# Appendix B: Trends, Projections, and Travel Patterns

This chapter reviews the region's growth in terms of population, housing units, and employment. The analysis is provided at the community level and regional level. The majority of this information is from the U.S. Census Bureau, although some of the employment data is from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD).

Historical Population Growth

The Southeastern Massachusetts Metropolitan Planning Organization (SMMPO) region continues to experience population increases that exceed the rate of growth statewide. During the period 1990 to 2000, the total population of the 27 SMMPO communities increased from 563,130 to 597,294, a 6.1 % increase. By comparison, the state population increased in the same period by 5.5%. This was consistent with performance in the prior decade, when the percentage increase in population for the region was 9.1%, compared to the statewide increase of 4.9%. Between 2000 and 2010, the SMMPO region showed an increase of 3.2% compared to the statewide increase of 3.1% during the same period. Between 2010 and the estimated population in 2015, the SMMPO region showed an increase of 1.1%. Figure B-1 summarizes population growth in the region. Figure B-2 illustrates how the region's rate of population growth compares to the State and national rates from 1970 to 2010.
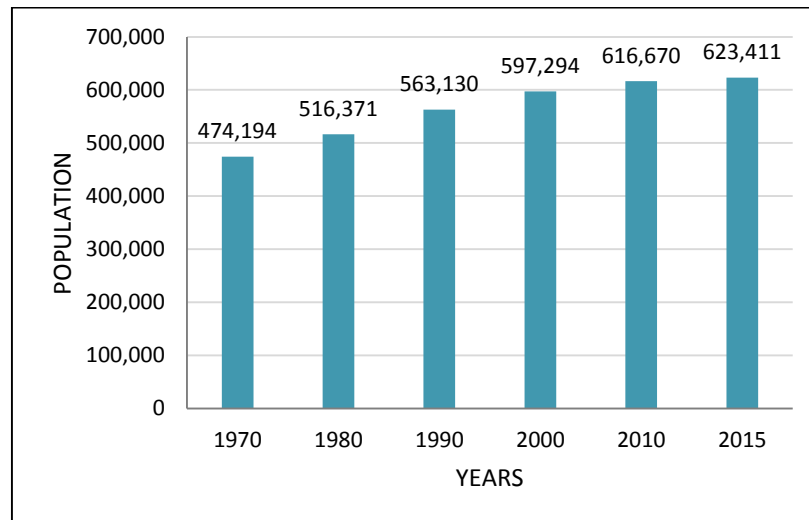
Figure B- 1: Population Growth in the SMMPO Region
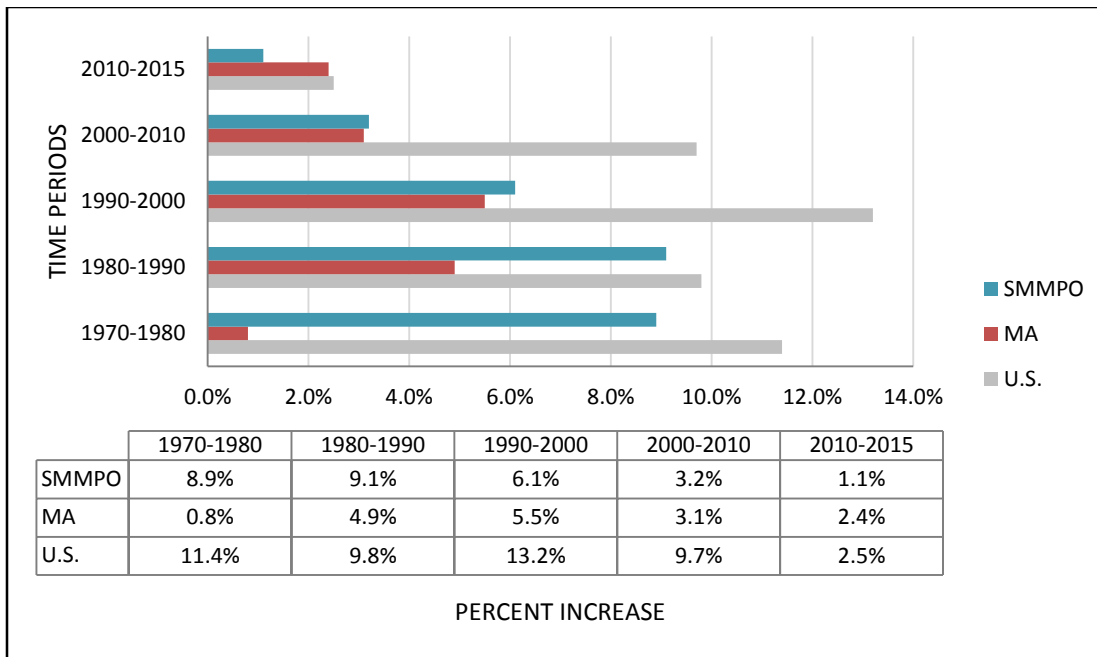
Figure B- 2: Percentage Increases in Population

The average annual rate of population growth in the region was 0.86% from 1970 to 1980, 0.87% from 1980 to 1990, 0.59% from 1990 to 2000 and 0.32% from 2000 to 2010. Rather than comparing the ten-year increase to the beginning of each decade, the rate of growth indicates growth compounded on an annual basis. That is, each year's base is adjusted to reflect the increase and then the growth is calculated from the new base. For 2000 to 2010, growth rates within the 27 communities varied from an annual average of 1.6% in Middleborough to an annual average of -0.34% in Fall River.

Based on the US Census Population Estimates for 2015, the SRPEDD region has continued to grow at a rate of 1.1% (0.22% annually) with a varying rate of 1.14% in Plainville and -0.04% in New Bedford.

Location of Population Growth - Within the region, population increases from 2000 to 2015 varied from a total increase of +19.0% in Middleborough, to a population loss of –3.5% in Fall River.

According to the U.S. Census Bureau, the top ten communities in terms of numerical population increase in 2000 to 2015 are shown in Table B-1.

Table B- 1: Top Ten Communities in Total Population Growth

Town	Population Growth	Growth Percentage		Town	Population Growth	Growth Percentage
1. Dartmouth	3,816	12.4%		6. N. Attleborough	1,720	6.3%
2. Middleborough	3,781	19.0%		7. Rehoboth	1,663	13.7%
3. Wareham	2,025	10.0%		8. Westport	1,524	10.7%
4. Attleboro	1,885	4.5%		9. Norton	1,326	7.4%
5. Raynham	1,861	15.9%		10. Lakeville	1,277	13.0%

Although Attleboro and Taunton gained population from 2000 to 2015, Fall River and New Bedford continue to decline. Comparing the urban centers' population over the years to the regional population continues to show a trend of the urban areas losing more population to the suburban areas of the region. The urban centers have increased in population between 2010 and 2015. Table B-2 illustrates the continuation of this trend from 1980 – 2015.

**Table B- 2: Population in the region's four urban centers, 1980-2015**

Community	1980	1990	2000	2010	2015*
Attleboro	34,196	38,383	42,068	43,593	43,953
Fall River	92,574	92,703	91,938	88,857	88,727
New Bedford	98,478	99,922	93,768	95,072	94,909
Taunton	45,001	49,823	55,976	55,874	56,504
Urban Centers Total	270,249	280,840	283,750	283,296	284,093
SMMPO Reg. Total	**524,389**	**563,130**	**597,294**	**616,670**	**623,411**
Urban Centers as % of Regional Total	**51.5%**	**49.9%**	**47.5%**	**46.0%**	**45.6%**
*Based on Estimates. Source: U.S. Census Bureau					
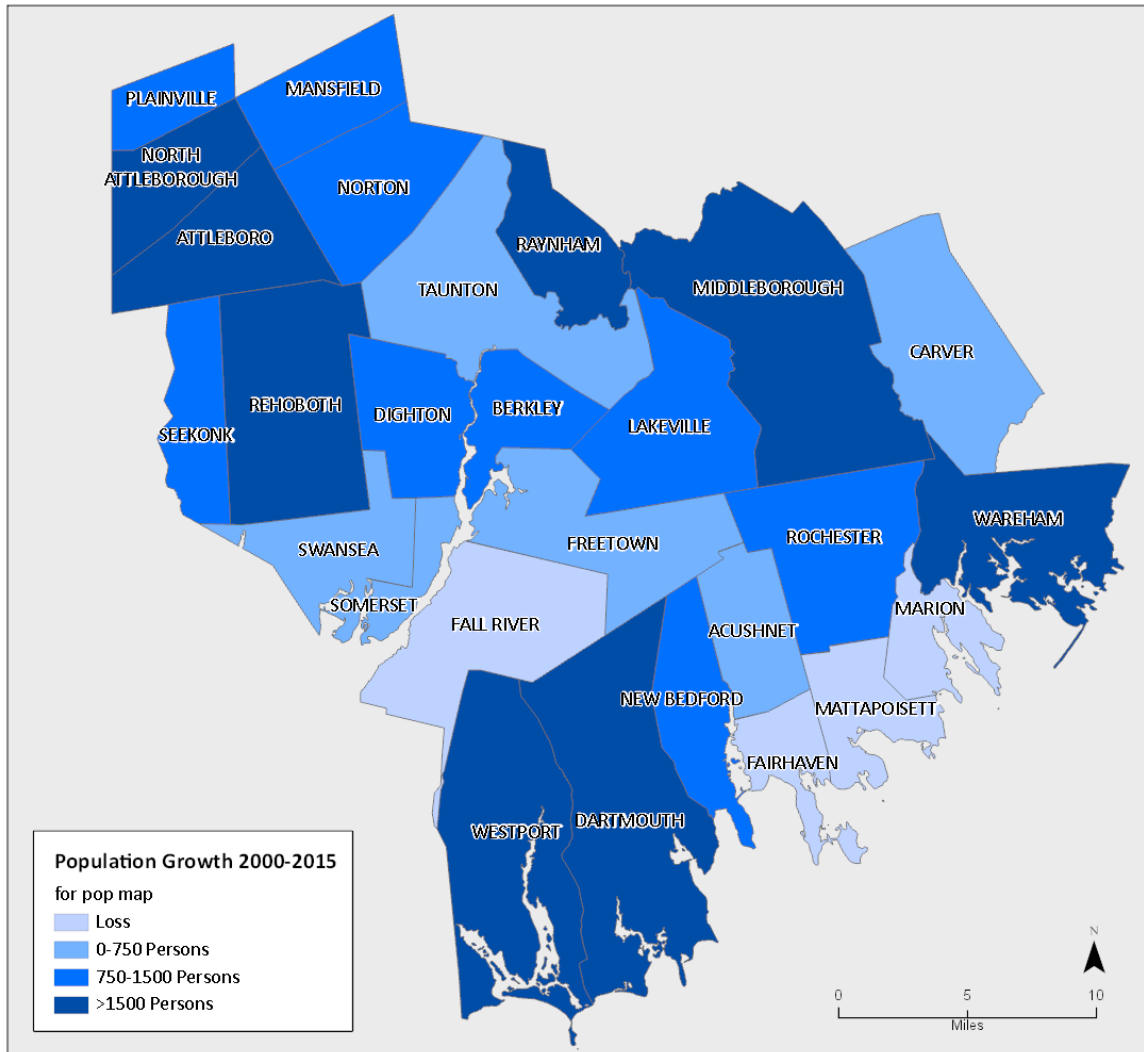
Figure B- 3: Population Growth 2000-2015

Figure B-3 shows the low, moderate, and high growth communities in the region from 2000 to 2015.

Trends in Households - Another trend related to population is household formation that exceeds population increase, resulting in a decrease in average household size. Nationally, household size decreased from 1990 to 2010, as there were more divorced couples, more childless households and an aging population. Within the SMMPO region, average household size also decreased. Figure B-4 illustrates that trend.
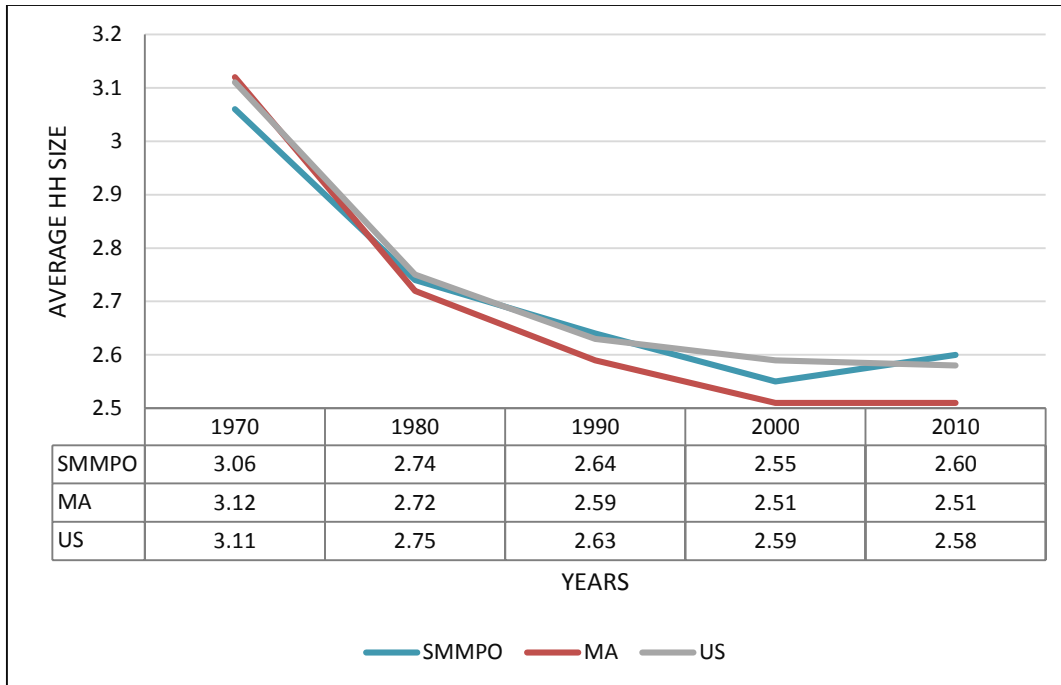
Figure B- 4: Average Household Size, 1970-2010

It is anticipated that the decline in average household size will continue through 2040, as the number of single person and no-children households increase. This will, in large part, reflect the aging of the baby boomer generation. Table B-3 documents these trends as recorded from 1970 – 2010 by the U.S. Census Bureau.

