THRIVE MONTGOMERY 2050 TRANSPORTATION ANALYSIS
JANUARY 2021

Contents

List of Tables

List of Figures

1 Executive Summary

In support of Thrive Montgomery 2050, the Montgomery County Planning Department conducted a transportation analysis to answer two questions:

- How could the county be impacted by ongoing trends related to the economy, climate change, demographics, technology, and lifestyle choices?
- Do these trends support the county's vision for the future, or are policy interventions needed to achieve the county's vision?

To examine the range of potential transportation outcomes, the policy measures were evaluated in the context of three scenarios: "Business as Usual," "On the Road," and "Home Alone Together." The analysis found that the uncertainty surrounding trends outside of the county's control could lead to very different outcomes for the county's transportation goals. An "On the Road" future that involves mass adoption of autonomous vehicles and where employment growth is focused on specific industries could lead to substantially higher numbers of vehicle trips, vehicle miles traveled (VMT) and travel times by automobile, compared to conditions in 2015. Conversely, a "Home Alone Together" future that involves the mass adoption of teleworking and e-commerce and where employment growth is focused broadly on a wide variety of jobs could see fewer vehicle trips, reductions in VMT and fewer trips by automobile, compared to conditions in 2015. The analysis found that population growth is also a significant contributor to growth in vehicle trips and VMT and to longer travel times by automobile.

Thrive Montgomery 2050 proposes a number of policies to help the county meet its economic health, equity and environmental resilience goals. The transportation analysis evaluated eight of these policies as a package that represents those thought to have the largest impact on the transportation metrics and that could be evaluated using the travel demand forecasting model. These included two land use policies and six transportation policies:

- Land Use Policies
  - Implement Complete Communities, as discussed in Thrive Montgomery 2050
  - Concentrate growth in existing commercial areas and transit areas
- Transportation Policies
  - Restrict the number of through travel lanes on transit corridors and reduce target speeds
  - Implement premium transit
  - Improve local bus service
  - Increase parking pricing
  - Increase auto travel pricing; reduce auto travel costs for travelers in the lowest income quartile
  - Improve local street network

Overall, the results from the Thrive Montgomery 2050 transportation analysis are encouraging as they show that county projects and policies have the ability to bend the curve in the growth of VMT, to increase access to local jobs via transit and to increase Non-Auto Driver Mode Share (NADMS). Still, the results indicate that the Thrive Montgomery 2050 policies are largely offsetting the impacts of population growth and the county may want to consider additional policies to address this. The four

policy types that stand out as having the greatest potential to further improve the transportation metrics include land use, teleworking, travel / parking pricing and regionalism.

1.1   Land Use

Perhaps the most significant reason that the results of the transportation analysis do not show more progress toward reaching the county's goals is related to the county's land use, particularly its housing patterns. In many ways, the transportation outcomes over the next 30 years will continue to be directly attributable to the land use decisions of the past. Much of suburban Montgomery County is not proposed to be changed by Thrive Montgomery 2050 and significant progress has already been made over the past 30 years to implement smart growth policies around Red Line and future Purple Line stations.

The policies in Thrive Montgomery 2050 focus on where new growth in the county will be located, but they do not reallocate existing housing stock. Consequently, the location of 96 percent of the county's dwelling units are not relocated by these policies. These areas include existing development; the growth already anticipated in the county's downtowns, town centers, and transit corridors; and existing and planned development in the incorporated jurisdictions. **To move closer to achieving the county's transportation goals, additional policies are needed to shift <u>existing</u> population and jobs from suburban communities to downtowns, town centers and transit corridors.**

For example, over time Montgomery County could acquire private property when it is put up for sale within the 100 or 500-year flood plain or expand the Agricultural Reserve. Or the county could create a market like the Transfer of Development Rights (TDR) program to buy up properties in these areas. There are likely multiple approaches the county could take, but without them, there is only so much that the transportation system can do given existing land use patterns.

1.2   Telework

While policies to encourage teleworking were considered during the development of Thrive Montgomery 2050, at the time the Alternative Futures were developed for this report they were not expected to contribute substantially to achieving the county's goals. The mass adoption of teleworking and e-commerce were assumed to be part of a technological innovation in the "Home Alone Together" scenario that would reduce trip generation by 25 percent over the next 30 years. What was thought to be a potential future when this project started over a year ago may now in fact be more a part of our actual future. The COVID-19 pandemic has shown the great potential that teleworking and e-commerce have to reduce VMT. In effect, the county may find itself closer to the "Home Alone Together" results for 2050, which generally were found to be more likely to move the county towards achieving its transportation goals.

As the country begins to get control over COVID-19 in the coming months and people begin to revert to their pre-COVID travel patterns, Montgomery County should pursue an effort to maintain an elevated level of teleworking, while seeking to offset some of its negative economic and social impacts.

1.3   Auto Travel and Parking Pricing

The transportation analysis evaluates the impacts of increasing the cost of travel by automobile and parking. The policies could take several forms, including a charge on VMT or congestion. To model these

policies, the assumption was that the cost of driving and parking would double. **Future studies will need to determine the extent to which the impact of these policies could be strengthened with higher charges.**

1.4   Regional Coordination

The transportation and land use recommendations in Thrive Montgomery 2050 are almost completely targeted at transportation conditions within the county. But many of the policies in Thrive Montgomery 2050 are most effective when pursued regionally. In particular, policies to increase the cost of travel by automobile are best pursued as part of a regional effort and will further incentivize travel by modes other than automobile. **Montgomery County will need to work with other jurisdictions in the region to institute policies, such as congestion pricing, to maximize their potential to reduce VMT.**

2   Introduction

As Montgomery County advances Thrive Montgomery 2050, its first comprehensive General Plan update in 50 years, it is important to reflect on how the county will change in the years to come. To do so, Montgomery Planning retained consulting services from Fehr & Peers DC to answer these questions:

- How could the county be impacted by ongoing trends related to the economy, climate change, demographics, technology, and lifestyle choices?
- Are these trends in support of the county's vision for the future, or are policy interventions needed to achieve the county's vision?

To address these questions, the Thrive Montgomery 2050 transportation analysis evaluated several relevant transportation metrics. The approach first evaluates how factors outside of the county's control (such as climate change and technological change), referred to as Drivers of Change in this report, could impact the county's transportation future, absent any new policy interventions. It then evaluates how several of the recommendations in Thrive Montgomery 2050 could help the county achieve its transportation vision.

3   Overview of the Analysis Approach

This section provides an overview of the approach that was used to conduct the Thrive Montgomery 2050 transportation analysis.

3.1   Alternative Futures

Many factors shape our communities. Some are within local or county control, while others are more far-reaching and are beyond the county's control, representing national or global trends. The scope of work for Thrive Montgomery 2050 outlines five of these overarching Drivers of Change: economic disruptions, climate change, demographic changes, technological innovations, and changes in lifestyle.

Regional travel demand forecasting models are the traditional approach that transportation planners use to understand future conditions. While these models incorporate changes to land use and the transportation system, they typically do not account for the Drivers of Change identified above. This "Business as Usual" approach has utility for many types of analysis, but it is less appropriate for a general plan that seeks to prepare the county to adapt to a rapidly changing world. With the potential for mass adoption of autonomous vehicles, teleworking and the automation of work, or flooding and extreme temperature fluctuations, the county's travel patterns in 30 years may not reflect past trends.

Therefore, in addition to evaluating the "Business as Usual" approach – the future that can be expected if the region continues to grow and change along its current path – the transportation analysis for Thrive Montgomery 2050 also evaluates four "Alternative Futures" that include fundamental changes to how people travel. Alternative Futures are plausible futures and incorporate a range of economic, environmental, demographic, technological and lifestyle changes that could occur in Montgomery County between today and 2050. So instead of predicting the impacts to the transportation system of a single future, this approach helps to understand a range of potential impacts that could reasonably occur.

Four Alternative Futures were developed to better understand the range of changes to the way people travel that could occur over the next 30 years. The main variability among them was based on Technological Innovations and Economic Disruptions, as explained below:

- Technological Innovations: Technological innovation is inevitable. Several of these anticipated innovations are linked to travel. One end of the spectrum represents technology trends that encourage travel, such as autonomous and electric vehicles. The other end of the spectrum represents technological trends that replaces travel, such as e-commerce, virtual reality, and video conferencing.
- Economic Disruptions: The economy is inextricably linked to the demographic, environmental, and equity outcomes for the region. One end of the spectrum represents a focus on existing Montgomery County industries and residents, encouraging local entrepreneurship, with no effort to attract outside businesses. The other end of the spectrum represents Montgomery County as a regional leader in attracting global corporations to establish employment opportunities in the county.

ALTERNATIVE FUTURES

"Alternative Futures" are plausible futures that incorporate a range of economic, environmental, demographic, technological and lifestyle changes that could occur in Montgomery County between today and 2050.

They are intended to help the County understand a range of possible outcomes that may arise over the next 30 years.

Alternative Futures are generated by forces outside of Montgomery County's control and are not a master plan scenario that the county can select to pursue.

Additionally, two land use-related considerations of "employment concentration" and "living preferences" were used to adjust corresponding land use distributions for each Alternative Future. For "employment concentration," "more concentrated employment" reflects a relatively larger effect of automation, resulting in shifts in employment growth from retail and industrial employment into office and other employment, which itself is more densely concentrated, while "less concentrated employment" shifts less job growth into more concentrated categories. All four Alternative Futures have more concentrated employment growth than the Business as Usual scenario.

For "living preference," "preference for more urban living" results in relocating household growth from less dense areas into more dense areas, while "preference for less urban living" shifts household growth from more dense areas into less dense areas.

For each of the future scenarios, the population, households and jobs were kept constant at the county level. Additionally, for each of the alternative futures all land use was removed from the 500-year flood plain due to climate change.

Different combinations of Technological Innovations, Economic Disruptions, employment concentration and living preferences were used to create these four Alternative Futures:

- On the Road
- Work Local, Play Local
- Home Alone Together
- Hello from the Other Side

Table 1 summarizes the conceptual transportation and land use characteristics of each Alternative Future.

It should be noted that the primary purpose of developing the Alternative Futures is not to select one scenario over another, but rather to identify different potential futures that are very different from each other. These scenarios are developed for analytical purposes, and in reality, the future may be a combination of elements of each.

A discussion of how the Alternative Futures were selected is provided in Attachment A.

