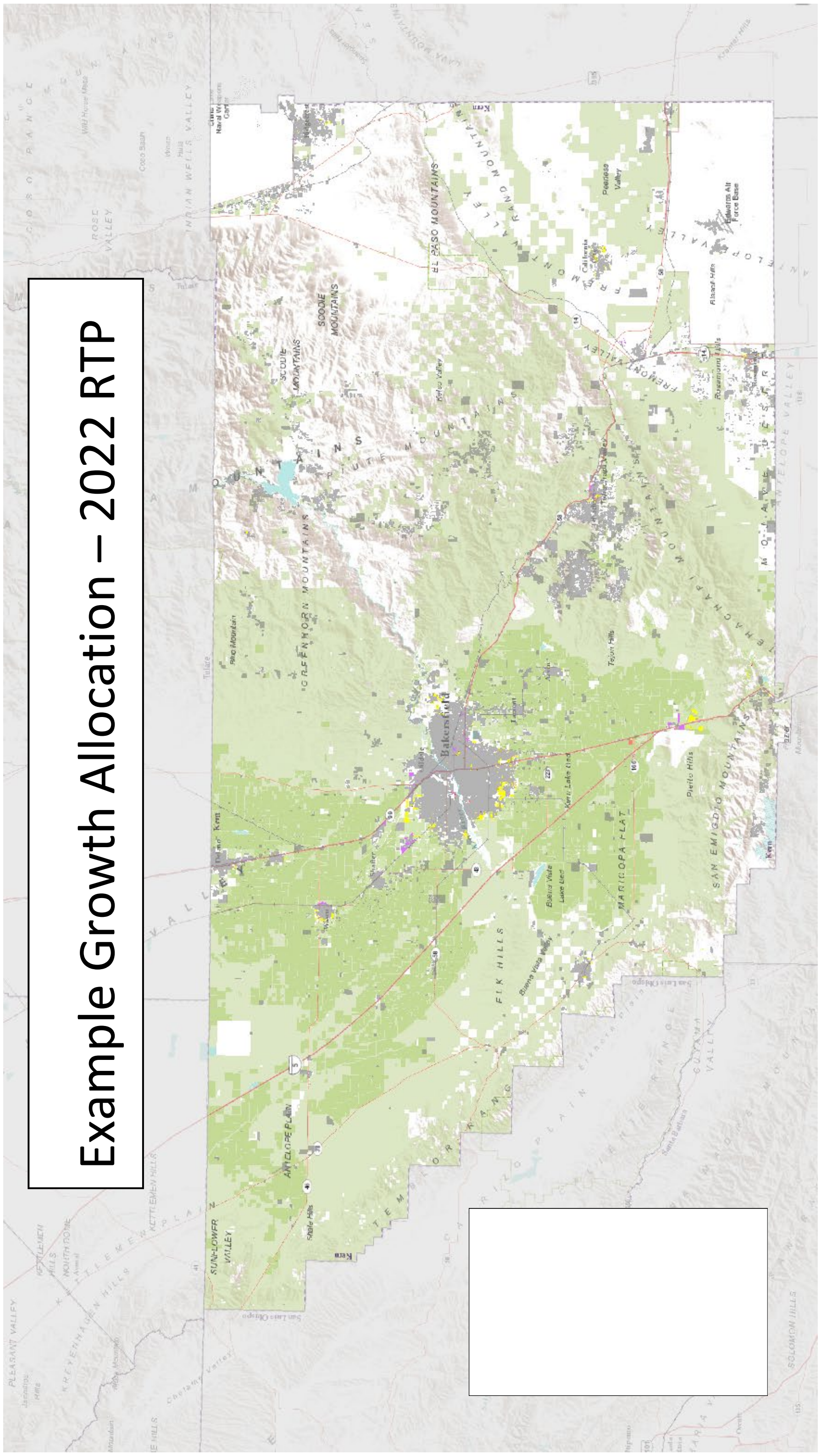
APPENDIX B – LAND USE MODEL ATTRACTION LAYERS