Table B- 3: Household Trends 1970-2010

Percentage of All Households that are Single Person Households					
Area	**1970**	**1980**	**1990**	**2000**	**2010**
Bristol County	18.6%	22.0%	23.8%	26.5%	27.4%
Massachusetts	18.8%	24.4%	25.8%	28.0%	28.7%
United States	17.6%	22.7%	24.6%	25.5%	26.7%
Percentage of All Households that are Households Without Children					
Area	**1970**	**1980**	**1990**	**2000**	**2010**
Bristol County	57.0%	61.2%	65.4%	67.0%	70.4%
Massachusetts	57.4%	64.6%	69.3%	69.4%	71.7%
United States	55.9%	62.5%	66.4%	67.2%	70.7%
Source: U.S. Census Bureau					

Housing Unit Increases - Following the peak building period of the late 1980's, the region has experienced relatively consistent building permit activity into the 21st century with approximately 2,000 building permits per year being issued (see Figure B-5). Since 2005, building permit activity dropped to as low as 619 in 2011 due to the recession, but in 2012, a total of 969 building permits were issued with 953 and 952 in 2013 and 2014 respectively. This trend continues through 2015 indicating that the annual number of these permits has remained consistent yet is significantly less than that of 10 years ago. This occurred in conjunction with the end of the national recession. Regardless of the permits issues, not all of these units were constructed, so the housing unit counts of the U.S. Census Bureau are used as a more reliable indicator of new housing units.
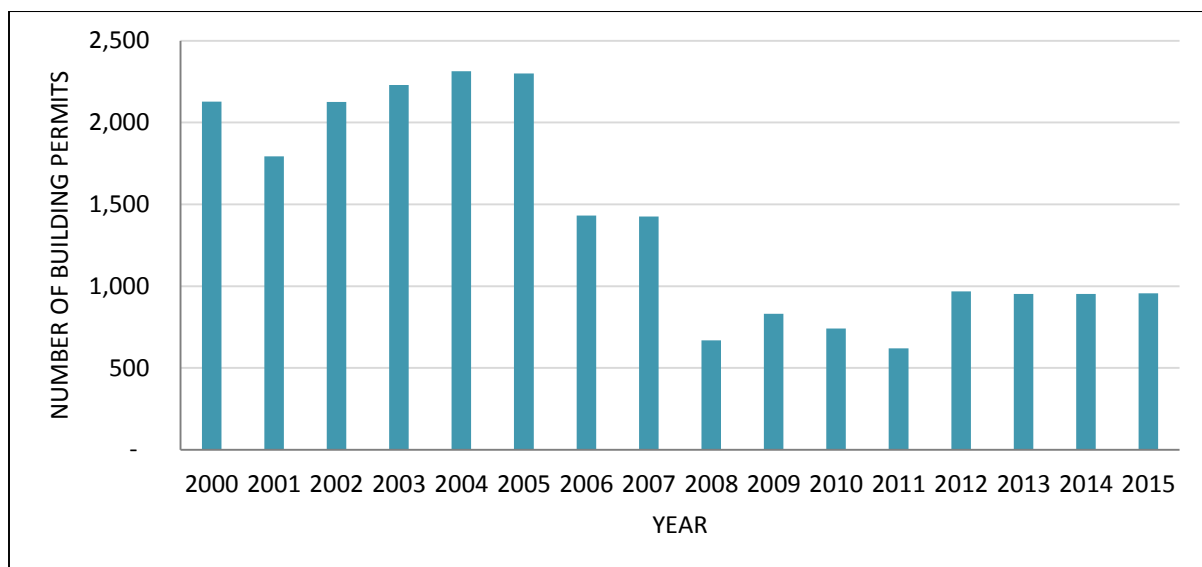
Figure B- 5: Regional Building Permits, 2000-2015

According to the U.S. Census Bureau, the region as a whole experienced an increase in total housing units of 7.4% between 2000 and 2010, and the percentage of the total housing stock that was occupied dropped from 93.4% to 91.2%. This decrease in occupancy reflects a loosening of the housing market; more vacant units on the market due to overbuilding and a record number of foreclosures caused by the recession. Table B-4 summarizes this information.
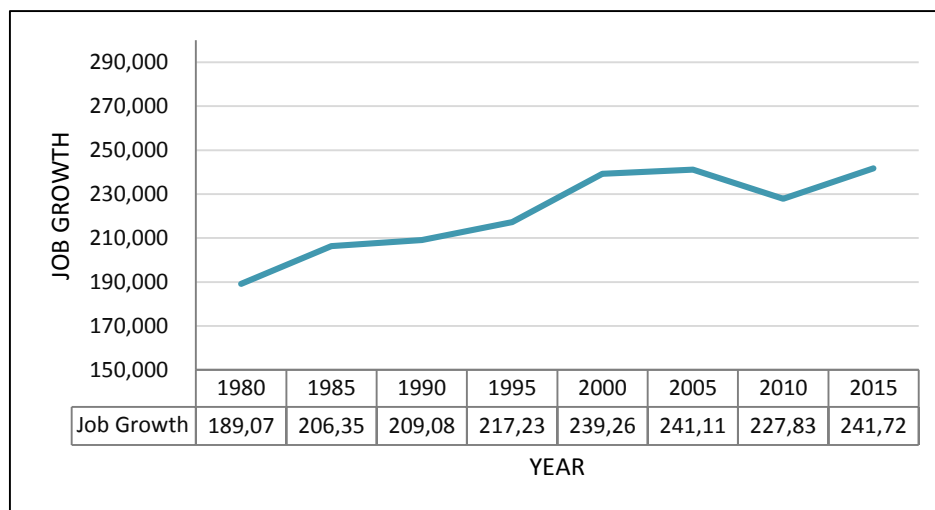
Table B- 4: Regional Housing Units, 1980-2010

Year	Total Housing Units	Occupied Housing Units	Occupied As Percentage of Total
1980	200,655	184,633	92.0
1990	228,304	208,604	91.4
2000	245,351	229,401	93.4
2010	263,510	240,223	91.2
Source: U.S. Census Bureau			

Employment Growth

A review of regional and community-level changes in employment was completed for the period of 1980 to 2015 as a whole and at five and ten-year increments. The results indicated a total regional increase in jobs by 52,658, a 28% increase during the 35-year period. The increase occurred in spurts, with slow and fast growth periods.

As shown in Figure B-6, the SMMPO saw a steady increase in jobs which peaked in 2007 at 242,164. Since 2007, the region has seen a decrease in employment by as much as 14,326 in 2010 due to the national recession. By 2013, the region had gained back those lost jobs with a regional total of 234,286 jobs; a difference of 7,878 when compared to 2007. However, when compared to 2000 which had a total of 239,268 jobs, the region has grown slightly at 1% in employment levels compared to the employment levels at the turn of the century.

	1980	1985	1990	1995	2000	2005	2010	2015
Job Growth	189,07	206,35	209,08	217,23	239,26	241,11	227,83	241,72

Figure B- 6: Regional Job Growth, 1980-2015

Between 2000 and 2010, some communities managed to grow in employment despite the economic recession that plagued the nation. The following communities ranked as the top ten in absolute job increases for the period 2001 to 2015 is shown in Table B-5.

Table B- 5: Top Ten Communities with the Highest Job Increases

Town	Job Growth		Town	Job Growth
1. Dartmouth	2,817		6. Plainville	1,386
2. Raynham	2,443		7. Middleborough	1,234
3. Wareham	2,219		8. Fairhaven	880
4. New Bedford	1,990		9. Westport	619
5. Freetown	1,788		10. Somerset	528

Employment By Sector - In 2000 the system used to report employment sectors, known as the Standard Industrial Classification System (SIC), was replaced by the North American Industry Classification System (NAICS). Under this system the retail sector is modified. The nature of the sales activity dictates retail versus wholesale and restaurants are given a separate category. NAICS also expands the classifications of service industries by creating a health services category, an arts & entertainment category and the real estate industry is separated from finance and insurance. These refinements are a better reflection of the changing nature of the economy and the new classification system is more adaptable. With NAICS, technological changes that influence the economy and the establishment of new industries can be more easily and accurately incorporated. Table B-6 summarizes employment by sector in the SMMPO region between 2001 and 2015.

Table B- 6: SMMPO Region Employment by NAISC, 2001 & 2015

Employment Category	2001	2015
Forestry, Fishing and Hunting	1,675	1,388
Mining	25	26
Utilities	655	968
Construction	10,608	11,488
Manufacturing	44,222	26,988
Wholesale Trade	10,338	10,709
Retail Trade	37,520	36,648
Transportation & Warehousing	5,641	8,113
Information	3,801	3,376
Finance & Insurance	5,253	4,920
Real Estate & Rental/Leasing	2,006	1,937
Professional Services	6,265	6,866
Management	3,103	1,885

Employment Category	2001	2015
Administrative and Waste Services	7,167	11,046
Educational Services	7,056	14,818
Health Care & Social Assistance	33,102	46,233
Arts, Entertainment, & Recreation	2,598	3,669
Accommodation & Food Services	19,392	23,302
Other Services	9,161	8,342
Public Administration	6,115	6,498
Total	**236,627**	**241,729**

From a transportation point of view, not all jobs are the same. Different sectors of the economy have different transportation impacts. The top five employment sectors that make 61% of employment in the SMMPO include Health Care/Social Assistance (19%), Retail Trade (15%), Manufacturing (11%), Accommodation/Food Service (10%) and Educational Services (6%).

Retail activity is a high trip generator because, in addition to the employee trips, the trips associated with the consumers must be considered. The 2001, 2003 and 2007 Regional Transportation Plans documented the region's trend towards a higher percentage of overall employment in the retail and service sector with less employment in the manufacturing sector. This trend has continued through 2015, with trade sector jobs now accounting for nearly 29% of all jobs in the region. Table B-7 illustrates these trends.

Table B- 7: Trade vs. Non-Trade Regional Employment, 2001-2015

Sector	2001	2015	% Change 2001-2015
Trade*	67,250	70,659	5.1%
Non-Trade	169,377	171,070	1.0%
Total	**236,627**	**241,729**	**2.2%**
* Source: MA EOLWD using retail, wholesale, and food/accommodations for trade and all other sectors for non-trade			

As illustrated in Table B-5, employment within the trade sector increased more than non-Trade and overall growth rate. Additionally, trade employment has increased from 28.4% of total employment in 2001 to 29.2% in 2015.

Employment by Location - The region has also continued to follow the trend established in the decade of 1980–1990 of experiencing a declining regional percentage of jobs within the region's four urban centers shown in Table B-8. The loss of jobs in these urban centers and

the creation of jobs in the suburban areas (including suburban sections within Attleboro and Taunton) both contribute to this shift.

A more careful review indicates that Taunton, mostly because of its industrial parks, has increased its number of jobs by 35% since 1980, while New Bedford and Attleboro have lost 26% and 22% of their jobs respectively. Fall River has lost 14% of its jobs since 1980. Attleboro, Fall River and Taunton all gained jobs from 1990 to 2000, however all four cities lost jobs since 2000. From 2000 to 2010, jobs in the urban center have experience a slight increase except for Taunton. Overall the jobs in the urban centers only account for 47% of the total employment in the region.

Table B- 8: Jobs in Four Urban Centers 1980-2015

Community	1980	1990	2000	2010	2015
Attleboro	24,006	21,561	22,599	16,340	17,839
Fall River	40,861	38,056	40,299	34,132	35,314
New Bedford	48,824	41,121	37,146	35,791	38,283
Taunton	17,274	19,882	24,319	23,529	23,260
Urban Centers Total	130,965	120,620	124,363	109,792	114,696
SMMPO Regional Total	**188,497**	**209,085**	**239,316**	**227,838**	**241,729**
Urban Centers as % of Regional Total	**69%**	**58%**	**52%**	**48%**	**47%**
Source: MA EOLWD					

Conclusions

Overall, the SMMPO region continues to grow in population, housing and employment. Population growth continues to grow in the suburban communities while remaining status quo within the four urban centers. This trend is attributed to a population that is growing older and entering retirement (baby boomer population) coupled with a continued shrinking household size. This correlates to a shrinking labor force population to fill in the job vacancies lost to the population entering retirement.

After a recession in the latter half of the first decade of 21st century, employment has grown to reach levels experienced in 2005 prior to the recession. The urban centers continue to comprise less than 50% of total employment for the region. Retail and Health Care Service Employment continue to grow.

