Built environment policies to reduce vehicle travel in Massachusetts

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ABSTRACT

Smart growth policies that reduce the distance between origins and destinations and facilitate non-auto modes of transportation present one of the most plausible paths towards a long term reduction in total vehicle-miles traveled (VMT) and associated emissions. While the implementation of any single smart growth policy may make only a small change in travel behavior, the combined effect of multiple changes to the built environment can be substantial.

The goals of this study were to determine—using land use, demographic, and passenger VMT data for the Commonwealth of Massachusetts—the importance of built environment variables in influencing household vehicle-miles traveled, and to evaluate the passenger VMT reduction potential of smart growth policy packages in the state. Among the built environment variables evaluated, land use mix (the average distance between homes and the nearest retail establishment) and household density had the largest impacts on passenger VMT. Other built environment variables found to exert significant influence on passenger VMT include sidewalk coverage, intersection density, managed parking, and the distance from homes to the nearest transit stop.

By enacting policies to change these built environment variables, Massachusetts could reduce statewide passenger VMT by 13.6% below the business-as-usual scenario by 2040. If policies to shift projected population gains in the state towards lower-VMT communities are enacted in addition to these built environment changes, VMT could be reduced by a total of more than 15%.

INTRODUCTION

Smart growth, the development of more compact communities that enable people to get around more easily without a car, is an increasingly popular tool to boost the efficiency of public infrastructure investments, lower transportation costs, and reduce emissions. This research expands on the previously documented connection between the built environment and travel demand through the use of detailed land use, demographic, and travel data to determine the relative importance of different built environment variables in influencing household vehicle-miles traveled (VMT), and to evaluate the VMT reduction potential of actionable policy packages in Massachusetts.

BACKGROUND

Driving behavior is influenced by many different factors, which can largely be classified as demographics (*1*) the cost driving (*2*), and the built environment (*3*). However, because governments cannot do much to change their demographics, and policies that directly increase the cost of driving, such as raising fuel taxes, tend to be unpopular, smart growth policies that change the built environment may present a more plausible paths towards a long term reduction in total vehicle-miles traveled (VMT). While the implementation of any single smart growth policy may make only a small change in travel behavior, the combined effect of multiple changes to the built environment can be substantial (*4*).

The smart growth strategies below can reduce VMT in four primary ways:

1. Reduce the distance between origins and destinations;
2. Increase mobility for alternative (non-single occupant vehicle) modes of transportation by improving safety, convenience, or network connectivity;
3. Increase the cost of driving relative to other modes;
4. Reduce the need to travel

Improved Transit Access

Simply making transit available as an alternative to driving can reduce VMT. People living in walkable neighborhoods with transit access tend to use transit significantly more than people living in other areas (*3*). A meta-analysis of studies focused on the connection between the distance between households and their nearest transit stop found that every one percent increase in a household’s distance to transit is associated with a 0.05 percent increase in household VMT (*4*).

Mixed Land Uses

Mixing land uses—locating residential, commercial, cultural, institutional and other uses in close proximity—reduces the distance between homes, workplaces, shops, schools, and other destinations, making transit, walking, and biking more viable alternatives to single-occupant car travel and reducing the miles driven by those who choose to drive. People living in communities with highly mixed land uses have been found to drive an average of 1.1 fewer miles per day than those living in areas with more segregated land uses (*5*). Another study that compared two suburban communities in North Carolina with similar demographic characteristics, one of which was new urbanist and the other which was a more conventional suburb, found that while the amount of leisure time involving physical activity was similar for residents in both communities, those in the new urbanist community did 40-55 minutes more walking and biking each week than those in the conventional suburb, and that these walking and biking trips supplanted car trips (*3*).