APPENDIX C – ATTRACTION BUFFERS



APPENDIX D – SAMPLE LAND USE MODEL OUTPUT MAP



APPENDIX E – SAMPLE UPLAN OUTPUT – LAND CONSUMPTION

Acres Consumed by Model Subarea

Acres of growth by	Land Use									
SUBAREAID	Industrial	Office	Retail	Residential Very High	Residential High	Residential Low	Residential Medium	Residential Very Low	Rural Residential	Grand Total
1	51	13	1	1		128	4	3		200
2	27	14	2		1	62	1	1		108
3	124	29	2		3	277	8	26	64	533
4	113	33	4	2	2	188	9	8	824	1183
5	443	66	20	70	241	2713	574	10	100	4238
6	130	60	3	1	2	482	43	130	22	874
7	8	7	1		1	48	1	12		77
8	32	30	1		1	104	2	2		174
9	9	3				28	1		124	165
10	178	25	8		1	22	2	1		237
11	3	2				5	2	7	17	36
12	40	17	1		1	86	2	2	1	149
Grand Total	1158	300	42	75	253	4144	649	203	1151	7975

*UPlan output does not include post model adjustments

Subareas

1. Greater Taft/ Maricopa
2. Greater McFarland
3. Greater Wasco
4. Greater Tehachapi
5. Greater Metropolitan Bakersfield
6. Greater California City
7. Greater Kern River Valley
8. Greater Ridgecrest
9. Greater Frazier Park
10. Greater Shafter
11. Greater Arvin
12. Greater Delano

APPENDIX F – 2022 LAND USE MODEL CALIBRATION AND VALIDATION

Land Use Model Calibration

In the Kern open-source land use model developed by UC Davis, UPlan, urban growth is distributed within constraints; it does not emerge unilaterally from infrastructure growth:

- Socioeconomic adjustments are subject to a zero-sum constraint. Thus, the land use model distributes geographically a pre-determined amount of regional growth. The regional growth is derived from a sophisticated economic forecast prepared by an economist.
- Growth of urban development is constrained geographically according to a combined land use map developed from General Plans and related parameters, input assumptions, and reference information provided by Kern COG's member agency planning staff and the public.

The land use model by inherent design incorporates the preferences of households, businesses, and real estate developers into the land use growth attractors to distribute growth geographically and generate a forecast of the overall land use pattern in future years. "*The model need not be calibrated on historical data because its intended use is for long-range scenario testing*."[1] Local land use polices have already changed significantly over the past 50 years, so a model that predicts past growth based on old policies will not be able predict growth being generated by current policies. Kern COG has been running UPlan for more than a decade and the initial calibration of the model was completed by UC Davis as part of the Kern Blueprint process, which was further refined in preparation of the development of Kern COG's first cycle SCS. For the first cycle SCS, Kern COG established the Regional Planning Advisory Committee (RPAC) made up of planning directors and city/county planners from each of Kern COG's member agencies. The RPAC worked with Kern COG staff and the existing Transportation Modeling Committee to calibrate the UPlan model in a process that generated over 100 model runs to refine inputs based on RPAC member expert expectations. Note that these adjustments were made primarily to incorporate data missing in the various attraction layers rather than the attraction distances set-up by UC Davis. Kern COG has continued to build from and refine the initial calibration adding latest data and planning assumptions to each RTP/SCS cycles development.

For the 2022 RTP/SCS cycle, Kern COG has included an analysis of the accuracy of past cycle model runs as part of this calibration document (see section below on "Land Use Model Validation"). In addition, the land use policies in place in the current 2020 base year can be changed again (e.g., allowable zoned residential density could be increased) and UPlan responds by forecasting a different land use pattern consistent with the constraints or opportunities resulting from the region's evolving land use strategies.