Socio-Economic Projections

SRPEDD, as staff to the Southeastern Massachusetts Metropolitan Planning Organization (SMMPO), has continued to update population, employment and housing unit projections for the region. These projections, generally done for a 25-year period, predict growth or decline in the region through the year 2040. Population and employment growth are very important to transportation planning, as they help determine where travel demand might be in the future.

Making Projections at the Regional Level

The Massachusetts Department of Transportation (MassDOT) enlisted the assistance of the Metropolitan Area Planning Commission (MAPC) and the UMASS Donahue Group consulting agency specializing in long range projections in population, housing and employment. Through this cooperative effort, socioeconomic forecasts were projected out to the year 2040 for the Regional Planning Agencies (RPA's) for review and ultimately to accept within their Regional Transportation Plan updates. The projections on total population, households, and employment were provided to each RPA as regional totals with a suggested breakdown and disaggregation of data for each SRPEDD community.

Methodology - MassDOT's projections for the SMMPO region follow the historical record with regard to state and national population trends. That is, these figures are lower than the U.S. Census Bureau projections for the nation and the projections for the State of Massachusetts. The U.S. Census Bureau population projections projects fertility, mortality, internal migration and international migration out to 2060 based on recent trends and then develops figures from these projections.

Population - To project population through the year 2040, MassDOT first looked at the Census Bureau's population forecasts for the state through 2030 and the 2009 census population estimates. A 2040 forecast was then constructed based on the extrapolation of one-half of the overall rate of growth forecast between 2020 and 2030. Regional forecasts were compiled using regional shares of state population from past censuses, with steep trends moderated.

Households - Future household forecasts were also based on previous censuses and changes in group quarters population, population in households and average household size. Population in group quarters as a percentage of total population was held constant to those in 2000. Households were determined by dividing the population in households by an average household size. The average household size for each region was forecasted to

decline each decade but was tempered by a small increase in household size as reported by the *American Community Survey* conducted in 2008 versus the 2000 Census.

Employment - In order to generate employment forecasts, employment data provided by the *Massachusetts Department of Labor and Workforce Development* were analyzed in regional shares.

Trends in statewide employment show a decrease from 2000 to 2010 of 0.9 percent. This is primarily because of the major recession that the state and the nation experienced in the latter half of the first decade of the 21st century. Employment has had resurgence to a certain degree since 2010 with an increase in 2010 to 3,112,000 jobs from the 2009 low of 3,095,144. The trend for this continued increase is expected statewide to 2020 with a nearly 7.6% increase in employment before it levels off in 2030 and experiences a slight increase by 2040. (See Table B-9)

Table B- 9: Employment Trends and Projections

	2000	2010	2020	2030	2040
Employment	3,227,286	3,199,467	3,443,242	3,481,819	3,523,509
Percent Change		-0.9%	7.6%	1.1%	1.2%

A number of factors were identified by MassDOT as having an effect on the state's future employment. One major factor is the lack of labor force growth. This reflects limited growth in the state's working-age population and decline in the state's civilian labor force participation rate. Other factors include continued net domestic out-migration; international immigrants boosting the supply of labor; net non-resident commuting leveling off and uncertainty over elderly labor force participation rates. The Bureau of Labor Statistics predicts an increase in elderly participation rates through 2020 up to 41.9%, followed by a decline through 2030 and 2040 down to 35.3%[1].

MassDOT Forecast Summary - Table B-10 summarizes MassDOT's forecasts for the SMMPO region.

Table B- 10: MassDOT Socioeconomic Forecasts, 2010-2040

	Employment	Households	Population
2010	229,400	240,223	616,670
2020	242,461	261,815	637,719
2030	242,848	277,728	650,104

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[1] U.S. Bureau of Labor Statistics. Table 3. Civilian labor force participation rates by sex, age, race and Hispanic Origin, 1986, 1996, 2006 and projected 2016. available at http://www.bls.gov/emp/emplab05.htm

|	Employment	Households	Population
2040	243,002	284,421	653,966
2010-2020	13,061	21,592	21,049
% Change	5.7%	9.0%	3.4%
2020-2030	387	15,913	12,385
% Change	0.2%	6.1%	1.9%
2030-2040	154	6,693	3,862
% Change	0.1%	2.4%	0.6%
2010-2040	**13,602**	**44,198**	**37,296**
% Change	**5.9%**	**18.4%**	**6.0%**
Source: MassDOT Planning, U.S. Census Bureau			

Overall, from 2010 to 2040, the region is expected to increase its jobs by 13,602 (6%), its households by 44,198 (18%) and its population by 37,296 (6%). The 2010-2020 decade is forecast to see the largest increase in jobs, with 13,061 of the 13,602 (96%) occurring then. This decade is also expected to see the highest amount of population growth, with 21,049 new residents or 56% of the total population growth forecast between 2010 and 2040. Household growth following population growth is expected to have a higher percentage, though household size is forecasted to decrease with each decade. Table B-11 summarizes household size forecasts for the SMMPO region as well as for the state.

Table B- 11: Average Household Size Forecasts, 2000-2040

	2000	2010	2020	2030	2040
SMMPO	2.55	2.51	2.48	2.45	2.43
Massachusetts	2.51	2.57	2.50	2.45	2.43
Source: MassDOT Planning					

Household size in the SMMPO region is forecast to decrease from 2.51 in 2010 to 2.43 by 2040. Overall, household size in the region is forecasted to be below the state over the next ten years and then follow the trend of the state projections by 2040.

Figure B-7 shows historic and projected population growth in the SMMPO region through 2040.
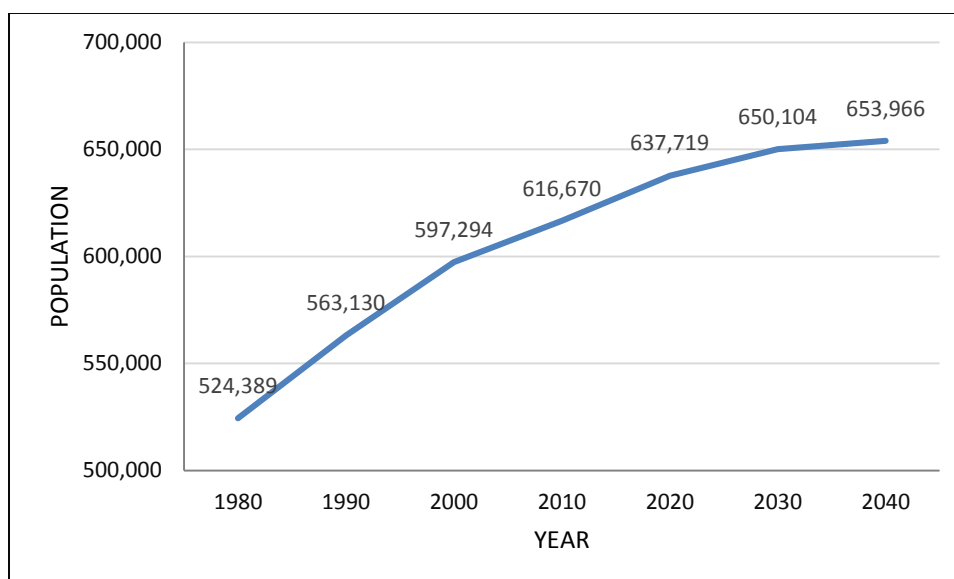
Figure B- 7: SMMPO Region Population Projection

As shown in Table B-12, the SMMPO region has historically grown at a rate greater than the State as a whole, but less than the national rate. This table also shows how the projections for the SMMPO region compare to population projections prepared by the U.S. Census Bureau and the effort developed by MassDOT. Based on this information, the SMMPO region is expected to have a lower rate of growth than the remainder of the Commonwealth and the nation.

Table B- 12: Comparison of Historical Growth & Projections for Regional Population

	Historical Growth			Growth Projections		
	1980-1990	**1990-2000**	**2000-2010**	**2000-2020**	**2000-2030**	**2000-2040**
SMMPO	7.4%	6.1%	3.2%	3.3%	5.7%	7.3%
State of Massachusetts	4.9%	5.5%	3.1%	3.8%	7.8%	10.2%
United States U.S. Census Bureau	9.8%	13.2%	9.7%	5.1%	12.9%	19.4%
Source: U.S. Census Bureau, Population Division, UMass Donahue Institute Population Projections V2015 pre-release February 10, 2015 RPA inputs to MAPC's development database: December 2014 -February 2015 MAPC's land use allocation model results, March 2015 MassDOT Planning staff calculations, March 2015.						

Retail versus non-retail employment at the regional level was determined based on trends since the year 2000 and from efforts completed with land use analysis from the 2016

Regional Transportation Plan. The MassDOT's total employment forecasts for each community were applied to the percentages for retail and non-retail employment.

Table B-13 summarizes retail versus non-retail employment forecasts for the region. A total of nearly 9,527 new jobs are forecast for the region from 2015 to 2040. The regional percentage of retail employment falls from 29.8% in 2010 to 24.5% in 2015, and is expected to maintain 24% retail employment into 2040.

Table B- 13: Retail vs. Non-retail Employment Forecasts, 2010-2040

	Total	Retail	%	Non Retail	%
2015	233,477	57,155	24.5%	176,322	75.5%
2020	242,456	59,212	24.4%	183,244	75.6%
2030	242,848	59,309	24.4%	183,539	75.6%
2040	243,004	59,347	24.4%	183,657	75.6%
2015-2020	8,979	2,057	-	6,922	-
% Change	4%	4%	-	4%	-
2020-2030	392	97	-	295	-
% Change	0%	0%	-	0%	-
2030-2040	156	38	-	118	-
% Change	0%	0%	-	0%	-
2015-2040	**9,527**	**2,192**	**-**	**7,335**	**-**
% Change	**4%**	**4%**	**-**	**4%**	**-**
Source: MassDOT Planning, SRPEDD Analysis					

Figure B-8 shows the regional employment projection for the SMMPO region for this Regional Transportation Plan.
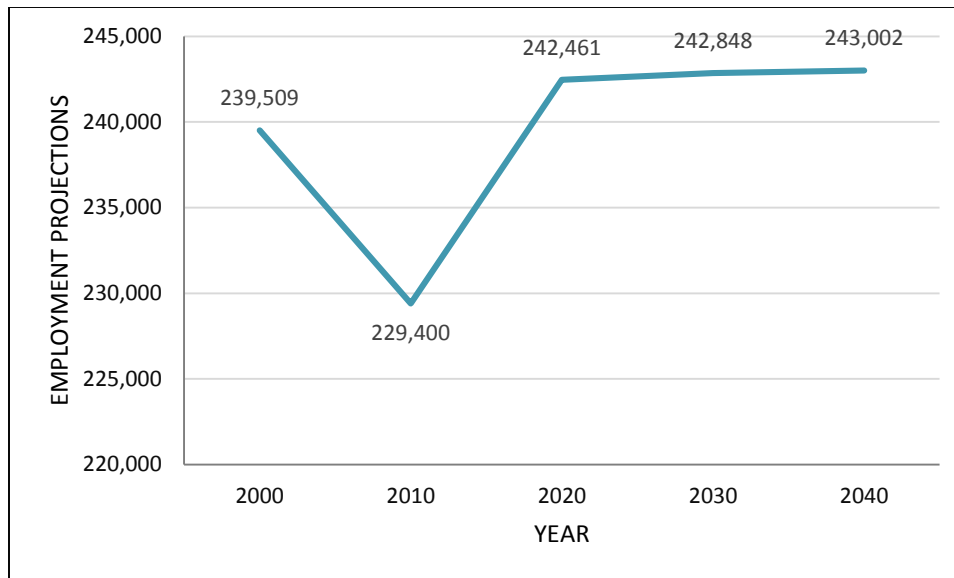
Figure B- 8: SMMPO Employment Projections

Projections by Community

SRPEDD reviewed MassDOT's regional forecasts for employment, population and households and distributed them to Census block groups. Community wide totals of the projections are shown in Table B-14. Census block groups represent the region's designated Traffic Analysis Zones (TAZs) for traffic modeling purposes. For this Regional Transportation Plan, staff relied on the methodology used in the 2012 Regional Transportation Plan for distributing the region's population, housing and employment forecasts with a traditional scenario that projected growth in the same manner as the region has grown over the past 30 years.

