5.1. ANTICIPATED FUTURE POPULATION AND EMPLOYMENT

In addition to documenting the current usage and performance of the transportation system, which was detailed in the previous chapter, the LRTP is required to examine the future usage and performance of the transportation system as well. This assessment makes use of the regional travel demand model, with future population and employment projections and the transportation projects that we anticipate completing during this plan.

The SMTC’s travel demand model was recently updated to a base year of 2017 and a horizon year of 2050 for the purposes of this LRTP and other planning efforts, including the work for I-81. The socioeconomic data (households and jobs) in the model were updated based on a variety of datasets, including 2016 American Community Survey (ACS) 5-year data\(^1\) and 2017 NYS Department of Labor employment data. Horizon year socioeconomic data was developed using various available forecasts and analyzing trends, as well as meetings with local planning agencies and municipal representatives. In meetings with local representatives, the previous horizon year (2035) household and population data were used as a starting point. The general consensus was to retain the 2035 conditions out to 2050 with a few exceptions. The local representatives identified site-specific locations of growth or decline in their geographic areas of expertise. This information was used to refine future development patterns in the region, without altering the estimated total future population and employment numbers. The projections for the City of Syracuse were updated based on Census data trends, which showed a lower level of decline than had been previously

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\(^1\) The model update is a lengthy process, which began in 2018. At that time, the 2016 ACS was the latest available 5-year data set.
SMTC’s travel demand model is a “four step model” that can be used to predict the amount, type, and location of travel that residents will undertake, now and in the future. The model uses inputs such as population and economic forecasts, the geographic dispersion of people and jobs throughout the region, and a description of the transportation system (roads and transit system). The model outputs can be used to evaluate the regional impact of changes to the transportation system, changes in land use, or changes in policy (such as pricing). The travel demand model cannot forecast future land use or evaluate traffic operations at specific intersections. In addition to its use for the LRTP and CMP, the SMTC utilizes the travel demand model in subarea or corridor studies, which may include evaluating different development patterns, such as infill development or more dispersed development, or the impacts of different levels of density or types of uses (commercial or residential, for example). The model can also be used to evaluate the impact of additional road connections on travel patterns in the region. Recent studies such as the US 11 Corridor Study and the Fayetteville Route 5 Transportation and Land Use Analysis have included use of the travel demand model to determine the potential impacts of future development, and inform the creation of planning-level concepts for land use and transportation system changes.
expected. Feedback from local representatives also supported using the previous 2035 employment numbers for the new 2050 horizon year. There was an overall consensus on this assumption since current economic conditions have slowed growth for several years and in some sectors have created a decline. In addition, local representatives provided updated information on site-specific development plans as well as projected job gains/losses by sector. However, the horizon year employment total increased slightly in the most recent model update based on Woods and Poole Economics’ employment projections and trend analysis using newly available employment data from the NYS Department of Labor and U.S. Bureau of Labor Statistics.

**Socioeconomic data updates for the travel demand model**

Part of the recent updates to the travel demand model involved moving the base year from 2007 to 2014 and then to 2017, and the horizon year from 2035 to 2050. The SMTC met with a variety of stakeholders to update the socioeconomic data in the model. The Empire State Development Corporation and the New York State Department of Labor provided information on current conditions and trends at the state level. The Central New York Regional Planning and Development Board, Syracuse-Onondaga County Planning Agency, Onondaga County Office of Economic Development, CenterState Corporation for Economic Opportunity, City of Syracuse Department of Neighborhood and Business Development, City of Syracuse Industrial Development Agency, and the City of Syracuse Bureau of Planning & Sustainability provided feedback on socioeconomic data at the city, county and region level. Additionally, in 2009, the SMTC collected information from local representatives from the Towns of Camillus, Cicero, Clay, DeWitt, Lysander, Manlius, Onondaga, Salina, and Van Buren. These municipalities were determined to be the most dynamic in regards to household and employment change over the 33 year modeling period.

In addition to the database compiled during meetings with local representatives, other datasets were referenced to update the model data to 2017 and 2050, including:

- 2010 U.S. Census data
- 2016 U.S. Census American Community Survey (ACS) 5-year data
- 2017 parcel data for Onondaga County (Syracuse-Onondaga County Planning Agency)
- 2017 Infogroup data on employers with 10+ employees (NYSDOT)
- 2017 Onondaga County employment totals by sector (New York State Department of Labor)
- 2015-2018 aerial photography for household and employment location confirmation (NYSDOT)
- 2017 U.S. Bureau of Economic Analysis (BEA) Onondaga County full-time employment by industry sector (CA25N)
- 2050 employment projections by sector and population projections for Onondaga County (Woods and Poole Economics, Inc.)
- 2040 population projections for Onondaga County (Cornell University Program on Applied Demographics).

For full details on the data used in the model update, see the SMTC Travel Demand Model Documentation.
Table 5.1 summarizes the household and employment data by municipality for the SMTC’s travel demand model. The total number of households in the region is projected to grow by 5.8 percent between 2017 and 2050, and the number of jobs in the region is projected to grow by 13.4 percent over the same timeframe. Figure 5.1 and Figure 5.2 show the change in household density and employment density, respectively, from 2017 to 2050.

