KTMPO
KILLEEN-TEMPLE
metropolitan planning organization

Future Growth Scenario Report

KTMPO Metropolitan Planning Area

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Legend:
- KTMPO Planning Area
- Counties
- Fort Hood
- Cities
- Interstate Highway
- US Highways
- State Highways
- Business US & FM
- County Road

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Prepared by Alliance Transportation Group, Inc.

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Table of Contents

List of Figures

List of Tables

Introduction

The Killeen-Temple Metropolitan Planning Organization (KTMPO) performs an update to their Metropolitan Transportation Plan (MTP) on a recurring four-to-five-year cycle. As part of this MTP update, KTMPO issues a Call for Projects to undergo a rigorous evaluation and scoring process to prioritize and approve a final project list for inclusion in the MTP. The KTMPO Travel Demand Model (KTMPO TDM) is a useful tool in populating select criteria as part of the project scoring process. However, the KTMPO TDM is developed based on a fixed set of demographic projections. Though these demographics are believed to be a valid estimation of what could be expected in the future, growth trends and development plans could change throughout the region over time.

As such, the consideration of different theoretical alternative futures is a valuable planning-level exercise that can ensure funding resources are being allocated appropriately to locations where they are most needed. The review of alternative futures can reinforce the need and prioritization of project improvements, or the futures could show that a specific project is highly correlated to one scenario and offers little benefit to the region under other potential conditions. The review of alternative futures can indicate there may need to be a shift in project focus based on observed trends and hotspots throughout the region.

The KTMPO TDM was used to model three separate scenarios for the purpose of demonstrating the impacts of different theoretical alternative futures on the transportation system. The modeled scenarios were:

- **2045 Standard KTMPO TDM Forecast Scenario** – default forecast scenario of the KTMPO TDM. No modifications were made to this scenario, as it was used as the baseline scenario for performance and financial comparisons.
- **2045 Future Growth Scenario** – alternative forecast scenario developed based on emerging trends and significant drivers of transportation system demand.
- **2045 Land Use Plan Scenario** – alternative forecast scenario developed based on available land use plans of local jurisdictions of the KTMPO TDM region.

This report documents the review performed, assumptions, methodology, and outcomes of the theoretical 2045 Future Growth and 2045 Land Use Plan Scenarios.

Control Total Review

The KTMPO Travel Demand Model demographic control totals were compared to available sources to determine if any refinements were necessary as part of the estimation of the alternative futures. The sources reviewed include:

- **2018 Texas Demographic Center (TDC) 2045 estimations**
    - The TDC reports population by county or MSA area. The KTMPO TDM includes only portions of Coryell and Lampasas Counties, which results in a boundary discrepancy for direct comparisons. **Figure 1** illustrates the boundaries included in the KTMPO TDM.
- **Texas Department of Transportation's (TxDOT) Statewide Analysis Travel Demand Model Version 4 (SAMV4)**
    - The SAMV4 is the culmination of an extensive review of Census data, County Business Patterns (CBP), Bureau of Labor Statistics (BLS), Bureau of Economic Analysis (BEA), and other demographic sources. Although the boundaries of the SAM-V4 traffic analysis zones (TAZs) are not a perfect match to the KTMPO TDM TAZs, the SAM-V4 still provides a rich source of comparison data.
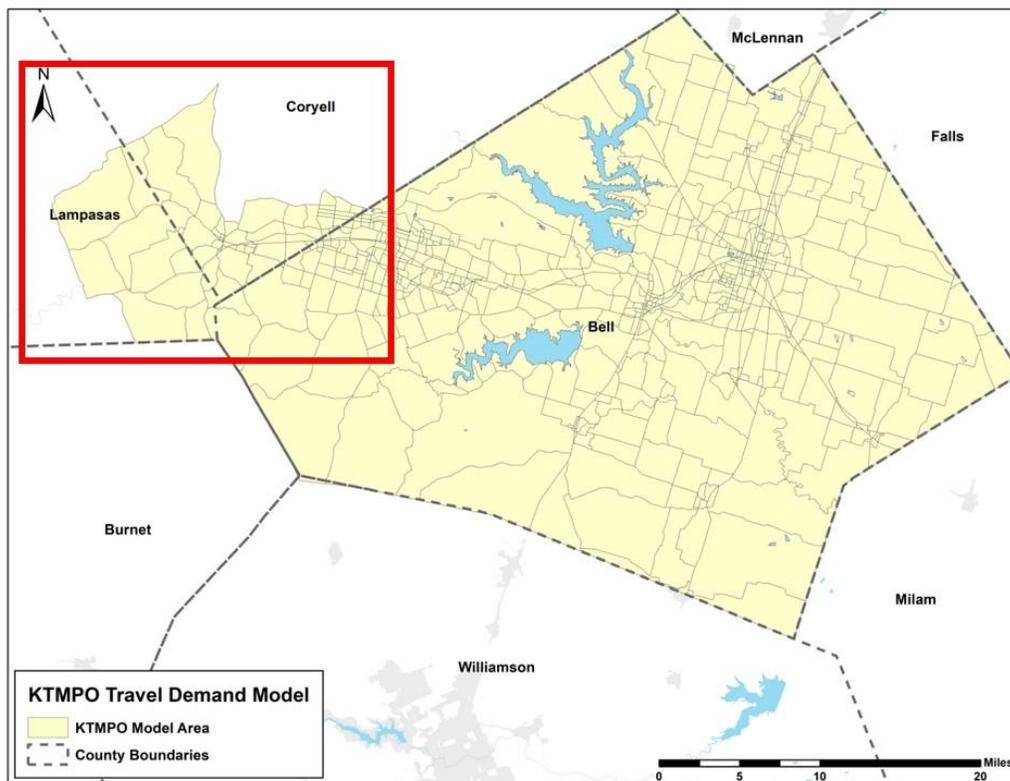

Figure 1: KTMPO TDM Boundaries

The comparison of the county control totals is summarized in **Table 1**. At the time of this study, the TDC was still reporting population forecasts at different migration scenarios (0.0, 0.5, and 1.0), which provided a range of forecasts with 0.0 being more conservative and 0.5 being more aggressive. As noted, the boundaries of the KTMPO TDM do not perfectly match the TDC or SAMV4 boundaries. With that being said, the county control totals of the 2045 KTMPO TDM compare reasonably to both the TDC and SAMV4. This suggests that the control totals of the 2045 KTMPO TDM were reasonably estimated.

Table 1: County Control Total Comparison of the KTMPO Region

Source	Population				Employment			
	Region	Bell	Coryell	Lampasas	Region	Bell	Coryell	Lampasas
2045 KTMPO TDM	599,300	503,319	73,432	22,549	265,956	227,958	34,174	3,824
2045 SAMV4	603,999	467,776	107,986	28,237	288,875	259,879	21,601	7,395
2045 TDC 0.0 Scenario	534,312	418,212	94,033	22,067	N/A			
2045 TDC 0.5 Scenario	659,006	524,806	107,138	27,062	N/A			
2045 TDC 1.0 Scenario	795,059	643,497	118,150	33,412	N/A			

Stakeholder Engagement

Stakeholders and planning partners identified a number of focus points to be explored in the demographics of the 2045 Standard KTMPO TDM Forecast Scenario when developing the alternative future scenarios. These focus points were determined through open dialog discussions and the use of an interactive online mapping tool that allowed users to participate and provide input on locations of growth. Three main focus points were identified by the stakeholders and planning partners for review and consideration when developing the alternative future scenarios:

- Locations of too high or low population and employment,
- Education employment throughout the KTMPO region, and
- Environmental justice areas potentially impacted by demographic development trends.

Online Outreach Tool

An interactive online mapping tool was used to allow stakeholders and planning partners to participate and provide input on locations of growth. The demographics of the 2045 Standard KTMPO TDM Forecast Scenario was developed a number of years ago, and, as is the case with all regions, plans for development frequently change as funding and priorities change. The

stakeholders and planning partners served as an excellent resource for this review, as they are the local knowledge experts on how the KTMPO region continues to change.

