



## Mixed-Use Development Trip Generation Evaluation Tool Testing

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Completed: 02/21/19

### Overview

The Planning Board will be briefed on the status of collaborative work underway by Fehr & Peers DC and Toole Design in support of the performance evaluation of analysis tools for application in Montgomery County to estimate trip generation from mixed-use development. The tools evaluated range from traditional Institute of Transportation Engineers (ITE) methods to locally calibrated and validated mixed-use development (MXD) trip generation estimation tools. This effort is the **first step** in support of the exploration of the potential for the development of a Montgomery County-focused, customized MXD trip generation estimation tool. As such, this effort is primarily an “investigation/research” exercise. At this point, the most significant “tangible” product derived from the work performed to date is Montgomery County-specific, site-level, mixed-use development person trip generation data that potentially may be used in combination with similar data collected in other jurisdictions in the Washington region to enhance the application of the Local Area Transportation Review (LATR) process.

A technical memorandum (including an Executive Summary) documenting the approach and the results of the work described above has been developed and is available for public review. **(See Attachment 1.)**

### Background

There is currently available limited data pertaining to urban, multimodal trip generation at the individual site level. This lack of data limits the ability of the Department to accurately assess development impacts on the transportation system in urban and multimodal contexts. To date, the Department has relied on a variety of data sources, including ITE trip generation rates, Census data, and Washington Metropolitan Area Transit Authority (WMATA) Development-Related Ridership Survey data, when assessing the impact of new development on the transportation system. Even when taken together, these sources generally fail to provide a robust idea of a development’s trip generation. ITE’s *Trip Generation Manual*, long relied upon as the industry standard for predicting travel behavior, represents vehicle trip rates in areas with single-use, low density zoning and land uses, typically with limited or no pedestrian, bicycle and/or transit amenities. Thus, with very rare exceptions, ITE rates are only truly applicable in contexts where auto access is the dominant mode. ITE rates are only given for automobile trips and, *de facto*, assume most access and all impacts are due to the automobile.

The County, by contrast, is diverse in land use character – ranging from single-use, low density zoned areas with limited non-auto amenities to primarily dense and mixed-use areas with the availability of walking, biking, and public transit modes. The latter represents a very different trip-making context. This context is guaranteed to create fewer vehicle trips than ITE rates would predict and, quite possibly, more total trips overall (due to different trip-chaining patterns and greater density, for example). The limitations associated with ITE rates for this context are well understood, not least by ITE, which is currently embarked on a process to improve the applicability of their practice guidance for urban and mixed-use contexts. Census data also have limitations in that only journey to work trips are represented. Journey to work tends to have unique characteristics that are not necessarily representative of travel for other purposes. Thus, inference to other trip types cannot be made from Census data. Finally, while the WMATA data provide local multimodal information, the data are out-of-date and were collected at limited sites. These sources are neither complete nor easily combined, hence the need for the fresh perspective on trip generation that is reflected by this project

In recognition of the circumstances described above, the Department has taken an initial step to develop context-sensitive multimodal trip generation rates for application in the Local Area Transportation Review (LATR) process that pivot from ITE vehicle trip generation rates based on policy-area factors derived from the application of the Department’s Montgomery County-focused adaptation of the Metropolitan Washington Council of Governments (MWCOC) regional travel demand model (called “Travel/4”). This step is a recognition that ITE trip generation rates are generally based on surveys in suburban areas and are not representative of most of the Montgomery County development environment. The policy-area factors used in this process are created using Travel/4 and are applied by policy area and land use.

More recently, the Department embarked on two (2) separate (but closely related) initiatives to improve the capability to estimate trip generation estimation from mixed-use development:

- **Site-level, Person Trip Generation Survey** - Toole Design, supported by a FY 19 grant issued under MWCOC’s Transportation and Land Use Connections (TLC) Program, performed work that focused on the conduct of a field survey designed to collect person trip generation data (by mode) at selected **mixed-used, office with retail development sites** in the County.
- **MXD Trip Generation Tool Testing** - Fehr & Peers DC (FPDC) performed work including two key tasks: (1) the conduct of a field survey designed to collect person trip generation data (by mode) at selected **mixed-used, residential over retail development sites** in the County and (2) the performance evaluation of alternative trip generation estimation tools for application in the County.

## Summary

The work performed by the consultant teams included: (1) site selection for trip generation data collection; (2) the design of a process for collecting person trip generation data; and (3) the execution of a person count and intercept survey that captured total trip generation and allowed trip generation estimation by mode. Data collection at twenty (20) sites was performed that represents the foundation of a database. The data will help the Department to better assess potential transportation impacts of new development throughout Montgomery County and supplement data derived from similar multimodal trip generation data collection initiatives recently undertaken in the Washington, DC

metropolitan area and in other parts of the country. In addition, the data collected were analyzed/evaluated and used to estimate person trips and trips by auto, transit, walk and bike modes.

There is a widespread belief that the available tools for estimating travel demand from urban development are not as accurate as they could be. The implications include: 1) the County may be hindered in developing appropriate travel impact mitigations; 2) the County lacks good information to communicate to existing residents regarding potential travel impacts of proposed development; and 3) the County, with better tools, would be able to make stronger, more relevant policy based on more reliable understanding of travel demand and development impacts.

The Department is clearly interested in the question of how trip generation is shaped by the relationship between land use and transportation infrastructure – particularly in more urbanized areas. The ultimate objective of the initiative is to develop a better suite of tools to understand development impacts so that appropriate mitigations can be made. The project documented here represents the significant step of collecting data that capture multimodal trip-making behavior at the building level. Better data is foundational to creating a better process.

As noted above, the work performed by the consultant teams entailed the collection of site-level multimodal urban trip generation data at twenty (20) selected sites in Montgomery County. These sites were analyzed using several of the available tools for estimating travel impacts. Potentially, staff envisions the results of this project could support the development of a Montgomery County-focused MXD+<sup>1</sup> model that could be applicable not only in the County but also in other urbanizing local jurisdictions in the region. The work performed to date represents a significant first step in realizing that vision.

The benefits of the work performed by the consultant teams are multi-fold, addressing the concerns that prompted the initiatives described above. First and foremost, this work has produced detailed data on individual site trip generation that has not previously been available. These data will allow the Department to better understand travel demand, which in turn allows for a better understanding of the potential transportation impacts of developments in Montgomery County. These data will also increase the sample size of data derived from similar efforts undertaken by other local jurisdictions – improving the reliability of available multimodal trip generation data in the region. This will lead to more appropriate mitigations and fewer inappropriate mitigations at the site level – thereby supporting land use sustainability and transportation accessibility goals. By quantifying observed behavior, these data can also assist in addressing traffic impact concerns from residents, decision makers, and other stakeholders. Similarly, the data could lead to better County-wide policy-making by more closely tying policies about mitigations to how people make trips.

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<sup>1</sup> MXD+ is a multimodal trip generation estimation tool designed by Fehr and Peers to model trip generation for mixed-use developments (<http://www.fehrandpeers.com/mxd/>).

## Recommendation

Staff recommends the Planning Board direct staff to further explore the key recommendations described in the attached technical memorandum that offer potential to improve site-level trip generation estimation. In order of resource requirements and level of effort intensity, these recommendations are:

1. **Implement ITE 10<sup>th</sup> Edition Trip Generation Manual methods for site-level person and vehicle trip estimation;**
2. **Consider the implementation of the Mixed-Use Development (MXD)+ tool based on ITE 10<sup>th</sup> Edition Trip Generation Manual methods with local calibration for person and vehicle trip estimation; and**
3. **Consider developing a customized MXD trip generation tool for Montgomery County.**

## Attachment:

1. February 20, 2019 memorandum, “Mixed-Use Trip Generation Tool Testing”, Fehr & Peers DC (in collaboration with Toole Design)

EG/JS/aj





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## MEMORANDUM

Date: February 20, 2019  
To: Eric Graye, Maryland-National Capital Park and Planning Commission  
From: Alex Rixey, Jesse Cohn, and Sogand Karbalaieali, Fehr & Peers DC  
Subject: **Mixed-Use Trip Generation Tool Testing**

*DC18-0040*

## ACKNOWLEDGEMENTS

This project was funded by the Maryland-National Capital Park and Planning Commission (M-NCPPC) and the Metropolitan Washington Council of Governments (MWCOC) Transportation-Land Use Connections (TLC) grant program. The consultant team included Toole Design, who coordinated data collection for eight office with retail sites and calculated trip generation estimates using the ITE Trip Generation Manual and M-NCPPC LATR Guidelines for all twenty sites; Quality Counts, who collected data for eight office with retail sites, and WBA Research, who collected data for twelve residential over retail sites.

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## EXECUTIVE SUMMARY

In 2015, Fehr & Peers DC completed an assessment of the Montgomery County Planning Department's transportation policy goals and existing metrics, recommended additional performance metrics to address the full suite of policy goals, and evaluated the tools available to calculate those performance metrics. Two outcomes of that study were a preliminary finding that Travel/4 model<sup>1</sup> trip generation had limited sensitivity to changes in built environment context and changes in the magnitude of land use, and a recommendation to further evaluate the accuracy of trip generation approaches that could be deployed in the County.

The Maryland-National Capital Park and Planning Commission (M-NCPPC) Local Area Transportation Review (LATR) Guidelines already allow for adjustments to the trip generation rates presented in the latest edition of the Institute of Transportation Engineers' (ITE) Trip Generation Manual. The goal of this study is to explore options for refining trip generation estimation in three key ways:

1. Introduce sensitivity to built environment and demographic characteristics, such as density, diversity, design, destination accessibility, distance to transit, and development scale;
2. Introduce sensitivity to the level of parking supply at the site level; and
3. Enable direct estimation of person trips and trips by mode, including auto, transit, and active modes.

Furthermore, trip generation estimates are needed at two scales for two main purposes:

1. The site level, in support of the LATR process; and
2. The area level, in support of the County's travel demand model and the analysis involved in larger-scale studies, such as sector or master plans.

The result of this line of inquiry may be a recommendation to:

1. Apply one or more of the analyzed methods directly in Montgomery County;
2. Modify one or more of the analyzed methods for use in Montgomery County; or

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<sup>1</sup> The Travel/4 model is a Montgomery County-focused adaptation of the Metropolitan Washington Council of Governments (MWCOC) Version 2.3.52 regional travel demand model.



3. Develop one or more new mixed-use trip generation methods specifically for use in Montgomery County (or collaboratively with other jurisdictions for application in similar contexts in the region).

## APPROACH

In pursuit of these goals, this study takes the first step by testing the applicability of available mixed-use trip generation tools for a limited set of land uses and development contexts in Montgomery County. The methods tested include:

- M-NCPPC's LATR Guidelines;
- ITE's Trip Generation Manual (9<sup>th</sup> and 10<sup>th</sup> Editions);
- MXD<sup>+</sup>, a platform designed by Fehr & Peers to model trip generation for mixed-use developments, pivoting from both 9<sup>th</sup> Edition ITE Trip Generation Manual trip rates ("MXD+ 9<sup>th</sup> Edition") and 10<sup>th</sup> Edition ITE Trip Generation Manual rates ("MXD+ 10<sup>th</sup> Edition"); and
- TripsDC, a locally calibrated and validated trip generation tool based on data from residential over retail developments within Washington, DC.