### Table 5.1: Households and jobs by municipality in the SMTC travel demand model

<table>
<thead>
<tr>
<th>Town/ City</th>
<th>2017</th>
<th>2050</th>
<th>Change</th>
<th>Percent Change</th>
<th>2017</th>
<th>2050</th>
<th>Change</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camillus</td>
<td>10,230</td>
<td>11,017</td>
<td>787</td>
<td>7.7%</td>
<td>7,975</td>
<td>8,850</td>
<td>875</td>
<td>11.0%</td>
</tr>
<tr>
<td>Cicero</td>
<td>12,502</td>
<td>13,570</td>
<td>1,068</td>
<td>8.5%</td>
<td>13,039</td>
<td>14,418</td>
<td>1,379</td>
<td>10.6%</td>
</tr>
<tr>
<td>Clay</td>
<td>24,141</td>
<td>26,322</td>
<td>2,181</td>
<td>9.0%</td>
<td>22,736</td>
<td>30,207</td>
<td>7,471</td>
<td>32.9%</td>
</tr>
<tr>
<td>DeWitt</td>
<td>11,737</td>
<td>12,039</td>
<td>302</td>
<td>2.6%</td>
<td>44,185</td>
<td>48,655</td>
<td>4,470</td>
<td>10.1%</td>
</tr>
<tr>
<td>Elbridge</td>
<td>2,360</td>
<td>2,497</td>
<td>137</td>
<td>5.8%</td>
<td>2,466</td>
<td>3,391</td>
<td>925</td>
<td>37.5%</td>
</tr>
<tr>
<td>Fabius</td>
<td>728</td>
<td>778</td>
<td>50</td>
<td>6.9%</td>
<td>605</td>
<td>619</td>
<td>14</td>
<td>2.3%</td>
</tr>
<tr>
<td>Geddes</td>
<td>7,490</td>
<td>7,472</td>
<td>-18</td>
<td>-0.2%</td>
<td>7,805</td>
<td>8,396</td>
<td>591</td>
<td>7.6%</td>
</tr>
<tr>
<td>Granby</td>
<td>44</td>
<td>47</td>
<td>-3</td>
<td>6.8%</td>
<td>9</td>
<td>10</td>
<td>1</td>
<td>11.1%</td>
</tr>
<tr>
<td>Hastings</td>
<td>3,901</td>
<td>4,253</td>
<td>352</td>
<td>9.0%</td>
<td>2,508</td>
<td>2,799</td>
<td>291</td>
<td>11.6%</td>
</tr>
<tr>
<td>LaFayette</td>
<td>2,000</td>
<td>2,240</td>
<td>240</td>
<td>12.0%</td>
<td>1,079</td>
<td>1,131</td>
<td>52</td>
<td>4.8%</td>
</tr>
<tr>
<td>Lysander</td>
<td>8,945</td>
<td>10,476</td>
<td>1,531</td>
<td>17.1%</td>
<td>6,364</td>
<td>8,444</td>
<td>2,080</td>
<td>32.7%</td>
</tr>
<tr>
<td>Manlius</td>
<td>13,731</td>
<td>14,647</td>
<td>916</td>
<td>6.7%</td>
<td>10,530</td>
<td>11,213</td>
<td>683</td>
<td>6.5%</td>
</tr>
<tr>
<td>Marcellus</td>
<td>2,479</td>
<td>2,835</td>
<td>356</td>
<td>14.4%</td>
<td>1,651</td>
<td>1,797</td>
<td>146</td>
<td>8.8%</td>
</tr>
<tr>
<td>Onondaga</td>
<td>9,263</td>
<td>10,527</td>
<td>1,264</td>
<td>13.6%</td>
<td>7,586</td>
<td>8,283</td>
<td>697</td>
<td>9.2%</td>
</tr>
<tr>
<td>Onondaga Nation</td>
<td>306</td>
<td>306</td>
<td>0</td>
<td>0.0%</td>
<td>125</td>
<td>126</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Otisco</td>
<td>978</td>
<td>1,013</td>
<td>35</td>
<td>3.6%</td>
<td>290</td>
<td>311</td>
<td>21</td>
<td>7.2%</td>
</tr>
<tr>
<td>Pompey</td>
<td>2,557</td>
<td>2,832</td>
<td>275</td>
<td>10.8%</td>
<td>446</td>
<td>512</td>
<td>66</td>
<td>14.8%</td>
</tr>
<tr>
<td>Salina</td>
<td>15,179</td>
<td>15,331</td>
<td>152</td>
<td>1.0%</td>
<td>20,189</td>
<td>21,654</td>
<td>1,465</td>
<td>7.3%</td>
</tr>
<tr>
<td>Schroeppl</td>
<td>3,357</td>
<td>3,570</td>
<td>213</td>
<td>6.3%</td>
<td>1,722</td>
<td>1,823</td>
<td>101</td>
<td>5.9%</td>
</tr>
<tr>
<td>Skaneateles</td>
<td>3,019</td>
<td>3,128</td>
<td>109</td>
<td>3.6%</td>
<td>4,646</td>
<td>5,061</td>
<td>415</td>
<td>8.9%</td>
</tr>
<tr>
<td>Spafford</td>
<td>724</td>
<td>778</td>
<td>54</td>
<td>7.4%</td>
<td>1,72</td>
<td>183</td>
<td>11</td>
<td>6.4%</td>
</tr>
<tr>
<td>Sullivan</td>
<td>6,253</td>
<td>6,717</td>
<td>464</td>
<td>7.4%</td>
<td>4,646</td>
<td>4,968</td>
<td>322</td>
<td>6.4%</td>
</tr>
<tr>
<td><strong>Syracuse</strong></td>
<td><strong>69,978</strong></td>
<td><strong>71,642</strong></td>
<td><strong>1,664</strong></td>
<td><strong>2.4%</strong></td>
<td><strong>102,078</strong></td>
<td><strong>114,971</strong></td>
<td><strong>12,893</strong></td>
<td><strong>12.6%</strong></td>
</tr>
<tr>
<td>Tully</td>
<td>1,083</td>
<td>1,173</td>
<td>90</td>
<td>8.3%</td>
<td>1,063</td>
<td>1,158</td>
<td>95</td>
<td>8.9%</td>
</tr>
<tr>
<td>Van Buren</td>
<td>6,074</td>
<td>6,672</td>
<td>598</td>
<td>9.8%</td>
<td>3,997</td>
<td>4,483</td>
<td>486</td>
<td>12.2%</td>
</tr>
<tr>
<td>West Monroe</td>
<td>1,428</td>
<td>1,516</td>
<td>88</td>
<td>6.2%</td>
<td>423</td>
<td>462</td>
<td>39</td>
<td>9.2%</td>
</tr>
<tr>
<td><strong>MPA Total</strong></td>
<td><strong>220,487</strong></td>
<td><strong>233,358</strong></td>
<td><strong>12,871</strong></td>
<td><strong>5.8%</strong></td>
<td><strong>267,276</strong></td>
<td><strong>303,125</strong></td>
<td><strong>34,849</strong></td>
<td><strong>13.4%</strong></td>
</tr>
</tbody>
</table>