Figure 2 through **Figure 4** show various components of the Online Tool. The online mapping tool was designed as a standalone feedback tool that contained the following components:

- Introduction that fully explained the purpose of the Future Growth Scenario, provided questions users should ask themselves when leaving feedback, and explained what will be done with the feedback received.
- How-to instructions on how to use the tool to provide feedback
- Interactive scenario maps that contained the population and employment growth from 2015-2045. These maps were used to gather feedback from the stakeholders.
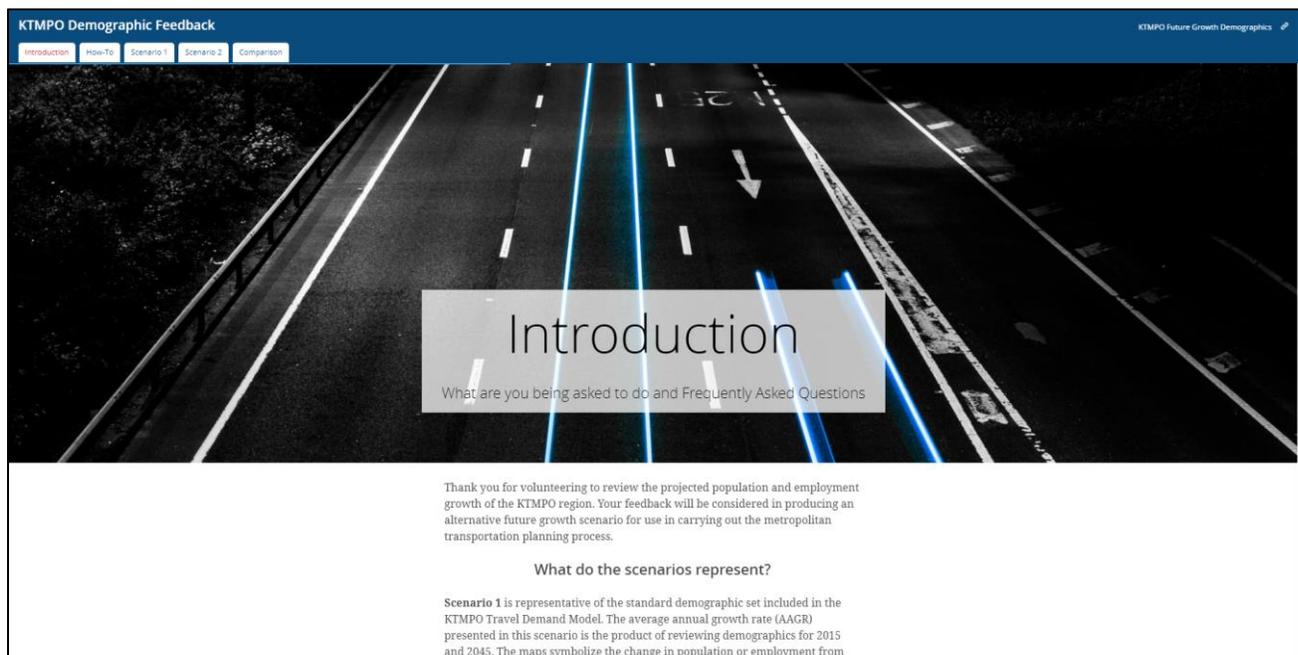
Figure 2: Introduction and Explanation Page of the Online Tool
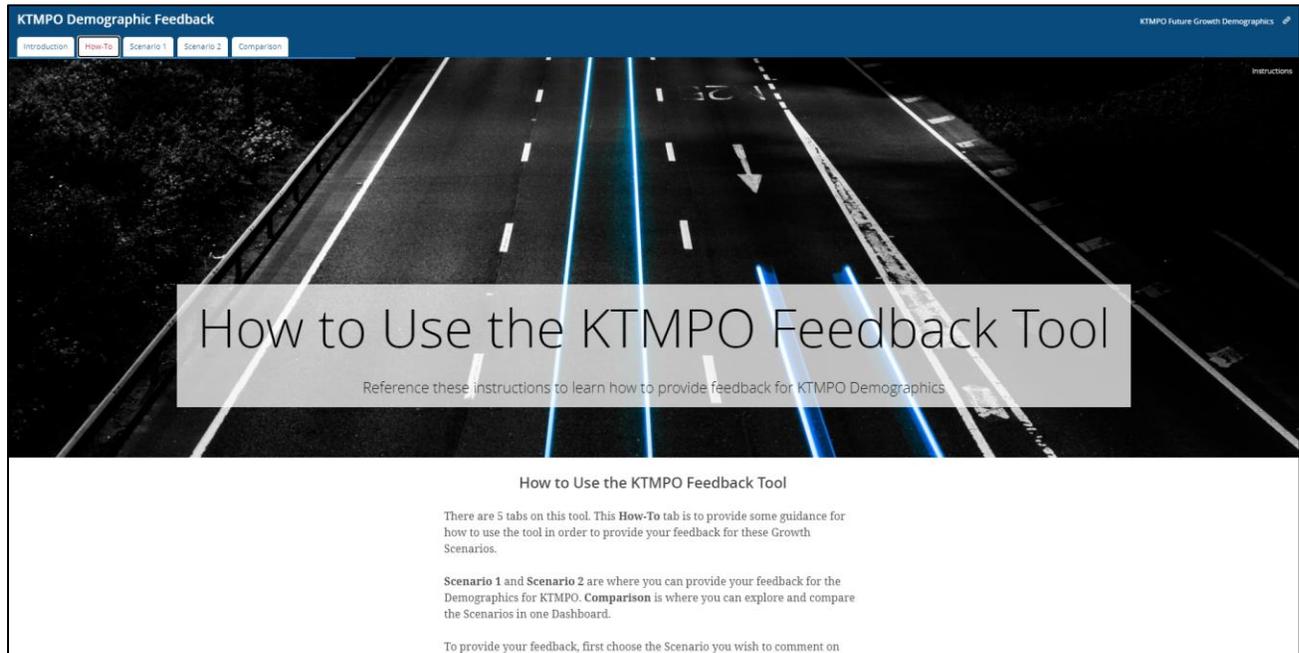
Figure 3: Instructions Page of the Online Tool
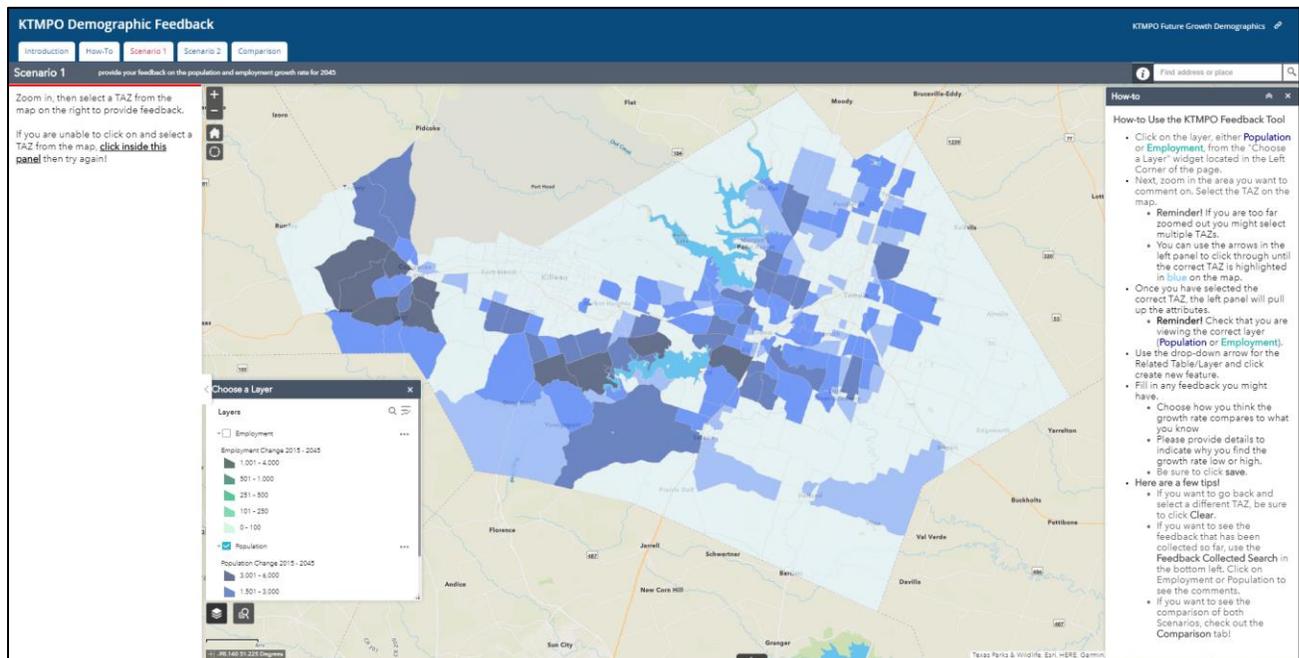
Figure 4: Interactive Map for Stakeholder Feedback