To identify the benefits and limitations of each method, the estimated trip generation from each method is compared to the observed data, where applicable. Two levels of analyses, site-level and area-level, have been considered to assess applicability for site-level development review and area master plan analysis, respectively. At the site-level, 20 locations in Montgomery County—12 residential over retail sites and 8 office with retail sites—were chosen to analyze using all four methods for the AM and PM peak hours. At the area level, which relies on 2007-2008 Regional Household Travel Survey<sup>2</sup> data as a proxy for observed data, only daily MXD+ results are used to analyze a set of 20 areas defined as selected policy areas or traffic analysis zones (TAZs) located within policy areas.

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<sup>2</sup> In 2007 and 2008, the Metropolitan Washington Council of Governments (MWCOC) conducted a survey of 11,000 households in the Washington region and adjacent areas to gather updated information on area wide travel patterns.



## RESULTS

### SITE-LEVEL RESULTS

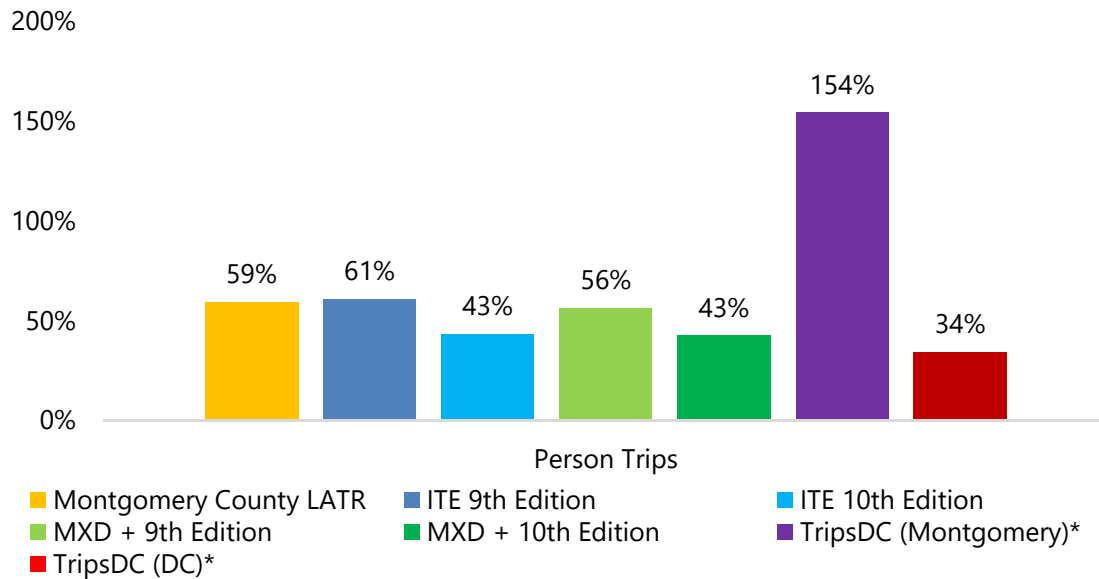
For site-level analysis, the observed and predicted values of person trips, vehicle trips, and external walk, bike, and transit trips are compared. We use “Weighted Mean Absolute Percent Error (WMAPE),” interpreted as the average percent deviation (positive or negative) of the predicted value from the observed value across all sites, weighted by the observed counts at each site, as the metric to assess the accuracy of each tool; smaller values of WMAPE reflect a more accurate prediction. For example, if one site overpredicts by 50% and a second site underpredicts by 50%, the Mean Absolute Percent Error (MAPE) would be 50%, not zero percent; if these sites are of different sizes, the WMAPE may vary from the simple average MAPE. Using WMAPE, we compare person trips; vehicle trips; and external walk, bike, and transit trips.

#### Person Trips Comparison

For the analyzed sites in Montgomery County, ITE 10<sup>th</sup> Edition Trip Generation Manual and MXD+ 10<sup>th</sup> Edition provide person trip estimates with comparable accuracy during the AM peak hour across residential over retail and office with retail land use types. In the PM peak hour, MXD+ 10<sup>th</sup> Edition provides the most accurate prediction of person trips for residential over retail sites, while LATR and MXD+ 10<sup>th</sup> Edition provide person trip estimates with comparable accuracy. MXD+ 10<sup>th</sup> Edition and ITE 10<sup>th</sup> Edition Trip Generation Manual provide the most accurate overall person trip predictions, with an overall WMAPE of 43%. This represents a substantial improvement over ITE 9<sup>th</sup> Edition and LATR, with overall WMAPE values of 61% and 59%, respectively (**Figure 1**). When applied to sites in the District of Columbia, TripsDC provides the most accurate person trip estimation, with a WMAPE of 34%.



**FIGURE 1 WMAPE FOR PERSON TRIPS**



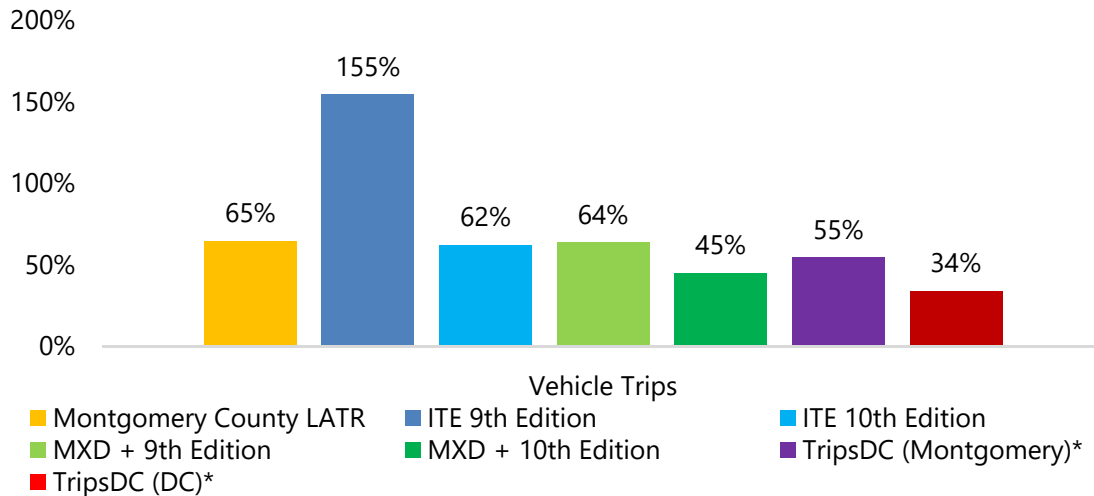
\*Two values are provided for TripsDC: one value for the application to the sites analyzed in Montgomery County and a second value for the application of TripsDC to sites in the District of Columbia, for comparison purposes only.

### Vehicle Trips Comparison

For the analyzed sites in Montgomery County, MXD+ 10<sup>th</sup> Edition provides the most accurate overall prediction of vehicle trips, with an overall WMAPE of 45%; MXD+ 10<sup>th</sup> Edition also provides the most accurate prediction for each combination of AM and PM peak hour and land use type. For residential over retail uses in the PM peak hour, TripsDC provides a comparable level of accuracy. For vehicle trip generation overall, MXD+ 10<sup>th</sup> Edition, with WMAPE of 45%, substantially outperforms ITE 10<sup>th</sup> Edition Trip Generation Manual and LATR with overall WMAPE values of 62% and 65%, respectively (**Figure 2**). When applied to sites in the District of Columbia, TripsDC provides the most accurate person trip estimation, with a WMAPE of 34%.



**FIGURE 2 WMAPE FOR VEHICLE TRIPS**



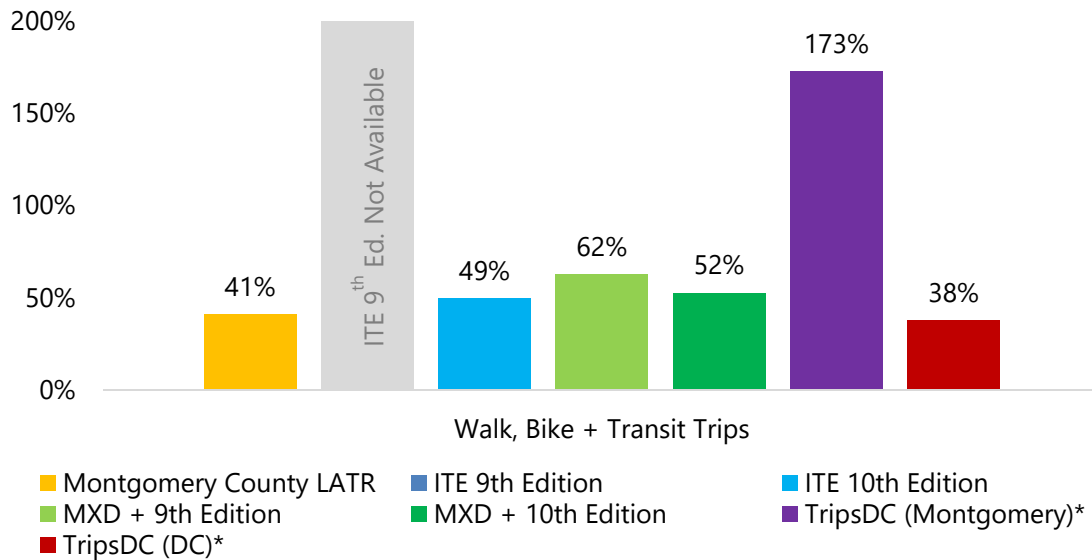
\*Two values are provided for TripsDC: one value for the application to the sites analyzed in Montgomery County and a second value for the application of TripsDC to sites in the District of Columbia, for comparison purposes only.

### External Walk, Bike, and Transit Trips Comparison

For the analyzed sites in Montgomery County, the Montgomery County LATR method provides the most accurate overall prediction of external walk, bike, and transit trips, with an overall WMAPE value of 41% (**Figure 3**). This represents a substantial improvement over the ITE 10<sup>th</sup> Edition Trip Generation Manual and MXD+ 10<sup>th</sup> Edition methods, with overall WMAPE values of 49% and 52%, respectively. When applied to sites in the District of Columbia, however, TripsDC provides slightly more accurate external walk, bike, and transit trip estimates, with a WMAPE of 38%.



**FIGURE 3 WMAPE EXTERNAL WALK, BIKE, AND TRANSIT TRIPS**



\*Two values are provided for TripsDC: one value for the application to the sites analyzed in Montgomery County and a second value for the application of TripsDC to sites in the District of Columbia, for comparison purposes only.