Note: Households include group quarters
Change in number of households per square mile (by TAZ)

- Decline of greater than 1,000
- Decline of 500 - 1,000
- Decline of 100 - 500
- Decline of 0 - 100
- No Change
- Growth of 0 - 100
- Growth of 100 - 500
- Growth of 500 - 1,000
- Growth of greater than 1,000

Source: SMTC Travel Demand Model
FIGURE 5.2: CHANGE IN EMPLOYMENT DENSITY, 2017-2050

Change in number of jobs per square mile (by TAZ)
- Decline of greater than 500
- Decline of 250 - 500
- Decline of 50 - 250
- Decline of 0 - 50
- No Change
- Growth of 0 - 50
- Growth of 50 - 250
- Growth of 250 - 500
- Growth of greater than 500

Source: SMTC Travel Demand Model
In absolute terms, the greatest increase in households is anticipated in the Town of Clay, with a gain of 2,181 households, or 9.0 percent growth. The second largest anticipated gain is in the City of Syracuse, with a net gain of 1,664 additional households (a 2.4 percent increase over 2017 conditions). Growth in the number of households within the city is concentrated within Downtown, University Hill, and the Lakefront area. A total of 2,876 new households are expected within these three areas, but since declines in households are anticipated within other areas of the city, the result is a net gain of 1,664 households in the city.

On the employment side, the city far outweighs any other municipality in the sheer number of new jobs anticipated (nearly 13,000). The towns with the most significant (in absolute terms) expected job growth include Clay (7,471 new jobs), DeWitt (4,470 new jobs), and Lysander (2,080 new jobs).

The future household and employment data were used to model a “Future No-Build” scenario. This scenario examines how the transportation system would operate in the future with the household and employment changes expected by 2050 but with no modifications to the existing transportation network. In other words, the transportation system would stay the same as it is today, but population and jobs would continue to grow/decline as noted in Table 5.1.

### 5.2 Anticipated Future Transportation Projects

In addition to a Future No-Build scenario, the SMTC also modeled a scenario that included anticipated future transportation projects in combination with the 2050 household and employment projections. This represents the Anticipated Future scenario, since it includes the projects that the member agencies anticipate completing over the life of this LRTP. The City of Syracuse, NYSDOT, Onondaga County Department of Transportation (OCDOT), and Centro developed lists of future projects that they would like to complete to address known capacity or accessibility concerns, in addition to the priority projects identified at the beginning of the LRTP process (completion of the I-81 Viaduct Project, enhanced transit system, and regional trail network).
The following projects were included in the 2050 Anticipated Future scenario for travel demand modeling:

**New York State**
- Route 370 at John Glenn Boulevard intersection improvements
- Onondaga Lake Parkway safety improvements
- Reconstruct Route 11 at Route 49 intersection
- NY 31 at Thompson Road and South Bay Road intersection improvements
- Route 481 northbound off-ramp at Circle Drive
- I-81 interchange at Route 31
- Intersection improvements at NY 5 and NY 257

**Onondaga County**
- Caughdenoy Road and NY 31 improvements
- Buckley Road shared turn lane and Buckley Road/Bear Road intersection upgrades
- 7th North Street at Buckley Road intersection upgrades

**City of Syracuse**
- North/south/east/west corridors interconnect expansion
- James Street 3-lane cross-section from State Street to Grant Boulevard/Shotwell Park
- Conversion of downtown streets to two-way operation
- Roundabout at James Street/Shotwell Park/Grant Boulevard
- Water Street closure

**Centro**
- Reduction of peak and off-peak headways
- Express I-81 route with Park-n-Ride facilities
- Bus rapid transit (BRT) on James Street/South Avenue and from University Hill area to Destiny USA.

Additional details about these projects and how they were incorporated into the travel demand model can be found in the SMTC Travel Demand Model Documentation.
5.3 FUTURE SYSTEM PERFORMANCE
5.3.1 Vehicle miles traveled

Using the household and employment data as inputs, the travel demand model can provide estimates of daily vehicle miles traveled (DVMT) in the region. Table 5.2 provides DVMT estimates for the Syracuse MPA for the base year condition (2017), the 2050 Future No Build, and the 2050 Anticipated Future scenarios. As described in the previous sections, the 2050 Future No Build includes the household and employment projections developed by SMTC staff in coordination with various planning and economic development agencies and municipalities. The No Build scenario does not include any modifications to the existing transportation system. The 2050 Anticipated Future includes the same household and employment forecasts, but also includes transportation projects that the SMTC member agencies anticipate completing over the life of this plan.

The model outputs indicate a 3.5 percent increase in per capita DVMT and an increase in total DVMT of 10.7 percent from the 2017 existing conditions to the 2050 Anticipated Future conditions. The increase in VMT is a result of the household and job growth conditions used as inputs to the model. The population is anticipated to grow by about 6 percent from 2017 to 2050, with much of this growth expected in towns at the edges of Onondaga County (especially in the northern half of the county). Based on this scenario, the model predicts longer travel distances to the primary job centers in the city. Although a downward trend in VMT has been observed nationally in recent years, the VMT estimates for the SMTC MPA are the result of a model that is driven primarily by land use assumptions, not forecast based on VMT trend data. Note that the Anticipated Future transportation projects result in a very small increase in overall regional DVMT and per capita DVMT as compared to the 2050 Future No Build condition.