Table 1: Alternative Futures Characteristics

Alternative Futures	On the Road	Work Local Play Local	Home Alone Together	Hello from the Other Side
Drivers of Change				
Technological Innovation	Tech enables travel	Tech enables travel	Tech replaces travel	Tech replaces travel
Economic Disruption	Outside business attraction	Organic growth	Organic growth	Outside business attraction
Land Use Considerations				
Employment Concentration	Much more concentrated	Much more concentrated	More concentrated	More concentrated
Living Preferences	Less urban	More urban	More urban	Less urban

Table 2 summarizes the differences among the Alternative Futures in the trip generation, trip distribution, and land use components of the travel demand forecasting model, compared to the Business as Usual scenario. The table shows that trip generation increases by 25 percent for the "On the Road" and "Work Local, Play Local" scenarios due to the mass adoption of autonomous vehicles, which would increase auto travel as these innovations make travel by automobile easier. Similarly, the table

shows that trip generation decreases by 25 percent for the "Home Alone Together" and "Hello from the Other Side" scenarios, reflecting that teleworking and e-commerce reduce the need to travel.

The table also shows that the relative attractiveness of shorter-duration trips would increase by 25 percent for the "Work Local, Play Local" and "Home Alone Together" scenarios due to organic growth in local business. The relative attractiveness of shorter-duration trips would decrease by 25 percent for the "On the Road" and "Hello from the Other Side" scenarios due to outside business attraction resulting in greater propensity to take more regional trips.

Table 2: Alternative Futures analysis approach

Alternative Futures		On the Road	Work Local Play Local	Home Alone Together	Hello from the Other Side
Trip Generation		+25%	+25%	-25%	-25%
Trip Distribution*		-50%	+50%	+50%	-50%
Land Use	Employment Concentration**	+40%	+40%	+20%	+20%
	Flooding	Remove/ reallocate	Remove/ reallocate	Remove/ reallocate	Remove/ reallocate
	Preference for Urban Living***	-50%	+50%	+50%	-50%

*percentage to increase (+) or decrease (-) relative attractiveness of shorter-duration trips
**percentage of retail and industry jobs to remove and reallocate to office and other jobs in concentrated locations, reflecting automation of work
***percentage of household growth to reallocate from less dense areas to more dense areas (+) or more dense areas to less dense areas (-) relative to Business as Usual (BAU)

Attachment B describes the Alternative Futures in greater detail and summarizes the adjustments that were made in the modeling process related to land use, trip generation, and trip distribution for each.

3.2   Metrics Evaluated

Several transportation metrics were evaluated, including: Non-Auto Driver Mode Share, vehicle miles traveled, travel time and job access. Results for each metric were then stratified by equity areas to determine if there is a difference between how equity areas perform with the metrics compared to non-equity areas, using the Metropolitan Washington Council of Governments (MWCOG) Equity Emphasis Areas (EEA) geographies. Additional details about the evaluation metrics can be found in Attachment C.

3.2.1   Non-Auto Driver Mode Share

Non-Auto Driver Mode Share (NADMS) reflects the share of person trips for which the individual traveler was not the driver of an automobile and is a proxy for understanding the county's decreasing reliance on automobiles. The calculation includes non-motorized (walk and bicycle) trips, transit trips, and trips by auto passengers in high-occupancy vehicles (HOV) as a share of all person trips.

3.2.2   Vehicle Miles Traveled

Vehicle Miles Traveled (VMT) represents the total daily miles traveled by automobiles and can be used to forecast emissions of greenhouse gases and particulate matter. Two VMT calculation approaches are applied:

- VMT for Trips Beginning or Ending in Montgomery County: this metric tallies the miles traveled by automobiles to the land uses at the origins and destinations of their trips.
- VMT on Roads in Montgomery County: this metric tallies the total daily miles traveled by automobiles on roads in Montgomery County regardless of their origins or destinations.

3.2.3   Travel Times

Travel time reflects the total amount of time spent traveling by auto and transit from the start to the end of the trip. Over the years, travel times have increased in the region and are now some of the highest in the nation. Three travel time metrics are included in the analysis:

- Total Daily Travel Time: Auto Travel Time and Transit Travel Time reflect the total amount of time spent traveling by auto and transit, respectively.
- Average Per-Trip Travel Time: The total travel times by mode described above are normalized by the number of trips by each mode to produce an average travel time per trip.
- Per-Capita Travel Time: Total travel times by mode are divided by total population, total employment, and total service population (population plus employment) to illustrate how much time on average a person spends traveling by each mode.

3.2.4   Job Access

Transportation planning seeks to provide people with access to opportunities and amenities. The job access metrics reflect the average number of jobs that can be reached from locations throughout Montgomery County within 45 minutes. Both Regional Job Access and Montgomery County Job Access are calculated separately for travel by auto and travel by transit:

- Average Regional Job Access by Auto within 45 minutes
- Average Regional Job Access by Transit within 45 minutes
- Average Montgomery County Job Access by Auto within 45 minutes
- Average Montgomery County Job Access by Transit within 45 minutes

3.2.5   Equity Emphasis Areas

An equity analysis was included as part of the assessment of Alternative Futures and Thrive Montgomery 2050 Policies. The analysis is based on Equity Emphasis Areas (EEAs), developed by the Metropolitan Washington Council of Governments (MWCOG)[1] to identify Census tracts with significant concentrations of low-income (less than one-and-a-half times the federal government's official poverty threshold) or minority population groups (African American, Asian, and Hispanic or Latino). Specifically, a Census tract is considered an EEA if it has:

---

[1] Equity Emphasis Area overview: https://www.mwcog.org/transportation/planning-areas/fairness-and-accessibility/environmental-justice/equity-emphasis-areas/

- A concentration of individuals identified as low-income that is more than one-and-a-half times the regional average, or
- High concentrations of two or more minority population groups, and/or
- High concentrations of one or more minority population groups combined with low income concentration at or above the regional average.

A map of the EEAs in Montgomery County is shown in Figure 1.

This analysis compares the metrics results in EEAs to non-EEAs to see if a disparity exists between the two geographies. Because Census tracts do not precisely align with the regional travel demand forecasting model's TAZ boundaries, results for each of the metrics are spatially allocated to EEAs or non-EEAs by the proportion of their area overlapping with an EEA or non-EEA geography.

Figure 1: Equity Emphasis Areas in Montgomery County (source: MWCOG)
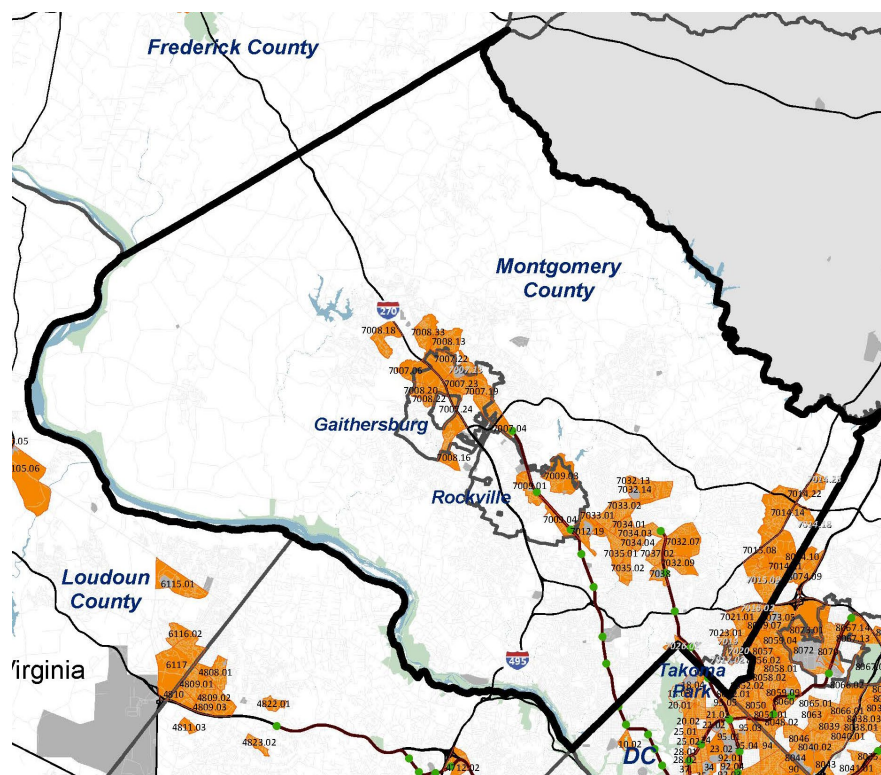
3.3   Policies Evaluated

The transportation analysis evaluated eight policies in Thrive Montgomery 2050. These policies are evaluated as a package, rather than individual actions. They represent those policies that were thought to have the largest impact on the transportation metrics and that could be evaluated using the regional travel demand forecasting model. Broad assumptions were made to evaluate these policies and in actuality they may be implemented differently. A detailed discussion of how each metric was evaluated is included in Attachment C.

1. **Restrict Through Travel Lanes on Selected Transit Corridors and Reduce Target Speeds**
   This policy recommendation restricts through travel lanes to a total of four (two in each direction) along the county's master-planned transit corridors, including:

- Corridor Cities Transitway from Shady Grove to Clarksburg
- Georgia Avenue from Silver Spring Transit Center to Olney
- MD 355 from Bethesda Purple Line Station to Clarksburg
- New Hampshire Ave from DC to Colesville
- North Bethesda Transitway from White Flint to Rock Springs
- Randolph Rd from White Oak to White Flint
- University Blvd from Wheaton to Takoma Langley
- US 29 from Silver Spring Transit Center to Burtonsville
- Veirs Mill Road from Rockville Metrorail Station to Wheaton Metrorail Station

2. **Implement Complete Communities**

This policy creates Complete Communities by introducing a mix of uses throughout the county by adding jobs (e.g. corner stores, daycares, cleaners) locally. To translate this recommendation to the assumptions in the regional travel demand forecasting model, a portion of retail job growth was distributed to areas beyond transit areas, downtowns, and town centers.

3. **Concentrate Growth in Existing Commercial Areas and Transit Areas**

This policy concentrates almost all new population and employment growth between 2015 and 2050 in existing downtowns and town centers; Metrorail, Purple Line, and MARC station areas, as well as four BRT corridors (Georgia Ave, MD 355, US 29 and Veirs Mill Road).

Of the 220,000 new residents anticipated by 2050, roughly 50,000 (or 22 percent) would be shifted to downtowns, town centers, and transit corridors from other areas of the county. That is because over half of new residents are already expected to reside in areas currently designated as downtowns, town centers and transit corridors under Business As Usual conditions and one quarter are expected to reside in independent municipalities that are not subject to Thrive Montgomery 2050 (including the cities of Rockville and Gaithersburg).

4. **Implement Premium Transit**

This policy implements premium transit service improvements to Metrorail, BRT, Purple Line, and MARC. To test this policy, the following enhancements were assumed:

- Metrorail: Reduced headways on the WMATA Red Line from 6 minutes to 5 minutes during peak periods and from 12 minutes to 10 minutes during off-peak periods.
- MARC Brunswick Line: Several changes were made: 1) implemented 30-minute headways during peak and off-peak periods for the MARC Brunswick Line, 2) implemented two-way service throughout the day, and 3) extended two-way MARC Brunswick Line service to the Alexandria VRE station via Union Station, L'Enfant, and Crystal City VRE stations with the same 30-minute headways applied to the Brunswick line service.
- Purple Line: Reduced headways to 3 minutes during peak periods and 6 minutes during off-peak periods.