The results described above are summarized in **Table 1** the green end of the spectrum represents more accurate predictions, while the red end of the spectrum represents less accurate predictions. The WMAPE for the most accurate method for each row is presented in bold; WMAPE values within five percent of the most accurate method are bolded similarly. Detailed site-level comparison charts for all methods are provided in the Site-Level Results section. Because two key TripsDC variables, transit competitiveness and transit service intensity, were custom-calculated for the geography covered by the District of Columbia and were not available in Montgomery County, this analysis examined the range of possible values for comparable sites in the District and calculated the minimum and maximum range of trip generation estimates based on those possible values of the variables; both sets of TripsDC values are presented in the table below.





**TABLE 1 WMAPE BY METHOD, TIME PERIOD, AND LAND USE**

Output	Time Period	Site Type	WMAPE by Method						
			LATR	ITE 9 <sup>th</sup>	ITE 10 <sup>th</sup>	MXD+ 9 <sup>th</sup>	MXD+ 10 <sup>th</sup>	TripsDC (Min)	TripsDC (Max)
Person Trips	AM	Residential over Retail	64%	33%	32%	30%	31%	169%	
		Office with Retail	83%	94%	56%	89%	61%	n/a	
		All Sites	76%	70%	47%	66%	49%	n/a	
	PM	Residential over Retail	81%	55%	48%	55%	41%	143%	
		Office with Retail	36%	56%	38%	49%	38%	n/a	
		All Sites	49%	55%	41%	51%	39%	n/a	
Vehicle Trips	AM	Residential over Retail	65%	142%	53%	56%	45%	72%	89%
		Office with Retail	80%	196%	89%	83%	61%	n/a	n/a
		All Sites	75%	176%	76%	73%	55%	n/a	n/a
	PM	Residential over Retail	84%	191%	56%	56%	37%	41%	51%
		Office with Retail	48%	119%	52%	59%	39%	n/a	n/a
		All Sites	58%	141%	53%	58%	38%	n/a	n/a
External Walk, Bike + Transit Trips	AM	Residential over Retail	32%	n/a	35%	63%	68%	163%	235%
		Office with Retail	63%	n/a	66%	103%	71%	n/a	n/a
		All Sites	49%	n/a	52%	85%	70%	n/a	n/a
	PM	Residential over Retail	46%	n/a	39%	47%	42%	180%	208%
		Office with Retail	30%	n/a	53%	51%	43%	n/a	n/a
		All Sites	36%	n/a	48%	50%	43%	n/a	n/a

Note: Color scales are independent for each type of output (Person Trips, Vehicle Trips, and External Trips)



## AREA-LEVEL RESULTS

For the area-level MXD+ and LATR comparisons, we rely on a sample of data from the 2007-2008 MWCOG Regional Household Travel Survey to serve as our observed value for each area. For this comparison we rely on Average Percent Error in addition to MAPE. At this level, “observed” (surveyed) external vehicle trip mode shares for the selected areas ranged from 57% in Silver Spring to 95% in Olney, with an average value of 79%. The MAPE for area-level MXD+ external vehicle trip mode share predictions is nine percent for both the MXD+ and LATR methods. The Average Percent Error for LATR is six percent, while the Average Percent Error for MXD+ is only four percent, indicating that errors for MXD+ are more evenly balanced between over- and underestimates, but the absolute level of error is approximately the same for both approaches.

## CONCLUSIONS AND RECOMMENDATIONS

Trip generation is not an exact science. Regardless of method, trip generation estimates are based on observed data from comparable sites and statistical relationships to site and area characteristic variables. Across all methods and sites tested, estimates within even 30% of the observed value were the exception, not the rule. Still, findings from this study suggest that trip generation in Montgomery County could be improved over current LATR practice, if not perfected, by either implementing MXD+ 10<sup>th</sup> Edition or undertaking one or more of three options for implementing a custom trip generation tool like TripsDC in Montgomery County. Numbers in parentheses refer to the more detailed recommendation descriptions below. In order of level of effort required to implement, these recommendations are:

- Test the complete range of potential TripsDC input values to determine whether any combination of inputs would result in more accurate trip generation (2.a).
- Implement MXD+ 10<sup>th</sup> Edition for site-level person and vehicle trip estimation (1).
- Calculate values of missing TripsDC input values for Montgomery County and re-test application of TripsDC (2.b).
- Develop a custom trip generation estimation tool, either independently or in collaboration with other regional jurisdictions (2.c).

**1. MXD+ 10<sup>th</sup> Edition provides the most accurate estimates of person and vehicle trips** for the sites analyzed in Montgomery County, offering a substantial vehicle trip accuracy improvement over LATR adjustments to ITE 10<sup>th</sup> Edition. LATR provides a more accurate estimate of the number



of trips by walking, biking, and transit combined; however, this is generally the result of combining less accurate person trip estimates with less accurate mode share estimates, which balance each other. A key benefit of MXD+ is that it can be used for both site and area-level analysis for a wide range of land use types. In terms of this study's three goals, MXD+:

1. Introduces sensitivity to site-specific built environment and demographic characteristics;
2. Is not sensitive to parking supply; and
3. Improves upon the ITE 10<sup>th</sup> Edition Trip Generation Manual estimation of person trips and trips by mode in the sense that site-specific factors sensitive to built environment and demographic characteristics are applied to vehicle trip generation rates to derive person trips and trips by mode; however, these results still reflect factors of vehicle trip generation and not direct estimates.

**Recommendation:** Consider applying MXD+ 10<sup>th</sup> Edition, with additional adjustments, to improve prediction accuracy for person trips and especially vehicle trips relative to LATR and the ITE 10<sup>th</sup> Edition Trip Generation Manual.

**2. TripsDC is not calibrated to Montgomery County conditions, but indicates potential for a custom tool.** Although results from the minimum end of the TripsDC range are comparable in accuracy to the MXD+ 10<sup>th</sup> Edition results for vehicle trips for the PM peak hour, all other trip estimates overstate trip generation by approximately 140% to 240%. When applied to sites in D.C., however, TripsDC has WMAPE values of approximately 34% for person trips and vehicle trips and 38% for combined walk, bike, and transit trips, which would be an improvement over all other methods tested. In terms of this study's three goals TripsDC:

1. Introduces sensitivity to site-specific built environment and demographic characteristics.
2. Is sensitive to parking supply.
3. Enables direct estimation of person trips and trips by mode, including auto, transit, and active modes; however, as currently calibrated to Washington, DC residential over retail sites, these estimates are highly inaccurate for Montgomery County. When applied in the District, TripsDC had transit trip WMAPE values of 45-55%, walk trip WMAPE values of approximately 40%, and bike trip WMAPE values of 48-55%, depending on the peak hour; direct estimates from Montgomery County or comparable context data could provide more accurate, direct estimates of each mode.



**Recommendation:** Consider developing a TripsDC-style custom tool for Montgomery County. It is uncertain how well a custom tool would perform. However, if a Montgomery County custom tool could achieve the same local performance as TripsDC, switching from LATR to a custom tool could reduce person trip error from approximately 59% to 34%, vehicle trip error from 65% to 34%, and combined walk, bike, and transit trip error from 41% to 38%. **Developing a complete custom tool is a resource-intensive process;** potential mitigation strategies that may be considered in support of moving forward with this recommendation include:

- a. First take an incremental step to test the complete range of possible values of Transit Competitiveness and Transit Service Intensity on the 20 sites in this study to see if accuracy could be improved.
- b. If strategy (a) proves promising, calculate values of the transit competitiveness and transit service intensity variables for Montgomery County and re-test application of TripsDC.
- c. To reduce Montgomery County's burden in developing a custom tool, consider collaborating with neighboring jurisdictions to share the cost of data collection and tool development.



## INTRODUCTION

In 2015, Fehr & Peers DC completed an assessment of the Montgomery County Planning Department's transportation policy goals and existing metrics, recommended additional performance metrics to address the full suite of policy goals, and evaluated the tools available to calculate those performance metrics. Two outcomes of that study were a preliminary finding that Travel/4 model<sup>3</sup> trip generation had limited sensitivity to changes in built environment context and changes in the magnitude of land use, and a recommendation to further evaluate the accuracy of trip generation approaches that could be deployed in the County.

The Maryland-National Capital Park and Planning Commission (M-NCPPC) Local Area Transportation Review (LATR) Guidelines already allow for adjustments to the trip generation rates presented in the latest edition of the Institute of Transportation Engineers' (ITE) Trip Generation Manual. The goal of this study is to explore options for refining trip generation estimation in three key ways:

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2. Introduce sensitivity to the level of parking supply at the site level; and
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Furthermore, trip generation estimates are needed at two scales for two main purposes:

1. The site level, in support of the LATR process; and
2. The area level, in support of the County's travel demand model and the analysis involved in larger-scale studies, such as sector or master plans.

The result of this line of inquiry may be a recommendation to:

1. Apply one or more of the analyzed methods directly in Montgomery County;
2. Modify one or more of the analyzed methods for use in Montgomery County; or

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<sup>3</sup> The Travel/4 model is a Montgomery County-focused adaptation of the Metropolitan Washington Council of Governments (MWCOC) Version 2.3.52 regional travel demand model.



3. Develop one or more new mixed-use trip generation methods specifically for use in Montgomery County (or collaboratively with other jurisdictions for application in similar contexts in the region).

In pursuit of these goals, this study takes the first step by testing the applicability of available mixed-use trip generation tools for a limited set of land uses and development contexts in Montgomery County. The methods tested include:

- M-NCPPC's LATR Guidelines;
- ITE's Trip Generation Manual (9<sup>th</sup> and 10<sup>th</sup> Editions);
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- TripsDC, a locally calibrated and validated trip generation tool based on data from residential over retail developments within Washington, DC.

To identify the benefits and limitations of each method, the estimated trip generation from each method is compared to the observed data, where applicable. Two levels of analysis, site-level and area-level, have been considered to assess applicability for site-level development review and area master plan analysis, respectively. At the site-level, 20 locations in Montgomery County—12 residential over retail sites and 8 office with retail sites—were chosen to analyze using all four methods for the AM and PM peak hours. At the area level, which relies on 2007-2008 Regional Household Travel Survey<sup>4</sup> data as a proxy for observed data, only daily MXD+ results are used to analyze a set of 20 areas defined as selected policy areas or traffic analysis zones (TAZs) located within policy areas.

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<sup>4</sup> In 2007 and 2008, the Metropolitan Washington Council of Governments (MWCOC) conducted a survey of 11,000 households in the Washington region and adjacent areas to gather updated information on area wide travel patterns.