Increased Density

It has been well documented that areas with higher residential densities tend to have lower average VMT. One study that compared older more urban parts of Phoenix to newer inner suburban areas and the most recently built developments on the urban fringe found that residents in the older, denser neighborhoods drove 30 percent fewer miles than those in the inner suburbs and 70 percent less than those living in the newest, least dense neighborhoods at the edge of the urban area (*3*). A 2002 study, which analyzed the link between residential density and VMT in Los Angeles, Chicago, and San Francisco found that higher densities in all three cities were associated lower household VMT (*6*). Finally, Cervero and Murakami estimated the elasticity of VMT with respect to density to be -0.38 based on their analysis of VMT and population density in 370 urbanized areas in the US (*7*).

Reduced Road Capacity

Reducing road capacity has also been shown to reduce VMT. A 1998 study found an average traffic reduction of 25 percent following 100 road capacity reduction projects in Europe, North America, Australia, and Japan (*3*). Conversely, increasing capacity has been shown to increase per capita car travel (*8*).

Street Network Connectivity and Density

The connectivity and density of the street network are key variables affecting the ability and likelihood of people to use alternative modes of transportation. Dense connected networks allow for more direct routes between places. In fact, intersection density has been shown to be one of the greatest predictors of walking and bicycle mode shares (*5*). Areas with high connectivity for walkers and bikers and low connectivity for cars, such as neighborhoods with cul-de-sacs that have sidewalk shortcuts, have been found to have some of the highest rates of walking and biking (*9*).

Complete Streets

“Complete streets,” those built for all users—bicycles, pedestrians, transit riders, etc.—can reduce VMT by increasing the comfort, safety and convenience of non-auto modes. A recent review of the impact of strategies to promote bicycling to reduce VMT and greenhouse gas emissions found that improving bicycle infrastructure generally increases bicycling and reduces VMT (*10*). Other features common to complete streets such as on-street parking, curbs, sidewalks, and bicycle lanes have also been shown to reduce VMT. The presence of any one of these features was shown to increase travel by alternate modes and to reduce driving mode share by up to 5 percent (*5*).

Parking Management

Parking management includes a variety of policies and programs that result in a more efficient allocation of parking resources. Parking management strategies include reducing or eliminating parking minimums, installing parking meters in places where demand for streetside parking exceeds supply, and “parking cash-out” programs, where employers give employees the option of receiving a cash payment equal to the cost of the parking subsidy that employers would otherwise provide employees.

A 2006 analysis of previous studies on parking cash-out programs found that a financial incentive of $46 per month (1995 dollars) would reduce parking demand by an average of 26 percent (*11*).

METHODOLOGY

This study involved three primary tasks:

1. Conduct an empirical analysis to assess the relative importance of various built environmental variables in influencing daily passenger VMT.
2. Develop statewide passenger VMT projections for 2020, 2030, and 2040 under a business-as-usual scenario.
3. Develop policy scenarios and assess their likely VMT-reduction impacts in 2020, 2030, and 2040.

Data Sources

TABLE 1 details the data sources used in the study.

TABLE 1 Data Sources

Data	Description	Date	Source
Massachusetts parcel database	Tax-parcel geodatabase, including locations, lot and building size, and land use codes for all parcels in Massachusetts*	June, 2015	Metropolitan Area Planning Council (MAPC)
Massachusetts road inventory	Geodatabase containing information about the road network, including sidewalks and speed limits	June, 2014	Massachusetts Office of Geographic Information (MassGIS)
Massachusetts bicycle facility inventory	Geodatabase containing information about the existing and planned network of on- and off-road facilities	August, 2013	MassGIS
Massachusetts rail inventory	Geodatabase containing information about the Commonwealth’s rail network, including commuter rail stations	January, 2012	Massachusetts Department of Transportation (MassDOT)
MBTA bus routes and stops	GIS layer containing the locations of bus routes and stops in the Boston area	July, 2014	MassGIS
MBTA rapid transit routes and stops	GIS layer containing the locations of rapid transit routes and stops in the Boston area	September, 2014	MassGIS
Non-MBTA regional transit authority bus routes	GIS layers containing the locations of bus routes and stops outside of the Boston area	August, 2012	MassDOT

Data	Description	Date	Source
VMT by census block group	Average daily vehicle-miles traveled by different vehicle types by quarter during the 2008-2011 period	July, 2015	MAPC
Demographic projections to 2040 by municipality	Summary population, household, and employment statistics for every Massachusetts municipality	July, 2015	MassDOT
Population and households by block group, 2010	Population and household information from the most recent US Census	2011	US Census
Massachusetts Community Types	Document assigning all Massachusetts municipalities to one of five different Community Types.	July, 2008	MAPC
*Note: Due to errors in the parcel database for Nantucket Island, Nantucket was excluded from the analysis.			