A total of eleven (11) comments were provided from various stakeholders indicating locations where they felt the population or employment of the 2045 KTMPO TDM was showing growth that was too high or low based on their local expert knowledge. **Figure 5** shows the location and the feedback of the comments provided by the stakeholders via the Online Tool. These comments were taken into consideration during the development of the alternative future scenarios.
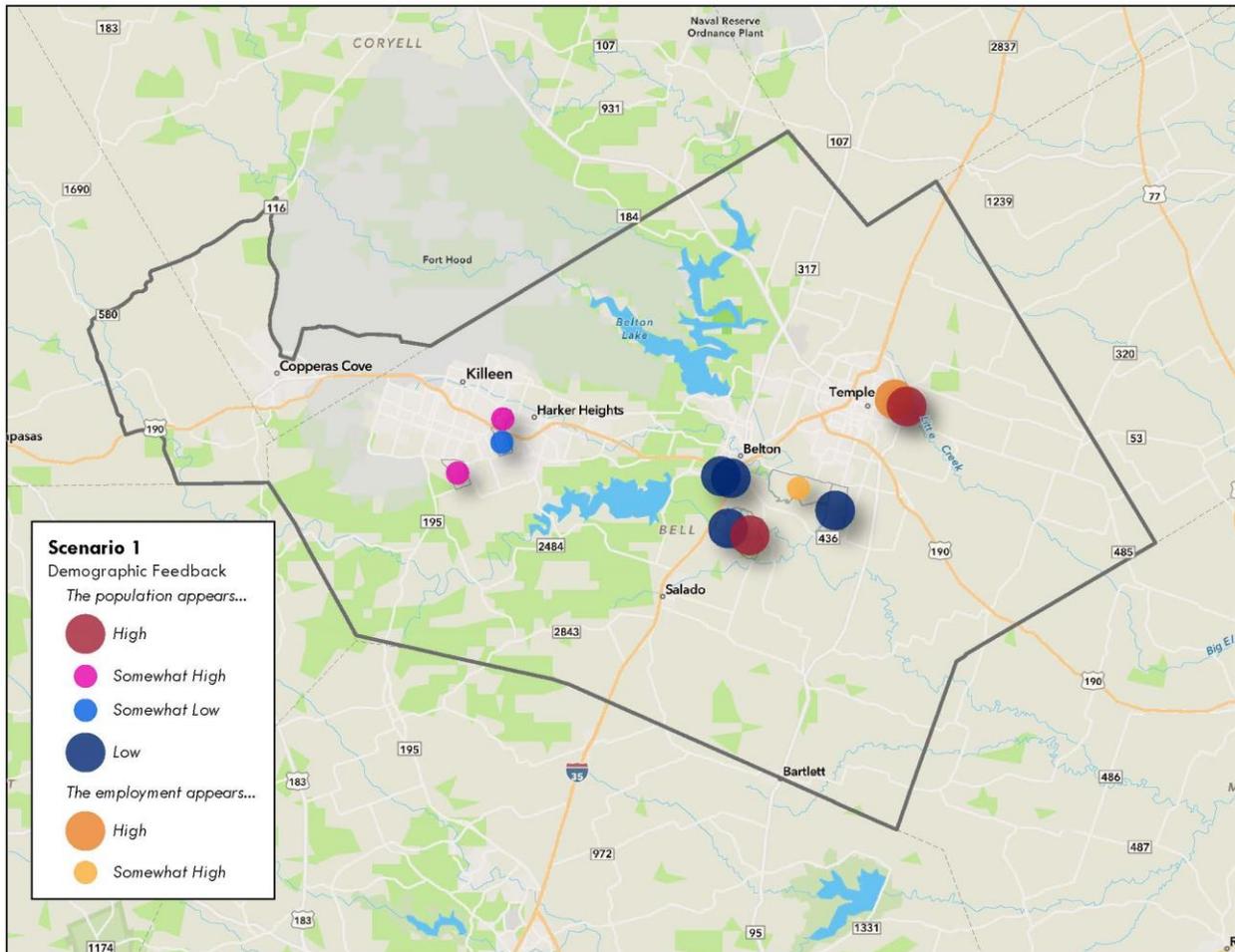
Figure 5: Online Outreach Tool Feedback

Education Employment

Figure 6 shows the locations where education employment exists in both the 2015 and 2045 standard scenarios of the KTMPO TDM. As shown, the education employment of the 2045 Standard Forecast Scenario is estimated to exist at many more locations than the education employment of the 2015 Standard Scenario.
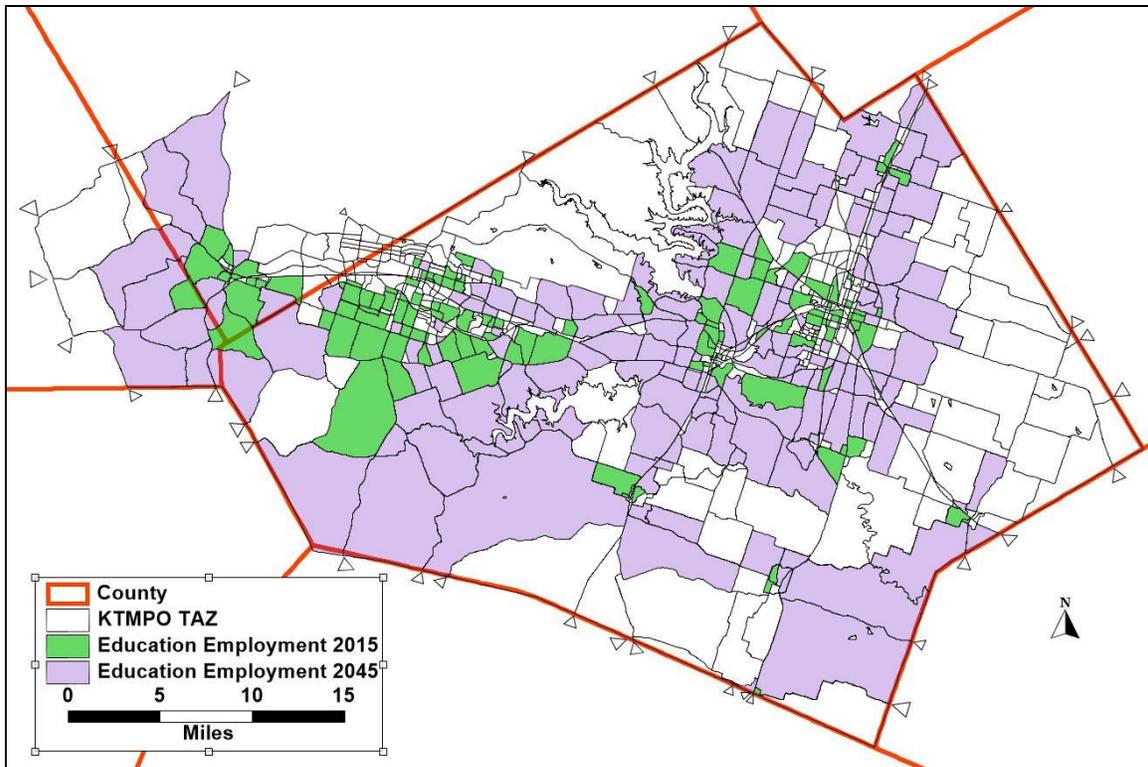
Figure 6: Change in Employment from 2015 to 2045

The existing 2045 Standard KTMPO TDM Forecast Scenario estimates future education employment based on the location of population growth within the region. While logical, the estimated education employment is applied to nearly every TAZ in the KTMPO TDM that has population growth, regardless of what the magnitude of the population growth happens to be. The issue with this assumption is that it does not accurately represent what could be expected of a school location where employment is centralized at distinct locations rather than being dispersed across an entire region.

As part of the review of education employment, the developable land, development density, and 2045 population growth were explored at the TAZ level of the KTMPO TDM to determine if any appropriate adjustments should be made to the 2045 education employment when developing the alternative forecast scenarios.