## TOOLS TESTED

### M-NCPPC LATR GUIDELINES

The M-NCPPC LATR Guidelines detail the Montgomery County Local Area Transportation Review Process. According to the Montgomery County Code, the Planning Board must find that public facilities will be adequate to serve proposed development, or an applicant must provide those facilities or make a traffic mitigation payment toward area-wide transportation needs. The process outlined in the Guidelines is based on vehicle trips estimated using the version of the ITE Trip Generation Manual in effect when the project was approved. The 10<sup>th</sup> Edition of the ITE Trip Generation Manual was published in September 2017. Therefore, any projects that have been approved since September 2017 and all new projects must use the 10<sup>th</sup> Edition of the Manual. After calculating the baseline vehicle trips from ITE, reductions are taken for internal capture that occurs within mixed-use sites and pass-by trips, if applicable. The Guidelines then provide vehicle trip rate adjustment factors and mode split assumptions by policy area which are applied to ITE estimated external vehicle trips to estimate both person and vehicular trip generation for sites within the County. The context-sensitive trip generation reduction practices reflected in the LATR process are described below.

- **Vehicle Trip Generation Rate Adjustment Factors.** These factors are provided in Appendix Table 1a for each combination of policy area and land use type (residential, office, retail, and other). Adjustments range from 61% of ITE rates in the dense, transit-rich Bethesda CBD to over 100% in the more suburban and rural portions of Montgomery County.
- **Transit Proximity.** Sites located outside a Red policy area but located within 1,000 feet of an existing or planned site for a light-rail transit (LRT) or a bus rapid transit (BRT) station may shift additional trips from auto drivers to transit patrons based on the walking distance to transit, with reductions of up to 20 percent for office development or up to 10 percent for residential development, scaling with the walking distance from transit.
- **Parking Management.** LATR allows reductions in vehicle trip generation of 1 percent for each 2 percent reduction in parking below the minimum number of spaces specified in Section 59.6.2.4 of the Montgomery County Code for residential uses, and a 1 percent trip generation reduction for each 3 percent reduction in parking for office uses.



## ITE 9<sup>TH</sup> EDITION TRIP GENERATION MANUAL

The 9<sup>th</sup> Edition of the ITE Trip Generation Manual was published in 2012 concurrent with the 2<sup>nd</sup> Edition of the ITE Trip Generation Handbook. The 2<sup>nd</sup> Edition of the ITE Trip Generation Handbook is an instructional document that provides guidance on the proper use of the trip generation data presented in the Manual. The 9<sup>th</sup> Edition of the ITE Trip Generation Manual is an informational report to be used in estimating the number of trips generated by a specific land use. Data contained in this document were primarily collected at suburban locations with little or no transit service, nearby pedestrian amenities, or travel demand management programs. The number of trips can be calculated based on key independent variables such as gross square footage, dwelling units, or number of employees for a weekday, morning peak hour, afternoon peak hour, or weekend. Trip generation calculated using the 9<sup>th</sup> Edition of the ITE Trip Generation Manual results only in the number of vehicle trips generated at a study site.

## ITE 10<sup>TH</sup> EDITION TRIP GENERATION MANUAL

The 10<sup>th</sup> Edition of the ITE Trip Generation Manual was published in 2017 concurrent with the 3<sup>rd</sup> Edition of the ITE Trip Generation Handbook. The relationship between these documents is the same as the previously released versions described above in that the Handbook is an instructional document that provides guidance on the proper use of the trip generation data presented in the Manual. Relative to the 9<sup>th</sup> Edition of the ITE Trip Generation Manual, data incorporated in the 10<sup>th</sup> Edition of this document was refined by removing older data points and vastly expanding the dataset to cover a range of sites including central city office towers, walkable midtown commercial districts, mid-rise apartments near rail transit stations, and suburban residential subdivisions. In a significant update relative to the process described in the 2<sup>nd</sup> Edition of the ITE Trip Generation Handbook, the 3<sup>rd</sup> Edition version of this document provides updated guidance for the evaluation of mixed-use developments and the establishment of local trip generation rates, as well as new guidance on techniques for estimating both person and vehicular trip generation rates.





## MXD+

MXD+ is a platform designed by Fehr & Peers to model trip generation for mixed-use developments. This method accounts for the trip reduction of mixed-use developments influenced by land use and built environment variables. The method aims to avoid overestimation of trip generation and an excessive development cost. External vehicle trip generation in MXD+ is influenced by built environment and site context variables, including density, diversity, design, distance to transit, destination accessibility, development scale, and demographics. The original MXD method originated from a national study of the trip generation characteristics of 239 mixed-use developments sponsored by the United States EPA (with review by ITE). MXD+ incorporates the internal capture relationships developed in NCHRP 684, combining the findings of both research efforts into a single method.<sup>5</sup> In 2014, Fehr and Peers converted the MXD+ spreadsheet tool to a web-based tool to streamline the compilation of input variables, calculation of results, and creation of output reports.

In general, MXD+ first uses land uses such as residential, office, retail, etc. as inputs to estimate the theoretical “raw” number of vehicle trips based on ITE trip generation. Then, MXD+ applies predicted reduction percentages for internalized trips, external walk/bike trips, and external transit trips to produce an estimate for the number of vehicle trips traveling into or out of the site. MXD+ has four steps to estimate daily external vehicle trips based on the development mixed usage and context variables. These steps are:

1. Compute daily trip estimates using standard rates and equations based on ITE Trip Generation Manual 9<sup>th</sup> and 10<sup>th</sup> Edition. These are Raw Trips.
2. Estimate the probability that a trip will stay internal to the mixed-use development ( $P_{\text{internal}}$ )
3. Estimate the probability that an external trip will be made by walking or biking ( $P_{\text{walkbike}}$ )
4. Estimate the probability that an external trip will be made by transit ( $P_{\text{transit}}$ )

Based on the calculated probabilities in steps 2 through 4, the external vehicle trips can be calculated using the equation below:

$$\text{External Vehicle Trips} = \text{Raw Trips} \times (1 - P_{\text{internal}}) \times (1 - P_{\text{walkbike}} - P_{\text{transit}})$$

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<sup>5</sup> Walters, Jerry et al. “Getting Trip Generation Right – Eliminating the Bias Against Mixed Use Development”. American Planning Association. May 2013.



The probabilities ( $P_s$ ) depend on several variables, which are characteristics of the mixed-use development and its context. Each of these variables provides a means of quantifying each of the “D” characteristics that influence trip generation in smart growth settings.

The variables affecting  $P_{\text{internal}}$  are employment, land area, diversity of land-use, and household size. The  $P_{\text{walkbike}}$  is controlled by land area, household size, job diversity, and population. The  $P_{\text{transit}}$  is affected by employment, household size, and transit access.

## TRIPSDC

TripsDC is a locally calibrated and validated trip generation tool based on data from 55 residential over retail developments within Washington, DC. The tool is preloaded with variables to apply the model at any address within the city and estimate trips by auto, walk, bike, and transit. This tool is most effective for residential-over-retail developments on sites between 0.5 and 5 acres with up to 750 residential units and up to 75,000 square feet of retail.

The land uses were limited to multi-family apartments and neighborhood retail. While residential-only developments are an acceptable application of the tool, retail-only developments are not recommended as the statistical analysis did not include this type of land use. For sites that propose zero parking supply, the tool can be used with consideration for manual adjustments, given how the statistical analysis included limited examples of this type of site.

Trips DC includes two models, a person trip model and a mode choice model. The person trip model was fitted as a linear regression model based on the magnitude of the on-site land uses (number of residential units and square feet of commercial uses). The model and its fit to the observed local Washington, DC site-level data are included in **Table 2**. During the AM peak hour, residential and commercial land uses generate about 1.1 person trips per unit and 3.2 person trips per 1,000 square feet, respectively. During the PM peak hour, residential land uses generate approximately 1.0 trips per unit, while commercial land uses generate 9.2 person trips per 1,000 square feet. The coefficients for land uses during both time periods are significant at the 99% confidence interval.



**TABLE 2 PERSON TRIP MODEL**

Variable	Estimate	Standard Error	P Value	Significance
AM Peak Hour ( $R^2 = 0.8544$ )				
Residential Land Use On-Site	1.069	0.097	2.88E-15	>99%
Commercial Land Use On-Site	3.185	0.773	0.000133	>99%
PM Peak Hour ( $R^2 = 0.8795$ )				
Residential Land Use On-Site	1.038	0.128	6.77E-11	>99%
Commercial Land Use On-Site	9.196	1.013	2.23E-12	>99%

The mode choice model is a multinomial logistic regression model, which uses seven independent contextual variables to calculate the mode choice for each site:

- Employment within one mile
- Neighborhood population density
- Parking provided per service population (assumes 2.5 residents per unit and 2 employees or visitors per 1,000 square feet)
- Distance to transit (binary variable, within 0.25 miles)
- Transit competitiveness (ratio of jobs within 45 minutes by transit relative to jobs within 45 minutes by auto)
- Transit service intensity (defined as the number of transit trips per hour per acre)

The model coefficients for each variable are unique to each time period (AM and PM peak hour) and mode (auto passenger, auto driver, transit, bicycle, and walk). The mode choice model fit is summarized in **Table 3**. For all modes and time periods, the model had less than 10% error from the observed mode choice data. Specific model coefficients may be found in the DDOT MXD+ Model Development Report (July 2017).



**TABLE 3 MODE CHOICE MODEL FIT**

Validation Statistic	Auto Vehicle Trips	Transit Trips	Walk Trips	Bike Trips
AM Peak Hour				
Average Model Error	6%	-3%	1%	9%
R <sup>2</sup>	.69	.41	.57	.45
PM Peak Hour				
Average Model Error	4%	-8%	2%	3%
R <sup>2</sup>	.79	.43	.58	.55