Empirical Analysis

The goal of the empirical analysis was to develop one or more models linking built environment variables to total daily household passenger VMT. The analysis was conducted at the block group level; each block group in Massachusetts was assigned a score on each of the six following metrics:

1. Household density – households per square mile of land area
2. Average distance to transit – average distance from residential parcels to the nearest bus, rapid transit, or commuter rail stop via the road network
3. Average distance to retail (a measure of land use mix) – average distance from residential parcels to the nearest retail establishment nearest via the road network
4. Intersection density – number of intersections linking at least three road segments per square mile of land area
5. Sidewalk coverage – fraction of the road network with a sidewalk on at least one side
6. Managed parking – block groups with at least one single-use parking structure within one mile of their boundaries are scored 1, others receive a score of 0.

Due to a lack of data, the existence of a nearby single-use parking structure was used as a proxy for managed parking because they are associated with a scarcity of free parking. Results from the model indicate that nearby single-use parking structures are associated with lower household VMT, suggesting its validity as a proxy for managed parking in the area.

After each block group was categorized based on the six variables above, a multiple linear regression was conducted to assess the influence of each variable on household passenger VMT.

Business-As-Usual Scenarios

To develop business-as-usual (BAU) scenarios, municipalities were grouped according to their Community Type (Figure 1). Communities within each type share similarities in land use, housing patterns, and recent and projected development patterns. Total projected households in 2020, 2030, and 2040 in each Community Type were calculated using data from the Massachusetts Department of Transportation demographic projections for each municipality.

Average daily passenger VMT was assigned to households in each Community Type using the regression equation developed during the empirical analysis phase, holding all built environment variables constant.