Based on the review, a number of adjustments were made to the 2045 education employment, as shown in **Figure 7**. The 2045 employment was adjusted to ensure it occurred at logical locations that contained a reasonable level of developable land for the assumed construction of schools, was focused near emerging communities within the region based on development densities, and that the actual growth in education employment reasonably depicted what would be expected of a school facility. Most 2045 education employment adjustments made reallocated education employment to be centralized around higher areas of population growth while ensuring education employment reflected minimum levels expected of a school (roughly 20-25 employees).
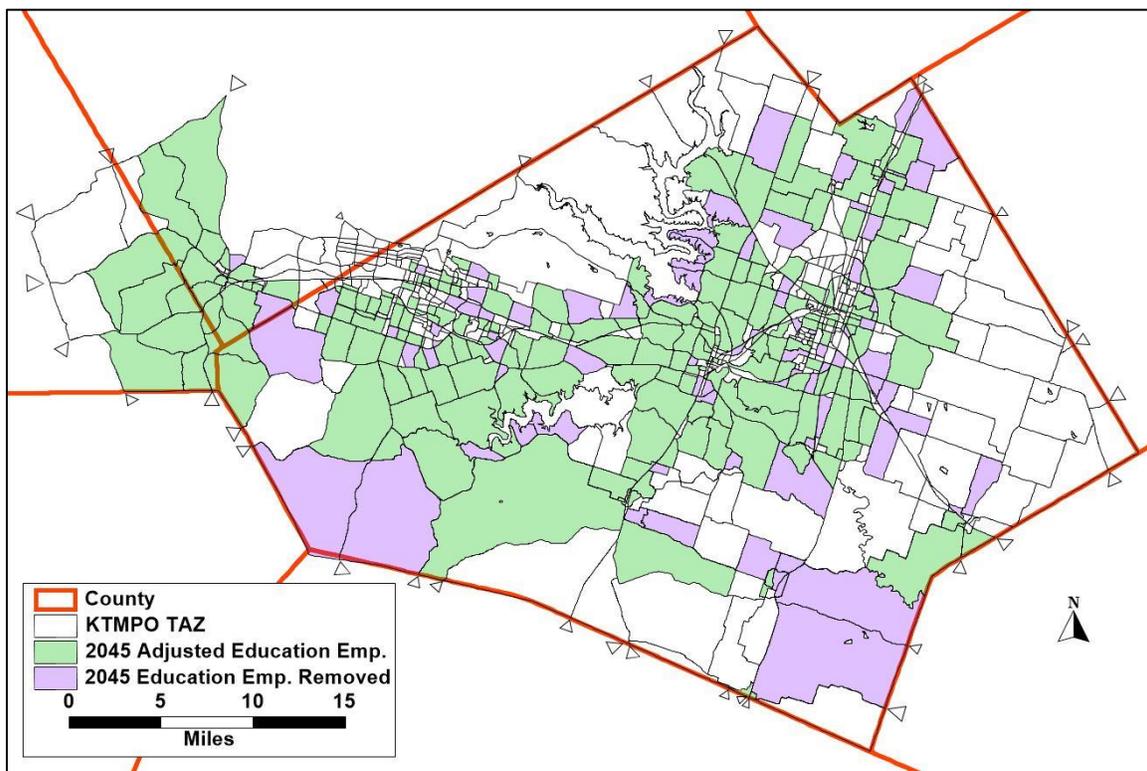
Figure 7: Reallocation of Education Employment in 2045

Environmental Justice (EJ) Areas

EJ areas defined in the KTMPO Public Involvement Plan as of 6/15/2020 were reviewed to determine if any adjustments were needed in order to correctly interpret any social equity issues related to the scenario. Demographic growth in the region was reviewed to ensure the updated EJ areas are reasonably depicted in the Future Growth Scenario. **Figure 8** identifies locations that experienced a change in EJ area designation.
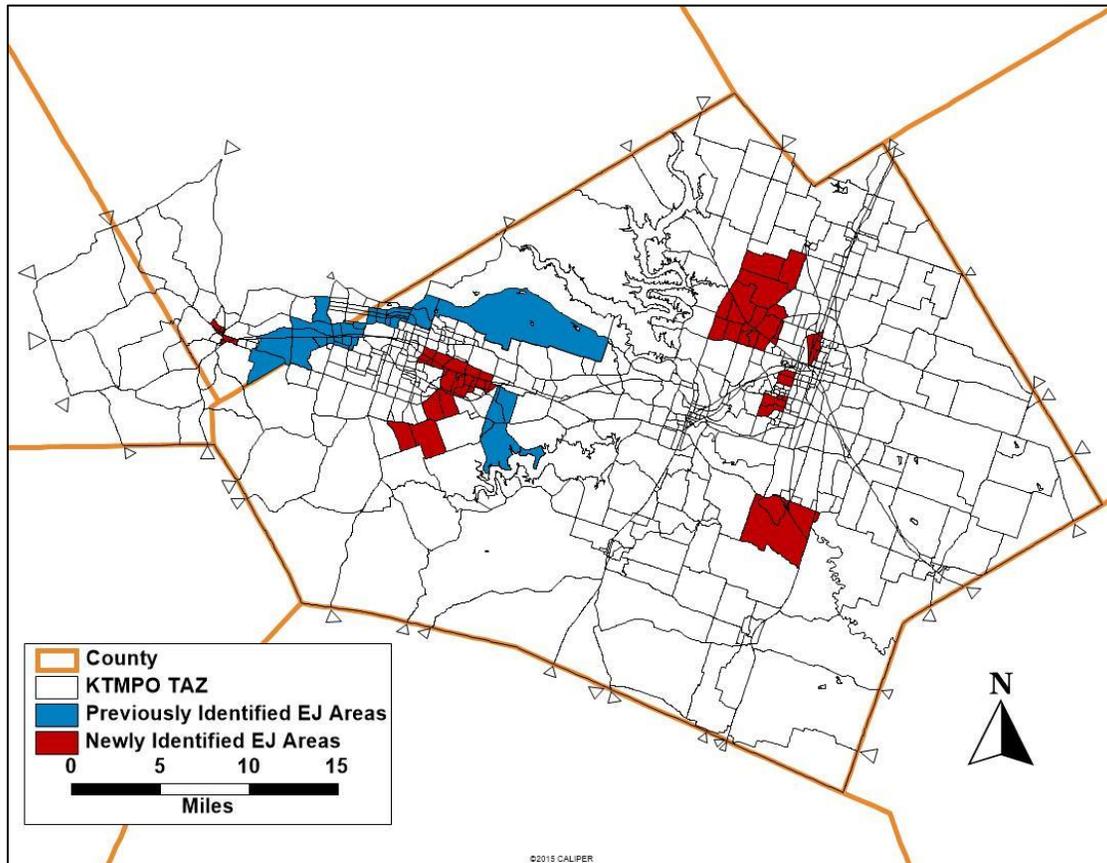
Figure 8: Changes in EJ Areas

The previously identified EJ areas that were no longer captured in the most recently defined EJ areas did not require adjustment, as the growth was reasonable based on the environment of these areas. There were a number of zones identified that fell within Fort Hood, while others were along waterway or challenging terrain.

The newly identified EJ areas contained a reasonable level of growth overall. Some of the new EJ areas contained a high level of growth, but they are primarily in vacant land areas and serve the purpose of ensuring employment and housing opportunities are provided to the surrounding EJ areas. No changes were necessary for alternative future scenarios based on the updated EJ areas.

Emerging Trends and Significant Drivers of Transportation System Demand

Emerging trends and significant drivers of transportation system demand were identified and reviewed to understand their impact on overall transportation system demand. The trends discussed are strictly theoretical as part of this planning-level exercise and do not aim to predict future travel in the KTMPO region. Each of the following trends were recommendations presented to the stakeholders to see what option was most reasonable for the region to consider in developing the Future Growth Scenario.

1. **Option 1 - Growing market share of e-commerce/home delivery and the decline in brick and mortar storefronts.**
    -   The growing market share of e-commerce/home delivery could be directly related to the decline of brick and mortar storefronts. With this consideration in mind, a potential alternative future growth scenario could see a decline in overall retail employment as storefronts begin closing. Goods would still need to be delivered to homes and businesses via existing transportation methods, and for the purpose of this exercise, trucks will be considered the primary method of delivery of goods.
    -   Analysis procedure – Maintain TAZ employment control totals but decrease retail employment, increase basic employment (distribution centers), and potentially increase the truck control total.
2. **Option 2 - Autonomous vehicles**
    -   Research indicates that there is a belief that autonomous vehicles will reduce usage of public transportation (transit), while also indicating that growth for a region could expand outward to suburban and rural areas as travel could become more efficient. Limitations such as waterways, military, airports, etc. would be considered to ensure growth is focused on logical locations throughout the region. Note that the KTMPO Model does not model transit related trips, and all analysis will be done in terms of vehicles.
    -   Analysis procedure – Maintain county level demographic growth but shift a portion of the growth (10-20%) from areas identified as central business district (CBD)/urban to suburban/rural.
3. **Option 3 - Transit-oriented development and downtown revitalization**
    -   Goals of transit-oriented development and downtown revitalization focus on improving and growing urban areas. Inversely to the autonomous vehicle recommendation, the transit-oriented development and downtown revitalization recommendation would result in increased growth of urban areas and lower growth in rural areas. The inward growth would be the result of improved public transportation and improved livability of urban areas. Limitations such as waterways, military, airports, etc. would be considered to ensure growth is focused on logical locations throughout the region. Note that the KTMPO Model

does not model transit related trips, and all analysis will be done in terms of vehicles.

- <u>Analysis procedure</u> – Maintain county level demographic growth but shift a portion of the growth (10-20%) from areas identified as suburban/rural to central business district (CBD)/urban.

These three options were discussed with project stakeholders and planning partners to garner feedback on what was potentially the most realistic emerging trend for the KTMPO region. Option 1 – Growing market share of e-commerce/home delivery and the decline in brick and mortar storefronts was agreed to be the most desirable option for use in the Future Growth Scenario.