## SITE-LEVEL COMPARISON

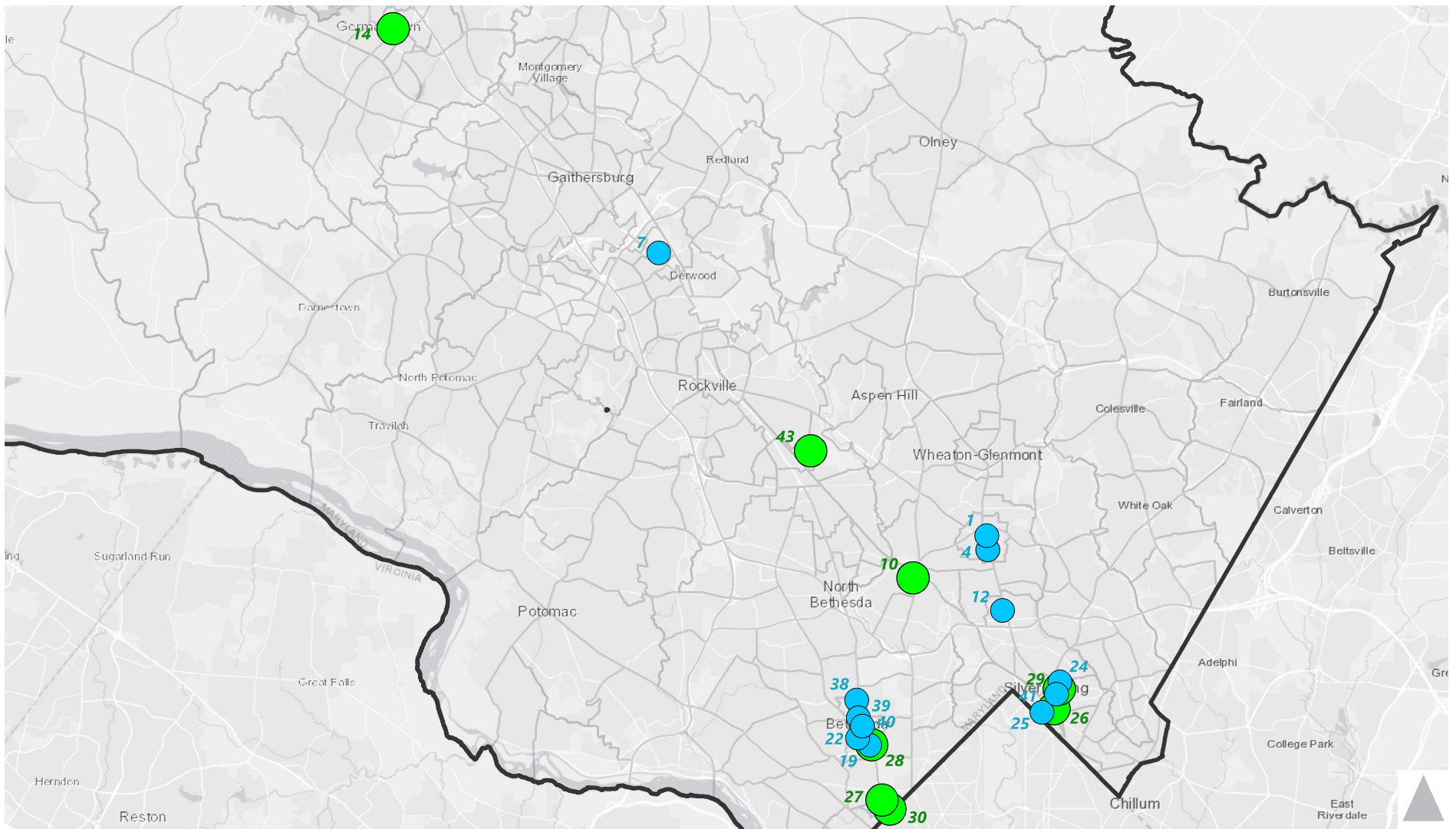
For site-level analysis, the four tools described above—ITE 9<sup>th</sup> Edition, ITE 10<sup>th</sup> Edition, M-NCPPC LATR Guidelines, MXD+ (based on ITE 9<sup>th</sup> and 10<sup>th</sup> Edition Trip Generation Manual trip rates), and TripsDC—were applied to 20 sites, including 12 residential over retail sites and 8 office with retail sites distributed across Montgomery County. The resulting estimated person trip, vehicle trip, and combined walk, bike, and transit trip generation values were compared against data collected from field observations at each site. Additional details on the site selection process, data collection, analysis, and results are provided below.

### SITE SELECTION

Twenty sites were evaluated for this study, including a mix of residential and mixed-use sites (specifically, 12 residential over retail sites and 8 office with retail sites). Sites were selected based on a variety of criteria, ensuring sites were representative of development in Montgomery County as well as applicable for the selected trip generation tools:

- **Geographic coverage:** Sites were selected to provide a range of geographic contexts across Montgomery County.
- **Comparable land uses to those used to develop the trip generation methods being tested:** ITE and LATR Appendix 1 Adjustments focus on single uses, such as residential, office, and retail, while MXD+ incorporates the effects of site context on single-use sites as well as the effect of combinations of land uses within a site. TripsDC was built for residential-over-retail sites.
- **Comparable contexts for TripsDC:** TripsDC was estimated using data from a range of contexts within the District of Columbia and may not transfer well to more exurban or rural sites with different context characteristics. Selected Montgomery County sites have characteristics comparable to the District sites used to develop TripsDC.
- **Parking:** TripsDC, applicable to residential-over-retail sites, is sensitive to the amount of parking provided. Residential-over-retail sites included a range of parking supply levels to provide information about the parking sensitivity of the tool in Montgomery County.

The 20 sites selected for analysis are depicted in **Figure 4**.



- Residential with Retail     TAZ
- Office with Retail



## SITE-LEVEL DATA COLLECTION

Site-level data for each site included the quantity and type of land use included in the site, the quantity of available on-site parking, and observed trip-making data. Additional context data specific to each trip generation methodology is described in the Site-Level Analysis section, below. Land use data were compiled from internet research and reviewed by M-NCPPC staff. On-site parking quantity was inventoried during the field observations described below.

Observed trip-making data was collected during two-hour peak commute periods, 7:00-9:00 AM and 4:00-6:00 PM, and data collection occurred mid-week (Tuesdays, Wednesdays, and Thursdays). Data was collected in dry weather conditions on a day without a holiday, early school release, a significant regional vehicular crash, transit system shutdown, or other event that would cause irregular behavior and bias the data.

Data collection consisted of person counts and intercept surveys. Person counts were conducted at all doors to the building. Surveyors tallied the number of person trips entering and exiting each building by door. If the same person makes multiple trips through a door (such as entering and exiting a store), each trip was recorded individually.

Site visitors were intercepted as they entered or exited the building. Participants were verbally asked the survey questions, and the surveyor tallied their responses. Surveyors and counters indicated which doorway is being surveyed, to ensure the samples and counts were clearly matched. The survey generally consisted of three questions:

- **Internalization:** People were asked if they had visited or are headed to another retailer within the building. If so, the participant's mode was recorded as walk, and the survey was complete.
- **Mode of Access:** If the participant was not traveling to or from another location within the building, they were asked their mode of access. The intent of this question was to capture the primary mode of access. For example, if someone took the bus to an adjacent intersection, then walked to the building, their primary mode would be considered bus. For those who did not travel to the site in a personal vehicle, the survey was then complete.
- **Parking Location:** If respondents arrived at the site in a personal vehicle, they were asked where they parked, either in an on-site garage, on the street, or another location. For those responding "other", surveyors discerned if the person is traveling to the site on foot from



another nearby site (in which case the accurate mode for this trip was walking), or parked in a public lot and walked over (where the accurate mode was the originally recorded vehicle mode).

Questions varied slightly based on whether a person was entering or exiting the building. The survey asked only about the access or egress that was in progress when the subject was approached – i.e. someone entering the building was only asked about their arrival and not about their hypothetical departure, someone leaving was asked only about their departure and not about how they had earlier arrived. A more in-depth summary of the data collection protocol is included in **Appendix A**.

Collected site-level characteristics, including address, land uses, number of residential units, commercial square footage by category, and number of parking spaces, are provided in **Appendix B**. Site-level observations are included in **Appendix C**.

## SITE-LEVEL ANALYSIS

### M-NCPPC LATR GUIDELINES

Trip generation calculated using the methodology described in the M-NCPPC LATR Guidelines is based on adjusted ITE 10<sup>th</sup> Edition Trip Generation Manual vehicle trip generation. The LATR Guidelines provides ITE vehicle-trip generation rate adjustment factors and mode split assumptions by policy area. The adjustment factors and mode splits are applied to the external trips calculated from the ITE 10<sup>th</sup> Edition vehicle trip generation to calculate the total person trips and person trips by mode for the LATR method. The policy areas for each site selected for study and the relevant adjustment factors and mode splits from the LATR Guidelines are provided in **Appendix G**.

No reductions for transit proximity or parking reduction were applied to the study sites. Four out of the twenty sites are located outside of a Red policy area but none of the four are within 1,000 feet of an existing LRT and BRT station. Since this method is being compared to actual trips under existing conditions, planned transit stations were not considered. In order for the reductions for parking management to apply, a site is to include specific supportive actions identified to reduce parking demand. No such strategies were identified and therefore, the parking management reductions were not applied.





## ITE 9<sup>TH</sup> EDITION TRIP GENERATION MANUAL

The trip generation methods used in support of this project are calculated based on specific land uses included in the ITE Trip Generation Manuals. To maintain consistency across the methods, the same land uses were selected from both the 9<sup>th</sup> Edition and 10<sup>th</sup> Edition ITE trip generation manuals. The selected ITE land uses, real world uses, and square footages or number of dwelling units are provided in **Appendix D**.

These land uses and square footages were used with the 9<sup>th</sup> Edition of the ITE Trip Generation Manual and 2<sup>nd</sup> Edition Handbook to calculate the estimated number of vehicle trips for each of the sites. For each site and time period, the Manual provides the entering/exiting directional distribution, weighted average rate, standard deviation, fitted curve equation, and R<sup>2</sup> value. The Handbook outlines the process to determine whether to use the weighted average rate, regression equation, or to collect local data. For the purposed of this project, land uses which resulted in the recommendation to collect local data were noted and the weighted average or regression equation was selected to move forward using only data available in the Manual.

Within multi-use developments of office, retail, and residential sites some of the estimated trips are expected to come another land use internal to the site during the PM peak. Therefore, the net external trips for multi-use developments were calculated and reported as the total trip generation. The ITE 9<sup>th</sup> Edition Manual and 2<sup>nd</sup> Edition Handbook do not provide a method to calculate person trip generation or trip generation by travel mode other than vehicular.

## ITE 10<sup>TH</sup> EDITION TRIP GENERATION MANUAL

The 10<sup>th</sup> Edition of the ITE Trip Generation Manual and 3<sup>rd</sup> Edition of the ITE Trip Generation Handbook provide steps for calculating total person trip generation from the calculated vehicle trip generation. The baseline vehicle trip generation was calculated using the same land uses that were selected to match those from the 9<sup>th</sup> Edition Manual. The trip generation data in the 10<sup>th</sup> Edition Manual is separated by setting/location. The majority of the ITE data is from the General Urban/Suburban setting. Although the Dense Multi-Use Urban setting would be a better match for several study sites, due to the limited data, and to maintain a consistent approach in applying the entire trip generation process from the 3<sup>rd</sup> Edition Handbook, the General Urban/Suburban setting was used for all sites.



The ITE 3<sup>rd</sup> Edition Handbook provides several steps which make up the methodology to convert the baseline vehicle trip generation into person trip generation. The methodology is described below.