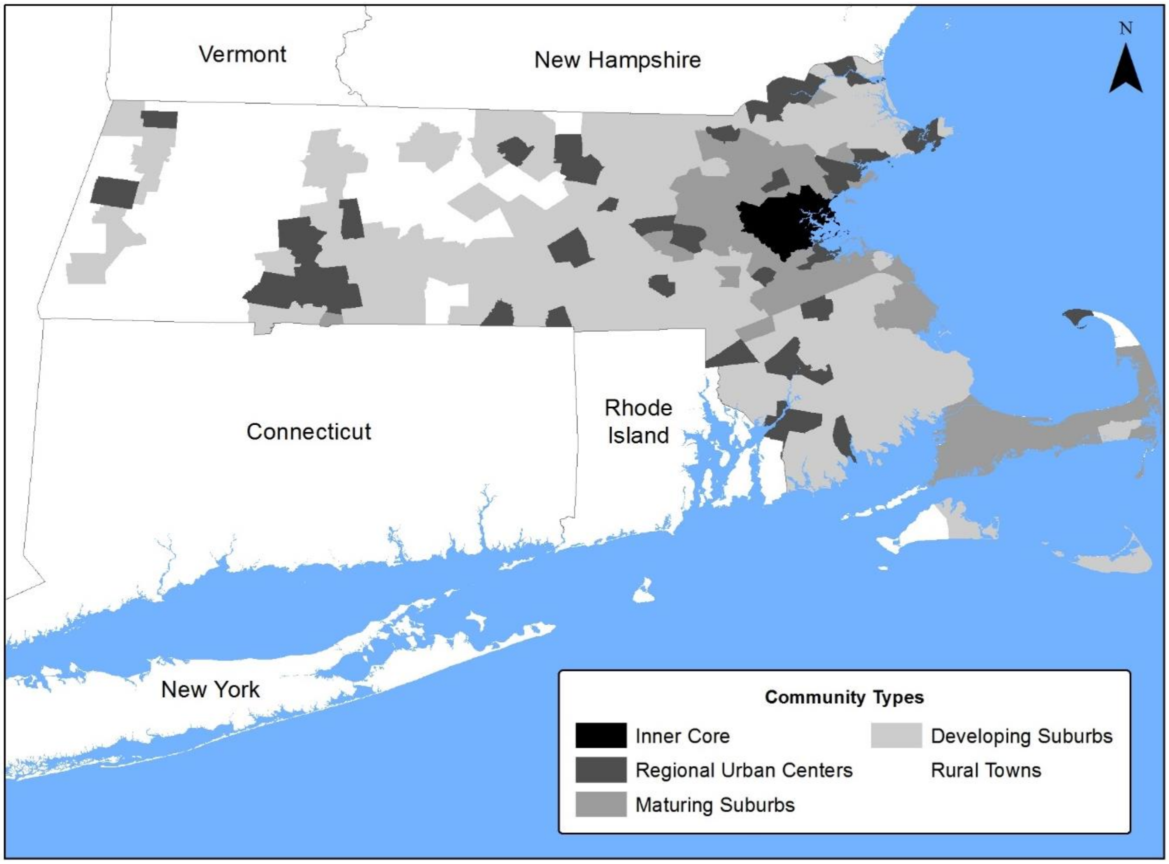


FIGURE 1 Massachusetts Community Types.

Policy Scenarios

A variety of policy packages were evaluated to estimate their likely impact on passenger VMT. The policy packages that were evaluated can be divided into three types:

- Those that change the built environment in ways expected to reduce VMT based on the empirical analysis, such as increasing intersection density or sidewalk coverage
- Those that direct the state’s population growth towards lower VMT Community Types
- Combinations of built environment and population shift policies.

Limitations

Two limitations to the applicability of our findings relate to residential self-selection and the infeasibility of substantially increasing housing density (policy scenario B.2) given the state's slow rate of growth.

While walkable neighborhoods are likely to attract residents interested shifting some of their trips from auto to walking or biking, this is unlikely to overwhelm the effects of changes to the built environment. Surveys indicate that modal preferences normally fall below other considerations in housing decisions and research indicates that the built environment affects household travel attitudes over time (*12*). In addition, demand for housing in walkable and transit-oriented environments tends to exceed supply (*12*).

Policy scenario B.2, which calls for increasing average household densities across the state in all Community Types other than Rural Towns, is likely unfeasible under current growth projections. However, the scenario was included to evaluate the importance of household density relative to other variables.

RESULTS

Empirical Analysis

All six built environment variables evaluated were found to be significantly related to household passenger VMT. Table 2 compares the five Community Types according to their household VMT and the built environment variables included in the analysis.

TABLE 2 Comparison of Community Types on Key Variables

Community Type	Mean Distance to Transit (mi)	Mean Intersection Density (per sq. mi)	Mean Distance to Retail (mi)	Mean Household Density (per sq. mi)	Mean Managed Parking	Mean Sidewalk Coverage	Mean Daily Passenger VMT per Household 2008-2011
Inner Core	0.12	278	0.16	8,683	0.63	0.79	26.82
Regional Urban Centers	0.53	169	0.32	3,003	0.33	0.56	40.68
Maturing Suburbs	0.83	105	0.60	1,001	0.06	0.34	52.96
Developing Suburbs	1.97	51	0.69	510	0.04	0.22	62.04
Rural Towns	4.51	10	1.29	44	0.01	0.02	67.27

See **Empirical Analysis** section, below TABLE 1, for additional information on units and methodology.

Because less densely developed areas are less likely to have transit service, sidewalks, or managed parking the regression equation developed for Rural Towns and Developing Suburbs excludes these variables (Table 3). The equation used for communities in the Inner Core, Regional Urban Centers, and Maturing Suburbs includes all built environment variables (Table 4).