Table B- 14: SMMPO Population and Household Projections

	2010		2020		2030		2040	
	Pop.	**HH**	**Pop.**	**HH**	**Pop.**	**HH**	**Pop.**	**HH**
Acushnet	10,303	3,934	10,362	4,170	10,238	4,305	9,871	4,239
Attleboro	43,593	16,884	45,415	18,600	46,440	19,788	46,706	20,331
Berkley	6,411	2,109	7,010	2,456	7,544	2,752	7,881	2,914
Carver	11,509	4,297	12,159	5,009	12,589	5,540	12,155	5,517
Dartmouth	34,032	11,237	36,646	12,682	39,280	14,148	41,828	15,277
Dighton	7,086	2,472	8,010	2,872	9,001	3,281	10,042	3,688
Fairhaven	15,873	6,672	15,784	6,974	15,356	7,039	14,542	6,812
Fall River	88,857	38,457	87,606	39,640	84,917	39,671	81,813	39,032
Freetown	8,870	3,162	9,194	3,394	9,353	3,487	9,313	3,441
Lakeville	10,602	3,725	11,221	4,218	11,882	4,652	12,175	4,833

Mansfield	23,184	8,399	23,199	9,263	23,927	10,097	23,912	10,251
Marion	4,907	1,896	4,614	1,867	4,256	1,736	3,762	1,494
Mattapoisett	6,045	2,505	5,624	2,447	5,118	2,303	4,438	2,024
Middleborough	23,116	8,468	27,456	10,942	32,006	13,419	34,964	14,805
New Bedford	95,072	38,761	99,134	41,544	101,777	43,455	105,284	45,602
North Attleborough	28,712	10,943	29,108	11,823	29,136	12,559	28,958	12,755
Norton	19,031	6,416	19,683	7,334	19,696	8,032	19,244	8,127
Plainville	8,264	3,303	9,145	3,857	9,886	4,350	10,391	4,736
Raynham	13,383	4,875	13,801	5,226	14,570	5,713	15,747	6,250
Rehoboth	11,608	4,101	12,054	4,726	12,136	5,323	12,135	5,622
Rochester	5,232	1,813	5,789	2,097	6,274	2,327	6,604	2,440
Seekonk	13,722	5,071	14,592	6,082	15,044	7,101	15,038	7,540
Somerset	18,165	7,087	17,820	7,209	17,175	7,255	16,555	7,162
Swansea	15,865	6,079	15,276	6,297	14,323	6,320	13,201	6,063
Taunton	55,874	22,332	56,411	23,559	55,767	23,992	54,424	23,793
Wareham	21,822	9,071	24,063	10,524	25,505	11,520	26,227	12,000
Westport	15,532	6,154	16,543	7,006	16,908	7,562	16,756	7,673
Total	**616,670**	**240,223**	**637,719**	**261,815**	**650,104**	**277,728**	**653,966**	**284,421**

Employment

Land use analyses were used to distribute the total regional retail/non-retail growth down to the TAZ level. Based on the analysis and land use trends in the region, the following assumptions were applied in the estimates for employment over the communities within the SRPEDD region. Dartmouth, Fall River, New Bedford and Taunton are expected to have the largest increases in non-retail employment from 2010 to 2035. Fall River and Taunton have or are currently expanding its industrial parks. Dartmouth has large tracts of open land along Faunce Corner Road slated for industrial and office development, to be served by a widened Faunce Corner Road interchange with I-195. New Bedford has several projects planned in its port that will greatly expand its job base. The largest increases in retail employment are expected in Attleboro, Dartmouth and Raynham. Raynham has plans for a large shopping plaza and Dartmouth still has large parcels slated for retail development and/or expansion of existing retail plazas. Attleboro has numerous vacant storefronts due to retail closures during the recession that could easily be redeveloped in the future, along with plans for downtown redevelopment. Table B-15 shows the anticipated growth in employment in the region by community at ten-year intervals.

Table B- 15: SMMPO Employment Projections

	2010	2020	2030	2040
Acushnet	1,108	1,171	1,173	1,174
Attleboro	16,598	17,543	17,571	17,582
Berkley	527	557	558	558
Carver	2,665	2,817	2,821	2,823
Dartmouth	15,228	16,095	16,121	16,131
Dighton	1,746	1,845	1,848	1,850
Fairhaven	6,022	6,365	6,375	6,379
Fall River	34,005	35,941	35,998	36,021
Freetown	3,872	4,092	4,099	4,102
Lakeville	2,990	3,160	3,165	3,167
Mansfield	10,992	11,618	11,636	11,644
Marion	2,219	2,345	2,349	2,351
Mattapoisett	1,694	1,790	1,793	1,794
Middleborough	8,169	8,634	8,648	8,653
New Bedford	36,147	38,205	38,266	38,290
North Attleborough	11,175	11,811	11,830	11,838
Norton	5,971	6,311	6,321	6,325
Plainville	3,574	3,777	3,784	3,786
Raynham	8,605	9,095	9,109	9,115
Rehoboth	1,630	1,723	1,726	1,727
Rochester	787	832	833	834
Seekonk	7,781	8,224	8,237	8,242
Somerset	4,445	4,698	4,706	4,709
Swansea	5,142	5,435	5,443	5,447
Taunton	24,118	25,491	25,532	25,548
Wareham	8,758	9,257	9,271	9,277
Westport	3,432	3,627	3,633	3,635
Total	**229,400**	**242,461**	**242,848**	**243,002**

Conclusion

When considering socioeconomic projections for transportation planning, it is not only important to review the increases in both population and employment, but also the locations of major growth. The projections under the traditional scenario will have a profound effect on the region's transportation infrastructure by the year 2040:

- A 36% increase in regional population from 2010;

- A 6% increase in regional employment from 2010;

- A continued increase in the number of Health Care and Retail jobs;

- A continued shift in the locations of both population and employment growth from the region's urban areas to suburban and rural areas. From 2010 to 2040, population in the region's four urban centers (Attleboro, Fall River, New Bedford and Taunton) is projected to fall from 46% to 44% of the total regional population. From 2010 to 2040, employment in the region's four urban centers is projected to be 48.3% of total regional employment.

The continued increases in both population and employment will lead to more people using the region's transportation system. Additionally, the location of this growth under the traditional scenario, will be primarily outside of the region's four walkable urban centers and in areas without fixed route transit service. This will generally increase total vehicle miles traveled over time. Growth outside of areas accessible by public transit or on foot leaves automobile travel as the only available option for transportation. All of these predictions and factors will undoubtedly put a strain on the region's transportation infrastructure, primarily its roadways as automobile travel increases.

The region's transit service covers extensive geography, suggesting a high potential for a modal switch from automobiles to buses and trains. However, service is very limited on both regional transit authorities, and train service is primarily Boston-centric. Nonetheless, if service could be improved to run more frequently and over an extended time period, the region could realize a large increase in ridership without much change to coverage.

Regional Land Use Assessment: Town by Town, TAZ by TAZ Modeling of Future Growth

This section details technical work that SRPEDD's Comprehensive Planning staff completed in partnership with SRPEDD's Transportation Department. The purpose of this work was to create an in-house, GIS-based tool to model land uses over time. The main software platform was ESRI's ArcGIS and the CommunityViz 360 extension.

The work relied on local parcel and assessors' records, a wide variety of GIS data, MassDOT population & employment control totals, and extensive local knowledge to estimate where new dwelling units, retail jobs, and non-retail jobs (service, office, and industrial jobs) will take place at target years 2020, 2030, and 2040. The project took place over the course of three years, from 2016 to 2018. In early 2019, SRPEDD created a "Climate & Sustainability" growth scenario to supplement the baseline, "Business as Usual" growth modeling.

As with all models, SRPEDD acknowledges that these projections are not perfect.[2] They simply provide another useful perspective on how and where our communities may grow in the future. The remainder of this document provides a summary of and technical "recipe" for these modeling efforts.

Summary of Modeling Approach

The project's goal was to allocate a community's projected growth (provided by MassDOT and reviewed by SRPEDD staff) on a parcel-by-parcel basis by assessing which lots have remaining capacity under zoning (a Build-Out analysis) and where growth is most likely to occur (a Suitability Analysis). The work flow proceeded in the following order:

1. Prepare GIS inputs:
    a. Estimate **existing development** per parcel based on assessor's records, local knowledge, and visual inspection.
    b. Identify and code key **zoning** district information, including but not limited to the maximum allowed density of dwelling units and commercial floor area per parcel.
    c. Input **town-wide base year numbers and projected target year numbers** for households, retail jobs, and non-retail jobs.
2. Use the **Build-Out** tool to calculate each parcel's remaining capacity for new development under current zoning. The tool does this by essentially "subtracting"

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[2] "All models are wrong, but some are useful." – George E. P. Box

existing development on the parcel from the total allowed development under existing zoning. It's important to note that the model does not permit growth placement on permanently protected open space or on wetlands. The tool then creates point data for each potential building and places them on parcels. These points include attributes, such as that building's capacity in square feet (for commercial space) and in dwelling units. Using various coded formulas in the CommunityViz software, planners adjust the build-out to further refine it. For example, the Build-Out tool does not have a consideration of whether a parcel has necessary frontage or enough frontage to build an access road. The resulting **Adjusted Build-Out** serves as the basis for available development in town – in other words, the community's "supply" of remaining building potential.[3]

3. Score each potential building according to its likelihood of receiving growth, using the **Suitability** tool and an extensive list of factors (see "Suitability Factor Inputs Table" table, below) that represent key "perspectives on development," such as a building's relationship to flood plains, civic amenities, and market characteristics. Planners can adjust these factors and their weights to examine growth suitability from different perspectives. For example, the "Business as Usual" Scenario weights all suitability inputs evenly. On the other hand, the "Climate & Sustainability" Scenario changes the relative importance of various factors (such as flood zones and availability of sewer) to model different development pressures under potential future conditions. This scoring serves as a proxy for "demand" for growth.

4. **Allocate dwelling units** to buildings based on its Suitability score and a randomness factor using the Allocator 5 tool.

5. Use the Allocator 5 tool to **allocate jobs** to commercial buildings based on Suitability score and randomness. To prepare for this step, we convert the square footage capacity of each building to job capacity based on regional square footage averages for four the job types (retail, service, office, and industrial). This produces a projection of industrial, office, retail, and service jobs and single family, multi-family, and mixed-use Dwelling Unit (DU) per potential building for a given year.

6. **Aggregate** this information from the parcel level to the Transportation Analysis Zone (TAZ) level for use in SRPEDD's Regional Travel Demand Forecasting Model.

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[3] SRPEDD's Regional Land Use Assessment includes a diagram of how the various model components interact. The Technical Workflow Document, which describes all steps of the Business As Usual modeling, is included in the same document.

Table B- 16: Suitability Factor Inputs

Factor	Base Model Score	Climate Model Score	Significance Statement
WATER RESOURCES GROUP	**5**	**9**	**Very significant group consideration**
Surface Water Protection	5	5	No more significant than any other in-group factor
Cold Water Fisheries	5	5	No more significant than any other in-group factor
Aquifers	5	5	No more significant than any other in-group factor
Wellhead Protection Zones	5	5	No more significant than any other in-group factor
PRIORITY AREA GROUP	**5**	**9**	**Very significant group consideration**
Community PDAs	5	5	No more significant than any other in-group factor
Community PPAs	5	5	No more significant than any other in-group factor
GEOLOGICAL GROUPS	**5**	**9**	**Very significant group consideration**
Challenging Slopes "C" class	5	5	No more significant than any other in-group factor
Hydric Soils	5	5	No more significant than any other in-group factor
Poorly/Very Poorly Drained	5	5	No more significant than any other in-group factor
Bedrock	5	5	No more significant than any other in-group factor
CIVIC AMENITIES GROUP	**5**	**6.5**	**Moderately significant group consideration**
Near Sewer	5	9	Much more significant than other in-group factors
Walkability Score	5	7.5	Somewhat more significant than other in-group factors
Near Schools	5	5	No more significant than any other in-group factor
Near Colleges	5	5	No more significant than any other in-group factor
Near Fire Station	5	5	No more significant than any other in-group factor
Near Hospitals	5	5	No more significant than any other in-group factor
OPEN SPACE GROUP	**5**	**6.5**	**Moderately significant group consideration**
Priority Habitat	5	9	Much more significant than other in-group factors
Core Habitat	5	8	Somewhat more significant than other in-group factors
Critical Habitat	5	7	More significant than other in-group factors
Prime Farmland	5	8	Somewhat more significant than other in-group factors
Open Space	5	5	No more significant than any other in-group factor
NON-INDUSTRIAL MARKET GROUP	**5**	**6.5**	**Moderately significant group consideration**
Extent Developed	5	3	Less significant than other in-group factors
Recently Developed	5	5	No more significant than any other in-group factor
How Highly Improved	5	3	Less significant than other in-group factors
Near Recent	5	9	Much more significant than other in-group factors
INDUSTRIAL MARKET GROUP	**5**	**6.5**	**Moderately significant group consideration**
Near Interchange	5	5	No more significant than any other in-group factor

Factor	Base Model Score	Climate Model Score	Significance Statement
Near Sewer	5	9	Much more significant than other in-group factors
Extent Developed	5	3	Less significant than other in-group factors
Recently Developed	5	5	No more significant than any other in-group factor
How Highly Improved	5	3	Less significant than other in-group factors
NEAR COMMUTER RAIL FACTOR	**5**	**8**	**Somewhat more significant than other factors**
FLOODPLAIN FACTOR	**5**	**9**	**Much more significant than other factors**
AVOID EXEMPT FACTOR	**5**	**5**	**No more significant than other factors**
ZONING OVERLAYS FACTOR	**5**	**8**	**Somewhat more significant than other factors**
RANDOMNESS IN DEVELOPMENT	**3**	**0**	**Concern for climate factors will restrict development into the most suitable locations**

Note the model does not permit growth placement in permanently protected open space or wetlands. These features are complete constraints as opposed to Suitability Factors.

In order to demonstrate the model steps outlined above and the resulting growth projections under the "Business as Usual" and "Climate and Sustainability" scenarios, SRPEDD described the modeling for the one representative community, the town of Carver below.