- Bus Rapid Transit: Implemented all bus rapid transit recommendations, shown in the map below, with 5-minute headways, with the exception of the US 29 and MD 355 corridors, where the service patterns in the regional travel demand model will result in slightly different headways. Reduced end-to-end run times by 25 percent during peak periods and by 10 percent during off-peak periods from their baseline assumptions in the regional travel demand forecasting model.

Figure 2: Planned Bus Rapid Transit Corridors

5. **Improve Local Bus Service**
   This policy improves WMATA local bus, WMATA express bus, and RideOn local bus service. To test this policy, it was assumed that headways on all bus routes in Montgomery County would be reduced by 50 percent.

6. **Increase Parking Pricing**
   This policy increases the price of paid parking in Montgomery County. To test this policy, it was assumed that the cost of paid parking would increase by 100 percent.

7. **Increase Auto Travel Pricing; Reduce Auto Travel Costs for Travelers in the Lowest Income Quartile**

This policy is intended to disincentivize travel by automobile by increasing the cost of travel for higher income travelers. To test this policy, the cost of automobile travel on all roadways in Montgomery County assumes a charge of $0.05 per mile. To address equity concerns, the policy exempts travelers in the lowest income quartile from the increased per-mile charge.

8. **Improve Local Street Network**
   This policy assumes that a grid of streets will be implemented on the local street network in downtowns, town centers, and BRT station areas. To test this policy, the block density in downtowns and town centers is increased to a minimum of 150 blocks per square mile, equivalent to the dense street grid in King Farm. It also increases the block density in BRT station areas not in downtowns or town centers to 100 blocks per square mile.

4   Results

This section of the report summarizes the results of the analysis. The year 2015 is treated as the baseline year and all analysis for the year 2050 is compared against the results for 2015. The analysis identifies how external factors outside the county's control (the Drivers of Change) could impact each of the five future scenarios, absent any new policy interventions. It also evaluates how the eight Thrive Montgomery 2050 policies could help the county achieve its transportation vision. Since this analysis shows that the "Home Alone Together" scenario and the "On the Road" scenario generally represent the full range of results, while the "Business as Usual" scenario is in the middle, the project team did not carry forward the analysis of the "Work Local, Play Local" and "Hello from the Other Side" scenarios in the Thrive Montgomery 2050 policy evaluation (see Figure 3), as their value for comparison with other scenarios was limited.

A detailed discussion of the results from the external factors analysis and the Thrive Montgomery 2050 policy analysis is provided in Attachment C and Attachment D, respectively.

Figure 3: Analytical Process

Tables A-1 through A-5 in Attachment E summarize the transportation evaluation results for existing conditions (the year 2015) and future conditions (the year 2050). For 2050, results are shown for the impact of "External Factors" and for "External Factors & Thrive Montgomery 2050 Policies." The contents of the tables are as follows:

- Table A-1: Person Trips
- Table A-2: Mode Split
- Table A-3: Vehicle Miles Traveled
- Table A-4: Travel Time
- Table A-5: Per-Capita Travel Time
- Table A-6: Job Access

4.1   General Findings

As shown in Figure 4, between 2015 and 2050, the population of Montgomery County is expected to increase 21 percent, from approximately 1,015,000 residents to nearly 1,237,000 residents, while employment in the county is expected to increase 36 percent, from approximately 520,000 to 710,000 jobs.

Figure 4: Change in Demographics, 2015 to 2050
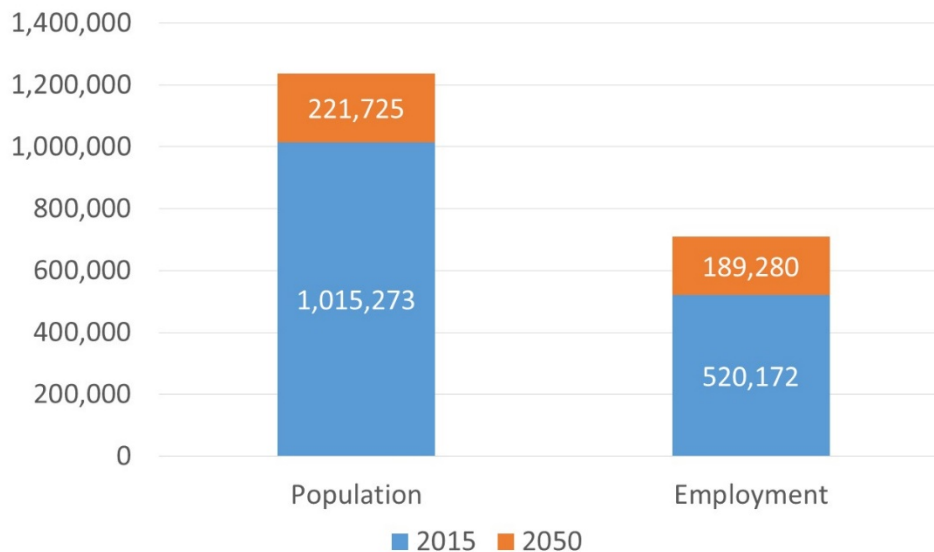
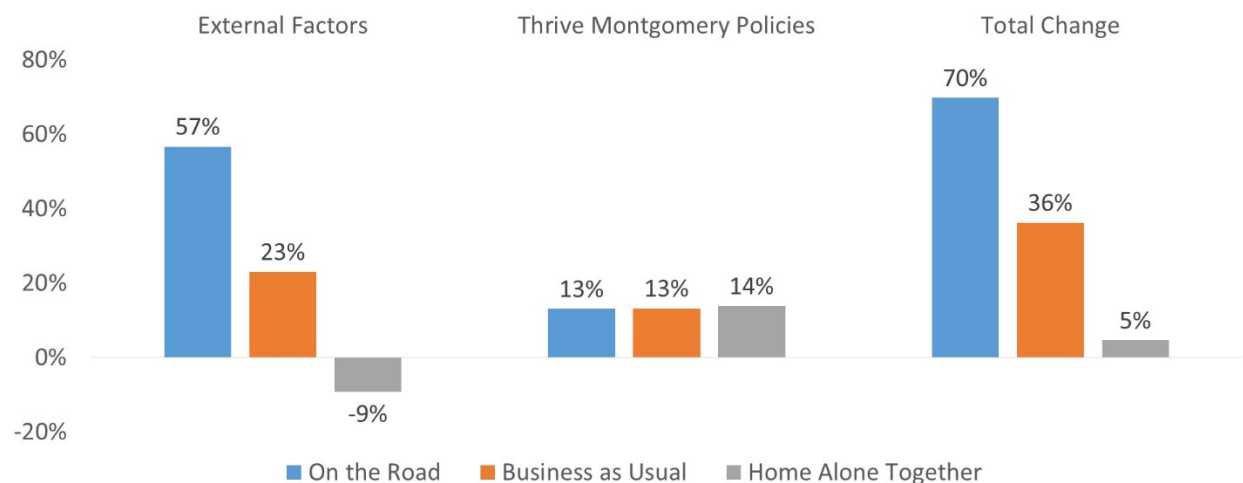### 4.1.1   Average Person Trips per Weekday

In 2015, there was an average of 3.2 million person trips per weekday (see Table A-1). As shown in Figure 5, external factors increase person trips per weekday by as much as 57 percent (1.8 million trips) for "On the Road" and reduce person trips by as much as 9 percent (0.3 million trips) for "Home Alone Together." The change in person trips is largely related to the 21 percent growth in population between 2015 and 2050 and the trip generation assumptions underlying each Alternative Future. For the "Business as Usual" scenario, the growth in person trips (23 percent) largely matches population growth. For the "On the Road" scenario, the growth in person trips (57 percent) is a result of technological advancements, such as autonomous vehicles, which are assumed to make it easier to drive. Person trips

decrease for the "Home Alone Together" scenario because teleworking and e-commerce reduce the need to make commute and shopping trips.

The Thrive Montgomery 2050 policy measures increase the average number of person trips per weekday in all three scenarios by approximately 13 percent to 14 percent (roughly 0.4 million trips). Overall, the average number of person trips grows between 70 percent (2.2 million trips) in "On the Road" and 5 percent (0.2 million trips) in "Home Alone Together" relative to 2015. This is because Thrive Montgomery 2050 policies would concentrate future growth in dense locations, which tends to increase the number of trips that households make.

Figure 5: Change in Person Trips, 2015 to 2050

### 4.1.2 Average Vehicle Trips per Weekday

In 2015, about 2.3 million vehicle trips were made in Montgomery County during a typical weekday (see Table A-1). As shown in Figure 6, external factors result in as much as a 37 percent increase in vehicle trips (0.9 million trips) in "On the Road" and a reduction of up to 5 percent of vehicle trips (0.1 million trips) in "Home Alone Together." The change in vehicle trips is a result of the 21 percent growth in population, the changes in person trips and trip lengths. The impact of external factors on vehicle trips is very similar to the impact on person trips with greater trip generation rates for "On the Road" and reduced trip generation rates for "Home Alone Together."

The effect of the Thrive Montgomery 2050 policy measures is to decrease the number of vehicle trips by between 10 percent (0.2 million trips) in "Business as Usual" and 2 percent (<0.1 million trips) in "Home Alone Together." These findings show that the Thrive Montgomery 2050 policies are having their intended impacts under all alternative futures: pricing mechanisms that increase the cost of driving encourage people to leave their cars at home while more dense land uses, transit investments and improvements to walking and bicycling make walking, bicycling and transit more attractive.

The combined effect of external factors and Thrive Montgomery 2050 policies is that the change in vehicle trips ranges from an increase of 33 percent (0.8 million trips) in "On the Road" to a decrease of 7 percent (0.2 million trips) in "Home Alone Together" relative to 2015.