TABLE 3 Regression Equation - Average passenger VMT per household per day, Rural Towns and Developing Suburbs

	Unstandardized Coefficients	Standardized Coefficients	p-value
(Constant)	62.226		0.000
Average distance to nearest retail (miles)	7.439	0.309	0.000
Intersection density (per square mile)	-0.037	-0.136	0.000
Household density (per square mile)	-0.007	-0.308	0.000
$R^2 = 0.40$			

TABLE 4 Regression Equation - Average passenger VMT per household per day, Inner Core, Regional Urban Centers, and Maturing Suburbs

	Unstandardized Coefficients	Standardized Coefficients	p-value
(Constant)	47.572		0.000
Average distance to nearest retail (miles)	8.537	0.196	0.000
Intersection density (per square mile)	-0.009	-0.082	0.000
Average distance to nearest transit (miles)	2.533	0.136	0.000
Sidewalk coverage (intersections per mile)	-9.835	-0.202	0.000
Household density (per square mile)	-0.001	-0.249	0.000
Parking Scarcity (y/n)	-6.362	-0.201	0.000
$R^2 = 0.585$			

Business-As-Usual Scenarios

BAU passenger VMT projections for 2020, 2030, and 2040 were developed for each Community Type by multiplying the number of projected households by the average daily household passenger VMT predicted by the regression equation, assuming no change in the built environment. Table 5 details the projected daily passenger VMT in each Community Type in 2020, 2030, and 2040.

TABLE 5 Projected Daily Passenger VMT by Community Type, BAU - 2020-2040

		2020		2030		2040	
MAPC Community Type	Average Daily Household VMT	Households	Passenger VMT per Day	Households	Passenger VMT per Day	Households	Passenger VMT per Day
Inner Core	26.25	618,506	16,236,322	668,852	17,557,949	708,541	18,599,820
Regional Urban Centers	39.56	850,636	33,648,347	890,325	35,218,313	910,083	35,999,874
Maturing Suburbs	49.07	512,810	25,163,002	538,037	26,400,862	548,342	26,906,516
Developing Suburbs	61.90	693,191	42,911,739	736,445	45,589,362	757,084	46,867,012
Rural Towns	71.14	45,066	3,206,164	44,905	3,194,710	43,367	3,085,291

Policy Scenarios

The model used to evaluate the impacts of VMT-reduction policies is based on built environment variables, average daily household VMT between 2008 and 2011, and projected demographic changes through 2040. Because it is based on the registered location of passenger vehicles and includes only certain built environment and demographic variables, the analysis is limited by these factors.

Focus growth in low-VMT communities

Shifting population growth towards lower VMT communities is one way to reduce auto-related GHG emissions. There are several ways that states can influence where growth and development can occur. They can offer grants or other incentives to local governments that zone for increased residential density or boost density through other programs, such as transfer of development rights (TDR); and they can revise existing development review measures that may make it more difficult to develop land in dense urban areas than on the urban fringe.

Two focused growth scenarios were modeled for their effect on statewide passenger VMT:

A.1 Shift 50% of projected population growth in Rural Towns, Developing Suburbs, Maturing Suburbs, and Regional Urban Centers, to the Community Type with the next highest density classification.

A.2 Shift 50% of total projected growth in Developing Suburbs and Maturing Suburbs into urban Community Types, divided evenly between the Inner Core and Regional Urban Centers.

Change the built environment to reduce household VMT

Changing the built environment to enable more non-SOV trips and/or reduce the length of car trips can reduce VMT in all types of community. Household VMT is significantly correlated with the distance from homes to retail destinations, household density, transit accessibility, sidewalk coverage, parking scarcity, and intersection density.