"Business as Usual" Growth Examples

In Carver, the Build-Out process (**steps 1 and 2, above**) calculated the complete universe of possible buildings that could be constructed in town with remaining capacity to hold a dwelling unit or a commercial or industrial use; this is based on the existing layout of parcels town-wide, zoning regulations governing use and development intensity, and the presence or absence of existing development. See **Map 1**, which shows the locations of potential new development by type (residential or non-residential).

From there, the "Business as Usual" Suitability Factors were set to the neutral levels shown in the Suitability Factor Inputs Table (**step 3 above**). **Map 2** is based on the same universe of potential new buildings that is shown in Map 1, but uses the Non-Industrial Suitability score calculated in the Suitability Analysis for each potential building to extrapolate a smooth surface of Non-Industrial Suitability values across the entire town's land area. Recall that the Suitability Score is an assigned value created from all of the factors listed in the Suitability Factor Inputs Table. The score indicates how desirable and probable it is for a location to host new development in the future. It is a relative measure between locations that allows them to be compared throughout town.

Finally, the universe of possible building points is considered in light of the maximum amount of growth predicted for the town through the 2040 planning horizon. For example, Carver is predicted to gain 947 dwelling units, 12 retail jobs, and 55 non-retail jobs. This amount of growth can be accommodated in far fewer new buildings than the universe of possibilities calculated in the Adjusted Build-Out. Consequently, the predicted growth is allocated **(steps 4 and 5 above)** to those potential buildings with the highest suitability scores, allowing for a certain level of randomness. **Map 3** shows where growth was allocated in this final step. The last step of this final phase is to summarize all growth by Transportation Analysis Zone (TAZ), reporting dwelling units (DU), retail jobs (RET), and non-retail jobs (NRET). In turn, this data provides necessary inputs of the Regional Travel Demand Forecasting Model.

In general, the new modeling techniques projected similar growth in TAZs when compared to prior modeling efforts. Where there were significant changes (defined as +/-25%), staff explored the modeling in affected TAZs. The intent of this effort was to "truth check" the shifts by identifying key factors, such as a zoning change or new infrastructure, that successfully explained growth shifts between TAZs in each community. The result of this truth checking was high confidence in the new modeling approach and use of all output data.

Example of "Climate and Sustainability" Growth

The Climate and Sustainability Growth Scenario works from the same universe of potential buildings placed in Carver by the build-out process. In other words, the Build-Out and Adjusted Build-Out do not change between Scenarios.[4] As a result, **Map 1** does not change between scenarios. The difference between scenarios is created by weighing the Suitability Factors to best represent the suitability of land under different sets of assumptions. In this case, whereas the Business as Usual scenario demonstrates the likely location for growth to occur based on the existing physical and regulatory environment, the Climate and Sustainability Scenario demonstrates the most suitable location for growth to occur if factors related to sustainability and resiliency are weighted heavily in siting new development.

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[4] Future modeling efforts could run different Build-Outs (based, for example, on assumptions about smart growth zoning changes or prohibited growth in flood prone areas) for different Scenarios. In the future, SRPEDD could also change Control Total assumptions for each community, holding the regional Totals constant, to model anticipated growth shifts.

SRPEDD considered two main categories of factors related to resiliency and sustainability considerations as follows:

1. **Factors Preserving Natural Features that Mitigate Climate Change Effects:**

   - Locate development outside of floodplains.

   - Promote the sequestration of floodwaters and water quality by limiting development in aquifer recharge areas.

   - Preserve prime habitat, prime farmland, and other open space areas that can sequester carbon.

2. **Factors Encouraging Development Patterns with Less Climate Change Impacts**

   - Encourage new development to locate near existing development.

   - Direct new growth to Priority Development Areas (PDAs).

   - Encourage new growth near existing water and transportation infrastructure.

The shifts in Suitability Factor weights shown in Table B-15 above reflect our operationalization[5] of these concepts within the model, and resulted in a recalculation of each building's suitability score. **Map 4** shows the interpolated town-wide non-industrial suitability scoring outcome under the Climate and Sustainability growth scenario. A comparison of **Map 2** and **Map 4** shows definite areas that fell in relative suitability between the Business As Usual and Climate Scenarios. These changes are particularly observable in the southern portion of town, in TAZ 379, where the 20th to 40th percentile (relatively unsuitable) expanded across a larger area, and in TAZ 380, where areas that had scored in the 80th to 100th percentile fell down into the 60th to 80th percentile. In comparison, the norther portion of town in TAZs 383, 358, and 360, areas that were very unsuitable transitioned to the moderate 40th to 60th percentile, or shifted up from moderate categories to highly suitable categories.

Map 5 explores this difference, demonstrating the growth allocation differences between the Business as Usual and Climate scenarios. This map removes the buildings where growth was identically placed in both Scenarios, enabling the viewer to focus on the net differences between Scenarios. The colocation of layered Suitability Factors varies across the region, with differing results between towns. In Carver's case, there were a number of environmental "push" factors that removed development from environmentally sensitive locations, particularly where these features overlap. But the suitability weighting seems

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[5] "Operationalization is the process of strictly defining variables into measurable factors. The process defines fuzzy concepts and allows them to be measured, empirically and quantitatively." - https://explorable.com/operationalization

particularly affected by the "pull" factor of proximity to sewer. Weighing this factor more highly in the context of a town where environmental push factors were relatively evenly disbursed pulled allocated growth from the southern portion of the town, where no sewer is present, toward the northern portion, where the infrastructure is present. Change across TAZ areas for Carver are shown the table below:
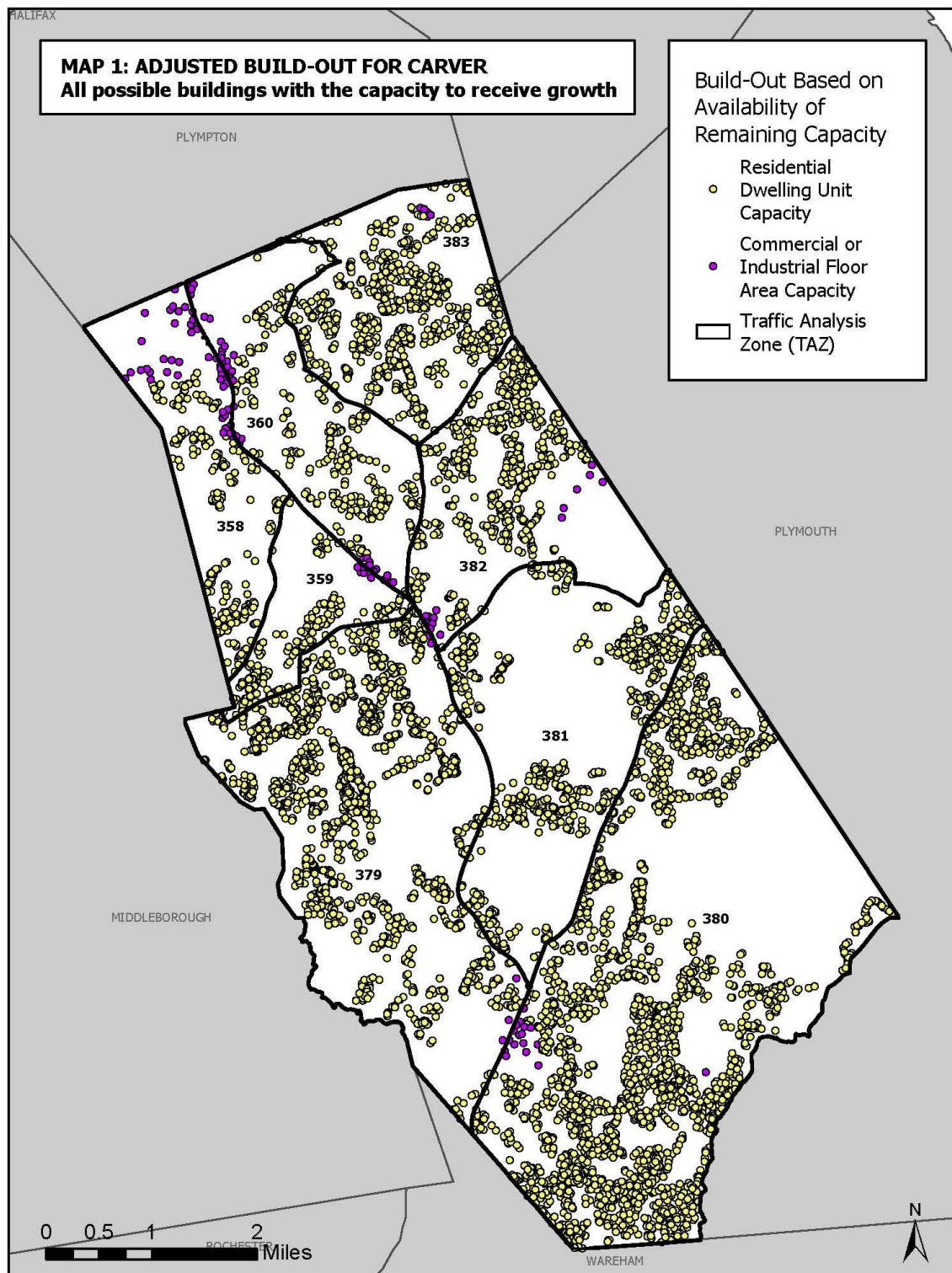
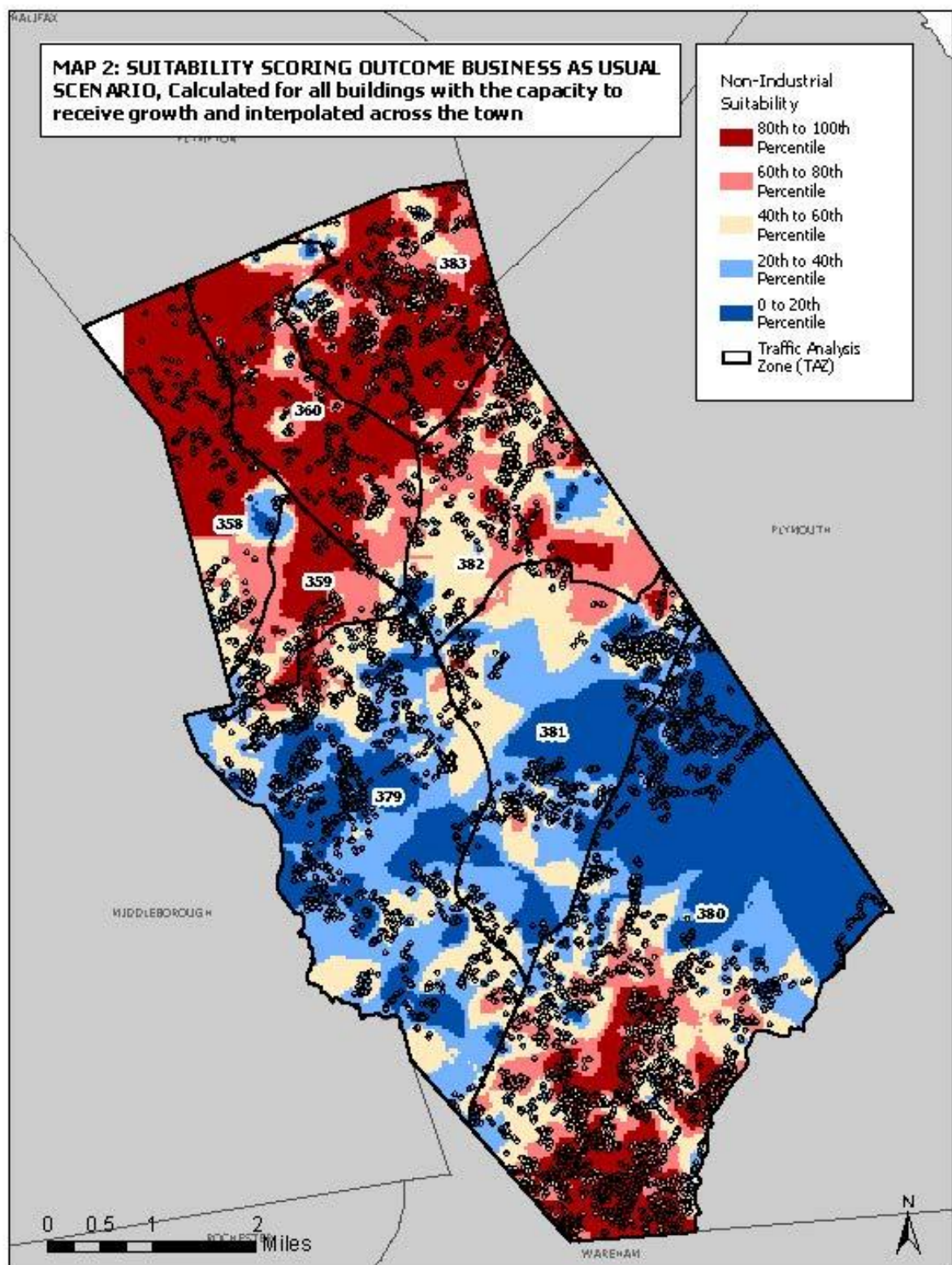**Table B- 17: "Business as Usual" & " Climate and Sustainability" Scenarios Comparison**