The land use model future years were run in steps (2020-2035 & 2035-2046), each with their own growth attractors, to distribute new housing and employment, and from these to produce zonal output

[1] Johnston, Bob & Lehmer, Eric & Gao, Shengyi & Roth, Nathaniel & Mccoy, Michael. (2007). UPlan Land Use Allocation Model 2.6 User's Manual.: 7 https://www.researchgate.net/publication/266186307

files for the transportation model that contain household counts and employee counts by sector. This provides the travel model with information on land use intensity in different locations and the spatial distribution of potential trip attractors and generators within the region.[2]

Attraction Layers

In the 2007 research paper prepared by UC Davis in collaboration with Delaware Valley Regional Planning Commission, researchers found the UPlan model to predict realistic development patterns "and provide a basis for land use planning and evaluation." See footnote 2. The research paper further explains the use of attraction layers which encourage future development in proximity to existing urban areas, transportation facilities, and infrastructure. Kern COG coordinated extensive outreach with local planners and developers to evaluate and calibrate attraction layers which result in realistic development patterns for each subregion within Kern County.

The 2022 Kern COG UPlan model uses multiple attraction layers in each scenario to generate development scenarios (See F1 for attraction buffer distances and values). Each attraction layer is weighted for each land use category it is relevant to (i.e. Airports and Railroads are strong attractors for Industrial Developments vs Open Space as a strong attractor for Residential Developments). Listed below are attraction layer categories used in the 2022 RTP development (detailed tables of attraction layers and weighting are provided in Appendix F1).

Airports	Open Space/Parks	Tentative Tracts
City Centers	Railroads	Transit
General Plan Amendments	Redevelopment Areas	
Highway Access	Sewers	
New Construction	Specific Plans	

Initial attraction values were provided by UC Davis based on their experience with implementing the software in other regions nation-wide. Those values have been kept mostly unchanged since the initial calibration.

Airports, Transit, Railroads, Highway Access, are data layers which provide attractions for development in proximity to transportation facilities as cited in the 2007 UC Davis research paper and in additional research papers on calibration and validation of land use models such as the 2013 paper from Wageningen University.[3] During the advisory process described above the local jurisdictions with land use authority provided empirical information that through the implementation of existing policies the region's airports were acting as magnets for commercial and industrial growth. see footnote 2.

[2] Walker, W. & Gao, Shengyi & Johnston, Robert. (2007). UPlan: Geographic Information System as Framework for Integrated Land Use Planning Model. Institute of Transportation Studies, UC Davis, Institute of Transportation Studies, Working Paper Series. 1994. 10.3141/1994-16. http://escholarship.org/uc/item/4178v7vg
[3] Jasper van Vliet. Calibration and Validation of Land-Use Models. Ph.D. thesis, Wageningen University, Wageningen, The Netherlands (2013) ISBN: 978-94-6173-443-3: 27 https://www.researchgate.net/publication/283419016_Calibration_and_validation_of_land-use_models

For attractors related to **Highway Access**, Kern COG found the initial attraction values provided by UC Davis were consistent with a distance of decay as supported by the CALTRANS Standard Environmental Reference (SER) Volume 4. The land use model provides six buffer zones that gradually increase the attractiveness value for residential and commercial site the closer to the interchange you get. The buffers range in attractiveness from the highest (9) at 0 - .3 miles (500 m) from the freeway access point to zero (0) added attractiveness at greater than 1.25 miles with an average added attractiveness at approximately ½ mile around freeway interchanges. The SER also noted that there was considerable uncertainty in the data that could be used to validate distance-decay,

> *"Because the studies reviewed present conflicting findings about the effects of freeway construction on residential property values, they do not provide a reliable basis upon which to predict the property value effects of future freeway construction.*
>
> *Most researchers concluded their studies by saying that additional research is needed on this topic, and they cautioned against generalizing from their findings in a particular case study to other freeway construction situations."* The SER further concludes that: *"Most studies documented a strong "distance-decay" relationship for freeway effects on adjacent neighborhoods."* [4]

The use of the multiple graduated attraction buffers is consistent with current studies indicating a strong distance-decay relationship for the effects of freeway access on adjacent neighborhoods values. The studies reviewed by Caltrans indicate difficulty in applying effects from one region to another. Because of this Kern COG has performed a validation analysis of the performance of highway access and other attractors in Metropolitan Bakersfield, demonstrating the attraction buffers performed well over the last decade. The results of this analysis are in the Land Use Model Validation section below.