<table>
<thead>
<tr>
<th>Analysis year/scenario</th>
<th>Total DVMT (miles)</th>
<th>DVMT per capita (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 Base (existing)</td>
<td>12,190,000</td>
<td>24.28</td>
</tr>
<tr>
<td>2050 Future No Build</td>
<td>13,490,000</td>
<td>25.11</td>
</tr>
<tr>
<td>2050 Anticipated Future</td>
<td>13,500,000</td>
<td>25.13</td>
</tr>
<tr>
<td>Percent change, 2017 to 2050</td>
<td>10.7%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

Table 5.2: Daily vehicle miles traveled in the Syracuse MPA
Changing the projected VMT will require changes to the anticipated future pattern of development or shifts in mode choice. Achieving a significant VMT decrease would require a significant change in predicted development patterns and a reduction in suburban growth levels, as well as a significant number of drivers shifting to mass transit for a variety of trips.

### 5.3.2 Congestion measures on primary corridors

As discussed in Section 4.4.2, SMTC’s 2019 Congestion Management Process (CMP) examined various measures of congestion on a set of primary commuter and freight corridors in our region using 2018 NPMRDS data. That analysis provides a detailed assessment of existing congestion in the region. To examine the impacts of future growth and anticipated projects on congestion, outputs from the SMTC’s travel demand model were analyzed. Two measures of congestion were considered using the model outputs: volume-to-capacity (V/C) ratio and travel time index (TTI). Road segments were considered to be congested if V/C ratio is at or above 0.9, or if the TTI is 2.0 or greater. The results for each modeled scenario are summarized in Table 5.3.

In all scenarios – existing and future in both the AM and PM peak conditions – congestion as measured by V/C ratio is very low, at fewer than 5 miles, or less than 2 percent of the mileage of the primary commuter and freight corridors. More miles are considered congested when considering TTI, with 11 to 16 percent of the total primary commuter corridor mileage and 3 to 6 percent of the total primary freight corridor mileage operating with a TTI of 2.0 or higher.

#### Table 5.3: Congestion on primary commuter and freight corridors

<table>
<thead>
<tr>
<th>Analysis year/scenario</th>
<th>Miles with V/C ≥0.9 (% of total mileage)</th>
<th>Miles with TTI ≥2.0 (% of total mileage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AM peak</td>
<td>PM peak</td>
</tr>
<tr>
<td><strong>Primary commuter corridors (313 miles total)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017 Base (existing)</td>
<td>1.94 (0.6%)</td>
<td>3.75 (1.2%)</td>
</tr>
<tr>
<td>2050 Future No Build</td>
<td>2.86 (0.9%)</td>
<td>4.46 (1.4%)</td>
</tr>
<tr>
<td>2050 Anticipated Future</td>
<td>2.97 (0.9%)</td>
<td>4.80 (1.5%)</td>
</tr>
<tr>
<td><strong>Primary freight corridors (234 miles total)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017 Base (existing)</td>
<td>1.84 (0.8%)</td>
<td>2.94 (1.3%)</td>
</tr>
<tr>
<td>2050 Future No Build</td>
<td>1.92 (0.8%)</td>
<td>3.24 (1.4%)</td>
</tr>
<tr>
<td>2050 Anticipated Future</td>
<td>2.03 (0.9%)</td>
<td>3.24 (1.4%)</td>
</tr>
</tbody>
</table>
By both measures, congestion increases from the 2017 Base condition to the 2050 Future No Build scenario, but the increase is relatively small. The largest increase indicated by these results is an additional 4.4 miles of the primary commuter corridors in the AM peak with a TTI of 2.0 or higher. The 2050 Future No Build and the 2050 Anticipated Future show nearly identical results for the congested mileage based on both measures.

5.3.3 EMISSIONS AND ENERGY ANALYSIS

In addition to the existing emissions assessment discussed in Chapter 4, the SMTC also utilized the U.S. EPA’s MOVES2014b model to estimate on-road mobile source emissions and energy usage associated with the 2050 Future No Build and 2050 Anticipated Future scenarios. The results of this analysis are shown in Tables 5.4 and 5.5, and a more detailed explanation of this analysis can be found in Appendix D.

This analysis indicates a significant drop in emissions from the 2017 Base scenario to the 2050 Future No Build scenario. This is primarily because the MOVES model assumes increases in vehicle efficiency in future years. As older vehicles leave the fleet and are replaced by

Telework in response to COVID-19

In March 2020, attics, basements, and spare bedrooms became the most valuable new office space in New York State. Governor Cuomo’s response to the coronavirus pandemic resulted in the temporary closure of all non-essential businesses on March 20th, forcing many office workers to work from home. By March 23rd, daily VMT in Onondaga County had fallen by 48 percent (StreetLight, 2020), video conferencing surged in popularity across the country (marketwatch.com, 2020), and webcams became such a critical piece of home office equipment that they were nearly impossible to buy (washingtonpost.com, 2020). While the technology for teleworking has been available for years (the term was coined in 1973), it has been slow to catch on for a variety of reasons. If the coronavirus pandemic demonstrates that telework is a viable alternative to commuting, it could have a long-term effect on how Americans view work and workplaces and could reduce daily traffic congestion. This is a trend that transportation planners will be monitoring carefully for long-term implications.

Sources:

The modeling indicates a slight increase in congestion between 2017 and 2050.
Future emissions are expected to decline substantially, primarily due to anticipated increases in fuel efficiency for passenger vehicles.