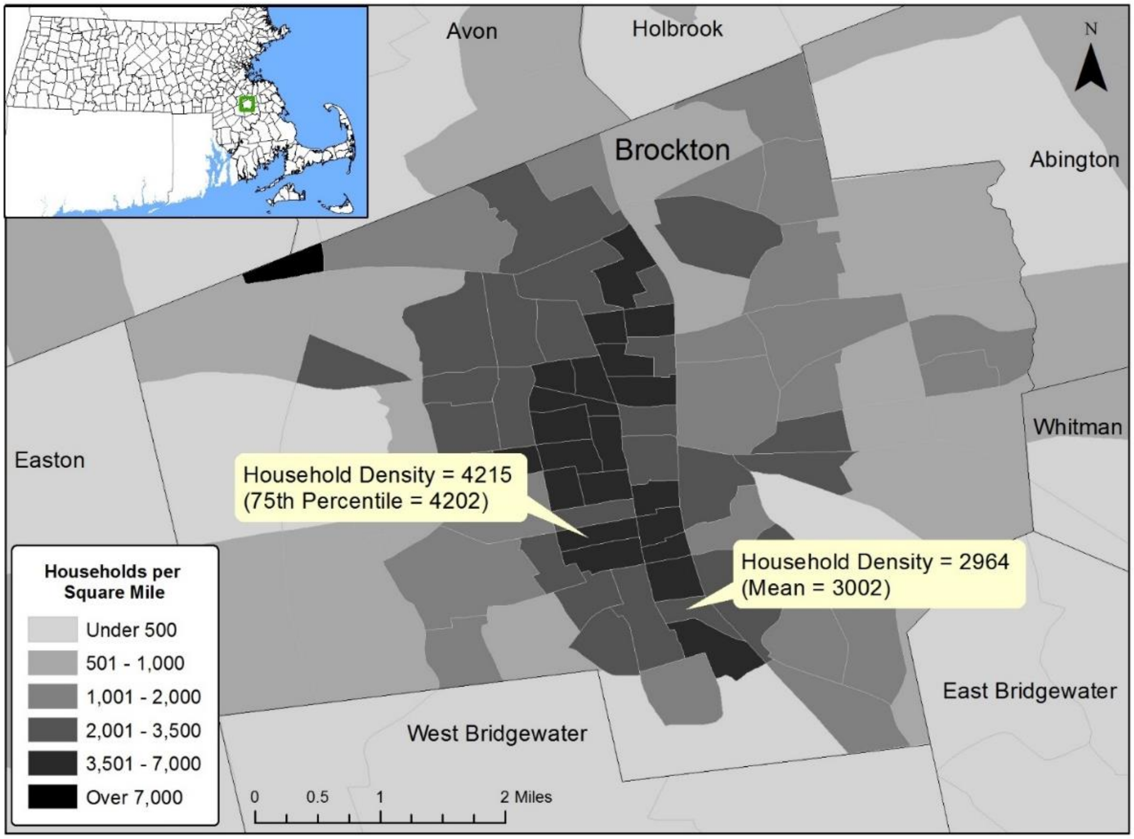
To ensure that the degree of change to the built environment variables used in the policy scenarios was consistent across variables, the level of change was set as moving from a variable's current mean level in a Community Type to the current 25th or 75th percentile level in that Community Type—depending on whether the variable is correlated positively or negatively with VMT—by 2040. In the interim years of 2020 and 2030, progress is assumed to be 1/3 and 2/3, respectively, of the way towards the 2040 goal. Table 6 details the mean, median, and 25th/75th percentile values for each variable in block groups of each Community Type. Variables not included in the regression models are not shown. Because the managed parking variable was scored as either 1 or 0, depending on whether there was a single-use parking structure within a mile of the block group, the target for this variable was set as a 25 percent increase in the number of block groups in each community type with managed parking.

TABLE 6 Characteristics of Block Groups in Each Community Type

Variable		Inner Core	Regional Urban Centers	Maturing Suburbs	Developing Suburbs	Rural Towns
	Mean	0.16	0.32	0.60	0.69	1.29