It is also important to note that the Highway Access attraction is providing a more accurate **long term induced travel demand feedback** by varying the location of highway access points in scenarios and model years. The model is placing induced household growth at planned future highway access points dependent on the freeway network access points in the travel demand model. Kern COG is working with Rural Counties Task force on a Rural Induced Demand Study that reviews the effects of long-term induced travel being generated on by land use growth around new highway capacity and access in rural areas including Kern. The study should provide further data to refine this methodology.

Proximity to **Existing Urban Areas** provides additional attraction buffers. This attraction simulates cheaper construction costs created by cheaper access to adjacent utilities than properties further away from the urban fringe but still with urban zoning. This attraction layer is adapted from the UC Davis provided buffer using the latest available state Farmland Mapping and Monitoring Program urban/built up layer (derived from aerial imagery) and is edited to reflect recent subdivision activity and deletion of

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[4] Caltrans. Transportation Effects on Property Values. Standard Environmental Reference Vol. 4, pp. D2 – D6 https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/f0003658-appendixd-propertyvalues-21102011-a11y.pdf

rural built-up areas recharge basins and solar fields. Vacant lots, and redevelopment areas are removed from the existing urban layer, providing opportunities for infill development depending on the scenario. Attractors for existing urban include the **City Centers, New Construction,** and **Redevelopment** layers.

General Plan Amendments, Specific Plans, Tentative Tract typically represent a discretionary action by the land use regulatory authority. These actions are typically at the behest of the property owner or developer to induce development or a particular usage on the site.

An additional infrastructure layer which attracts development is the existing **Sewers** layer. New developments that are built further from existing sewers lines have a greater economic burden and research has shown availability of sewer as a statistically significant relationship to land use development[5].

Discouragement Layers and Mask Layers

A discouragement is the opposite of an attraction; an undesirable feature of a place where future development may take place, such as hilly areas. A discouragement does not prevent growth, although it will stop allocation of it until all other areas of that type are allocated. A discouragement represents an area that lacks desirable attributes and makes future development more costly. Discouragements for hilly areas are useful in representing the higher cost to develop these areas. [6] See also footnotes 1 and 2.

Below are a listed of discouragement layer categories used in the 2022 RTP development.

Hilly Area	Non-Compatible Use
Near Max Build Out	Project Level Area

A mask or exclusion is effectively an infinite discouragement, preventing all growth in each cell, even if all other cells have been assigned growth and unassigned growth remains. A good candidate for a mask in UPlan would be lakes or cliffs where growth would be (by today's economic and technological standards) improbable. See also footnotes 1, 2 and 5.

Below is a list of mask layer categories used in the 2022 RTP development.

Body of Water	Project Level Adjustment
Existing Development/Non-Infill	Steep Hillside

Land Use Model Validation

Validation analysis of the Kern COG land use model was performed using actual observed 2020 Census data as a metric to compare against 2020 projections in the 2014 & 2018 RTP models. The Metro Bakersfield census blocks analyzed for 2010 & 2020 saw a growth of 20,398 households resulting in 12.2%

[5] Analysis of Land Use Change: Theoretical and Modeling Approaches, Helen Briassoulis, University of the Aegean (2020)
[6] Comparing Quantity, Allocation and Configuration Accuracy of Multiple Land Change Models
Brian Pickard, Joshua Gray and Ross Meentemeyer

growth rate. Whereas assumptions in the 2014 Kern COG land use model projected a household growth rate of 22% over a similar period. Between 2010 and 2020 actual Census observed growth was approximately half (51%) of the projected growth in 2014 model for the same period. 2018 was a little closer requiring a smaller adjustment. After adjusting the projected growth down to match the actual growth, the household projection for 2020 in the regional statistical areas model behaved as follows:

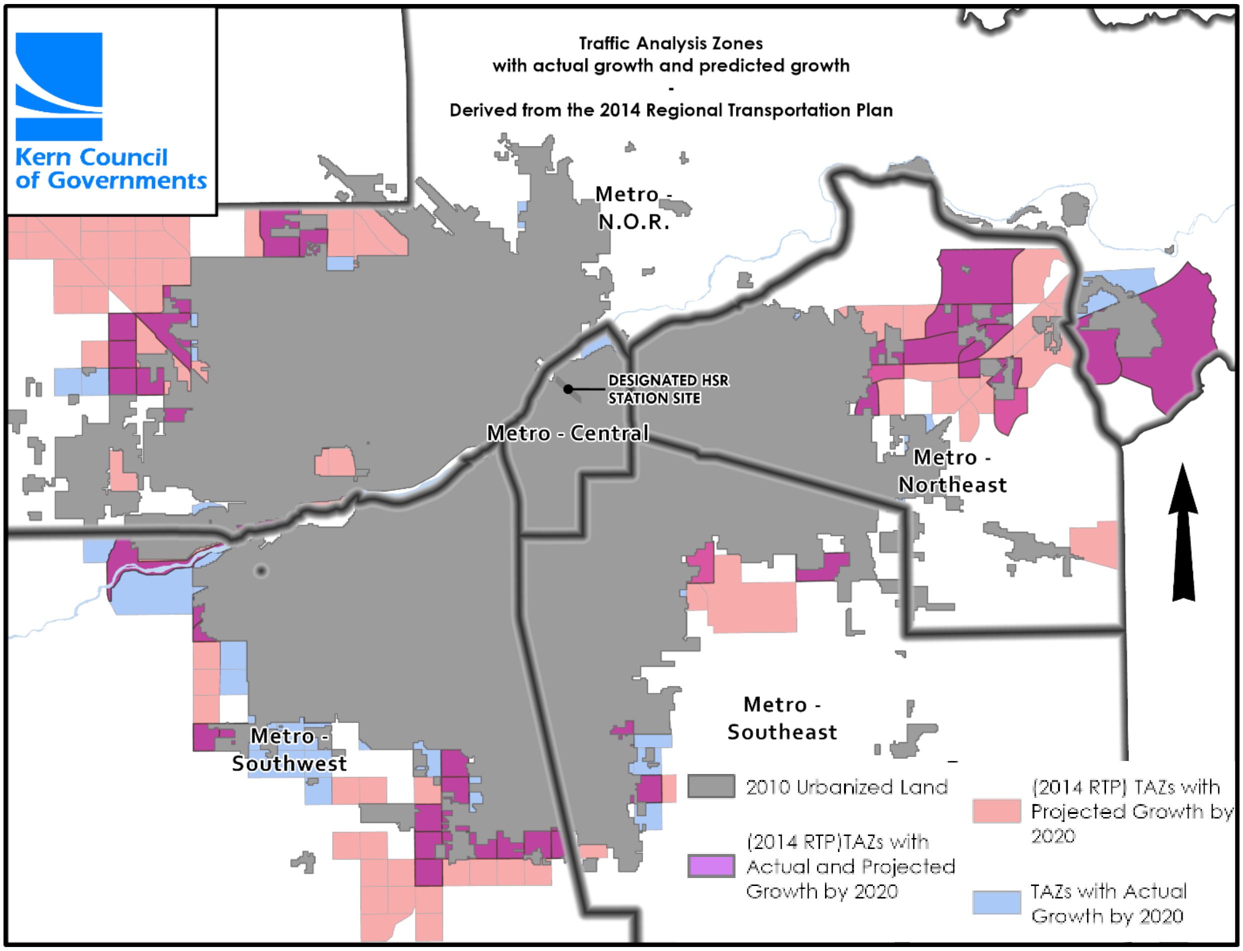
LAND USE MODEL PROJECTED HOUSEHOLD DISTRIBUITON BY SUB AREA FOR 2020 VERSUS CENSUS

Metro Sub Area	2014 RTP (2020 Prjctn.)	2018 RTP (2020 Prjctn.)	2020 Census
Metro-Southwest	98.50%	103.47%	100.00%
Metro-Southeast	96.20%	100.66%	100.00%
Metro-Northeast	90.60%	91.93%	100.00%
Metro-NOR	83.70%	92.61%	100.00%
Metro-Central	69.40%	106.82%	100.00%
MEAN	87.01%	98.92%	100.00%

Note: For this analysis 2014 & 2018 RTP projections were adjusted down to account for error of overall projection used for each RTP cycle to match actual census growth.