Figure 6: Change in the Number of Vehicle Trip, 2015 to 2050
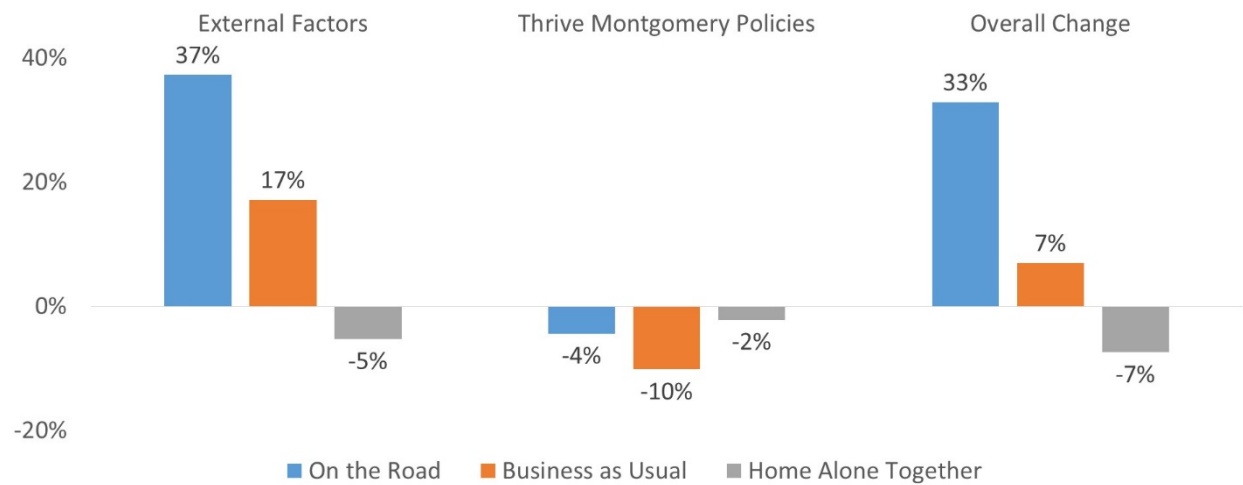
4.1.3   Average Vehicle Trip Distances

In 2015, the average vehicle trip distance was estimated to be 8.8 miles (see Table A-3). As shown in Figure 7, vehicle trip distances are forecast to grow slightly between 2015 and 2050, by between 3 percent (0.3 miles) in "On the Road" and 1 percent (0.1 miles) in "Business as Usual." The impacts of Thrive Montgomery 2050 policies are mixed, increasing vehicle trip distances by up to 4 percent (0.4 miles) in "Business as Usual" and decreasing vehicle trip distances by as much as 2 percent (0.1 miles) in "Home Alone Together." Overall, the change in trip distances ranges from 5 percent (0.5 miles) in "Business as Usual" to 1 percent (0.1 miles) in "Home Alone Together" relative to 2015.

Figure 7: Change in Average Vehicle Trip Distances, 2015 to 2050
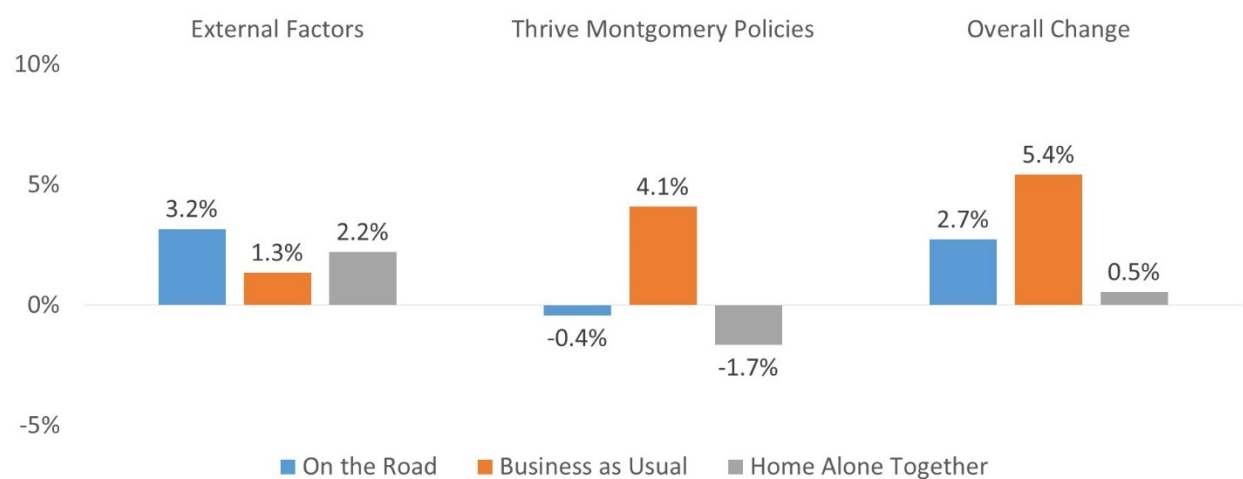
## 4.2   Non-Auto Driver Mode Share (NADMS)

In 2015, the estimated NADMS in Montgomery County was 41 percent for all trips (see Table A-2). As shown in Figure 8, external factors increase non-auto driver mode share by between 2 percent and 6 percent. NADMS grows the most for "On the Road" because congestion becomes heavy (a 37 percent increase in vehicle trips) in this scenario. Driving alone and carpooling drop and walking and bicycling

increase by about 5 percent. NAMDS grows the least for "Home Alone Together" because congestion drops (a 5 percent drop in vehicle trips) in this scenario. Driving alone drops but most of these trips switch to carpooling.

Thrive Montgomery 2050 policies increase non-auto driver mode share by 4 percent in "Business as Usual" but have a limited impact on "On the Road" and "Home Alone Together." The reasons for this may be that for "On the Road" many people have already shifted to walking, bicycling and transit, diminishing the impact of the Thrive Montgomery 2050 policies. In contrast, in "Home Alone Together," congestion is still quite low, which dampens the impact of policies intended to make walking, bicycling and transit competitive with driving. "Business as Usual" threads the needle and shows the greatest increase in NADMS.

Regardless, the combined effect is to increase NADMS by between 3 and 8 percent relative to 2015, to between 44 and 49 percent overall.

**Figure 8: Change in Non-Auto Driver Mode Share, 2015 to 2050**
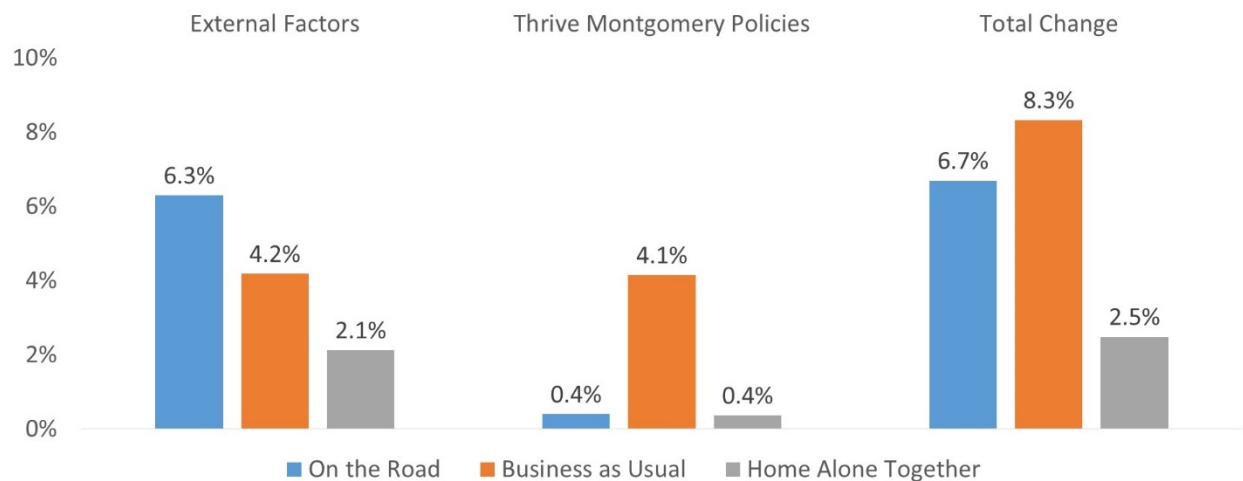
4.3   Vehicle Miles Traveled (VMT) Analysis

Growth in VMT tends to follow growth in population and economic activity. In 2015, VMT on roads in Montgomery County was estimated to be 24.1 million miles per day (see Table A-3). As shown in Figure 9, absent policy interventions, VMT growth in the "Business as Usual" scenario is expected to be 20 percent (or 5.0 million trips per day), mirroring population growth. Due to the increased number of vehicle trips and preference for longer trips assumed for the "On the Road" scenario, VMT growth would be 38 percent (9.1 million trips per day). For "Home Alone Together," which has fewer vehicle trips and a preference for shorter trips, the change in VMT is only 3 percent (0.6 million trips per day).

Even though Thrive Montgomery 2050 policies increase person trips, they would reduce VMT by between 4 percent (0.9 million trips per day) in "Home Alone Together" and 6 percent (1.6 million trips per day) in the other scenarios, because the majority of these new person trips are by non-drivers. While VMT reductions of 4 to 6 percent may seem low, this is actually a substantial reduction compared to the results of individual projects and policies. Overall, the change in VMT is between 31 percent (7.6

million trips per day) in "On the Road" and a reduction of 1 percent (0.3 million trips per day) in "Home Alone Together" relative to 2015.

Figure 9: Change in Vehicle Miles Traveled (roads in Montgomery County only), 2015 to 2050
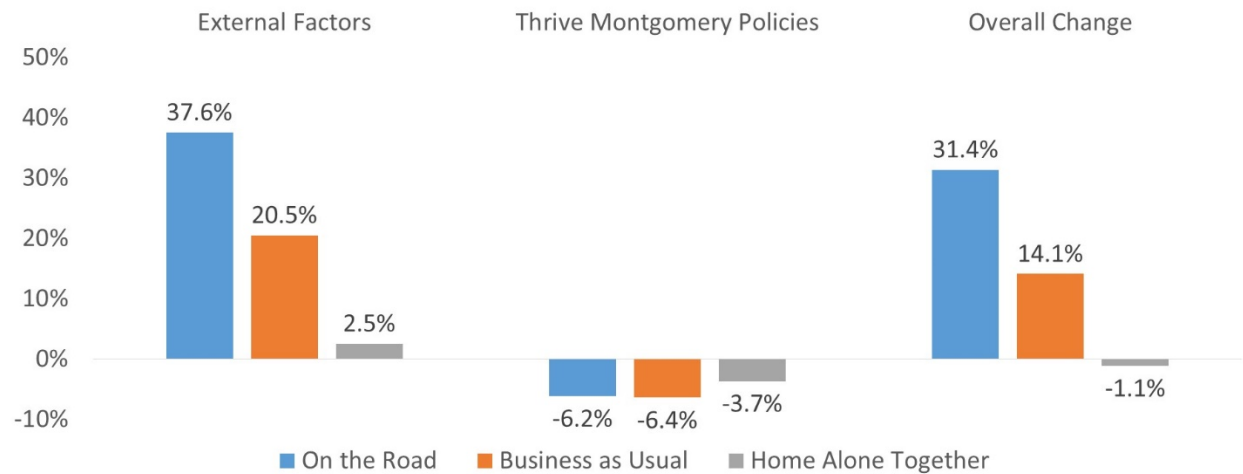
The findings are similar for VMT for trips that start or end in Montgomery County. In 2015, VMT due to trips that start or end in Montgomery County was estimated to be 20.2 million miles per day (see Table A-3). As shown in Figure 10, absent policy interventions, VMT growth in the "Business as Usual" future is expected to be 19 percent (3.8 million trips per day), also mirroring population growth. Due to the increased number of vehicle trips and preference for longer trips assumed for the "On the Road" future, VMT growth in that scenario would be 42 percent (8.4 million trips per day). For "Home Alone Together," which assumes fewer vehicle trips and a preference for shorter trips, the reduction in VMT is 3 percent (0.7 million trips per day). Thrive Montgomery 2050 policies would reduce VMT by between 4 percent (0.8 million trips per day) in "Home Alone Together" and 6 percent (1.2 million trips per day) in "Business as Usual," resulting in an overall growth of VMT between 37 percent (7.4 million trips per day) in "On the Road" and a reduction of 7 percent (1.4 million trips per day) in "Home Alone Together" relative to 2015.