Distance (mi) to nearest retail	Median	0.13	0.21	0.48	0.55	1.19
	25th percentile	0.08	0.12	0.31	0.32	0.82
Households per square mile	Mean	8,683	3,002	1,001	510	44
	Median	6,190	2,283	687	286	23
	75th percentile	10,176	4,202	1,373	669	38
Percent of road network with sidewalks on at least one side	Mean	0.79	0.56	0.34		
	Median	0.87	0.58	0.30		
	75th percentile	0.96	0.83	0.53		
Distance (mi) to nearest transit	Mean	0.12	0.53	0.83		
	Median	0.09	0.22	0.56		
	25th percentile	0.06	0.11	0.26		
Intersections per square mile	Mean	278	169	105	51	10
	Median	248	154	85	34	5
	75th percentile	342	233	144	72	10
Managed parking	Mean	0.63	0.33	0.06		
	25 percent increase	0.79	0.41	0.08		

Basing targets for each variable on their 25th/75th percentile level, ensures that proposed changes would represent an evolution towards the denser better networked neighborhoods that already exist within each Community Type. In Figure 2, which details the household density of block groups in Brockton, Massachusetts, a Regional Urban Center, the two block groups which are identified have densities very close to the mean and 75th percentile levels in Regional Urban Centers across the state. 25 percent of block groups in each Community Type already exceed 2040 built environment targets and many communities, like Brockton, include neighborhoods that meet these targets.



Household Density = 4215
(75th Percentile = 4202)

Household Density = 2964
(Mean = 3002)

FIGURE 2 Mean and 75th percentile densities in Brockton, MA.

Eight built environment scenarios were modeled to determine their impact on passenger VMT through 2040, relative to the BAU scenario:

B.1 Increase land use mix – Reduce the average distance between residences and their nearest retail establishment in all Community Types to the 25th percentile level.

B.2 Increase household density – Increase average household density in all Community Types, except Rural Towns, to the 75th percentile level. Because the 75th percentile household density in Rural Towns is below the 2010 mean, household density in these areas is held constant through 2040. This level of densification is likely unfeasible under current growth projections.

B.3 B.1 and B.2 – Increase both household density and land use mix.

B.4 Improve sidewalk coverage – Increase average sidewalk network coverage (percentage of road miles with a sidewalk of at least 3 feet in width on at least one side) to the 75th percentile in the Inner Core, Regional Urban Centers, and Maturing Suburbs.

B.5 Improve transit access – Decrease the average distance from residences to the nearest transit stop to the 25th percentile level in the Inner Core, Maturing Suburbs and Regional Urban Centers.

B.6 Increase intersection density – Increase intersection density to the 75th percentile level in all Community Types except the Inner Core. Inner Core communities are excluded because these areas are already heavily developed with very high intersection densities.

B.7 Reduce the availability of free parking – Increase the number of block groups in each Community Type with managed parking by 25 percent, excluding Rural Towns and Developing Suburbs.

B.8 All Built environment measures – Increase land use mix, household density, sidewalk coverage, transit accessibility, and intersection density, and reduce the availability of free parking.

Combine policies to focus growth and make changes to the built environment to reduce VMT

Combining policies to encourage population growth in low-VMT communities with those that help to reduce VMT in existing communities is likely to offer the largest reductions in passenger VMT.

C.1 A.1 and B.1 – Shift 50 percent of projected population growth to the next higher density Community Type and increase land use mix.

C.2 A.2 and B.1 – Shift 50 percent of projected population growth in the suburban Community Types into urban Community Types and increase land use mix.

C.3 A.1 and B.2 – Shift 50 percent of projected population growth to the next higher density Community Type and increase household density.

C.4 A.2 and B.2 – Shift 50 percent of projected population growth in the suburban Community Types into urban Community Types and increase household density.

C.5 A.1 and B.8 – Shift 50 percent of projected population growth to the next higher density Community Type and enact all built environment measures.

C.6 A.2 and B.8 – Shift 50 percent of projected population growth in the suburban Community Types into urban Community Types and enact all built environment measures.

Findings

Table 7 details the results of the scenario analysis. The most effective single way to reduce VMT proved to be reducing the distance from residences to retail establishments, i.e. increasing land use mix. Increasing land use mix (B.1) could reduce statewide passenger VMT by 4.3 percent by 2040, relative to the business-as-usual (BAU) scenario. Implementing all built environment measures (B.8) could reduce VMT by 13.6 percent by 2040. If all built environment measures are enacted and population growth is focused in more urban areas (C.6), VMT could be reduced by more than 15 percent relative to BAU by 2040. Only the policy packages that include all built environment measures would be expected to reduce statewide passenger VMT below its 2010 level by 2040.