- The first step after calculating baseline vehicle trips accounts for mixed-use development and internal capture. The methods to account for mixed-use development in the Handbook were applied to the baseline vehicle trip generation to determine total external person trips. The Handbook recommends the methodology that is presented in NCHRP Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments. A spreadsheet tool that applies the calculations based on input data is provided on the ITE website and was used for these calculations. Mode share and vehicle occupancy used in this step were gathered from Appendix B in the Handbook and are provided in **Appendix D**. Mode share values for transit and non-motorized uses were rounded up to the nearest percentage.
- After the mixed-use development methodology, the 3<sup>rd</sup> Edition of the ITE Trip Generation Handbook summarizes the approach for estimating person and vehicle trip generation for developments in compact and urbanized areas where walking, bicycling, and transit are viable modes of transportation (Infill Development). This methodology was applied to calculate the total trips by mode for each site. An underlying assumption for this methodology is that a particular land use will generate the same number of person trips regardless of the context, therefore the number of person trips calculated in the previous step was assumed to remain constant while the mode splits would change. Additionally, it was assumed that the vehicle occupancy remains constant. The mode split assumptions for this step were gathered from Appendix C in the Handbook and applied to the total person trips and are provided in **Appendix D** in this memorandum. Mode share values for transit and non-motorized uses were rounded up to the nearest percentage.
- The Handbook also provides a methodology to adjust the trip generation for Transit-Friendly Development (TFD). This methodology was not applied for the purposes of this study. The methodology states that TFD is any development that is directly connected, immediately adjacent to, or directly oriented toward a rail or rapid transit station or stop (including heavy rail, light rail, streetcar, commuter rail, and bus rapid transit) or a multi-route bus transit center with high-frequency service. It was determined that this definition eliminates the majority of the sites included in the study. Additionally, the TFD methodology is extremely site-specific accounting for land use, proximity to transit, type of transit, size of development, and site context. Due to the minimal amount of data that would match the characteristics of the study sites, no adjustments were made to account for transit-friendly development.



## MXD+

MXD+ first calculates daily, AM peak hour and PM peak hour person trips from the trip generation rates provided in the ITE 9<sup>th</sup> Edition and ITE 10<sup>th</sup> Edition Trip Generation Manuals, then uses site and context variables to estimate percentage reductions for internalized trips and external trips by walking, biking, and transit. The core variables in MXD+ and their sources are described in **Table 4**.

**TABLE 4 MXD+ MODEL VARIABLES**

Variable	Definition	Unit	Source
Residential Land Use	Total residential land use on project site	Dwelling units	Project site plan
Commercial Land Use	Total commercial (retail, office, etc.) land use on project site	1,000 square feet or employees	Project site plan
Developed Area	Gross site area of land within the project site (not including open space)	Acres	Project site plan
Intersection Density	Vehicle intersections (3+ legs) density nearby the project site	Intersections per square mile	Environmental Protection Agency Smart Location Database
Household Size	Average household size, defined separately for within and nearby the project site	Persons per household	American Community Survey (ACS) 2012
Vehicle Ownership	Average vehicle ownership per household, defined separately	Vehicles per household	ACS 2012
Employment within One Mile	Number of jobs within one-mile watershed of the project site	Employment	MWCOG regional travel demand model
Employment with 30 minutes by Transit (as % of regional employment)	Share of total regional jobs located within 30-minute door-to-door transit commute of the project site	Percent of total regional employment	MWCOG regional travel demand model

The 9<sup>th</sup> and 10<sup>th</sup> Edition ITE Trip Generation Manual land use codes associated with the sites are applied in MXD+ as inputs. Following the guidance in the ITE Trip Generation Handbook, 3rd Edition, either the average rate or linear or logarithmic equation rate was selected based on the number of available study points, the  $R^2$  for the equation, and the standard deviation of study values. These decisions are documented in **Appendix D**.



**Appendix J** summarizes the person trips (or raw trips), total reductions, and generated auto trips (or net trips) based on ITE 9<sup>th</sup> and 10<sup>th</sup> Editions and the MXD+ adjustments. The detailed site-level results of the MXD+ analysis, including raw trips; internalized trips; externalized walk, bike, and transit trips; and auto trips are presented in **Appendix K**.

## TRIPSDC

While the other tools were applied to both the mixed-use office and retail sites as well as the residential and residential-over-retail sites, TripsDC applies only to sites with a residential land use. To calculate the total number of trips generated by the site, the number of residential units and square feet of commercial land uses were input into the person trip model. To calculate the mode choice for the evaluated sites, inputs were collected from a variety of sources summarized in **Table 5**.

**TABLE 5 MODE CHOICE MODEL SOURCES**

Variable	Definition and Unit	Source
Employment within One Mile	Number of jobs within one mile of the site	Longitudinal Employer-Household Dynamics (LEHD) data and Metropolitan Washington Council of Governments (MWCOC) regional travel demand model
Neighborhood Population Density	People per square mile	MWCOG regional travel demand model
Parking Provided per Service Population	Parking spaces divided by (2.5 * residential units + 2 * commercial KSF)	Parking observations and project description
Distance to Transit	binary variable, 1 if site is within 0.25 miles of a transit station, 0 if site is not within 0.25 miles of a transit station	WMATA Station shapefile, calculated as distance between MetroRail stations and sites
Transit Competitiveness	Ratio of jobs within 45 minutes by transit relative to jobs within 45 minutes by auto	Estimated based on TripsDC sites with comparable employment, population density, and distance to transit
Transit Service Intensity	Number of transit trips per hour per acre	Estimated based on TripsDC sites with comparable employment, population density, and distance to transit

While several variables could be calculated directly for this study, some variables were unavailable. Transit competitiveness and transit service intensity have only been calculated for parcels in



Washington, DC; this dataset is not available for Montgomery County. As a result, comparable sites were identified in Washington, DC based on their employment within one mile, neighborhood population density, and distance to transit. For these comparable sites, the minimum and maximum values of transit competitiveness and transit service intensity were applied in the mode choice model in order to provide a range of possible TripsDC mode choice outputs. Mode choice model inputs for each site are included in **Appendix M**.

## SITE-LEVEL RESULTS

### SITE LEVEL OVERALL COMPARISON

The trip generation estimates provided by the selected tools for person trips, vehicle trips, and combined walk, bike, and transit trips are compared below. In order to compare methods and observe their deviation from collected counts, relative error is defined as the difference between observed value and estimated value divided by the observed value; a positive relative error indicates an overestimate of trips while a negative relative error indicates an underestimate of trips. Site-level results are presented for residential over retail sites and office with retail sites in **Appendix O**.

To further summarize the results, we use “Weighted Mean Absolute Percent Error (WMAPE),” interpreted as the average percent deviation (positive or negative) of the predicted value from the observed value across all sites, weighted by the observed counts at each site, to assess the accuracy of each tool; smaller values of WMAPE reflect a more accurate prediction. For example, if one site overpredicts by 50% and a second site underpredicts by 50%, the Mean Absolute Percent Error (MAPE) would be 50%, not zero percent; if these sites are of different sizes, the WMAPE may vary from the simple average MAPE.

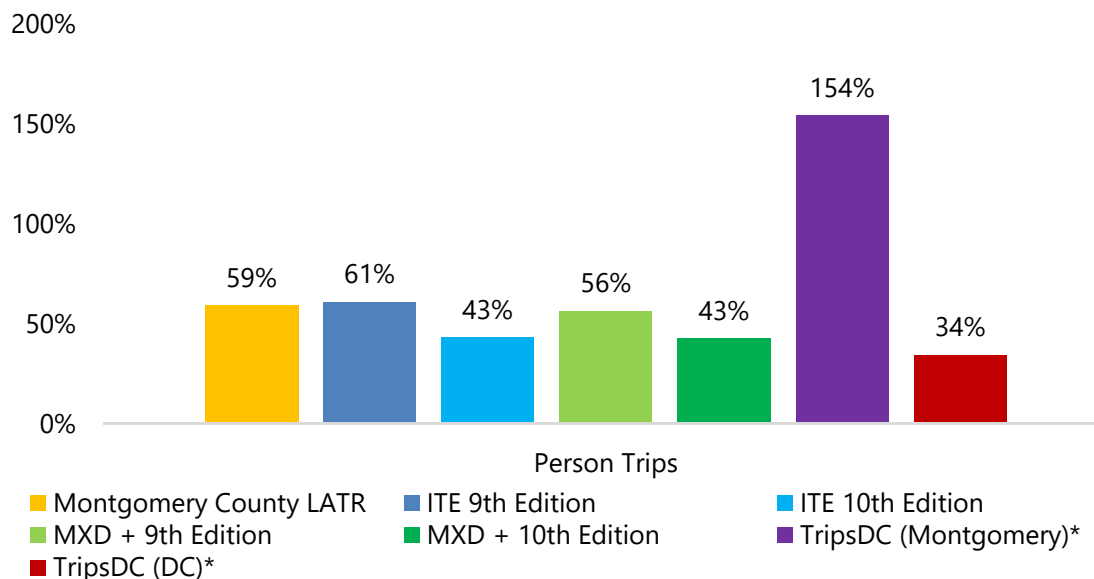
### Person Trips Comparison

ITE 10<sup>th</sup> Edition Trip Generation Manual, LATR, and TripsDC explicitly generated person trips. ITE 9<sup>th</sup> Edition Trip Generation Manual does not explicitly generate person trips; for this tool, it is assumed that person trips equal vehicle trips. MXD+ is also capable of person trip generation given an assumed vehicle occupancy value; however, in this project, one person per vehicle was assumed, so the person trip values for MXD+ include external walk, bike, and transit trips plus one person trip per vehicle trip. TripsDC is only tested for sites with residential over retail development, while ITE and LATR were applied for all selected sites.



For the analyzed sites in Montgomery County, the ITE 10<sup>th</sup> Edition Trip Generation Manual and MXD+ 10<sup>th</sup> Edition provide person trip estimates with comparable accuracy during the AM peak hour across residential over retail and office with retail land use types. In the PM peak hour, MXD+ 10<sup>th</sup> Edition provides the most accurate prediction of person trips for residential over retail sites, while LATR, ITE 10<sup>th</sup> Edition, and MXD+ 10<sup>th</sup> Edition provide person trip estimates with comparable accuracy for office with retail sites. MXD+ 10<sup>th</sup> Edition provides the most accurate overall person trip prediction, with an overall WMAPE of 43%, comparable to the ITE 10<sup>th</sup> Edition Trip Generation Manual's overall WMAPE of 43%. This represents a substantial improvement over ITE 9<sup>th</sup> Edition and LATR, with overall WMAPE values of 61% and 59%, respectively (**Figure 5**). When applied to sites in the District of Columbia, TripsDC provides the most accurate person trip estimation, with a WMAPE of 34%.

**FIGURE 5 WMAPE FOR PERSON TRIPS**



\*Two values are provided for TripsDC: one value for the application to the sites analyzed in Montgomery County and a second value for the application of TripsDC to sites in the District of Columbia, for comparison purposes only.