Figure 10: Change in Vehicle Miles Traveled (trips that start or end in Montgomery County), 2015 to 2050
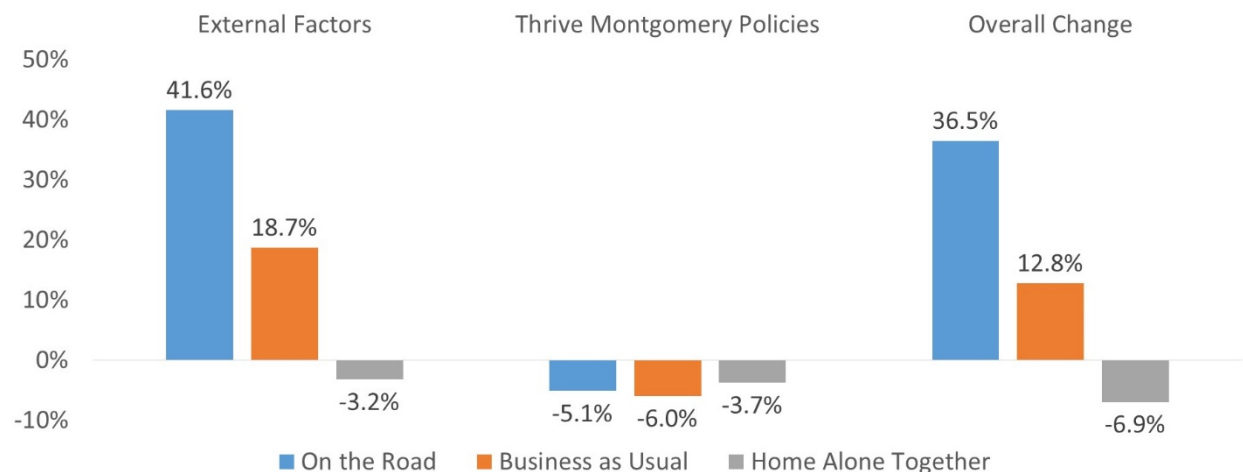
4.4   Travel Time Analysis

Over the years, travel times have increased in Montgomery County. For example, the average travel time for trips to and from work has grown from about 26 minutes in 1990 to 35 minutes in 2016, meaning the county's residents, workers and visitors have less time to spend doing other things.

4.4.1   Change in Average Travel Time per Auto Trip

In 2015, the average travel time per auto trip was almost 18 minutes (see Table A-4). As shown in Figure 11, external factors will increase average auto trip times in all scenarios, from a high of 28 percent (5 minutes) in "On the Road" and to a low of over 4 percent (about 1 minute) in "Home Alone Together." The change in average travel time per auto trip largely follows the changes to the number of vehicle trips. It is higher for "On the Road" due to higher levels of congestion and lower for "Home Alone Together" because of lower levels of congestion.

Thrive Montgomery 2050 policies will have almost no impact on auto travel times, except in "Business as Usual," in which travel times increase by 6 percent (1 minute). This is likely a result of changes to average vehicle trip distances, which increase slightly for "Business as Usual" but drop slightly for "On the Road" and "Home Alone Together." Overall, the change in average travel time per auto trip ranges from an increase of 27 percent (5 minutes) in "On the Road" to an increase of 3 percent (1 minute) in "Home Alone Together" relative to 2015.

**Figure 11: Change in Average Travel Time per Auto Trip, 2015 to 2050**
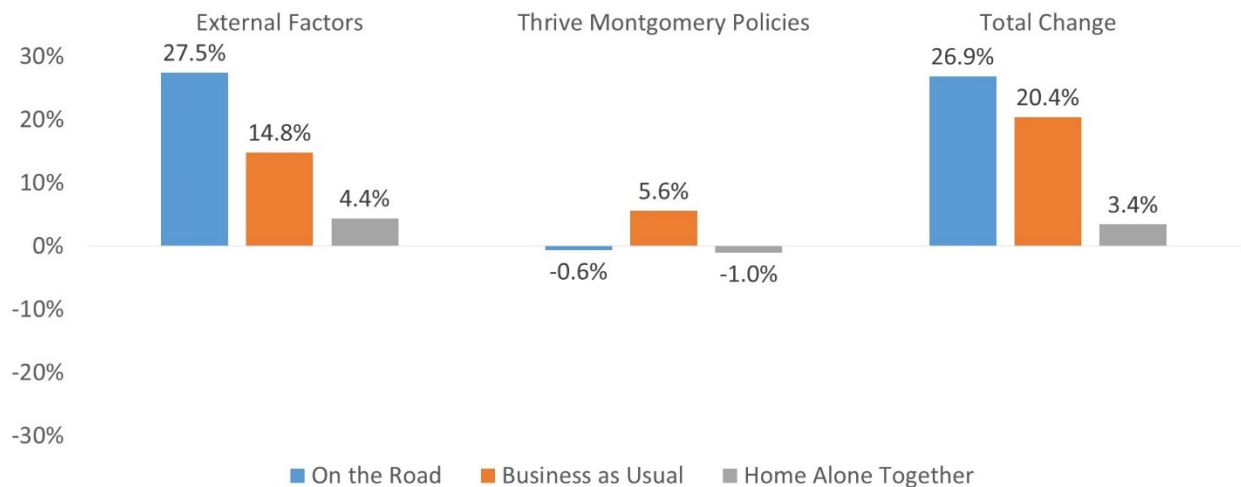
4.4.2   Change in Average Travel Time per Transit Trip

In 2015, the average travel time per transit trip was about 50 minutes (see Table A-4). As shown in Figure 12, the impact of external factors ranges from a slight increase of 2 percent (1 minute) for "On the Road" to a slight decrease of almost 4 percent (2 minutes) for "Home Alone Together." Thrive Montgomery 2050 policies will reduce average transit trip travel times by about 3 to 4 percent (about 2 minutes). Overall, average travel time per transit trip decreases as much as 7 percent (4 minutes) for "Home Alone Together" relative to 2015.

While these results initially appear to show that the Thrive Montgomery 2050 policies were unsuccessful at reducing transit travel times, in fact, other factors are likely at work. Our hypothesis is that transit travel times from one point to another are in fact decreasing by a higher rate, but that the results only

Thrive Montgomery 2050 – Transportation Analysis
January 2021

show a reduction of 3 – 4 percent for the average transit trip because while individual trips are
becoming shorter, longer transit trips are becoming more attractive and people are taking more of
them.

Figure 12: Change in Average Travel Time per Transit Trip, 2015 to 2050
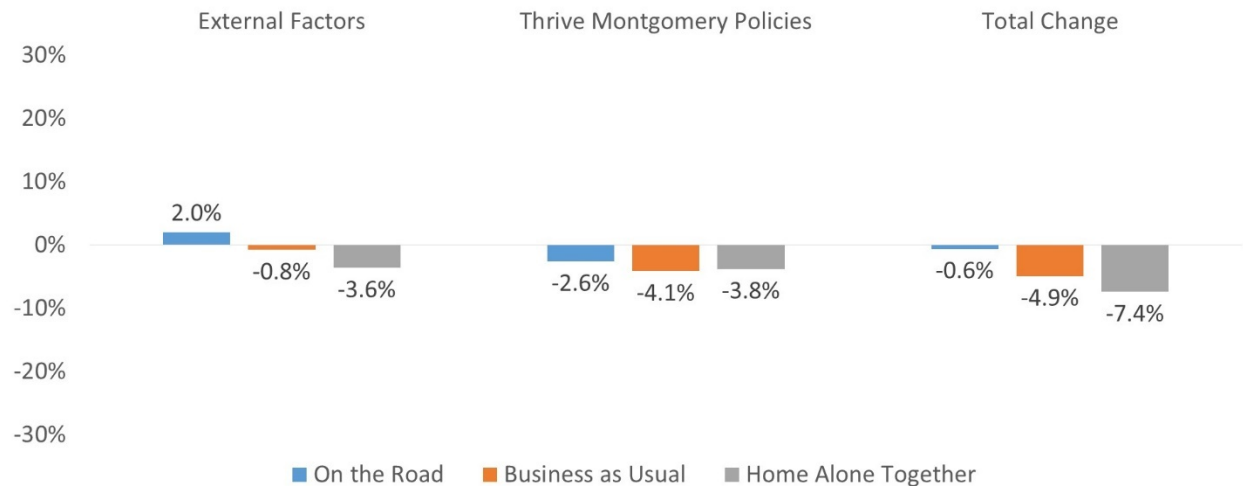
4.5 Job Access Analysis

The job access analysis evaluates the four metrics identified below. Overall, Thrive Montgomery 2050
policies have the greatest impact on access to Montgomery County jobs and a limited impact on access
to regional jobs[2].