Land Use Plan Scenario

Data related to previous plans and ongoing development initiatives of local jurisdictions were reviewed to determine if the development growth identified aligned well with the growth in the 2045 Standard KTMPO Forecast Scenario. Contact was made with each jurisdiction included in KTMPO region to determine if there was any available information on anticipated growth in their respective area. Plans were obtained from all possible jurisdictions in the KTMPO region. Available plans for each jurisdiction had varying years and only provided anticipated population growth. The population annual average growth rate (AAGR) from each available land use plan are shown in **Table 2,** with corresponding AAGRs reported by the 2010-2018 Census and 2015-2045 KTMPO TDM.

Table 2: Population Growth Rates of Land Use Plans, Census, and KTMPO TDM.

City	From Available Plan			From Census			From KTMPO TDM		
Rogers	2018	2028	AAGR	2010	2018	AAGR	2015	2045	AAGR
	1,300	1,500	1.5%	1,218	1,225	0.1%	1,475	2,410	2.1%
Belton	2015	2030	AAGR	2010	2018	AAGR	2015	2045	AAGR
	20,547	33,200	4.1%	18,216	22,222	2.7%	26,061	56,890	3.9%
Copperas Cove	2005	2030	AAGR	2010	2018	AAGR	2015	2045	AAGR
	31,500	55,781	3.1%	32,032	32,658	0.2%	35,997	61,964	2.4%
Harker Heights	2010	2018	AAGR	2010	2018	AAGR	2015	2045	AAGR
	27,600	30,785	1.4%	26,700	31,857	2.4%	35,494	46,954	1.1%
Killeen	2009	2040	AAGR	2010	2018	AAGR	2015	2045	AAGR
	117,039	200,000	2.3%	127,921	149,103	2.1%	136,724	160,927	0.6%
Nolanville	2010	2030	AAGR	2010	2018	AAGR	2015	2045	AAGR
	4,259	8,477	5.0%	4,259	5,715	4.3%	6,053	11,846	3.2%
Temple	2018	2038	AAGR	2010	2018	AAGR	2015	2045	AAGR
	80,465	112,056	2.0%	66,102	76,256	1.9%	78,714	110,867	1.4%
Troy	2010	2030	AAGR	2010	2018	AAGR	2015	2045	AAGR
	1,832	2,347	1.4%	1,645	1,997	2.7%	2,325	5,733	4.9%

In general, the available land use plans of local jurisdictions forecasted a more aggressive population growth rate for their respective areas as compared to the Census and the KTMPO TDM. Most notably, the more populous areas of Killeen, Copperas Cove, and Temple all have a slightly higher population growth rate in the land use plans as compared to the KTMPO TDM. This would indicate that the local jurisdictions, at the time of development of their respective plan, anticipated higher growth within the established urban subareas.

The growth rates calculated from the local jurisdictions were used directly as part of the Land Use Plan Scenario. Though the land use plans only provided information on anticipated population growth, the KTMPO Model balances population (productions) and employment (attractions) at the TAZ level in the trip distribution step. This means that the number of trips generated by the model will correspond reasonably to the increased population. The following steps outline the process used to estimate the 2045 Land Use Plan Scenario.

Estimation Procedure:

- Apply land use plan population growth rates to the 2015 KTMPO TDM population directly for each subarea.
    - Demographic forecasting of the Land Use Plan Scenario is not constrained to the accepted and approved control total of the 2045 KTMPO model, as this is a theoretical scenario that is based on a different set of projections.
- Apply AAGR from each land use plan to the 2015 KTMPO Base Year Scenario to produce an alternative 2045 Land Use Scenario.
- Maintain existing 2015 population-to-employment ratios to forecast 2045 employment.
- Locations not covered by a jurisdiction with a land use plan were directly maintained from the 2045 KTMPO Forecast Scenario.

Since the 2045 Land Use Plan Scenario is an entirely new 2045 forecast, it does not consider the feedback received from the stakeholders and planning partners from the Online Tool, and no education adjustments are included in this scenario.

The resulting traffic flow of the 2045 Land Use Scenario was compared to the standard 2045 Forecast Scenario of the KTMPO model, as shown in **Figure 9**.

The results indicate the following:

- In general, there is a higher total population for the KTMPO model region in this scenario than the standard 2045 Forecast Scenario, and the locations where the population and employment are located changed dramatically.
- The location of changed traffic volume correlates well with locations that showed a large difference in growth between land use plans and the KTMPO model.
    - Most notably, Killeen has a 2.3% growth rate identified in their land use plan, while the model forecasted a growth of 0.6% in this area.
    - Belton and Copperas Cove also experience slightly higher growth, while Temple is roughly constant.
- As one would expect, the large growth in Killeen means there is a significant increase in volume within that area. Since Killeen is both a large source of population and employment in this scenario, trips are both generated and attracted within a smaller space. This resulted in shorter average trip lengths throughout the model.
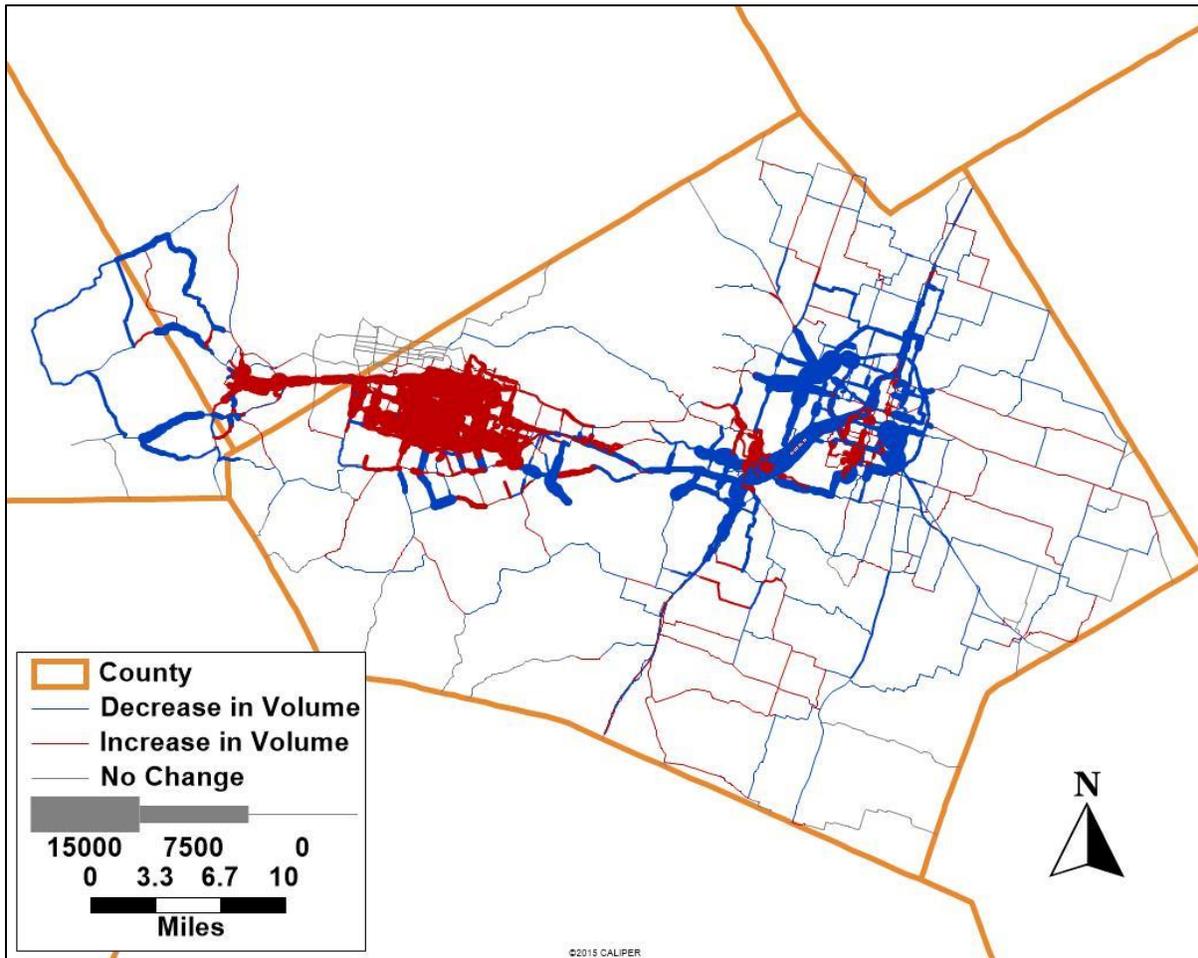
Figure 9: Change in Volume in 2045 Land Use Scenario Compared to 2045 Forecast Scenario

Future Growth Scenario

Growing market share of e-commerce/home delivery and the decline in brick and mortar storefronts.

This scenario aims to present an alternative, theoretical future growth scenario that has a decline in the overall retail employment as storefronts lose market share to e-commerce. Consequently, the reduction in retail employment is converted into basic employment (distribution centers) as the growing market share of e-commerce/home delivery increases.