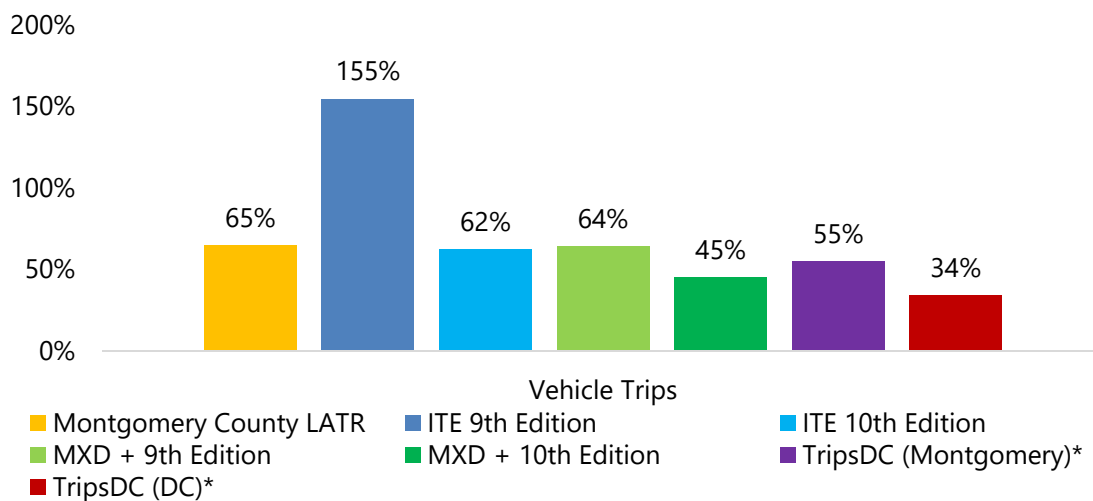
### Vehicle Trips Comparison

For the analyzed sites in Montgomery County, MXD+ 10<sup>th</sup> Edition provides the most accurate overall prediction of vehicle trips, with an overall WMAPE of 45%; MXD+ 10<sup>th</sup> Edition also provides the most accurate prediction for each combination of AM and PM peak hour and land use type. For



Residential over Retail uses in the PM peak hour, TripsDC's Minimum value provides a comparable level of accuracy. For vehicle trip generation overall, MXD+ 10<sup>th</sup> Edition, with WMAPE of 45%, substantially outperforms ITE 10<sup>th</sup> Edition and LATR with overall WMAPE values of 62% and 65%, respectively (**Figure 6**). When applied to sites in the District of Columbia, TripsDC provides the most accurate person trip estimation, with a WMAPE of 34%.

**FIGURE 6 WMAPE FOR VEHICLE TRIPS**



\*Two values are provided for TripsDC: one value for the application to the sites analyzed in Montgomery County and a second value for the application of TripsDC to sites in the District of Columbia, for comparison purposes only.

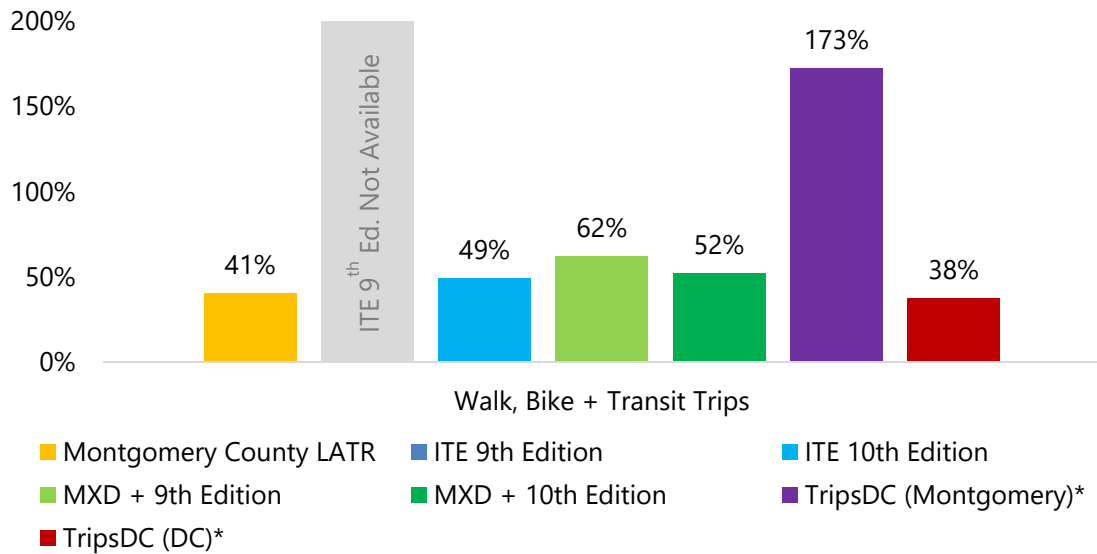
Geographic comparisons of vehicle trip generation errors for ITE 10<sup>th</sup> Edition, LATR, MXD+ 10<sup>th</sup> Edition, and TripsDC are provided in **Appendix O**.

### External Walk, Bike, and Transit Trips Comparison

For the analyzed sites in Montgomery County, the Montgomery County LATR method provides the most accurate overall prediction of external walk, bike, and transit trips, with an overall WMAPE value of 41% (**Figure 7**). This represents a substantial improvement over the ITE 10<sup>th</sup> Edition Trip Generation Manual and MXD+ 10<sup>th</sup> Edition methods, with overall WMAPE values of 49% and 52%, respectively. When applied to sites in the District of Columbia, however, TripsDC provides slightly more accurate external walk, bike, and transit trip estimates, with a WMAPE of 38%.



**FIGURE 7 WMAPE EXTERNAL WALK, BIKE, AND TRANSIT TRIPS**



\*Two values are provided for TripsDC: one value for the application to the sites analyzed in Montgomery County and a second value for the application of TripsDC to sites in the District of Columbia, for comparison purposes only.

### Summary

The above results are summarized in **Table 6**; the green end of the spectrum represents more accurate predictions, while the red end of the spectrum represents less accurate predictions. The WMAPE for the most accurate method for each row is presented in bold; WMAPE values within five percent of the most accurate method are bolded similarly.





**TABLE 6 WMAPE BY METHOD, TIME PERIOD, AND LAND USE**

Output	Time Period	Site Type	WMAPE by Method						
			LATR	ITE 9 <sup>th</sup>	ITE 10 <sup>th</sup>	MXD+ 9 <sup>th</sup>	MXD+ 10 <sup>th</sup>	TripsDC (Min)	TripsDC (Max)
Person Trips	AM	Residential over Retail	64%	33%	32%	30%	31%	169%	
		Office with Retail	83%	94%	56%	89%	61%	n/a	
		All Sites	76%	70%	47%	66%	49%	n/a	
	PM	Residential over Retail	81%	55%	48%	55%	41%	143%	
		Office with Retail	36%	56%	38%	49%	38%	n/a	
		All Sites	49%	55%	41%	51%	39%	n/a	
Vehicle Trips	AM	Residential over Retail	65%	142%	53%	56%	45%	72%	89%
		Office with Retail	80%	196%	89%	83%	61%	n/a	n/a
		All Sites	75%	176%	76%	73%	55%	n/a	n/a
	PM	Residential over Retail	84%	191%	56%	56%	37%	41%	51%
		Office with Retail	48%	119%	52%	59%	39%	n/a	n/a
		All Sites	58%	141%	53%	58%	38%	n/a	n/a
External Walk, Bike + Transit Trips	AM	Residential over Retail	32%	n/a	35%	63%	68%	163%	235%
		Office with Retail	63%	n/a	66%	103%	71%	n/a	n/a
		All Sites	49%	n/a	52%	85%	70%	n/a	n/a
	PM	Residential over Retail	46%	n/a	39%	47%	42%	180%	208%
		Office with Retail	30%	n/a	53%	51%	43%	n/a	n/a
		All Sites	36%	n/a	48%	50%	43%	n/a	n/a

Note: Color scales are independent for each type of output (Person Trips, Vehicle Trips, and External Trips)



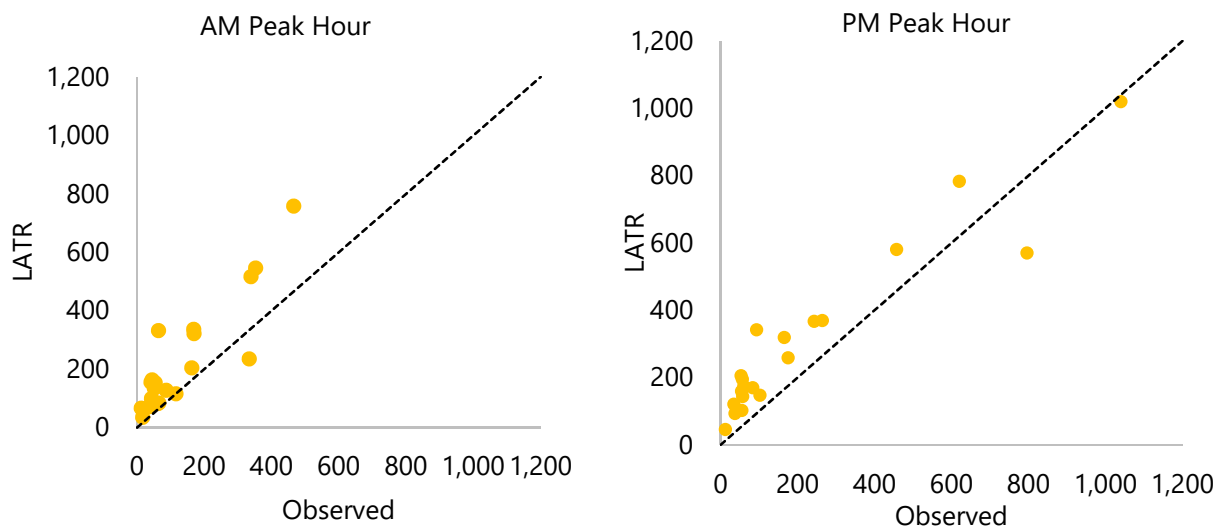
Additional, site-level comparisons of estimated to observed trip generation for each tool are provided below.

## M-NCPPC LATR GUIDELINES

Generally, LATR overestimates person trips and auto trips (**Figure 8** and **Figure 9**, respectively); auto driver mode share (**Figure 11**) and auto passenger mode share (**Figure 12**) are also generally overestimated. The results are more mixed for external walk, bike and transit trips. For sites with few observed walk, bike, transit trips, LATR overestimates the number of trips by these modes. However, for sites with larger numbers of walk, bike, and transit trips, LATR is more likely to underestimate the number of trips by these modes (**Figure 10**). Since LATR overestimates person trips, the underestimation of walk, bike, and transit trips is driven by underestimation of the transit (**Figure 13**) and non-motorized (**FIGURE 17**) mode shares. The black dotted lines represents the "match" line; the closer the points are to the line, the more similar the LATR values are to the observed counts. The table of results for all sites are included in **Appendix H**, and site-level comparison of LATR results to the observed trips is included in **Appendix I**.