The results indicate that after Metro sub area percent distribution were close to the Census, being as high as 30% off in Central in 2014 and better than 8% off by 2014. As expected, the closer you get to the forecast year the more accurate the forecast.

In addition to the geographic distribution by sub area, the analysis reviewed the geographical location of the development pattern at the TAZ level within the Metro Bakersfield Area. The area consists of 608 TAZs that have developable land, 45 of the 608 TAZs had actual growth from 2010-2020. The land use



model assigned growth to either the identical TAZ or an adjacent TAZ for all but four of the 45 TAZs or within 91.1%. The TAZ level distribution performed similar to the Sub Area performance.

Conclusions from the validation analysis find there were many unforeseeable reasons for growth distribution variation. Most notably, the California High Speed Rail (HSR) Station slated for the north side of Golden State Avenue near the intersection with F Street in Metro-Central was anticipated to be completed prior to 2020 in the 2014 projection. The HSR station is currently projected to be complete in approximately 2029. This is most noticeable in the Metro-Central and Metro-NOR (North of the River) areas. The proposed station location is along and near major transportation corridors linking four of Kern COGs five pre-defined regional statistical areas, Metro-NOR, Metro Southeast, to Metro Northeast to Metro Central. Those transportation corridors being Golden State Avenue, Union Avenue and State Route 178. Metro Southwest is the least directly affected by the HSR Station location and was the most accurate projection. Without the HSR station acting as a catalyst, the projected infill development has yet to take place.

Another unforeseen reason for the variation in growth distribution is that private developers allowed the entitlements to at least 71 residential tract maps to expire during the decade. The expired tentative tracts represent no less than 10,469 potential dwellings.

In addition, because slightly over half (51%) of the projected household growth did not occur, it is therefore appropriate to assume that the model would be reduced by a commensurate amount resulting in variations in the distribution of households as well. Still, the projections performed remarkably well, especially as the 2020 horizon year got closer.

Any long-term forecast is inherently going to be inaccurate to some degree. Accuracy is also negatively affected when working with small area populations such as neighborhood level transportation analysis zones. A model looking more than five years out is going to be very in-accurate and subject to major trend bifurcations such as COVID or delay of a HSR station. Kern COG updates it's forecast every 4 years to incorporate recent trend bifurcations which controls for longer term distribution variations found in the post modeling validation.

As shown in the table above, the Kern COG Land Use model as implemented for the 2018 RTP with a 2015 base year for years 2015-2020 and revised socio-economic performed substantially better than the 2014 forecast with a 2010-2020 forecast.

APPENDIX F1 – SAMPLE ATTRACTION LAYER BUFFERS AND WEIGHTING

Attraction Buffers

Landuse	Layer Name	Buffer Number	From	To	Weight
landuse1	airport_mf				
		1	0	1000	0
landuse1	built15_20				
		1	0	0	1
		2	0	250	15
		3	250	500	10
		4	500	750	6
		5	750	1000	4
landuse1	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse1	gpa1_31544				
		1	0	0	9
landuse1	gpa11_tejon				
		1	0	0	15
		2	0	1000	5
landuse1	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3
landuse1	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse1	infill10b				
		1	0	500	5
		2	500	1000	4
		3	1000	1500	3
		4	1500	2500	2
landuse1	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse1	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
landuse1	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse1	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse1	sports_vill				
		1	0	100	1
		2	100	500	0
		3	500	750	0
landuse1	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse1	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse1	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse1	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse1	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2
landuse2	built15_20				
		1	0	0	1
		2	0	250	15
		3	250	500	10
		4	500	750	6
		5	750	1000	4
landuse2	core_1013				
		1	0	1000	9
		2	1000	1500	8