There is no definitive data to support a direct relationship between increased e-commerce and the decline of brick and mortar storefronts, since we are very much living-out that scenario as we speak. As such, a relationship with the growing percentage of e-commerce sales was assumed to correlate to employment. As shown in **Table 3** and **Figure 10**, the percentage of e-commerce retail sales relative to the total retail sales steadily increases. It would be reasonable to assume this trend will continue in the future.

Table 3: U.S. Department of Commerce Retail E-commerce Sales (2018-2019)

Quarter	Total Retail Sales ($Millions)	E-Commerce Sales ($Millions)	E-Commerce % of Total
4th quarter 2019	1,459,855	185,700	13%
3rd quarter 2019	1,376,996	145,474	11%
2nd quarter 2019	1,377,667	138,956	10%
1st quarter 2019	1,237,688	127,888	10%
4th quarter 2018	1,402,015	159,650	11%
3rd quarter 2018	1,318,990	123,322	9%
2nd quarter 2018	1,331,200	121,969	9%
1st quarter 2018	1,217,263	114,694	9%
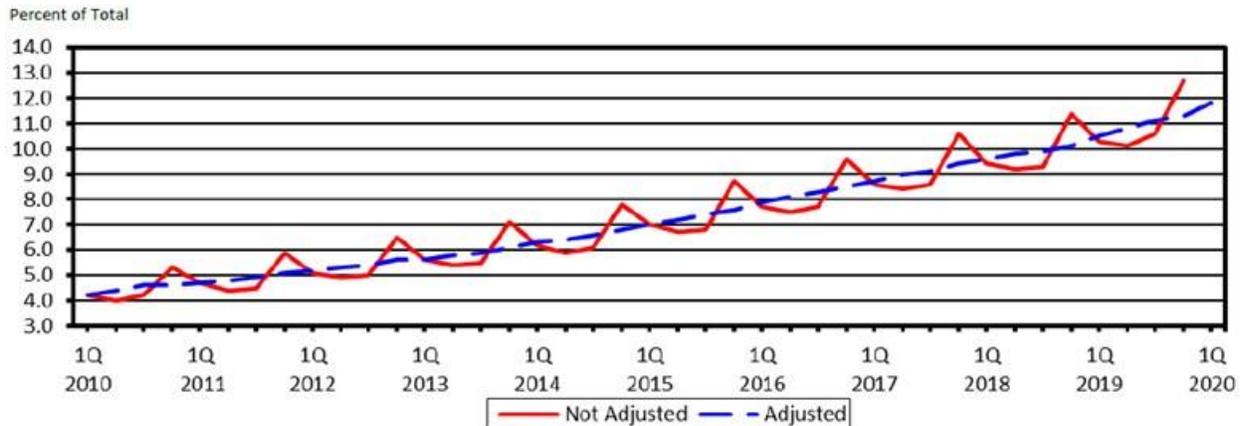
Figure 10: U.S Department of Commerce Retail E-commerce Sales (2010-2020)

Table 4 presents a list of the retail and basic employment adjustments considered for use in the scenario analysis. The 20% adjustment was selected and implemented as part of the Future Growth Scenario, as it agrees with the trend of increased e-commerce sales and the assumed correlation of sales and employment. This adjustment provides a reasonable representation of what could be expected in the future as part of this theoretical scenario. The 20% adjustment ensures that the scenario will capture a measurable change in the future, while not to creating a scenario that becomes too unrealistic.

Table 4: Selected Employment Adjustment

Potential Modification	Employment Sector			
	Basic	Retail	Basic + Retail	Employment Shift
2045 Base Employment	40,075	49,603	89,678	0
10% Adjustment	45,035	44,643	89,678	4,960
15% Adjustment	47,515	42,163	89,678	7,440
20% Adjustment	49,996	39,682	89,678	9,921
25% Adjustment	52,476	37,202	89,678	12,401
30% Adjustment	54,956	34,722	89,678	14,881
35% Adjustment	57,436	32,242	89,678	17,361
40% Adjustment	59,916	29,762	89,678	19,841

Neighboring regions were investigated to see if there were similar efforts performed for their respective regions. No information was readily available, though the standard basic and retail employment was compared for each region. The average annual growth rate for basic and retail employment of the neighboring CAMPO and Waco regions are presented in **Table 5**. KTMPO falls in the middle of the three regions in terms of overall growth.

Table 5: Employment Growth in Neighboring Regions

Employment Sector	CAMPO (2015-2045)	Waco (2010-2040)	KTMPO (2015-2045)
Basic Growth %	3.42%	0.07%	2.63%
Retail Growth %	3.03%	1.29%	2.14%

Estimation Procedure:
- Maintain county level employment control totals,
- Decrease retail employment universally, and
- Increase basic employment (distribution centers) at logical locations dictated by large amounts of existing basic employment.

The modification of the truck control total was explored to simulate increased truck traffic for home deliveries. It was found that the model calculated the truck control total internally and is not based on the user defined truck control total. As a result, no direct change was made to the estimation of trucks. Changes in truck travel were forecasted based on the changes in the regional employment profile resulting from the scenario begin evaluated.

Figure 11 presents the TAZs impacted by the change in TAZ retail employment.
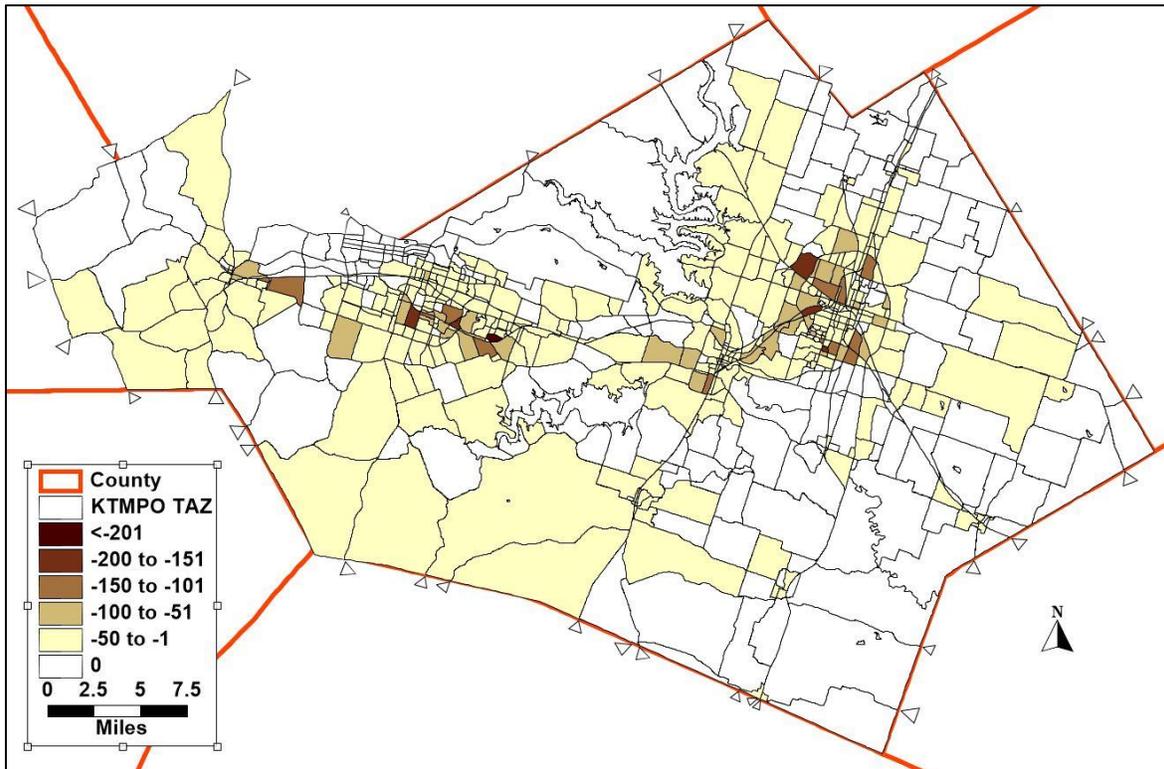
Figure 11: Change in Retail Employment - 20% Universal Reduction