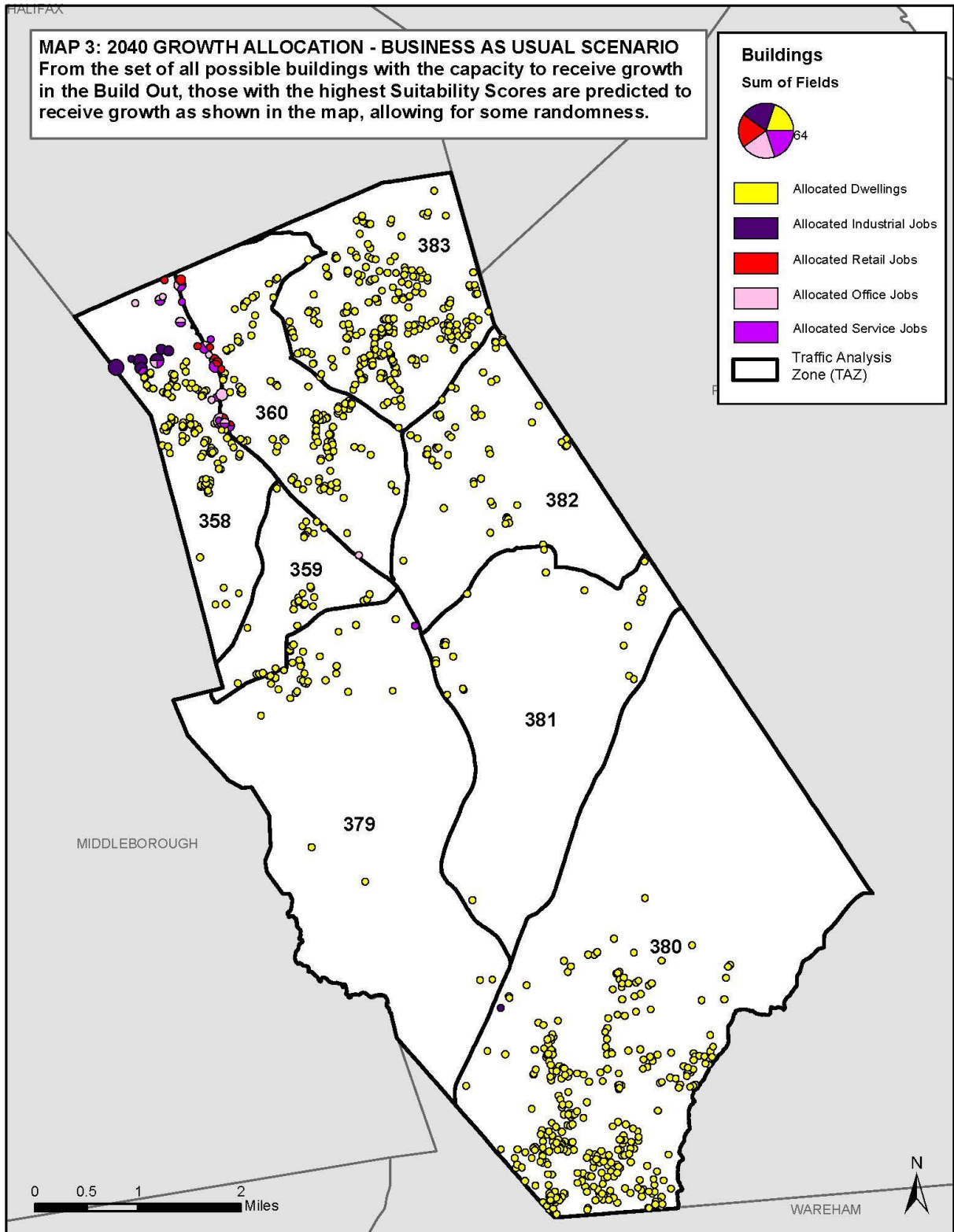| Change between the Business as Usual to Climate and Sustainability Scenarios in Carver by TAZ			
TAZ ID Number	Dwelling Unit Change	Retail Job Change	Non-Retail Job Change
358	5	0	-1
359	28	1	0
360	38	-1	-1
379	8	0	2
380	-248	0	2
381	-17	0	-2
382	-2	0	0
383	188	0	0

Because Suitability Scoring is a relative measure, results can change dramatically between towns. In Dighton, for example, the Map 5 equivalent showed a more nuanced displacement effect, with a stronger influence of "push" factors and more ambivalent shifts within the sewer service area, which itself overlapped with many environmental push features. In some towns, such as Mansfield, very minor changes were observed between Scenarios, given a clearer underlying break (less overlap) between areas with suitable and unsuitable characteristics in the context of the Climate Scenario weighting framework and more capacity for growth in highly suitable locations.

In cases where growth was anticipated for all three indicators (dwelling units, retail jobs, and non-retail jobs), dwelling units typically showed the greatest variation, which is most likely explained by the fact that most commercial operations are already confined to smaller and discrete business zoning districts. These cases contrast with towns where overall population declines are expected.

Map 6 is the counterpart to **Map 3**, demonstrating the overall allocation of growth in the Climate Scenario.

MAP 1: ADJUSTED BUILD-OUT FOR CARVER
All possible buildings with the capacity to receive growth

Build-Out Based on Availability of Remaining Capacity

- Residential Dwelling Unit Capacity
- Commercial or Industrial Floor Area Capacity
- Traffic Analysis Zone (TAZ)

MAP 2: SUITABILITY SCORING OUTCOME BUSINESS AS USUAL SCENARIO, Calculated for all buildings with the capacity to receive growth and interpolated across the town

Non-Industrial Suitability

80th to 100th Percentile
60th to 80th Percentile
40th to 60th Percentile
20th to 40th Percentile
0 to 20th Percentile
Traffic Analysis Zone (TAZ)

MAP 3: 2040 GROWTH ALLOCATION - BUSINESS AS USUAL SCENARIO
From the set of all possible buildings with the capacity to receive growth in the Build Out, those with the highest Suitability Scores are predicted to receive growth as shown in the map, allowing for some randomness.

Buildings
Sum of Fields

64

Allocated Dwellings
Allocated Industrial Jobs
Allocated Retail Jobs
Allocated Office Jobs
Allocated Service Jobs

Traffic Analysis Zone (TAZ)

MAP 4: SUITABILITY SCORING OUTCOME CLIMATE SCENARIO
Calculated for all buildings with the capacity to receive growth
and interpolated across the town

MAP 5: VARIANCE BETWEEN GROWTH SCENARIOS
Showing the suitability "push" and "pull" climate-related factors that change the location of growth allocation

Legend:
- Buildings placed in Business as Usual Scenario ONLY
- Buildings placed in Climate Scenario ONLY
- Development Push Factors (layered locations of flood hazard, geological, open space, and water features)
- Development Pull Factors (limited to proximity to sewer in the Carver case)
- Traffic Analysis Zone (TAZ)

MAP 6: 2040 GROWTH ALLOCATION - CLIMATE SCENARIO
From the set of all possible buildings with the capacity to receive growth in the Build Out, those with the highest Suitability Scores are predicted to receive growth as shown in the map.

Buildings

Sum of Fields

64

Allocated Dwellings

Allocated Industrial Jobs

Allocated Retail Jobs

Allocated Office Jobs

Allocated Service Jobs

Traffic Analysis Zone (TAZ)

HALIFAX

383

360

358

359

382

381

379

MIDDLEBOROUGH

380

0   0.5   1 ROCHESTER 2
Miles

WAREHAM

Travel Patterns

To adequately evaluate the region's transportation system, it is necessary to examine people's daily travel patterns from home to various destinations including work, school or shopping. An examination of the travel patterns determines the reasons for travel, the time used for daily travel, and the various modes of transportation used for travel. It also examines the behavior of motorists with the operation of vehicles on the region's roads. Conclusions from this information provide insight on how our transportation system is used and where improvements are necessary.

Work Travel

In the past, transportation travel patterns were based on the results of the Central Transportation Planning Package (CTPP); the typical commuting patterns derived from the U.S. Census data. This data is released upon completion of the US Census which is conducted at the beginning of each decade. Changes with the 2010 Census forced a change in the analysis associated with the development of the CTPP. Journey to Work information is now collected and analyzed through the American Community Survey (ACS).

The ACS is conducted by the U.S. Census Bureau annually for every county throughout the United States and provides demographic, socio-economic, and housing information. Results of this annual survey assist with making informed decisions for the future. The intent of the ACS provides communities with a sample of information that was previously only available upon completion of the U.S. Census every 10 years. For the 2010 Census, the ACS provides journey-to-work information needed for transportation planning.

According to the 2000 U.S. Census Journey-To-Work data, there were 334,558 one-way (home to work) work trips to, from, and within the SRPEDD communities. In 2010, this total increased to 345,311 but in 2015 the number decreased to 343,057. The following conclusions were compiled from these totals displayed in Table B-18.

Table B- 18: Journey-to-Work

Destination	1990	%	2000	%	2010	%	2015	%
Works & Lives in SMMPO	182,787	60.44%	182,679	54.6%	185,749	53.8%	182,784	53.3%
Works in, but lives outside of SMMPO	40,646	13.44%	52,020	15.6%	51,744	15.0%	55,819	16.3%

Destination	1990	%	2000	%	2010	%	2015	%
Lives in, but works outside of SMMPO	78,980	26.12%	99,859	29.9%	107,818	31.2%	104,454	30.4%
Total	**302,413**		**334,558**		**345,311**		**343,057**	

Trips within the SMMPO region increased between 2000 and 2010 but have since gone back to what they were in 2000. Trips into the region from outside of SMMPO have increased almost 8% since 2000. Between 1990 and 2000, the trend of residents working outside the SMMPO region grew by 26%, but that trend slowed to nearly 8% between 2000 and 2010. Between 2010 and 2015 the trend of working outside of the region but living within the region has decreased to -3.1%. Overall, the trend throughout the 21st century is a little more than 53% of the commuting population lives and works within the SMMPO, over 30% live within, but work outside the SMMPO and 16% live outside and work within the SMMPO. Essentially, the SMMPO exports more people for work than it imports.

This is an indication that the SMMPO region continues to remain a "bedroom community" region; where residents work outside our region and the communities themselves have minor growth in commercial or industrial activity.

This also indicates a willingness on the part of commuters to travel greater distances in order to live in a more affordable area. Furthermore, limited job opportunities within the SMMPO region require commutes to jobs outside the region. People living within the region are within close proximity to limited access highways and access to public transportation making it easy to live in but work outside of the region.

During the last 20 years, there has been no significant change in employment patterns within the state that indicate changes in these commuting patterns.

Travel Time

During the seventies and eighties, population growth was marked by large increases in small towns and slight decreases or modest growth in the cities. Between 1990 and 2000, Attleboro and Taunton have grown in population, while Fall River and New Bedford have experienced a decline. Since 2000, there has been growth in all of the cities within SRPEDD with the exception of Fall River. In addition, there has been a decline in population within 5 of the 23 remaining suburban communities, mainly along the shoreline. This trend is expected to continue with an overall 7% increase in the population for the SRPEDD region by 2040. The greatest growth will occur in communities in the northern portion of the region including the cities of Attleboro and Taunton.

Unemployment, (over 6%), in southeastern Massachusetts continues to exceed the state (4.8%) and national (5.3%) averages. Although employment is expected to grow over the next 25 years, a projected increase of only 6% is expected in the job market for southeastern Massachusetts.

Improved accessibility to jobs in greater Boston area created by the extension of I-495 resulted in an increase in commuting time during the late 1980s and throughout the 1990s. By the year 2000 and shown in Table B-19, the average SMMPO commute time increased by 5 minutes, higher than the national and state averages, but consistent with travel trends. By 2010, the travel time for the SMMPO area increased by one minute while the Massachusetts and National times have remained nearly the same. By 2015, travel time in the SMMPO increased again by 1 minute as well as throughout Massachusetts.

Table B- 19: Travel Time to Work

Journey to Work	Mean Travel Time (In Minutes)			
	1990	2000	2010	2015*
SMMPO	22.6	27.6	28.0	29.1
Massachusetts	22.7	27.0	27.3	28.7
United States	22.4	25.5	25.4	25.9
*2015 Statistics are based on the American Community Survey				

The trend of population willing to live in southeastern Massachusetts and commute to work in the greater Boston or Providence, Rhode Island area is expected to continue. This trend is validated by the rise in average travel times to work. The SMMPO population is willing to travel longer on their daily commute to live in more affordable communities.

Method of Travel

The most popular mode of transportation throughout the nation, state and region continues to be the automobile. Furthermore, a majority of commuters still travel alone to places of employment as shown in Table B-20. The U.S. Census reports that the percent of commuters carpooling in southeastern Massachusetts continues to decline. Although commuters that drive alone experienced a slight decline, it remains the most popular method of travel in southeastern Massachusetts.

Table B- 20: Population Percentages of Mode of Travel to Work

Method of Travel to Work	1990*	2000*	2010**	2015**
Drive Alone	80.8%	82.5%	80.3%	84.8%
Carpool	12.9%	10.6%	9.4%	7.2%
Public Transit	2.3%	2.5%	2.3%	1.9%
Taxi/Bicycled/Walk/Work at Home	4.0%	4.4%	2.9%	6.0%
*Source: CTPP Journey to Work Data, 1990 and 2000 US Census				
** Source: American Community Survey				

In addition to the US Census materials, the Massachusetts Department of Transportation invested in a statewide survey to assess transportation trends through a household travel survey. Completed in 2012, the survey provided information throughout the commonwealth through phone surveys and travel logs of 15,000 participants. The survey was coordinated to provide a statistical assessment of each MPO region to gather true and accurate statistics on travel patterns. The information and analysis gathered from the survey also helps to verify the results from the US Census on travel patterns in Massachusetts and the SRPEDD region as shown in Table B-21.