- Average Regional Job Access by Auto within 45 minutes
- Average Regional Job Access by Transit within 45 minutes
- Average Montgomery County Job Access by Auto within 45 minutes
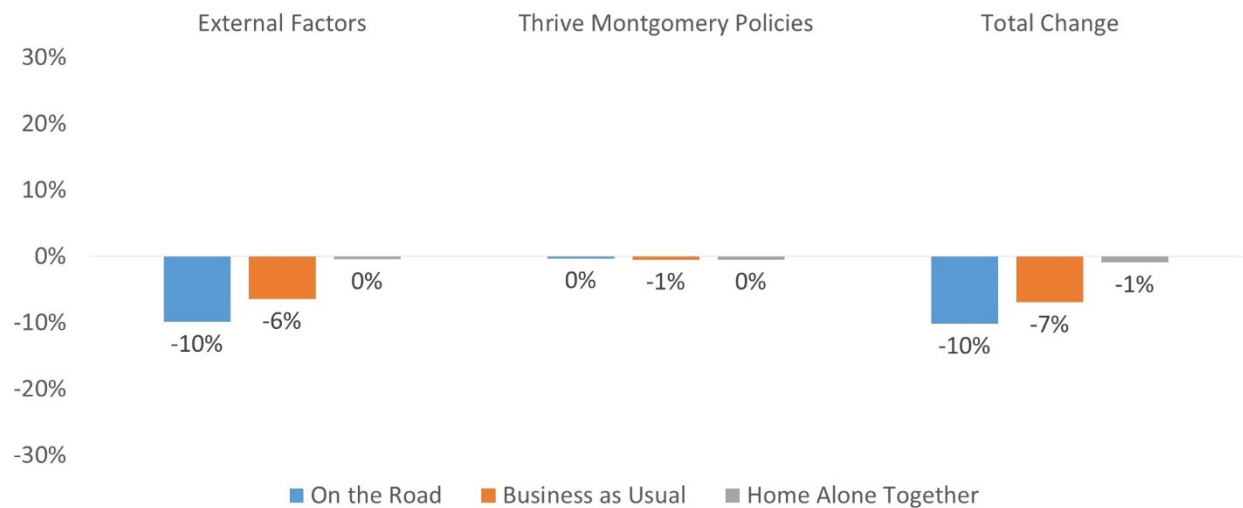- Average Montgomery County Job Access by Transit within 45 minutes

4.5.1 Average Regional Job Access by Auto within 45 minutes

In 2015, an average of about 28 percent of all jobs in the region could be accessed by automobile within
45 minutes (see Table A-6). As shown in Figure 13, external factors reduce this by 10 percent for "On the
Road" to 18 percent. Thrive Montgomery 2050 policies have a negligible impact on access to jobs in the
region by automobile.

The negligible change in average share of regional jobs accessible by auto due to Thrive Montgomery
2050 policies is largely because these policies largely impact auto travel times within Montgomery
County.


[2] Regional jobs includes Montgomery County jobs.

20

Figure 13: Percent Change in Total Regional Jobs Accessible by Auto within 45 minutes, 2015 to 2050

4.5.2 Average Regional Job Access by Transit within 45 minutes

In 2015, only about 3 percent of all jobs in the region could be accessed by transit within 45 minutes (see Table A-6), on average. As shown in Figure 14, both external factors and Thrive Montgomery 2050 policies have a negligible impact on access to jobs in the region by transit. Overall job access remains largely unchanged. The negligible change in average share of regional jobs accessible by transit is because the Thrive Montgomery 2050 policies largely impact transit travel times within Montgomery County.

**Figure 14: Percent Change in Total Regional Jobs Accessible by Transit within 45 minutes, 2015 to 2050**
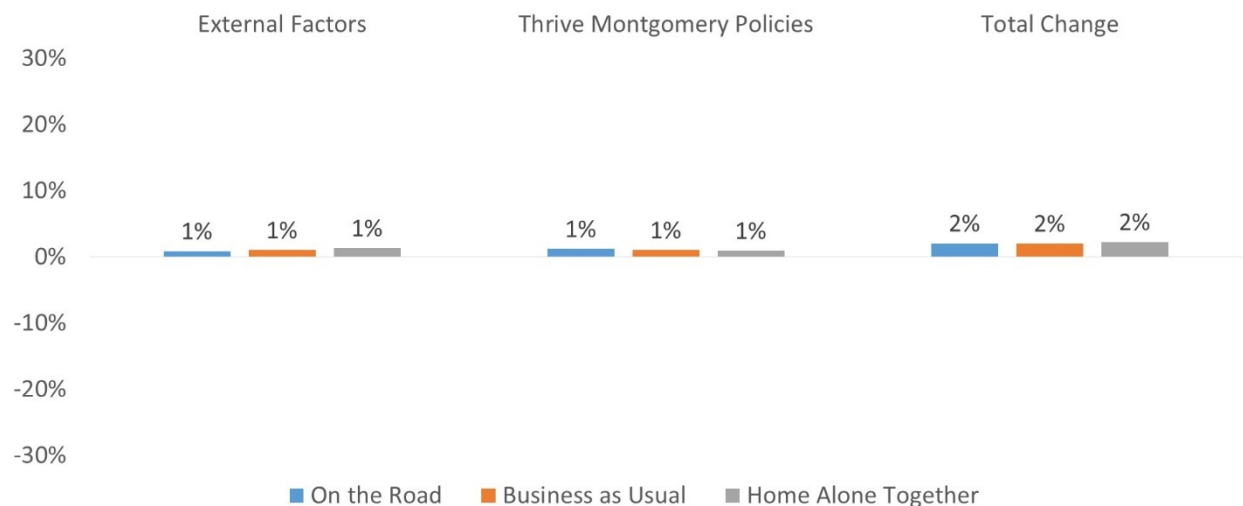
4.5.3 Average Montgomery County Job Access by Auto within 45 minutes

In 2015, an average of about 90 percent of all jobs in Montgomery County could be accessed by automobile within 45 minutes (see Table A-6). As shown in Figure 15, external factors reduce this by as much as 29 percent in "Business as Usual," or 61 percent, and increase access by as much as 3 percent in "Home Alone Together," or 93 percent. Thrive Montgomery 2050 policies increase access to jobs by as much as 20 percent in "Business as Usual" and reduce access to jobs by as much as 7 percent in "On the

Road." The overall impact on access to Montgomery County jobs by auto is a reduction as much as 16 percent in "On the Road" relative to 2015.

**Figure 15: Percent Change in Total Montgomery County Jobs Accessible by Auto within 45 minutes, 2015 to 2050**
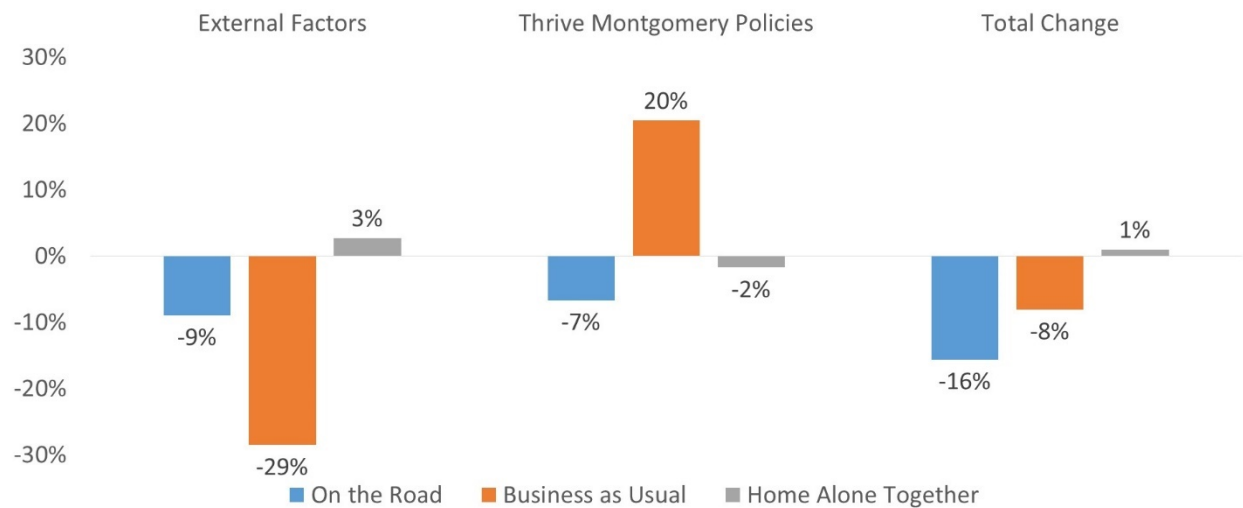
4.5.4 Average Montgomery County Job Access by Transit within 45 minutes

In 2015, an average of about 12 percent of all jobs in Montgomery County could be accessed by transit within 45 minutes (see Table A-6). As shown in Figure 16, external factors have a slight impact, ranging from an increase of 5 percent in "Home Alone Together" to 17 percent, to a reduction of 2 percent in "Business as Usual" to xx percent. Thrive Montgomery 2050 policies increase access to jobs by between 5 percent in "Home Alone Together" and 11 percent in "Business as Usual." Overall, access to Montgomery County jobs by transit increases by 10 percent relative to 2015.

The increase in the average share of trips accessible by transit due to the Thrive Montgomery 2050 policies is likely a result of improvements to speed up transit, including more dedicated transit lanes for bus rapid transit and more frequent local bus arrival times.

Figure 16: Percent Change in Total Montgomery County Jobs Accessible by Transit within 45 minutes, 2015 to 2050
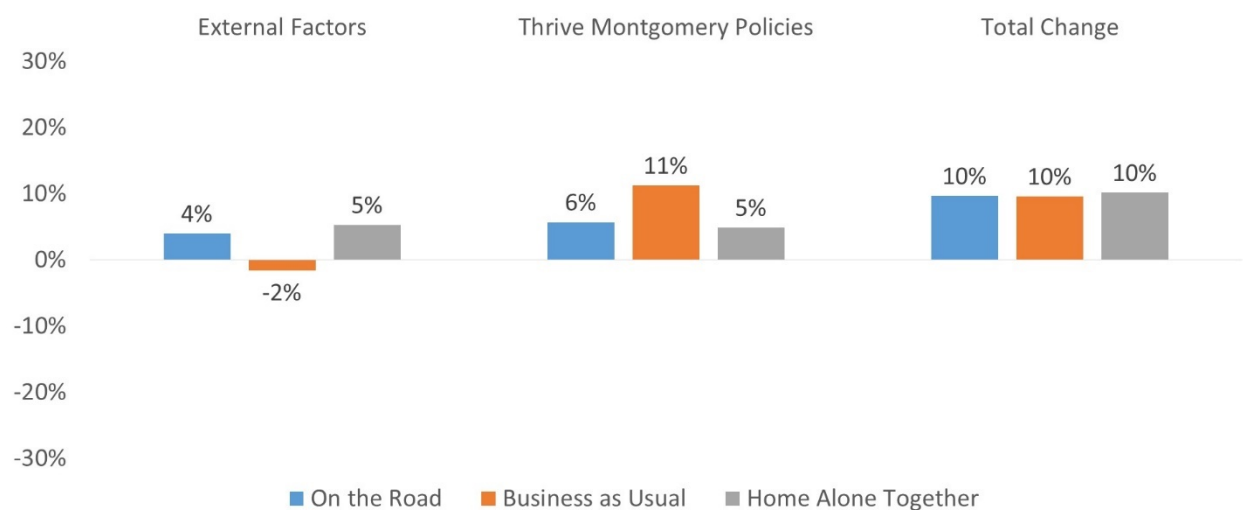
4.6   Equity Analysis

The equity analysis compares the results for each metric for EEA and non-EEA communities in Montgomery County. Table 3 summarizes the results for each metric. In the table, shading represents disparities between EEAs and non-EEAs with darker shading representing greater disparities. Generally, EEAs perform better than their more affluent counterparts, with comparable or shorter travel times, lower VMT generation, higher NADMS, and better job access by both auto and transit. These results are likely the case because EEAs are generally located in downcounty or mid-county areas and are along the county's primary transit corridors.