New York State’s 2015 Energy Plan includes the goal of achieving a 40 percent reduction in greenhouse gas emissions from 1990 levels by 2030. One element of this plan is encouraging drivers to switch over to zero emission vehicles (ZEV) such as plug-in electric vehicles. Through the ChargeNY program, the state is supporting new electric vehicle charging stations and offering rebates to consumers who buy electric vehicles. There are over 3,400 charging stations statewide (NYSERDA, 2019a). Annual electric vehicle registrations in New York increased from 4,600 in 2014 to over 17,000 in 2018 (NYSERDA, 2019b).

While VMT is expected to increase in the Syracuse MPA from 2017 to 2050, the overall on-road mobile source emissions are expected to decrease substantially. Similarly, the energy analysis shows a decrease in total energy use between the 2017 Base and 2050 Future No Build scenarios. An additional, though relatively small, decrease in energy use is associated with the 2050 Anticipated Future scenario.
5.4 FUTURE MODELING SUMMARY

The SMTC's regional travel demand model and the MOVES emissions model were used to determine the expected future usage and performance of the region's transportation system. In addition to the existing 2017 Base scenario, the modeling was completed for two future scenarios: 2050 No Build (with no changes to the current transportation system) and 2050 Anticipated Future (with transportation projects identified by the SMTC's member agencies as likely to be implemented before 2050). Based on various data sources and input from local planning and economic development agencies, the future model scenarios include an increase in total households and total jobs in the MPA of about 6 percent and 13 percent, respectively.

Total DVMT in the region is expected to increase by 10.7 percent from the 2017 condition to the year 2050 with the Anticipated Future transportation projects. The Anticipated Future transportation projects result in a very small increase in overall regional DVMT and per capita DVMT as compared to the 2050 Future No Build condition. The travel demand modeling for the Future No Build scenario indicates a small increase in congestion from the existing conditions, and minimal additional change with the anticipated future transportation projects.

The emissions and energy analysis both showed substantial improvement (fewer emissions and less energy consumed) from the 2017 Existing scenario to the 2050 Future No Build scenario, largely related to the anticipated efficiency increases in the vehicle fleet. The addition of the transportation projects identified in the 2050 Anticipated Future scenario results in a small decrease in energy consumed as compared to the 2050 Future No Build.

In summary, the modeling provides future estimates of congestion, emissions, and energy consumed. By nearly all measures, the projects included in the 2050 Anticipated Future scenario result in minimal changes, therefore, all of these projects were retained in the LRTP process and progressed to the financial analysis, as described in Chapter 6.
5.5 EMERGING TRENDS IN TRANSPORTATION TECHNOLOGY

In the second half of the 20th Century, improvements in transportation were primarily variations on existing technologies, with safety and fuel efficiency being two of the areas in which consumers saw the most dramatic progress. In the past ten years, several transportation innovations with revolutionary possibilities have emerged, including transportation network companies (TNCs) like Uber and Lyft, drone technology, and driverless vehicles. Artificial intelligence, remote sensing, wireless connectivity, and communications have been integrated into transportation in unprecedented ways, reshaping our expectations for both personal mobility and goods movement. Looking ahead, it is not unrealistic to imagine a transportation system that is orders of magnitude safer, cleaner, and more efficient than ever before. Some of the critical elements of such a system are already in place in cities around the country.

5.5.1 AUTONOMOUS VEHICLES

Over the past 20 years, the idea of the fully autonomous vehicle (AV) has gone from science fiction to nearly attainable. In 2019, Tesla released a “Smart Summoning” feature that – while imperfect – gave its vehicles the ability to navigate through parking lots for up to 200 feet on their own to find their owners (Hamilton, 2019). Also in 2019, Waymo, the self-driving car startup from Alphabet (Google’s parent company), began deploying driverless cars (without a human behind the wheel) to a pre-selected group of ride-hailing app users in a 50-square-mile area in Arizona (Hawkins, 2019). Meanwhile, the technology being built into consumer vehicles gets more advanced every year, bringing greater levels of automation into the market.

The terms “self-driving” and “autonomous” are sometimes broadly applied to all of these automated systems, but no vehicles on the market today are truly autonomous, in the sense of being able to operate on all roads in all kinds of weather without a driver. The Society of Automotive Engineers (SAE) uses the following six levels to describe vehicle automation, ranging from totally controlled by a human driver to totally controlled by autonomous systems:

New technology brings new acronyms

**Autonomous Vehicle (AV):** A vehicle that has some degree of automated driver assistance, including full or partial automation in which the vehicle no longer requires the active participation of a driver.

**Connected Vehicle (CV):** A vehicle that is able to communicate wirelessly with other vehicles, infrastructure, and other roadway users. Connected vehicles have on-board equipment that is able to receive, process, and transmit signals.

**Light Detection and Ranging (LIDAR):** High-resolution radar that provides a detailed real-time digital map of the surrounding area. Typically used on vehicles to provide a precise situational awareness for on-board systems to react to.

**Roadside Unit (RSU):** Devices that operate from a fixed position or on a portable device that send messages to, and receive messages from, nearby vehicles via short-range radio signals.
Level 0, No automation: a human driver directly controls how fast the vehicle goes and where it goes. Features like lane departure or blind spot warning are still considered Level 0 automation, since the system only warns the driver - it does not take control of steering to avoid the problem.

Level 1, Driver assistance: a human driver controls most of the vehicle's functions, but a driver support feature, such as adaptive cruise control or lane centering technology, is able to take over either steering or braking/acceleration.

Level 2, Partial automation: at this level, the vehicle can both steer and accelerate/decelerate on its own, but a human driver must be ready to take over in an emergency. Critically, the human driver is clearly responsible for whatever the vehicle does (Peng, 2018). This level of automation is being built into vehicles now, for example, in GM’s Super Cruise, Tesla’s Autopilot, and Nissan’s ProPilot Assist.