Table B- 21: Results of the HH Travel Survey, SMMPO Region vs. Massachusetts (Methods of Travel to Work)

Work Related Transportation			All Transportation		
Transportation Mode	SMMPO	Mass.	Transportation Mode	SMMPO	Mass.
Drive Alone	80.9%	72.0%	Drive Alone	58.4%	54.7%
Carpool	5.7%	2.8%	Carpool	20.0%	18.7%
Public Transit	4.0%	10.3%	Public Transit	7.8%	8.8%
Taxi/Bicycles/Walk	1.8%	5.5%	Taxi/Bicycles/Walk	13.6%	17.6%
Work at Home	5.7%	7.4%	Other	0.2%	0.2%
Other	1.9%	2.0%			
Source: Massachusetts Travel Survey - June 2012					

Examining work related transportation shows that the SRPEDD region heavily depends on the automobile for travel to work. This statistic supports the conclusion from the US Census Journey to Work data presented in Table B-20. Although the other modes presented vary from the US Census, the fact is that southeastern Massachusetts lack of transit connections to major employers and the Boston Metro region force residents to continue to rely on the

automobile as a principal means to work. This is conclusion is also made evident by the fact that the percent of carpooling exceeds the use of public transportation.

Examining transportation for all forms of travel shown in Table B-21 that include trips to work, shopping, medical facilities, recreation, etc., the breakdown by transportation mode for the SRPEDD region is equivalent to the rest of Massachusetts. It also indicates that the single occupancy vehicle, the automobile, remains a dominant choice in personal transportation.

Although public transit as a means to work experienced an increase in the mid-2000s, it has fallen to levels of use experienced in the 20th century. The increase rose to as much as 6% by 2008 and followed a state trend and was attributed to higher gasoline prices and an expansion in transit service in the region during the 1990's, including commuter rail services to the greater Attleboro/Providence, RI areas and service to Lakeville and Middleborough. In the Commonwealth, transit's share of work trips increased from 8.3% in 1990 to 8.7% in 2000 and to 9.1% by 2010. Nationally, transit's share fell from 5.3% in 1990 to 4.7% by 2000 and rose back to 4.9% by 2010. As of late and shown in table B-20, transit use and carpooling continue to decline.

The difficulty with serving work trips with public transportation is that employment centers (traditionally urban centers) are no longer the primary destination for work. With the exception of Boston, a majority of work trips are primarily many-origins-to-many destinations. Easily accessible high-speed freeways, low fuel costs, combined with suburban industrial and office parks continues to promote growth away from traditional employment centers. This type of travel behavior is the hardest to serve by fixed-route transit. Even employer-based para transit solutions, such as MassRides, are difficult to implement in the SMMPO region because of the small number of companies with 1,000 or more employees. Although the majority of these larger employers are located in or near major city employment centers, their employees are, more often than not, choosing to live in smaller towns throughout the region and beyond.

In the 1970's, global uncertainty about the availability of petroleum products led to dramatic increases in the price of gasoline. Gasoline escalated from 28 cents per gallon in 1970 to $1.22 per gallon in 1980. Consequently, ridesharing in 1980 was at an all-time high. By 1990, the actual price of gasoline prices, in terms of 1980 dollars, had dropped significantly, resulting in a dramatic reduction in ridesharing. By the end of the millennium, gas prices nationally averaged $1.17 per gallon, five cents below the adjusted average nearly 20 years earlier.

Since the 1980s, the price of gasoline stabilized while automobile manufacturers produced more fuel-efficient vehicles. Furthermore, relatively low fuel costs throughout the 1990's led commuters back to a practice of driving to work alone as previously shown in Table B-17 (Method of Travel to Work). This trend of commuters traveling alone to work has also increased the number of vehicles on the road, increasing congestion.

Beginning in 2005, gasoline prices rose to an all-time high of nearly $3.00 per gallon[6]. Several factors contributed to this dramatic increase including natural (Hurricane Katrina) and manmade (Gulf Oil Spill) disasters. Another contributor to high gas prices continues to be civil unrest in the Middle East which has made our supply of petroleum extremely volatile. Fuel prices continued to fluctuate in recent years, but remain above $3.00 per gallon until 2015 where prices fell below $3.00 per gallon. Dramatic increases in the price of gasoline has forced commuters traveling to Boston to carpool and use public transit, but according to the Massachusetts Household Travel Survey, there were no significant changes in the mode of transportation to work for the SRPEDD region. This trend is expected to continue with decreases in fuel costs. Although use of mass transit helps with the issues of traffic congestion and poor air quality, the motivation for most commuters to use an alternative means of transportation has mainly to do with availability and convenience relative to their residence and destination of employment.

Finally, although found to be a growing trend throughout the nation and Massachusetts, people who use taxis, bicycles, or walked to work has not changed significantly. What has changed is the number of employees working at home. This has become a rising trend due to advances in internet access as well as changes in employer policies.

Park-and-Ride Lots

There are eight formal park-and-ride lots currently serving commuter needs in southeastern Massachusetts. These facilities are specifically designated for use as commuter parking. They include five lots owned and maintained by the Massachusetts Department of Transportation (Freetown, Mattapoisett, New Bedford, Somerset, and Wareham); one owned by the community where it is located (Somerset); and two that are privately owned (Raynham and Taunton).

In addition to the formal lots, there are three locations considered to be semi-formal because there is no signage officially designating them for commuter parking. These locations are in Middleborough, Raynham and Seekonk. Unlike the formal lots, these areas

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[6] *U.S. Department of Energy, Energy Information Administration, Weekly Retail Gasoline Prices, as of June 16, 2006.*

may not possess lighting or delineated parking spaces. Parking permission is implied at these locations.

There are also numerous other locations throughout the region where commuters regularly park without specific permission to do so. These informal locations are generally in the parking lots of large shopping centers where commuters can intermingle with employee and patron parking or along the roadside near highway interchanges. Commuters are not granted specific permission to park in these facilities, but are usually not prohibited from doing so as long as sufficient capacity exists.

The identified formal and semi-formal park-and-ride lots are listed in Table B-22 and their location are depicted on Figure B-9. The table displays the number of formal and semi-formal commuter parking spaces available within the region and tracks the usage of these lots since 2014.

Table B- 22: Commuter Parking Inventory

SMMPO Region Park-and-Ride				2014		2015		2016		2017		2018	
City/Town	Location	Type	Spaces	In Use	%	In Use	%	In Use	%	In Use	%	In Use	%
Freetown	Gramp Dean Rd @ N Main St Rte 24 Exit 10	Formal	33	32	97%	32	97%	33	100%	33	100%	29	88%
Mattapoisett	North St @ Rte 6 Exit 19	Formal	80	12	15%	15	19%	13	16%	20	25%	15	19%
Middleborough	Middleboro Rotary	Informal	25	0	0%	0	0%	0	0%	0	0%	0	0%
New Bedford	Mt. Pleasant St @ Rte 140 Exit 4	Formal	202	131	65%	123	61%	126	62%	125	62%	139	69%
Raynham	Rte 138 @ Carver St	Informal	80	24	30%	31	39%	22	28%	29	36%	19	24%
Raynham	Rte 138 @ Raynham Dog Track I-495 Exit 8	Formal	150	27	18%	32	21%	33	22%	31	21%	33	22%
Seekonk	Rte 114A @ Pub 99	Informal	30	12	40%	8	27%	7	23%	6	20%	6	20%
Somerset	Rte 103 @ I-195 Exit 4	Formal	67	58	87%	57	85%	52	78%	56	84%	55	82%
Somerset	Rte 6 @ Rte 138	Formal	80	41	51%	51	64%	37	46%	34	43%	33	41%
Taunton	Rte 24 Exit 12 Silver City Galleria	Formal	185	142	77%	138	75%	132	71%	135	73%	156	84%
Wareham	Rte 6 @ Rtes 28/25	Formal	120	6	5%	10	8%	9	8%	7	6%	6	5%
		Totals	1052	485	46%	497	47%	464	44%	476	45%	491	47%
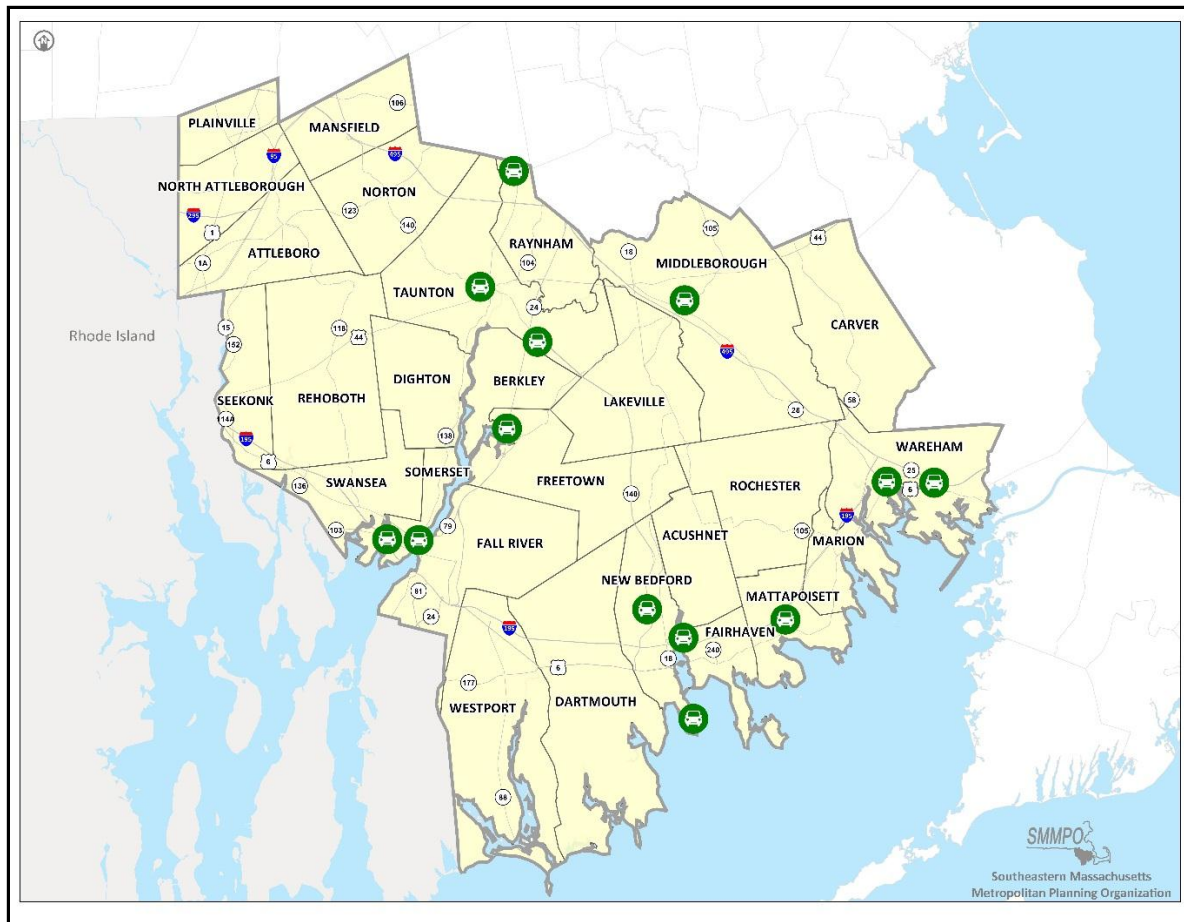
Figure B- 9: Park-and-Ride Lot Locations

There are a total of 1,052 parking spaces designated for commuter parking in the region. In 2006, the overall usage of these lots reached nearly 55% capacity. Much of this increase was based on the public's willingness to carpool or use commuter bus due to the increase in gasoline costs. Recently, use at park-and-ride lots continue to decline which follows the trend of mode choice with a decline in carpooling and public transit.

These facilities serve commuters that travel to Boston or Providence, RI. The park-and-ride lots within SRPEDD along the corridors serving these cities were recently studied to evaluate the supply and demand. The results are displayed in Table B-23.

Table B- 23: Park-and-Ride Lot Supply vs. Demand

Corridor Served	Spaces	2014		2015		2016		2017		2018	
		In Use	%	In Use	%	In Use	%	In Use	%	In Use	%
To Boston	730	368	50%	371	51%	359	49%	373	51%	391	54%
To Providence	177	111	63%	116	66%	96	54%	96	54%	94	53%
Boston/Providence	145	6	4%	10	7%	9	6%	7	5%	6	4%
Total	**1052**	**485**		**497**		**464**		**476**		**491**	

Previous counts revealed an increase in ridesharing demand along the east-west corridor along I-195 to the greater Providence area in the decade of the 1990s. A small portion of the demand for east/west travel included patrons of daily bus trips to the Foxwoods and Mohegan Sun Casinos located in Connecticut. Demand at the Somerset lots have changed with the completion of the Veteran's Memorial Bride on Route 6 which altered the access to the Slade's Ferry Road Park-and-Ride lot while the Route 103 lot remains at capacity with an expansion project for this lot currently under construction.