There is one exception to these results. The VMT on roads within the EEAs – a proxy for air quality – far exceeds the VMT on roads outside the EEAs on a per square mile basis. Here, EEAs would be exposed to more transportation-related air pollutants in all scenarios.

**Table 3: Comparison of EEAs and Non-EEAs across Evaluation Metrics**

| Metric	Existing Conditions	External Factors	Thrive Montgomery 2050 Policies
Average Vehicle Trip Distances	EEAs with similar but shorter trip distances	EEAs with similar but shorter trip distances	EEAs with similar but shorter trip distances in Business as Usual, similar but longer trip distances in "On the Road" and "Home Alone Together"
Person Trips per Capita	EEAs with similar but more trips per capita	EEAs with similar but more trips per capita	EEAs with similar but more trips per capita in "Business as Usual" and "Home Alone Together," similar but fewer trip per capita in "On the Road"
Vehicle Trips per Capita	EEAs with similar but fewer trips per capita	EEAs with similar but fewer trips per capita	EEAs with similar but fewer trips per capita
NADMS	EEAs with higher NADMS	EEAs with higher NADMS	EEAs with higher NADMS
VMT Generated per Capita	EEAs with lower VMT generation per capita	EEAs with lower VMT generation per capita	EEAs with lower VMT generation per capita
VMT on Area Roadways per Square Mile	EEAs with higher VMT per square mile	EEAs with higher VMT per square mile	EEAs with higher VMT per square mile
Travel Time	EEAs with similar but higher per-trip travel time. EEAs with similar but lower auto travel time and similar but higher transit travel time	EEAs with similar but lower per-trip travel time, auto travel time and transit travel time	EEAs with a higher per-trip travel time. EEAs with similar but lower transit travel times in "Business as Usual" and similar but higher transit travel times in "On the Road" and "Home Alone Together." EEAs with similar but lower transit travel time
Regional Job Access	EEAs with greater regional job access by auto and transit	EEAs with greater regional job access by auto and transit	EEAs with greater regional job access by auto and transit
County Job Access	EEAs with greater county job access by auto and transit	EEAs with greater county job access by auto and transit	EEAs with greater county job access by auto and transit

4.6.1   Travel Time

Travel time represents the time it takes to complete a trip. Travel time can be broken out in several ways, including an average for all trips (per-trip travel time) and travel times by mode (auto or transit travel times). Through the equity analysis, it is revealed that auto and transit travel times are similar between EEAs and non-EAAs (see Figure 17).

Figure 17: Travel Timer per Trip by Mode (EEAs vs non-EEAs)
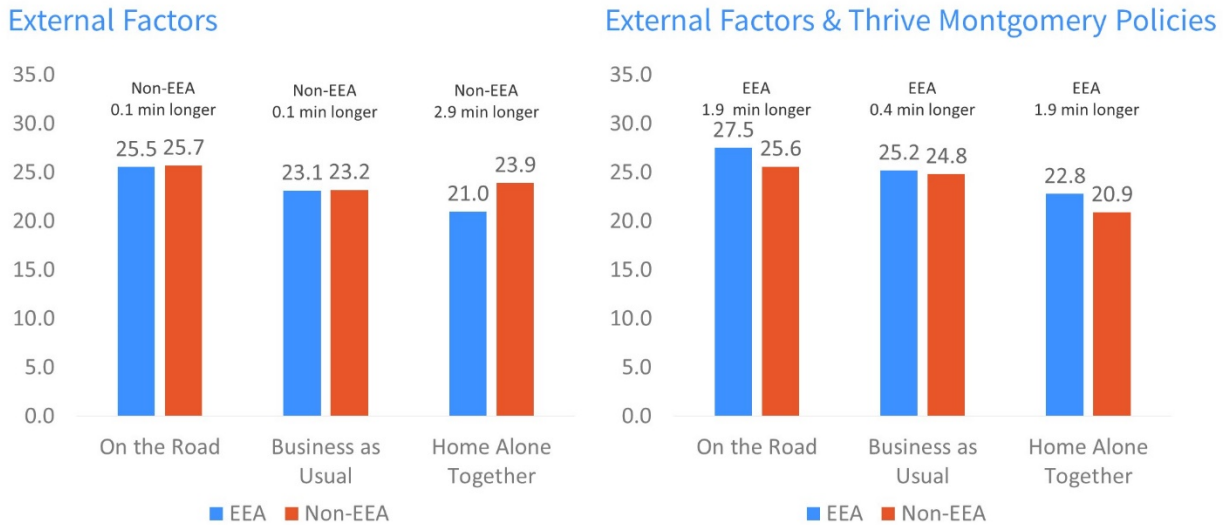
However, because travelers in EEAs are more likely to take transit trips – and transit trips are generally longer than auto trips – their per-trip travel time is higher. In 2015, the per-trip travel time for EEAs is 20.4 minutes and for non-EEAs is 20.2 minutes. As shown in Figure 18, external factors largely result in similar travel times EEAs relative to non-EEAs, though in "Home Alone Together" the travel times per trip become shorter in EEAs. However, Thrive Montgomery 2050 policies reverse this trend, ultimately putting EEAs at a disadvantage. The overall results include a greater gap in per-trip travel time for EEAs, nearly two minutes for "On the Road" and "Home Alone Together." To address this inequity, the county could either focus on reducing transit travel times or auto travel times in EEAs. To align with county goals, it may be preferable to prioritize transit improvements in EEAs.

**Figure 18: Travel Time per Trip (EEAs vs non-EEAs)**
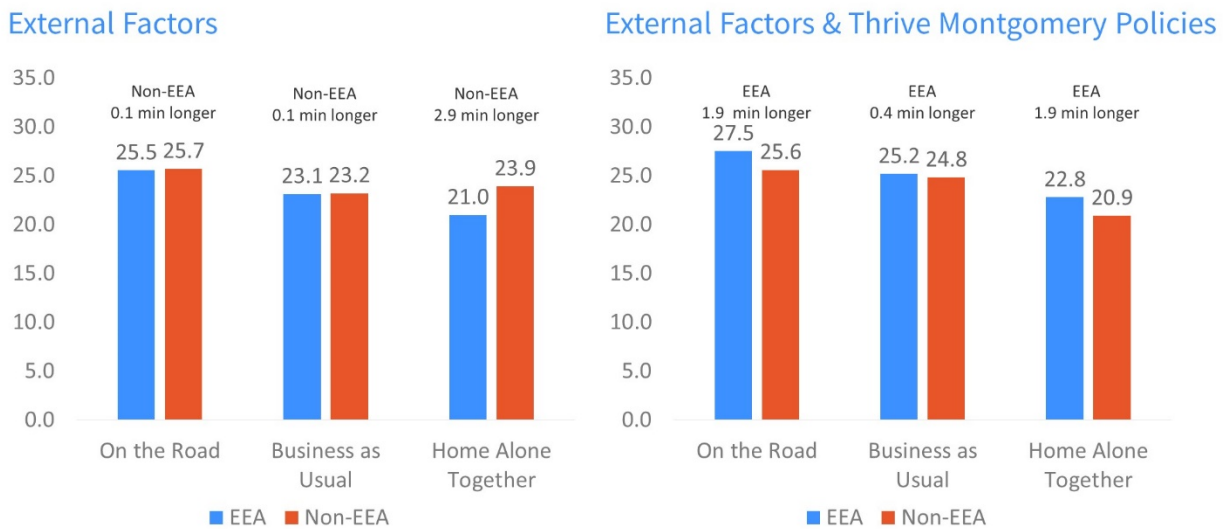
4.6.2   VMT per Square Mile

VMT is a proxy for air pollutants, and VMT per square mile provides an understanding of the concentration of those pollutants in different parts of the county. In 2015, EEAs experienced significantly higher VMT per square mile than non-EEAs. While non-EEAs have an average of 39,624 VMT per square mile, this number is nearly three times higher in EEAs (152,129 VMT per square mile). This is because more vehicle travel tends to occur in equity areas, which tend to have a greater density of streets and land uses.

Figure 19 depicts how the disparity between EEAs and non-EEAs increases or decreases for each scenario. Relative to the 2015 disparity, the external factors increase the disparity to varying degrees, from 4 percent on "Home Alone Together" to 47 percent in "On the Road." The Thrive Montgomery 2050 policies reduce the disparity, between 7 percent and 12 percent. The overall change falls short of mitigating the disparate impact on EEAs, as it either results in maintaining the existing disparity or increasing it (between 15 percent and 36 percent).

Figure 19: Percent Change in the Difference between EEA and non-EEA VMT per Square Mile, 2015 to 2050
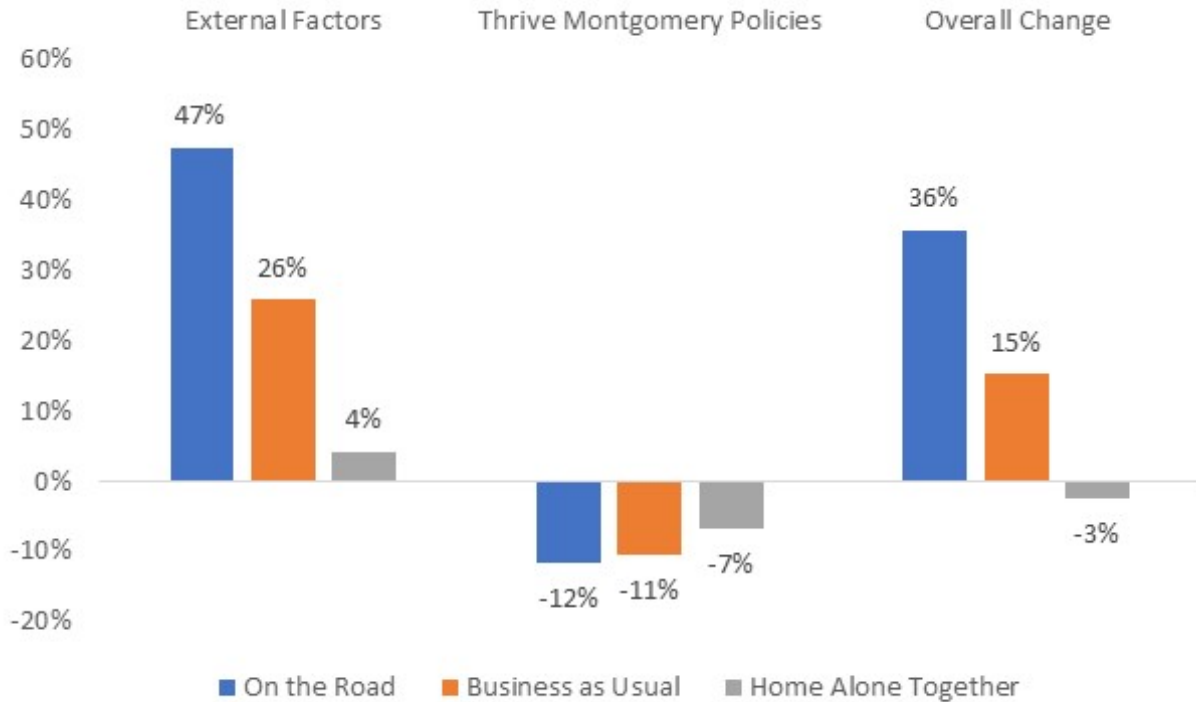
4.6.3   Considerations

The EEA geography that underlies the equity analysis is based on Census data from 2012 to 2016. That same geography is used to assess equity under existing conditions (2015) as well as future conditions (2050), and therefore assumes high concentrations of low-income and minority residents of Montgomery County will be in the same locations they are today. It is impossible to know if that will be the case. As the county grows over the next 30 years and as residents relocate within the county, the demographics of different communities may shift. it is important to acknowledge that this report makes a large assumption in maintaining these geographies.