Level 3, Conditional automation: Level 3 is the automation level at which many autonomous vehicles have been tested in recent years. At this level, the vehicle can navigate through city streets and obey traffic signals, but a driver must be behind the wheel ready to take over at all times. Some car manufacturers have been hesitant to implement
Level 3 technology for consumers, because a human driver who is only periodically needed may tend to get distracted. Also, because the driver is present but not necessarily in control of the vehicle at all times, it is not clear whether the automation or the human is responsible for what the car does at this level (Bigelow, 2019).

Level 4, High automation: the human driver is necessary for some aspects of driving, like getting the car to the freeway, but not needed for other tasks, such as self-parking or driving in a specific geographic area or on a specific route. The distinction between Level 3 and Level 4, according to the SAE, is that, if the automated system fails for some reason, Level 4 vehicles can get themselves to a “minimal risk condition” (such as pulling over to the shoulder and stopping) without human intervention. Waymo’s self-driving vehicles, currently operating within specific geographic limits in Arizona, are Level 4 vehicles. It seems likely that vehicles with Level 4 automation will become widely available to consumers (especially via ridesharing) between 2020 and 2025.

Level 5, Full Automation: a human driver is not needed, automated systems are always in operation, the vehicle’s autonomous operation is not limited by weather, and the vehicle can go anywhere at any speed. This is the definition of a truly “autonomous” vehicle. Getting to full Level 5 automation has proven challenging and estimates of when it will be available to consumers typically fall between 2025 and 2030.

The implications of Level 1 and 2 vehicles in the mass market are fairly straightforward. These technologies offer safety improvements without dramatically altering the experience of driving. Level 2 automation is advertised primarily in the context of freeway driving. Level 3 vehicles are slightly less straightforward: drivers gain a greater ability to disengage from the road, particularly on the freeway, but may not be ready to take control when needed. Turning commute time into relaxation or productive time may not be possible, or recommended, at this level.

At Levels 4 and 5, however, vehicles can be programmed for routines like a daily commute, or to park themselves after dropping off passengers. This may mean that new options are available for people.
who do not own, or no longer wish to own, a car: they may be able to subscribe to a service that lets them summon a car. The car would drive its passenger to their destination and, from there, either pick someone else up or park itself. If cars can park themselves, it may not be necessary to have large parking facilities in cities’ business districts. Parking areas could be moved to suburban or rural areas, freeing up space in cities for new development.

Given existing land use and commuting patterns, however, one implication of a world of shared AVs is that many trips would include a “zero occupant vehicle” (ZOV) leg that would equate to added vehicle miles traveled. During morning commute periods, for example, the number of people interested in getting from suburban communities to Downtown Syracuse is much greater than the number of people interested in the reverse commute. Most of the AVs returning to the suburbs to pick up passengers would be ZOVs, adding a completely new source of VMT and vehicle emissions (assuming the vehicles in question run on fossil fuels).

At Level 5 automation, travel time may no longer be considered wasted time (Schneider, 2018). If the vehicle is able to drive itself, passengers’ options for how to spend travel time expand. Commute time could be used for entertainment, sleeping, working, or a variety of other productive uses, altering how commuting is perceived and making long commutes less onerous. In some places, an onerous commute is one of the few checks on how far from a city development will sprawl. If commute time is no longer considered wasted time, it could alter the development potential of exurban areas, extending the reach of suburban sprawl.

In the Syracuse region, commute time is not a major factor limiting the range of suburban development. The average commute time in our region is 20.5 minutes - five minutes below the national average. There are plenty of undeveloped, rural areas within a 20 to 25-minute drive of the employment centers in the heart of Syracuse. Level 5 vehicle automation may not have the same effect on rural development here that it could have in larger, more thoroughly developed, metropolitan areas.
5.5.2 Connected vehicles and infrastructure

Like autonomous vehicles (AVs), connected vehicles (CVs) have come a long way in a short period of time. Connected vehicles use a combination of communications technology, including Wi-Fi and short range radio frequencies, to send signals from one vehicle to another (vehicle-to-vehicle connections, also called V2V), between vehicles and infrastructure (vehicle-to-infrastructure, also called V2I), and between vehicles and “nomadic devices” – possibly mobile phones, possibly some yet-to-be-developed device – worn or carried by pedestrians and cyclists to communicate their position to nearby vehicles. Because of the number of different connections that these technologies make possible, all of these forms of communication are sometimes called “V2X” – vehicle to everything – communication (McLellan).

Connected vehicle (CV) technology is currently being piloted in New York City, Tampa, Columbus, on the Interstate 80 corridor in Wyoming, and in a variety of other cities in the U.S. and around the world. In Tampa, 1,000 volunteers have had onboard units (OBUs) added to their vehicles to both send and receive messages. Nearly 50 small transmitters, called roadside units (RSUs) have been deployed on freeways and city streets. Radio signals from the RSUs can warn drivers of back-ups on freeway off-ramps, tell traffic signals to give buses a little more green-light time so they can make it through an intersection, and notify drivers of nearby pedestrians.

In the future, connected vehicle technology is a natural fit with Level 3, 4, and 5 autonomous vehicles. Vehicles in the CV pilot cities are currently able to send basic information to RSUs: their transmitters emit a signal that indicates their current position, speed, and heading. A vehicle that can not only “see” vehicles and pedestrians with LIDAR and other cameras, but can communicate with them via V2X signals, can stop or slow down before a collision happens. If a group of cars can form a platoon, in which all the vehicles are communicating speed, position, and heading with one another, they can safely move at high speeds with much less space between vehicles than with human drivers. This may mean that streets and highways can handle more vehicles than they currently do – effectively increasing roadway capacity without adding lanes.
Getting the most out of CV technology will mean large public investments in communications technology that is connected to infrastructure and that can both send signals to and receive signals from vehicles. This means not only the deployment of RSUs and other hardware (such as LIDAR units and cameras), but developing the capability to coordinate, maintain, and control these new technologies. This may not be very difficult for some roadway owners: NYSDOT has a long history of working with ITS. But at the county, city, town, and village levels, CV technology may challenge both budgets and organizational structures.