The relatively minor impact of scenarios A.1 and A.2, which shift population growth to lower VMT areas of the state is due to the state's relatively slow population growth, in faster growing states these types of strategies would be likely to have a larger impact.

TABLE 7 Projected Policy Impacts

Scenario		Change in VMT from BAU 2020	Percent change in VMT from BAU 2020	Change in VMT from BAU 2030	Percent change in VMT from BAU 2030	Change in VMT from BAU 2040	Percent change in VMT from BAU 2040
A.1	Shift 50% of forecast population growth into next highest density Community Type	-759,274	-0.6%	-1,420,902	-1.1%	-1,733,820	-1.3%
A.2	Shift 50% of forecast population growth in Developing Suburbs and Maturing Suburbs into Regional Urban Centers and Inner Core	-954,754	-0.8%	-1,785,854	-1.4%	-2,168,419	-1.6%
B.1	Increase land use mix	-1,738,728	-1.4%	-3,666,144	-2.9%	-5,637,363	-4.3%
B.2	Increase household density (outside of Rural Towns)	-968,256	-0.8%	-2,056,665	-1.6%	-3,195,033	-2.4%
B.3	Increase land use mix and household density	-2,706,984	-2.2%	-5,722,809	-4.5%	-8,832,396	-6.7%
B.4	Improve sidewalk coverage (outside of Rural Towns and Developing Suburbs)	-1,429,499	-1.2%	-3,017,573	-2.4%	-4,665,041	-3.5%
B.4	Improve transit accessibility (outside of Rural Towns and Developing Suburbs)	-576,957	-0.5%	-1,211,083	-0.9%	-1,858,409	-1.4%
B.6	Increase intersection density (outside of Inner Core)	-397,314	-0.3%	-837,520	-0.7%	-1,286,970	-1.0%
B.7	Decrease availability of free parking (outside of Rural Towns and Developing Suburbs)	-371,682	-0.3%	-792,484	-0.6%	-1,239,968	-0.9%
B.8	All built environment variables	-5,482,436	-4.5%	-11,581,469	-9.1%	-17,882,784	-13.6%
C.1	A.1 + B.1	-2,483,679	-2.0%	-5,033,547	-3.9%	-7,273,277	-5.5%
C.2	A.2 + B.1	-2,674,624	-2.2%	-5,381,587	-4.2%	-7,677,814	-5.8%
C.3	A.1 + B.2	-1,727,866	-1.4%	-3,478,386	-2.7%	-4,929,591	-3.8%
C.4	A.2 + B.2	-1,929,818	-1.6%	-3,867,666	-3.0%	-5,408,588	-4.1%
C.5	A.1 + B.8	-6,242,118	-5.2%	-13,003,535	-10.2%	-19,616,322	-14.9%
C.6	A.2 + B.8	-6,450,623	-5.3%	-13,418,009	-10.5%	-20,144,442	-15.3%

Conclusion

The scenarios examined above assume relatively modest changes to the built environment over a period of more than two decades. Under the scenarios that involve changes to the built environment, high-VMT suburban areas would be developed to more closely resemble existing lower-VMT areas in the state.

The results of the analysis demonstrate that modest changes can have significant impacts over time, even in a slow growing state like Massachusetts. The changes to the built environment modeled in the scenarios above do not make up an exhaustive list; due to time and data limitations it was not possible to assess the effect of bicycle networks, the relative importance of different types of retail, or the importance of schools, parks, or other non-retail neighborhood destinations. In addition, because the focus of this project was on residential passenger travel based on home location, the effects of smart growth at regional destinations—including employment, commercial, and entertainment centers—was not addressed.

Despite these caveats, it is clear that policies that increase residential access to destinations through density, land use mix, and better connected transportation networks that support non-auto modes can significantly reduce VMT.

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