EEAs are a binary measure, based on a cutoff point for the concentration of low-income and minority residents in a given Census tract. It should be noted that low-income and minority residents – as well as their more affluent and white counterparts – live in all Census tracts throughout the county. EEAs focus on a concentration of these communities, but do not capture the entire experience of low-income and minority residents in Montgomery County.

5   Conclusions

Overall, the results from the Thrive Montgomery 2050 transportation analysis are encouraging as they show that county projects and policies have the ability to bend the curve in the growth of VMT, to increase access to local jobs via transit and to increase NADMS. In fact, the combination of multiple bus and rail projects, land use changes and policies such that increase the cost of travel by automobile have a much greater impact than many individual projects the county is advancing, such as the Purple Line. For instance, while the Purple Line project is projected to reduce regional daily vehicle trips by almost 17,000 trips per day and VMT by almost 130,000 miles per day over a 30-year period compared to a

2010 baseline, the Thrive Montgomery 2050 policies would reduce VMT by up to 1,200,000 miles per day and regional daily vehicle trips by up to 230,000 trips per day over a 35-year period assuming a 2015 "Business as Usual" baseline (see Table 4). This is a huge step in the right direction.

Table 4: Thrive Montgomery 2050 Policies Compared to Purple Line Light Rail Project

	Reduction in VMT	**Reduction in Vehicle Trips**
Thrive Montgomery 2050 Policies	1,200,000	230,000
Purple Line Light Rail	129,828	16,790

Source: Purple Line, FEIS, Volume 1, page 3-11 to 3-12

Furthermore, the results show great variability toward achieving the county's goals. For instance, a future more along the lines of "Home Alone Together" could result in VMT in 30 years that is lower than VMT in 2015.

Still, the results appear to be offsetting the impacts of growth more than actively moving toward the county's goals and additional policies will be needed over the coming years. Four policies that stand out as having the greatest potential to further improve the transportation metrics include land use, teleworking, travel / parking pricing and regional coordination.

5.1   Land Use

Perhaps the most significant reason that the results do not show more progress toward reaching the county's goals is related to the county's land use, particularly its housing patterns. In many ways, the transportation outcomes over the next 30 years will continue to be directly attributable to the land use decisions of the past. Much of suburban Montgomery County is not proposed to be changed by Thrive Montgomery 2050 and significant progress has already been made over the past 30 years to implement smart growth policies around Red Line and future Purple Line stations.

Thrive Montgomery 2050 would build from these successes by shifting almost all future growth to existing downtowns, town centers and transit corridors. But the impact will be limited. Of the 220,000 new residents anticipated by 2050, only about 50,000 people (or 22 percent of the growth) would be shifted to these downtowns, town centers, and transit corridors from suburban areas of the county. That is because over half of new residents are already expected to reside in areas currently designated as downtowns, town centers and transit corridors and one quarter are expected to reside in municipalities outside of Montgomery County's planning authority (including the cities of Rockville and Gaithersburg). Therefore, this policy would affect only about 4 percent of the total 1.2 million Montgomery County residents anticipated by 2050 (see Figure 20).

Figure 20: Population Distribution among Land Use Types
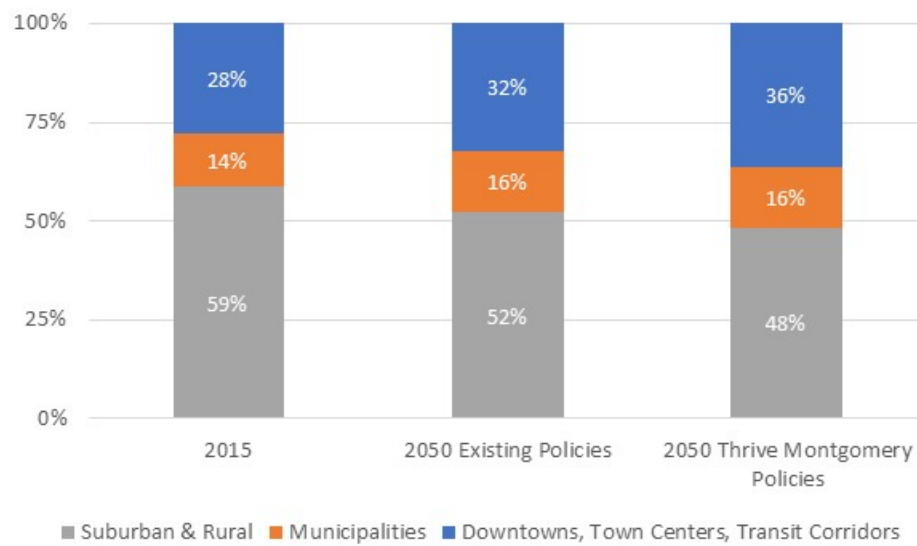
Similarly, of the 190,000 new jobs anticipated by 2050, roughly 26,000 (or 14 percent) would be shifted to downtowns, town centers, and transit corridors from other areas of the county. Overall, this policy would impact about 4% of the 710,000 total jobs anticipated by 2050 (see Figure 21).

Figure 21: Employment Distribution among Land Use Types
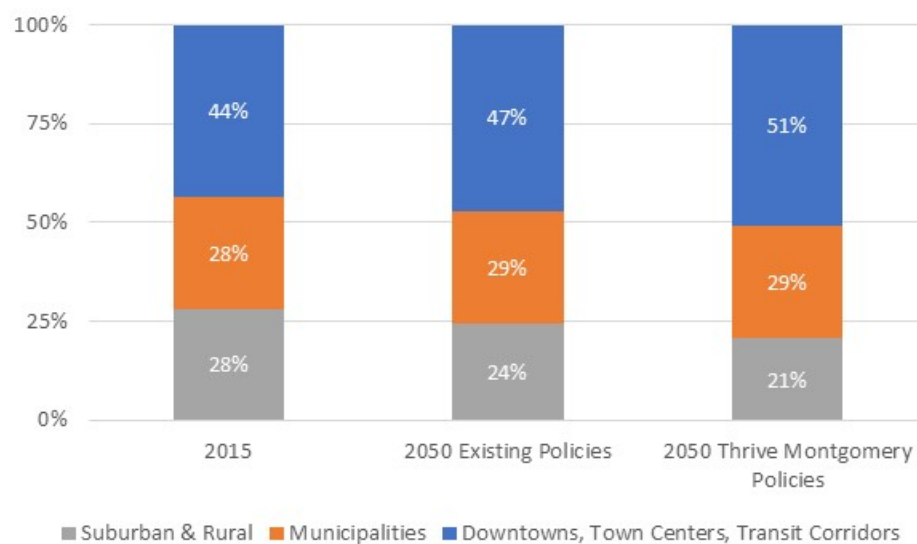
In many ways the transportation outcomes over the next 30 years will continue to be directly attributable to the land use decisions of the past as the location of 96 percent of the county's dwelling units and jobs are not expected to be shifted by Thrive Montgomery. **To move closer to achieving the county's transportation goals, additional policies are needed to shift existing population and jobs from suburban communities to downtowns, town centers and transit corridors.**

For example, over time Montgomery County could acquire private property when it is put up for sale within the 100 or 500-year flood plain or expand the Agricultural Reserve. And the county could create a

market like the TDR program to buy up properties in these areas. There are probably many approaches the county could take, but without them, there is only so much that the transportation system can do given existing land use patterns.

5.2   Telework

While policies to encourage teleworking were considered during the development of Thrive Montgomery 2050, at the time the Alternative Futures were developed for this report they were not expected to contribute substantially to achieving the county's goals. As described in the Alternative Futures section of this report, the mass adoption of teleworking and e-commerce were assumed to be part of a technological innovation in the "Home Alone Together" and "Hello from the Other Side" scenarios that would reduce trip generation by 25 percent over the next 30 years.

What was thought to be a potential future when this project started over a year ago may now in fact be more a part of our actual future. COVID-19 has shown the great potential that teleworking and e-commerce have to reduce VMT. A recent survey of employers in the DC region found that 55 percent shifted to a full-time teleworking during the pandemic. Additionally, more than half of employers anticipate a post-pandemic telework level that is higher than the pre-pandemic telework level, including 20 percent that anticipate continuing to telework at a level experienced during the pandemic.[3] In effect, the county may find itself closer to the "Home Alone Together" results for 2050, which generally were found to move the county towards achieving its transportation goals.

As the country begins to get control over COVID-19 in the coming months and people begin to revert to their pre-COVID travel patterns, Montgomery County should pursue an effort to maintain an elevated level of teleworking, while seeking to offset some of its negative economic and social impacts.

5.3   Auto Travel and Parking Pricing

The transportation analysis evaluates the impacts of increasing the cost of travel by automobile and parking. The policies could take several forms, including a charge on VMT or congestion. To model these policies, the assumption was that the cost of driving and parking would double. **Future studies will need to determine the extent to which the impact of these policies could be strengthened with higher charges.**

5.4   Regional Coordination

The transportation and land use recommendations in Thrive Montgomery 2050 are almost completely targeted at transportation conditions within the county. But many of the policies in Thrive Montgomery 2050 are most effective when pursued regionally. In particular, policies to increase the cost of travel by automobile are best pursued as part of a regional effort and will further incentive travel by modes other than automobile. **Montgomery County will need to work with other jurisdictions in the region to institute policies, such as congestion pricing, to maximize their potential to reduce VMT.**

---

[3] Transportation Planning Board, Regional Employer Telework Survey Results Briefing, September 16, 2020.

6 Attachments

Attachment A: Transportation Analysis Approach White Paper, October 25, 2019

Attachment B: Alternative Futures Transportation Analysis Methodology, March 16, 2020

Attachment C: Evaluation Measure Methodology and Results, June 9, 2020

Attachment D: Policy Evaluation, October 23, 2020

Attachment E: Comprehensive Results