Demand on the north-south corridor, mainly serving trips to Boston, has varied over the past decade, but has recently increased to 54% use. Although lots continue to have sufficient capacity, parking at the Taunton and New Bedford lots have experienced an increase since the FFY 2016 Regional Transportation Plan.

In 2009, SRPEDD conducted a formal study of commuter parking (Park-and-Ride) use and needs in the region. The following findings and recommendations were made from that effort:

- There continues to be a need for a commuter parking lot along the I-95 corridor between Attleboro, North Attleborough, and Mansfield. Rather than new construction, the study suggested implementing a shared-use facility with a developed land use with ample parking in the vicinity of the Tri-Boro Plaza Shopping Center in North Attleborough. A business, non-profit organization, or government entity may enter into a lease with MassDOT with a minimum of 50 parking spaces designated for ride share purposes. As part of the lease, the land owner would receive payment by MassDOT to allow commuter parking, but as part of the agreement, the land owner is responsible for the maintenance and upkeep of the lot. Also, local zoning ordinances would have to allow this use prior to any agreement. In the end, shared use lots preserve open space by using existing facilities and maintain a relatively low operating cost by eliminating the expensive construction of new facilities. Ideally, places of worship such as churches, synagogues, or mosques are best for these agreements due to the low parking use during the week.

- There is a continued need for additional commuter parking spaces at the interchange of I-195 at Route 136 in Swansea. This location has been identified for a new park-and-ride facility. In 1999, the construction of a park-and-ride lot was proposed by SRPEDD in the northwest quadrant of the Interchange. Route 136 is the logical and preferred route for Rhode Island commuters traveling between Bristol County, Providence and other Rhode Island locations. This location continues to remain valid because of its proximity to these main commuter routes. As previously explained with the recommendation for North Attleborough, a shared use

facility with one of the businesses in close proximity to the interchange may be an economical alternative for a park-and-ride lot in this area.

- A shared use facility should be considered for an additional park-and-ride facility in Fall River along I-195. This location would provide parking for commuters traveling to Providence, Newport, New Bedford, or Boston. A possible location could be the overflow parking at the UMASS Advance Technology and Manufacturing Center and the Medical Info Technology Center along Route 6. Half of this parking area is designated for use by UMASS Dartmouth. Negotiations between the university and MassDOT for a park-and-ride lot would be necessary to meet legal and liability obligations.

- Although the number of park-and-ride lot users has not dramatically increased over the past 3 years, three lots are in need of possible expansion of their existing facilities. These locations include:

    - Mount Pleasant Street – New Bedford;
    - Silver City Galleria – Taunton;
    - Route 103 at I-195 – Somerset.

    All three locations are considered to be close to or at capacity. The capacity of the lots located in New Bedford and Taunton is a reflection of the current lack of train service to Boston. Considering the improbable arrival of commuter rail service to Fall River, New Bedford, and Taunton anytime in the near future, use at these Park-and-Ride lots will remain at capacity. MassDOT should consider expansion of the Mount Pleasant Street and Silver City Galleria Mall facilities to meet commuting needs.

- In Somerset, the expansion of the facility at the Route 103 and I-195 area is planned for expansion for as part of the Transportation Improvement Program. (This project is currently under construction.) The expansion to the facility at Route 138, Route 6, and Slade's Ferry Avenue is questionable due to the change in traffic patterns from the completion of the Veteran's Memorial Bridge in 2012. The town of Somerset is presently planning for the re-development of the Slade's Ferry Avenue area. Part of the planning included relocating the existing Park-and-Ride lot to open space that is near the new Veterans Memorial Bridge, but that was met with opposition by residents of Newhill Avenue during the planning of the Brightman Street Bridge replacement.

- The demand for commuter parking in the vicinity of the Middleborough Circle Rotary is uncertain due to the informal parking areas in the vicinity of the rotary. Interim improvements at the rotary that doubled the carrying capacity are complete and MassDOT is currently assessing the effectiveness. However, field observations note that the vehicle queue that existed at the rotary prior to the interim improvements have greatly diminished. Potential park-and-ride locations at the rotary remain unclear, but with the implementation of South Coast Rail Phase One with the relocation of the Lakeville station to Route 28 in Middleborough, the demand for a Formal Park and Rides lot will require further Study.

Beyond the demand and particular capacity problems at some of these lots, security is another issue that needs to be addressed. Through interviews with some of the bus companies, it was discovered that patrons do not use certain formal park-and-ride lots due to lack of lighting and poor visibility from adjacent roadways. This is the case with the Mount Pleasant Street lot in New Bedford. This particular location was not visible from the road due to vegetation. Although an obstructed view may be preferable to neighbors abutting the lot, it presents a risk to the patrons utilizing the lot after dark. The city recognized this issue and has removed some of the trees obstructing the view to the lot.

It is significant that over 7% of commuters traveling within or leaving the SRPEDD area utilize carpools. Although this percentage of the commuting population helped lessen traffic congestion and improve air quality, over 84% of commuters continue to drive alone. This indicates a need for greater promotion to encourage ridesharing and alternative modes of transportation. There continues to be a need to focus efforts to encourage ride share programs in southeastern Massachusetts.

Traffic Growth

Between 2008 and 2018, traffic on the region's roads experienced growth. Roads that experienced some growth included the interstate, divided highways and arterial roads amounting to 1 to 1.6% annually. Over the ten-year period, these roads saw an increase of volume of about 15%.

Minor arterial and collector roads experienced a decline in traffic with an annual rate of less than 1% and declining. Over the ten-year period, these roads saw a decrease of volume of about 4%. Growth on the divided highways and arterials roads are typical due to the SRPEDD population working outside of the region with part of that commute for most people being made on interstate highways. Contributing factors to this early slow growth or even a decline can be attributed to the economic recession resulting in higher unemployment that occurred late in the last decade as well as higher gas prices. However,

recent increases in traffic coupled with a growing single occupancy vehicle rate and an increase in employment are factors to the recent increase in traffic. Table B-22 shows traffic growth on the region's roads between 2008 and 2018.

Table B- 24: Regional Traffic Growth 2008 to 2018

Roadway Type	Annual Growth Rate
Interstate Highways	1.6%
Arterial Roads	0.96%
Minor Arterials & Collector Roads	-0.4%
Regional Growth	1.06%

Long-range transportation planning produces a best estimate of future traffic conditions based on growth trends and local policy direction. It is developed by incorporating several possible futures, taking into account possible changing conditions, shifting policies, and changes in local attitudes. The Travel Demand Model allows us to look ahead to determine future problems. More importantly, it allows us to test alternative solutions to address those problems and determine the most appropriate plan to avoid or alleviate problems before they occur.

The Model is a computer-based tool (see Figure B-10) that uses a scaled depiction of the existing road network, characteristics of that network (such as speed, capacity, number of lanes, turning restrictions, travel time), socio-economic information (dwelling units, employment), and characteristics of normal travel patterns of people living and working in the region (i.e. average trip length, travel mode). Predetermined rates (number of daily trips per dwelling unit or employee) are applied to the data to calculate trips throughout the region. Then, based on the location of residential areas and their relationship to employment and commercial centers, the trips are dispersed from zone-to-zone onto the road network.
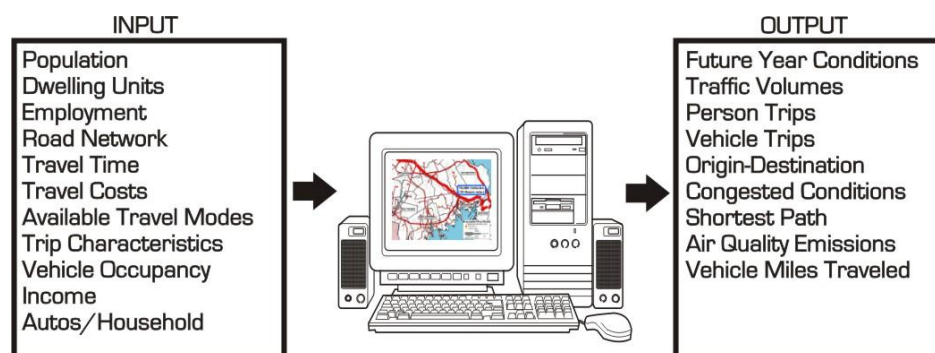
Figure B- 10: Travel Demand Forecasting Model

This process is conducted for the base year (2010) to determine if the model is reacting properly to the data with which it is operating. Once the accuracy of the model is verified (calibration), future socio-economic data is added and the modeling process is run for the future year. The travel demand model provides traffic projections (based on anticipated land use projections) to years 2020, 2030, and 2040.

Vehicle Miles Traveled - Vehicle Miles Traveled (VMT) represents the estimated total daily number of miles driven on the region's road network. It is derived from the Travel Demand Model by multiplying the estimated traffic volume on every road in the region by the length of that road. Volumes are adjusted to account for people that walk, carpool, take transit, etc.

Total travel in the region was 14,000,000 Vehicle Miles Traveled (VMT) per day in 2000 and increased to 16,451,000 VMT per day in 2010. By 2015, the VMT grew to 17,298,800 VMT representing an annual regional growth rate of than 1% per year. By 2040, the VMT is expected to increase to approximately 20,866,500 per day representing annual growth of less than 1% annually. This shows a moderation in traffic growth from the 1980's, which experienced annual growth at 2.5%.

Conclusions

Traffic growth is directly influenced by changes in living and work habits. In the previous 30-year period (1980-2010), population in the region grew by 20% while regional employment grew by 27%. It is expected that by 2040 population is expected to grow by 6%, while employment is expected to increase by 6%.

This traffic growth will not be uniform throughout the region. Some roads will experience major increases in traffic volume while others experience little or no growth. This is due to differences in the location of projected population and/or employment growth.

It is expected that single-occupancy travel (one person per vehicle) will continue to be the preferred method of travel in the region. Due to the lack of centralized employment centers, the automobile will continue to be the primary source for travel. Regardless of gas prices below $3.00 per gallon during the development of this plan, if gasoline costs rise from their current levels, ride sharing and mass transit programs may regain popularity. Travel to Boston would experience an increase in riders for commuter rail and bus as long as adequate service is provided.

In past decades, the trend of residential and employment sprawl, combined with relatively low gasoline prices perpetuated our continued dependence on automobiles as the primary

commuting choice in southeastern Massachusetts. Such a condition suggests that until land use policies encourage clustering of employment and residential land use, a large number of commuters will remain out of reach from public transportation.

It is possible that higher gas prices to our current costs might change people's habits by driving slower speeds to conserve fuel, participate in rideshare programs or use public transportation. Demand for commuter rail will continue with increasing traffic congestion on Routes 24 and I-95, combined with the expenses for parking within the City of Boston and the high cost of gasoline. Under our present situation and with the exception of travel to Boston, the current trend for commuter travel continues to be unsustainable. The lack of connectively and the frequency of service between alternative modes of transportation and the communities inhibit greater use of these services. Our current land use policies for residential and economic development perpetuate the continued reliance on the automobile.

Recommendations

To offset the issues of urban sprawl, increasing fuel costs and the reliance on single occupancy vehicles, steps need to be established to develop a more reliable and sustainable transportation network. This includes continued support of Priority Development Areas/Priority Protection Areas (PDA/PPA) where communities change their economic and land use strategies to focus development near adequately designed and multi-modal transportation centers. Similar to Smart Growth planning efforts of the past, this encourages Transportation Oriented Development that includes bus terminals, train stations or multi-modal centers incorporating all facets of transportation and provides more choices for residents other than the Single Occupancy Vehicle (SOV). Much of this effort is being planned with the South Coast Rail effort to bring commuter rail to Fall River and New Bedford by 2022.

Promoting ridesharing programs must take place regardless of the proposed addition of commuter rail to Fall River and New Bedford. Future commuter rail expansion will primarily serve people commuting to Boston. There will remain a need for Park-and-Ride lots in the SRPEDD region to serve commuters who travel to employment centers throughout Massachusetts and Rhode Island.

The use of private lots (shopping centers, public buildings, etc) through lease agreements to accommodate commuter parking needs should continue to be explored. A lease agreement between MassDOT and a privately owned parking facility will have to meet specific requirements before the lease can be granted to the property owner. These requirements include, but are not limited to:

- Minimum of 50 spaces designated for park-and-ride,
- Fencing around the lot for security,
- Paved and well maintained asphalt surface with delineated parking spaces,
- Clear of snow during the winter months.

In addition, if a certain area is chosen for a park-and-ride lot, MassDOT will proceed with a competitive bidding process to allow all qualified property owners the ability to bid on the lease agreement. The benefit is parking that is currently underused is being considered over the construction of new imperious paved parking facilities that contribute to increased runoff..

If a future goal is to lessen the burden of traffic congestion and become less dependent on the single occupancy vehicle, more work is needed to better inform and educate the general public on the benefits of ride sharing. Therefore, coordination between MassDOT, regional agencies and local government should be initiated with a more aggressive campaign to increase ride sharing in southeastern Massachusetts and throughout the state.

Traffic congestion cannot be solved by any one single solution. A reduction in traffic congestion can only be achieved with several different mode options to the single occupancy vehicle. Eventually, fossil fuels will become less abundant and more expensive, commuting through mass transit and ride sharing alternatives will become a necessity rather than an option. However, current land use, transportation systems and facilities do not support for alternative transportation choices. Educating the public today to the benefits of alternative modes of travel will only make the future transition to these alternative modes easier as we move further into the 21st century.