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse2	gpa1_31544				
		1	0	0	7
landuse2	gpa11_tejon				
		1	0	0	15
		2	0	1000	5
landuse2	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3
landuse2	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse2	infill10b				
		1	0	500	5
		2	500	1000	4
		3	1000	1500	3
		4	1500	2500	2
landuse2	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse2	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8
landuse2	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse2	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse2	sports_vill				
		1	0	100	1
		2	100	500	0
		3	500	750	0

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
landuse2	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse2	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse2	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse2	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse2	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2
landuse2	airport_mf				
		1	0	150	20
		2	150	250	10
		3	250	550	7
landuse3	built15_20				
		1	0	0	1
		2	0	250	5
		3	250	500	4
		4	500	750	3
		5	750	1000	2
landuse3	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse3	gpa1_31544				
		1	0	0	20
landuse3	gpa11_tejon				
		1	0	0	15
		2	0	1000	5

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
landuse3	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3
landuse3	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse3	ind_join_0912				
		1	0	50	10
		2	50	1050	5
		3	1050	2050	2
landuse3	infill10b				
		1	0	1000	5
		2	1000	2000	3
		3	2000	3000	2
landuse3	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse3	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8
landuse3	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse3	railroadsv2				
		1	0	500	10
		2	500	1500	8
		3	1500	2500	5
landuse3	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse3	sports_vill				
		1	0	500	8
		2	500	750	4
		3	750	1000	2
landuse3	swasco_core				
		1	0	500	10

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		2	500	1500	5
		3	1500	2500	2
landuse3	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse3	trans_stops_q				
		1	0	50	5
		2	50	500	3
landuse3	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse3	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse3	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2
landuse4	built15_20				
		1	0	0	1
		2	0	250	10
		3	250	500	6
		4	500	750	4
		5	750	1000	2
landuse4	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse4	gpa1_31544				
		1	0	0	20
landuse4	gpa11_tejon				
		1	0	0	15
		2	0	1000	5
landuse4	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
landuse4	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse4	ind_join_0912				
		1	0	50	5
		2	50	1050	3
		3	1050	2050	2
landuse4	infill10b				
		1	0	1000	5
		2	1000	2000	3
		3	2000	3000	2
landuse4	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse4	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8
landuse4	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse4	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse4	sports_vill				
		1	0	500	8
		2	500	750	4
		3	750	1000	2
landuse4	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse4	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse4	trans_stops_q				
		1	0	50	5

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		2	50	500	3
landuse4	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse4	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse4	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2
landuse5	built15_20				
		1	0	0	1
		2	0	250	10
		3	250	500	6
		4	500	750	4
		5	750	1000	2
landuse5	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse5	gpa1_31544				
		1	0	0	20
landuse5	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse5	ind_join_0912				
		1	0	50	5
		2	50	1050	3
		3	1050	2050	2
landuse5	infill10b				
		1	0	1000	5
		2	1000	2000	3
		3	2000	3000	2

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
landuse5	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse5	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8
landuse5	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse5	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse5	sports_vill				
		1	0	500	8
		2	500	750	4
		3	750	1000	2
landuse5	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse5	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse5	trans_stops_q				
		1	0	50	5
		2	50	500	3
landuse5	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse5	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse5	ttracts_rsmnd				

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		1	0	50	5
		2	50	1050	2
landuse6	built15_20				
		1	0	0	1
		2	0	250	10
		3	250	500	6
		4	500	750	4
		5	750	1000	2
landuse6	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse6	gpa1_31544				
		1	0	0	20
landuse6	gpa11_tejon				
		1	0	0	15
		2	0	1000	5
landuse6	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3
landuse6	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse6	ind_join_0912				
		1	0	50	5
		2	50	1050	3
		3	1050	2050	2
landuse6	infill10b				
		1	0	1000	5
		2	1000	2000	3
		3	2000	3000	2
landuse6	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse6	neardev_bak				
		1	0	150	17
		2	150	500	10