Figure 12 presents the TAZs impacted by the change in TAZ basic employment.
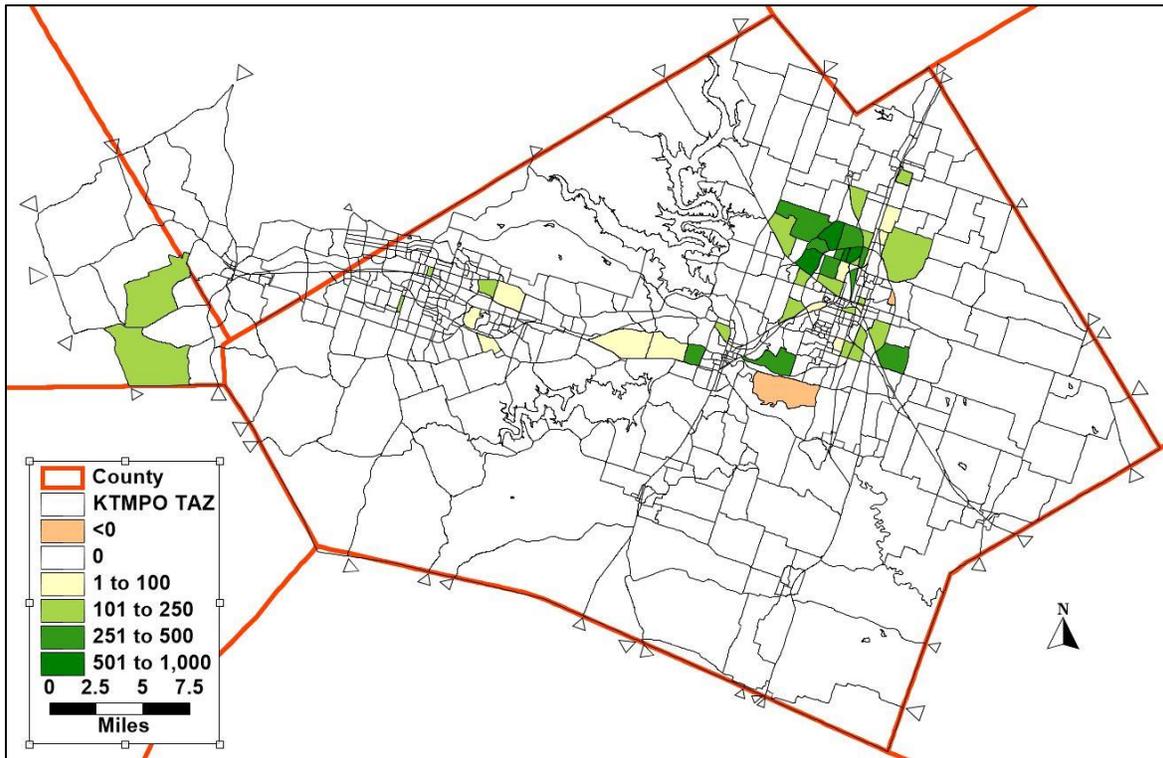
Figure 12: Change in Basic Employment – 20% Increase at Logical Locations

The resulting traffic flow of the 2045 Future Growth Scenario was compared to the standard 2045 Forecast Scenario of the KTMPO model, as shown in **Figure 13**.

The results indicate the following:

- The locations of changed traffic volumes are logically related to locations that experienced a significant change in demographics under the Future Growth Scenario.
- There is a reduction in commuting volume along I-14 (US Highway 190).
- There is a shift in traffic volumes south of Belton as population was relocated based on feedback received via the Online Tool. This large increase is located on Toll Bridge Rd as it attempts to access I-35.
- There is increased commuting volume to the northwestern portion of Temple. This area is the location where most of the new basic employment was allocated.
- The impact of modified education employment is seen throughout the region, but the volume change is not dramatic.
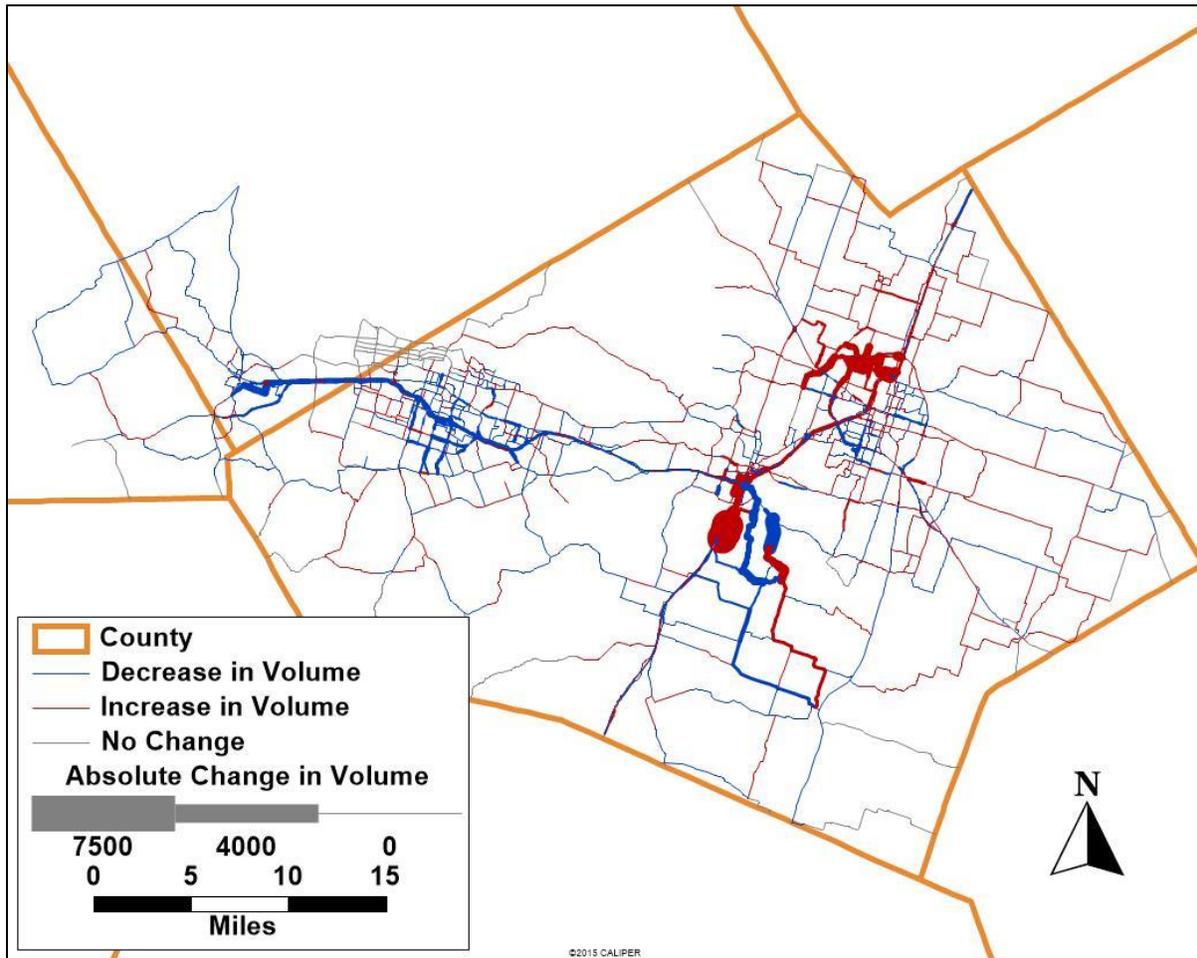
Figure 13: Change in Volume in 2045 Future Growth Scenario Compared to 2045 Forecast Scenario

Transportation System Outcomes

An evaluation was performed for the 2045 Standard Forecast Scenario, Future Growth Scenario, and Land Use Plan Scenario to show the relative impacts of each scenario. The comparison was intended to show the impact on regional performance measures as a result of the shift in land use of each scenario relative to the 2045 Standard Forecast Scenario of the KTMPO TDM.

Table 6 presents summarized regional measures from the three scenarios analyzed. The measures reported are the result of a review performed of the direct KTMPO TDM output which are automatically generated by the model in the form of Excel spreadsheets and summarized data tables.

Table 6: Comparative Measures from 2045 Scenarios

Measure	2045 Forecast Scenario	2045 Future Growth Scenario	2045 Land Use Scenario
Vehicle Miles Traveled (VMT)	15,773,167	15,750,531	15,583,642
Vehicle Hours Traveled (VHT)	471,867	470,119	449,980
Avg Speed (mph)	33.43	33.50	34.63
Delay (Vehicle Hours)	17,286	16,529	9,160
Percent of Links with V/C>1.0	19.94%	19.75%	20.42%

The results indicate the following:

- The standard 2045 Forecast Scenario and the 2045 Future Growth Scenario are fairly comparable, but the Future Growth Scenario has slightly increased speeds as congestion and delay are reduced.
- The 2045 Land Use Scenario is forecasted by applying growth rates directly to the existing 2015 demographics. As such, the growth is mostly focused in centralized locations of existing demographics rather than locations of vacant land (more rural areas).
- The 2045 Land Use Scenario shows higher speeds and dramatically lower overall delay. As shown in **Figure 9**, traffic became much more centered around the Killeen area due to the high levels of growth. In addition, there is increased volume in the city centers of Copperas Cove, Belton, and Temple. This resulted in two key impacts 1) a reduction of volume on roadways within the KTMPO model area outside of urban centers and 2) shorter trip lengths overall.
- Despite higher speeds and significantly less delay, the 2045 Land Use Scenario has more roadway links with a volume-to-capacity (V/C) ratio of 1.0 or greater. This can be attributed to the higher number of links found within urban areas where volumes are concentrated in this scenario.