CV costs. CV technology costs vary widely depending on the type of equipment used. The National Operations Center of Excellence, which has been encouraging states to install CV technology in test corridors, says that the cost to install “a working system at an intersection can vary from $15k to $50k.” Recent installations have gotten as low as $5,000 per intersection, depending on the quality of existing signal hardware. (National Operations Center of Excellence, 2017).

RSUs, which are the lynchpin for signal transmission and reception at an intersection, are fairly inexpensive: most recent sources put their cost at $1,300 to $3,000. Additional costs include installation at, and calibration to, a specific intersection, as well as annual operations and maintenance costs.

Backhaul communication – the connection between an intersection and a regional transportation control center – can be extremely expensive and, depending on the location, a technical challenge. A 2014 estimate of average per-site backhaul costs developed by FHWA ranged from $3,000 to $40,000, depending largely on the availability of existing infrastructure, such as fiber optic cable or dedicated wireless communications (FHWA, 2014).

On-board units. To date, the greatest benefit of CV technology installations has been to give states and cities the opportunity to test ideas and create a body of research to draw on in the future, as this technology becomes ubiquitous. Very few vehicles have the equipment (generically referred to as on-board units, or OBUs) that can send
information to and receive information from RSUs. This kind of two-way communication is necessary, both for the system to work properly and to provide a benefit to drivers.

Automakers are not currently including OBUs in most vehicles – in fact, Toyota announced in early 2019 that it was suspending its V2X program (Caparella, 2019). In part this is due to a lack of consensus among automakers on which form of V2X communication to implement: some favor the Wi-Fi-like dedicated short-range communications (DSRC), but more are moving toward a cellular system. No automaker wants to be in the position of committing to one technology over the other until a consensus emerges as to which “language” cars and infrastructure will be “speaking”. On the other hand, it seems likely that the information supplied from RSUs on things like construction detours and signal phase information at complex intersections will be critical to the safe operation of Level 4 and 5 AVs.

This rendering imagines an intersection in Downtown Syracuse with connected technology. Cars and infrastructure communicate with one another, and can also detect pedestrians in the crosswalk and warn them of oncoming vehicles by way of handheld devices. All of Downtown’s traffic signals could be connected to a central transportation management center.
5.5.3 Transit

Over the next 20 years, mass transit systems will face increasing competition from on-demand transportation alternatives. Many sources report that TNCs have already had a negative effect on transit ridership, as well as contributing to an overall increase in VMT in some cities (Bresiger, 2018; Clewlow, 2017; Ehrhardt, 2019).

If Level 4 or 5 automation makes it possible to summon a relatively inexpensive AV in the near future, transit may lose even more riders. Centro, the transit operator in our region, is constantly battling funding shortfalls – it cannot afford to lose a substantial percentage of its ridership. And our region cannot afford to lose Centro. Most serious observers agree that the need for mass transit will remain for decades to come, notwithstanding major improvements in vehicles. Improvements to cars are unlikely to make people want to use cars less. Additionally, automation may add vehicles to streets and highways in the form of ZOVs. In terms of dealing with traffic congestion, AVs do not necessarily offer less congestion, they offer more ways to ensure that time spent in congestion is not purely “lost”. Transit, on the other hand, takes vehicles off of the road, reduces VMT, and offers the ability to move more people than a single-occupant vehicle. Improvements in transportation should be implemented in ways that make transit more viable and relevant, not less.

To remain competitive with other forms of transportation, transit operators are working to make bus service more appealing to riders. Improvements that are being implemented in other cities include:

- “Bus Only” lanes, often painted red, that give buses the exclusive right to use certain lanes. Dedicated bus lanes can dramatically speed up transit times.
- New ways to pay for transit rides, including paying by smartphone.
- Electric buses, which have been shown to be more reliable than buses with internal combustion engines.
- “Mobility as a service” systems that bring several modes of transportation, including transit, TNCs, and micro-mobility services (such as bike share or scooter share) together in a single digital platform.
Like other AVs, driverless buses exist, but are extremely rare and only work within very specific constraints, like running up and down a single street or on a pre-programmed route in an office park. The long-term promise of autonomous shuttles is that they will be significantly less expensive to operate than vehicles that involve a driver, making it possible to deploy more vehicles on more routes. In Contra Costa County, where Bishop Ranch office park has been experimenting with providing transit service by way of a driverless shuttle, the county’s transportation authority envisions deploying dozens of small, autonomous shuttles to ferry people between their homes and transit hubs (ABC7, 2018).

5.5.4 Mobility as a Service

The key to the future of personal mobility may already be in your pocket or purse. Smartphones can summon a ride through Uber, Lyft and other TNC apps. Smartphone apps also let people rent bikes and (in some cities) electric scooters. And your smartphone can help you figure out whether or not your bus is running on time. Around the world, companies are developing apps that bring all of these modes together, making it possible to plan and pay for them all in one place: micro-mobility (scooters and bikes), car sharing, ride sharing, and transit.