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		3	500	1000	8
landuse6	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse6	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse6	sports_vill				
		1	0	500	8
		2	500	750	4
		3	750	1000	2
landuse6	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse6	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse6	trans_stops_q				
		1	0	50	5
		2	50	500	3
landuse6	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse6	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse6	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2
landuse6	airport_mf				
		1	0	150	10
		2	150	250	8
		3	250	550	7
landuse7	built15_20				

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		1	0	0	1
		2	0	250	10
		3	250	500	6
		4	500	750	4
		5	750	1000	2
landuse7	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse7	gpa1_31544				
		1	0	0	20
landuse7	gpa11_tejon				
		1	0	0	15
		2	0	1000	5
landuse7	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3
landuse7	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse7	ind_join_0912				
		1	0	50	5
		2	50	1050	3
		3	1050	2050	2
landuse7	infill10b				
		1	0	1000	5
		2	1000	2000	3
		3	2000	3000	2
landuse7	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse7	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8
landuse7	neardev_mcf				
		1	0	50	15

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		2	50	250	5
		3	250	500	4
landuse7	sewers_0811				
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse7	sports_vill				
		1	0	500	8
		2	500	750	4
		3	750	1000	2
landuse7	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse7	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse7	trans_stops_q				
		1	0	50	5
		2	50	500	3
landuse7	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse7	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse7	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2
landuse7	airport_mf				
		1	0	150	20
		2	150	250	10
		3	250	550	7
landuse8	built15_20				
		1	0	0	1
		2	0	250	5
		3	250	500	4

Attraction Buffers					
Landuse	Layer Name	Buffer Number	From	To	Weight
		4	500	750	3
		5	750	1000	2
landuse8	core_1013				
		1	0	1000	9
		2	1000	1500	8
		3	1500	2000	7
		4	2000	2500	6
		5	2500	3000	5
		6	3000	4000	4
landuse8	gpa1_31544				
		1	0	0	20
landuse8	gpa11_tejon				
		1	0	0	15
		2	0	1000	5
landuse8	gpas_kc22rtp				
		1	0	50	10
		2	50	500	3
landuse8	hwyacc_35med				
		1	0	500	9
		2	500	1000	7
		3	1000	1500	5
		4	1500	2000	3
landuse8	ind_join_0912				
		1	0	50	10
		2	50	1050	5
		3	1050	2050	2
landuse8	infill10b				
		1	0	1000	5
		2	1000	2000	3
		3	2000	3000	2
landuse8	middev_mcf				
		1	0	50	8
		2	50	250	3
		3	250	500	2
landuse8	neardev_bak				
		1	0	150	17
		2	150	500	10
		3	500	1000	8
landuse8	neardev_mcf				
		1	0	50	15
		2	50	250	5
		3	250	500	4
landuse8	sewers_0811				

Attraction Buffers					
Landuse	**Layer Name**	**Buffer Number**	**From**	**To**	**Weight**
		1	0	250	5
		2	250	500	4
		3	500	750	3
		4	750	1000	2
landuse8	sports_vill				
		1	0	500	8
		2	500	750	4
		3	750	1000	2
landuse8	swasco_core				
		1	0	500	10
		2	500	1500	5
		3	1500	2500	2
landuse8	tejonlake1				
		1	0	1000	5
		2	1000	2000	2
landuse6	trans_stops_q				
		1	0	50	5
		2	50	500	3
landuse8	trans_stps35				
		1	0	150	8
		2	150	250	7
		3	250	450	6
		4	450	650	5
		5	650	1000	4
		6	1000	1500	3
landuse8	ttracts_bak				
		1	0	0	12
		2	0	500	5
		3	500	1500	2
landuse8	ttracts_rsmnd				
		1	0	50	5
		2	50	1050	2

Note that these attraction layers are for one scenario year and layers may vary depending on scenario.