Fiscal Impact Analysis

Whenever land is developed in a given location, new costs are incurred by the local governments in order to provide additional services and infrastructures to that development. The local government is responsible for ensuring they are able to project the demand that new development places on the overall budget. The Metropolitan Planning Regulations encourage the use of scenario-based planning to help decision makers fully understand their full range of options for dealing with future transportation system needs. When an MPO employs scenario-based planning as part of the planning process, the Metropolitan Planning Regulations also require that the MPO perform a Fiscal Impact Analysis of the scenarios.

The method used to perform the Fiscal Impact Analysis focuses on a review of the infrastructure costs necessary to serve the transportation demand of each scenario. The KTMPO TDM was used to identify potential deficiencies in each scenario and to identify the additional infrastructure development necessary to support the transportation demand at an acceptable level of service (LOS). LOS F, which indicates a severely deficient roadway, was assumed to be represented by a model volume-to-capacity (V/C) ratio greater than a value of 1.0. LOS D+, which indicates an acceptable level of performance for roadways, was assumed to be a model V/C ratio less than 0.8. **Table 7** summarizes the assumed KTMPO TDM V/C ratio ranges for determining LOS.

Table 7: Level of Service Assumed Volume-to-Capacity Ranges

Level of Service	Volume-to-Capacity (V/C) Ratio Range
LOS D+	V/C<0.8
LOS E	0.8<=V/C<1.0
LOS F	1.0<=V/C

Estimation Procedure:
- Review completed model scenarios to determine roadway links of LOS D+, LOS E, and LOS F based on the total volume of each roadway link.
  - All volumes and capacities reviewed were for daily totals, as the 2045 KTMPO TDM does not report time-of-day information.
- Estimate the required model capacity (number of lanes) necessary to improve each roadway link to LOS D+ and LOS E.
  - The per lane capacity was defined by the speed-capacity lookup table of the KTMPO TDM and varies by functional classification.
- Estimate the number of newly added lane miles added to the transportation system.
- Estimate the construction cost per lane mile by freeway, arterial, and collector. **Table 8** shows the assumed USDOT Conditions and Performance Report[1] construction costs per lane mile for small urban areas used as part of this analysis.

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[1] USDOT Status of the Nation's Highways, Bridges, and Transit Conditions and Performance Report, 23rd Edition, 2019

Table 8: USDOT Conditions and Performance Construction Costs by Functional Classification

Functional Classification	Typical Cost per Lane Mile (2014$)
Freeway	$4.2 million
Principal Arterial	$3.6 million
Minor Arterial / Collector	$2.6 million

The construction costs associated with the number of added lane miles necessary to improve LOS is presented in three different ways:

- **Table 9** summarizes the required lane miles and associated construction costs to be added to the transportation system for each scenario in order to improve performance from LOS F to LOS D.
- **Table 10** summarizes the required lane miles and associated construction costs to be added to the transportation system for each scenario in order to improve performance from LOS F and LOS E to LOS D.
- **Table 11** summarizes the required lane miles and associated construction costs to be added to the transportation system for each scenario in order to improve performance from LOS F to LOS E.

Table 9: LOS F to LOS D Construction Costs by Functional Classification

Scenario	Freeway		Principal Arterial		Minor Arterial / Collector		Total	
	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)
2045 Forecast Scenario	238	$1,002	102	$366	323	$840	663	$2,208
2045 Future Growth Scenario	228	$958	100	$362	314	$817	642	$2,137
2045 Land Use Scenario	209	$876	100	$359	320	$833	629	$2,068

Table 10: LOS F and LOS E to LOS D Construction Costs by Functional Classification

Scenario	Freeway		Principal Arterial		Minor Arterial / Collector		Total	
	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)
2045 Forecast Scenario	281	$1,181	142	$510	489	$1,272	912	$2,963
2045 Future Growth Scenario	281	$1,182	142	$511	477	$1,240	900	$2,933
2045 Land Use Scenario	266	$1,116	148	$534	469	$1,220	883	$2,870

Table 11: LOS F to LOS E Construction Costs by Functional Classification

Scenario	Freeway		Principal Arterial		Minor Arterial / Collector		Total	
	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)	Lane Miles	Cost ($mil)
2045 Forecast Scenario	141	$593	73	$261	277	$721	491	$1,574
2045 Future Growth Scenario	141	$593	72	$261	276	$717	490	$1,572
2045 Land Use Scenario	132	$553	74	$268	276	$718	482	$1,537

The Fiscal Impact Analysis provides local decision makers with a sense of the investment that will be required to satisfy the potential future demand on the transportation system. The Fiscal Impact Analysis indicated the following in terms of the investment required to improve the LOS of roadways throughout the KTMPO region:

- The investment required to improve all LOS F roadways in 2045 to LOS E would be $1.5 billion dollars while improving LOS F roadways in 2045 to LOS D would be roughly over $2 billion. Improving all LOS F and LOS E roadways in 2045 to LOS D would be nearly $3 billion.
- The Future Growth Scenario and Land Use Plan Scenario required a lower investment total to improve the LOS of roadways in the transportation system.
  - This indicates that emerging trends or changes in growth patterns have the potential to reduce the dollar amount required to satisfy the needs of the transportation system. A mindful approach to reviewing and understanding the growth within the region is critical to ensuring investments are put towards needed improvements, as the overall cost savings could theoretically be tremendous (potentially hundreds of millions) if land use policies are developed to encourage these growth patterns.

- As shown by the results of the Land Use Plan Scenario in **Figure 9**, there is a reduction in volume on freeways and rural roadways, while there is an increase in volume on urban arterials and collectors. This is supported by the investment levels shown in **Table 9** through **Table 11**, as a lower investment is required for freeways to reach improved LOS.
- The Future Growth Scenario often shows the lowest investment required to improve arterials and collectors, though the investment on freeways is higher than the Land Use Plan Scenario and is comparable to that of the 2045 Standard Forecast Scenario.

Conclusion

The KTMPO TDM was used to model three separate scenarios for the purpose of demonstrating the impacts of different theoretical alternative futures on the transportation system. The modeled scenarios were:

- **2045 Standard KTMPO TDM Forecast Scenario** – default forecast scenario of the KTMPO TDM. No modifications were made to this scenario, as it was used as the baseline scenario for performance and financial comparisons.
- **2045 Future Growth Scenario** – alternative forecast scenario developed based on emerging trends and significant drivers of transportation system demand.
- **2045 Land Use Plan Scenario** – alternative forecast scenario developed based on available land use plans of local jurisdictions of the KTMPO TDM region.

The Future Growth Scenario and Land Use Plan Scenario showed that emerging trends in transportation demand and shifts in projected growth patterns had a noticeable effect on the transportation system. These scenarios offered a glimpse into a potential alternative future that showed slightly improved system performance and lower construction investment costs overall. The alternative futures effectively demonstrated the importance of going through this planning-level exercise to understand how the needs and required investment level of the transportation system can change over time as potential alternatives become reality. If the alternative futures are believed to be a reasonable assumption for what could be expected in the future, close examination can be performed to see if a shift in project focus is needed based on the trends and hotspots observed in the given scenario.

The consideration of different theoretical alternative futures is a valuable planning-level exercise that can ensure funding resources are being allocated appropriately to locations where they are most needed. The review of alternative futures can reinforce the need and prioritization of project improvements, or the futures could show that a specific project is highly correlated to only one scenario and offers little benefit to the region under other potential conditions. The review of alternative futures can indicate there may need to be a shift in project focus based on observed trends and hotspots throughout the region. Based on the traffic volumes of each scenario analyzed, the roadway projects in **Table 12** were identified as likely having a future benefit to the transportation system across all alternative future scenarios.

Table 12: KTMPO Roadway Projects Identified as Having a Potential Benefit Across All Scenarios

KTMPO ID	Project Name	Project Limits	Project Description
W35-04	FM 439	Roy Reynolds Drive to FM 3219	Widen from 4 to 6 lanes
K30-13	Chaparral Rd	SH 198 to FM 3481	Reconstruct and widen from 2 to 4 lanes
H45-04	FM 3481	Prospector Trail to Proposed Chaparral Rd Intersection	Widen from 2 to 4 lanes
W40-04a	Loop 121 Phase 1a	Lake Rd to US 190	Widen from 2 to 4 lanes
W25-02	SH 36	SH 317 to Lake Belton Bridge	Widen from 2 to 4 lanes

Each alternative future scenario performed indicated that the roadways covered by these KTMPO MTP projects were likely to have a future benefit based on the increased demand on the transportation system. As a result, the priority of these projects may theoretically rise as it is increasingly likely that the investment dollars will result in future benefit under different alternative futures for the KTMPO region.