In its ideal form, this “mobility as a service” (MaaS) model would convert each household’s transportation expenditures (fuel, insurance, maintenance, monthly lease or loan payments) into a subscription-based system that expands mobility options, improves safety, and reduces travel times. Household car ownership may become as outdated as a shelf full of compact discs. MaaS could do this in a few different ways, but generally MaaS systems are characterized by autonomous, connected, electric, and shared transportation. In most cases, MaaS concepts are built around a robust mass transit system. As of August 2020, electric scooters and bicycles with electric assist motors are legal in New York State, making it easier to imagine a local

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2 For more information on the legalization of electric scooters and bicycles with electric assist, see the New York State Department of Motor Vehicles’ website: https://dmvny.gov/registration/electric-scooters-and-bicycles-and-other-unregistered-vehicles.
MaaS system that would combine, for example, a bus rapid transit line with bus shelters that are also scooter and bike-sharing hubs, allowing riders to move seamlessly between modes. A commuter’s trip to work might mean stepping off a bus and into a waiting AV or onto a reserved electric scooter, all pre-paid and planned with a smartphone app.

As MaaS programs evolve, they will mean investing in transit, modifying the use of curbside space, and creating micro-mobility hubs and the infrastructure to support them in suburban areas. In our region, suburban commuters have limited options: transit does not compete well with private vehicles, and the transit system is oriented around a central, downtown hub. MaaS could change this by putting Centro’s service at the heart of a larger system that includes a variety of transportation options.

### 5.5.5 Freight

Like passenger vehicles and transit, land-based freight vehicles are moving toward greater automation. Progress on driverless freight vehicles has been motivated, in part, by the large cost savings – on the order of $168 billion by one estimate - that freight companies anticipate from converting to autonomous freight delivery (Morgan Stanley, 2013).

This transition has implications for commercial drivers. In the Central New York region, roughly 7,200 people are employed as heavy truck/tractor-trailer drivers or light truck/delivery services drivers. But given that AV technology will probably remain at Level 4 for the near future, and given the fact that relatively few truck drivers only drive a truck – many more also deliver freight from the truck to a house, office, or store – long-haul drivers may be affected by the conversion to autonomous freight vehicles in greater numbers than local delivery drivers. In our region, this would mean that some portion of the region’s 4,800 tractor-trailer drivers would be impacted. It is not too early for job training centers in our region to develop ways to approach this transition, which will likely unfold over the next ten years.

Driverless freight vehicles also hold out the promise of safety and efficiency improvements. Level 4 trucks would presumably be able to operate on the interstate system without the current restrictions on...
numbers of hours of driving in a 24-hour period. This would shorten trip times and increase efficiency. Similarly, safety improvements would be considerable: in 2017, 148,000 people were injured in crashes involving large trucks nationwide. As automation increases, this number would be expected to fall dramatically.

5.5.6 UNMANNED AERIAL VEHICLES (UAVs)

The idea that consumers would be able to click the “buy” button on an online retailer’s website and have a product delivered to their front door or backyard by a drone within the hour is neither new nor something that most consumers have a great deal of faith in at this point. Amazon’s drone delivery service, Prime Air, was unveiled in 2013, with the prediction that it would be in use around the country within five years. This prediction did not come to fruition. Currently, very little freight is delivered in the U.S. by drones. Drone deliveries tend to be relatively small (under five pounds), high-value items delivered over short distances – critical medical supplies being one of the most frequently-cited uses for this technology.

To date, the Federal Aviation Administration (FAA) has been very cautious in its approvals of the use of unmanned aerial vehicles (UAVs) to deliver packages. In October 2019, the FAA granted UPS Flight Forward (a subsidiary of UPS) permission to run the first official drone airline. While the company can operate its UAVs in any part of the country, it must still receive FAA permission to allow vehicles to fly beyond the operator’s line of sight. Local municipalities will need to be aware of developments related to UAV traffic management and how communities can proactively influence approved flight corridors in the region.

Industry experts see many possibilities for the delivery of freight by UAVs. Drones present the possibility of making the last-mile element of deliveries much more efficient than a box truck winding its way through neighborhood streets, with a delivery person carrying each parcel to a front door. In the future, delivery drivers may be able to launch multiple short-range drones from their vehicles to deliver lightweight items within a specific radius, saving fuel and driving time. In a similar vein, Amazon and Wal-Mart have proposed “floating warehouse” ideas:
concepts for storing merchandise on an airship stationed above (or moving between) metropolitan areas, with individual items delivered by drone to customers when they are ordered.

Merchandise delivery via drones may, in time, cut delivery times down from days to hours. If this proves to be the case, it will alter the value of land currently used for brick-and-mortar retail. Physical stores’ greatest advantage over online shopping is instant gratification. Once online retailers can offer low-cost delivery by drone within one or two hours, that advantage is considerably reduced. In Central New York, we are already seeing the decline of two major shopping centers: Shoppingtown and Great Northern Malls. Other retail centers may follow as online shopping becomes more convenient and rapid delivery becomes the norm.

5.5.7 Policy Considerations

In many U.S. cities, the emergence of ride sharing apps and micromobility services (such as electric scooters) caught planners and policy makers by surprise. These services caught on very quickly and became more popular than expected. Similarly, most Americans were not fully aware until well into the 2010s of the degree to which personal information is collected and turned into a marketable product by technology corporations.

As new technologies become available, it will be important for local and state governments and agencies to develop policies to protect residents and ensure that the benefits of new transportation options are shared equitably. Local leaders should consider developing regulations and plans that will:

- Ensure AV affordability, ADA-accessibility, and sharing;
- Make VMT reduction a goal;
- Ensure that personal data is managed based on general public interest, with an emphasis on privacy;
- Ensure conduit and fiber optic cables are available for new and reconstructed infrastructure;
- Develop a blueprint for rolling out regional transportation-communication infrastructure, including RSUs, signal controllers, and supporting personnel;
• Identify which corridors in our region should include lanes designated for AVs only;
• Focus on moving people rather than moving vehicles;
• Integrate new technologies into the public space in an organized, efficient way, i.e. parking fees and/or congestion pricing, curb access policies, dockless bike/scooter/etc. share; and
• Ensure new lane markings and signage are “machine readable”.

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