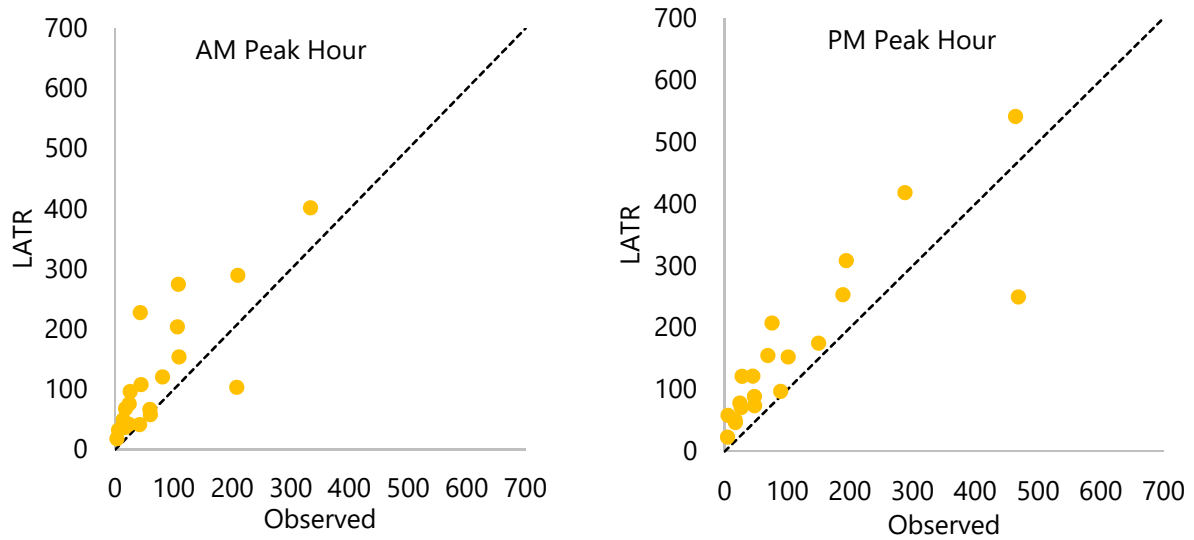
### Modal Trips Comparison

**FIGURE 8 LATR PERSON TRIP COMPARISON**

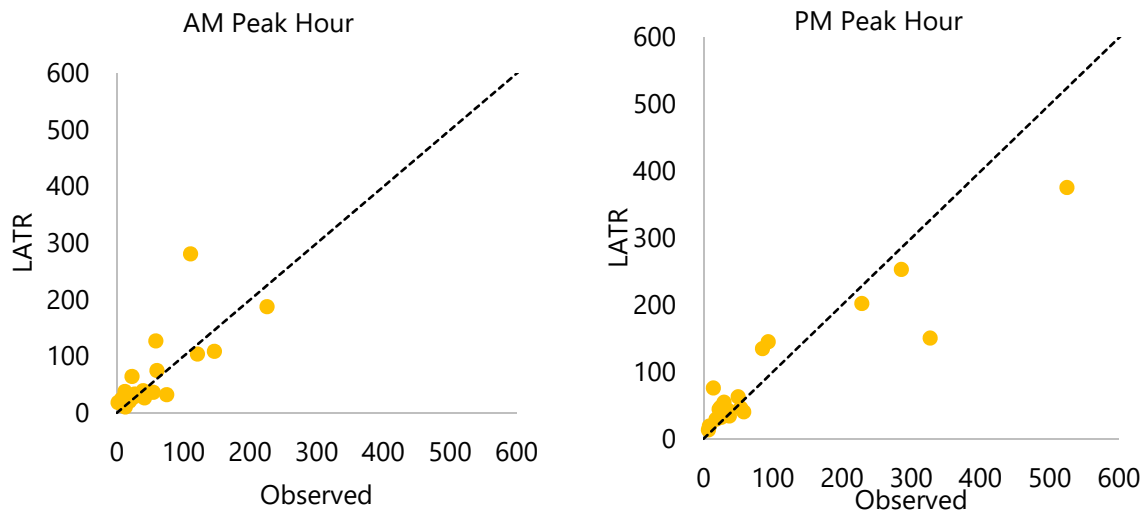




**FIGURE 9 LATR AUTO TRIP COMPARISON**



**FIGURE 10 LATR EXTERNAL TRIP COMPARISON**

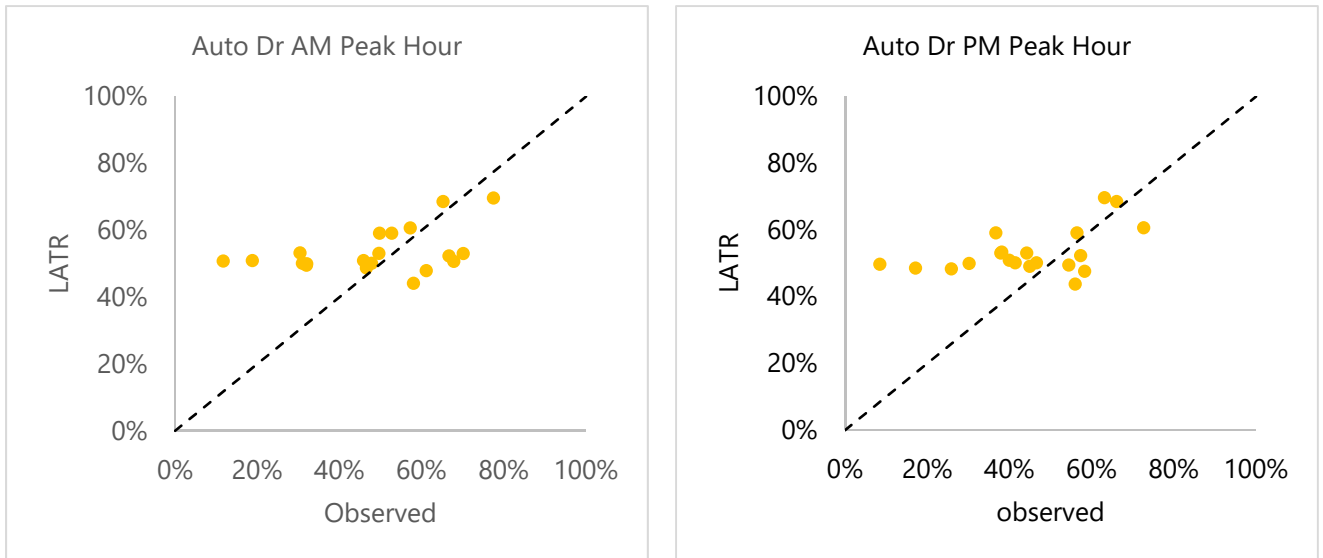




## Mode Choice Comparison

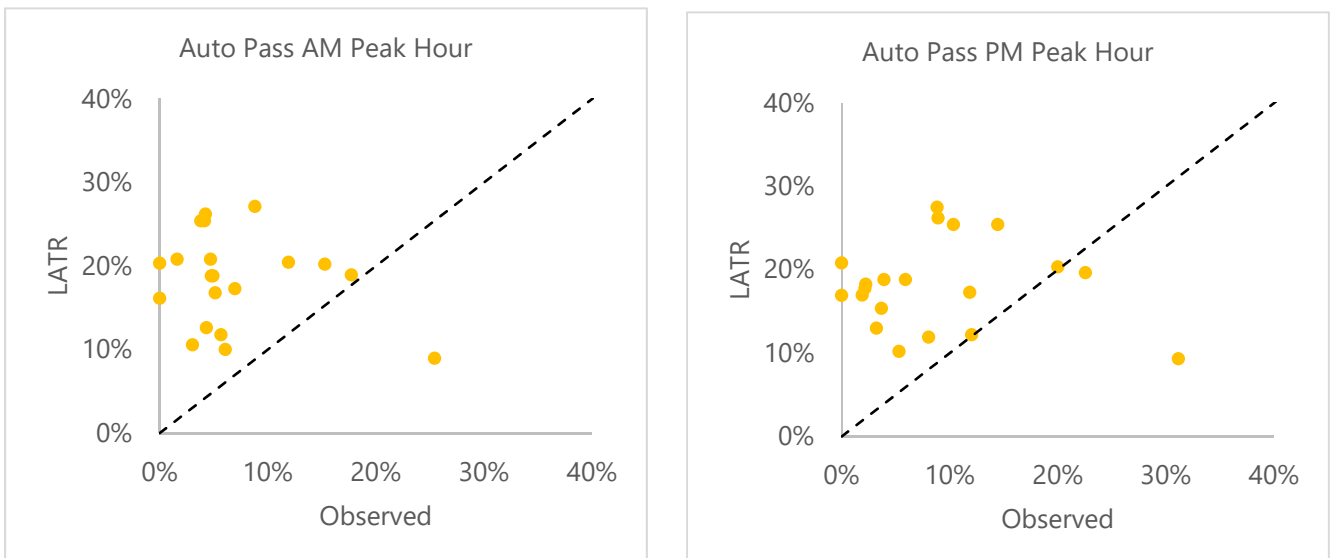
### *Auto Driver Mode Share*

**Figure 11 LATR MODE CHOICE COMPARISON – AUTO DRIVER**



### *Auto Passenger Mode Share*

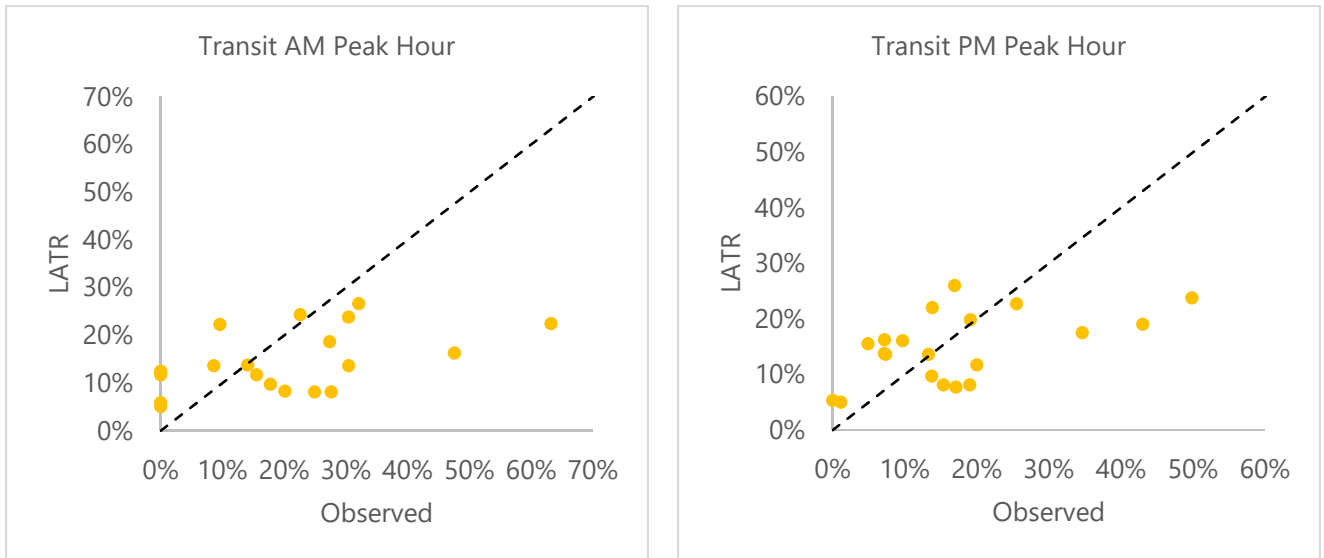
**Figure 12 LATR MODE CHOICE COMPARISON – AUTO PASSENGER**





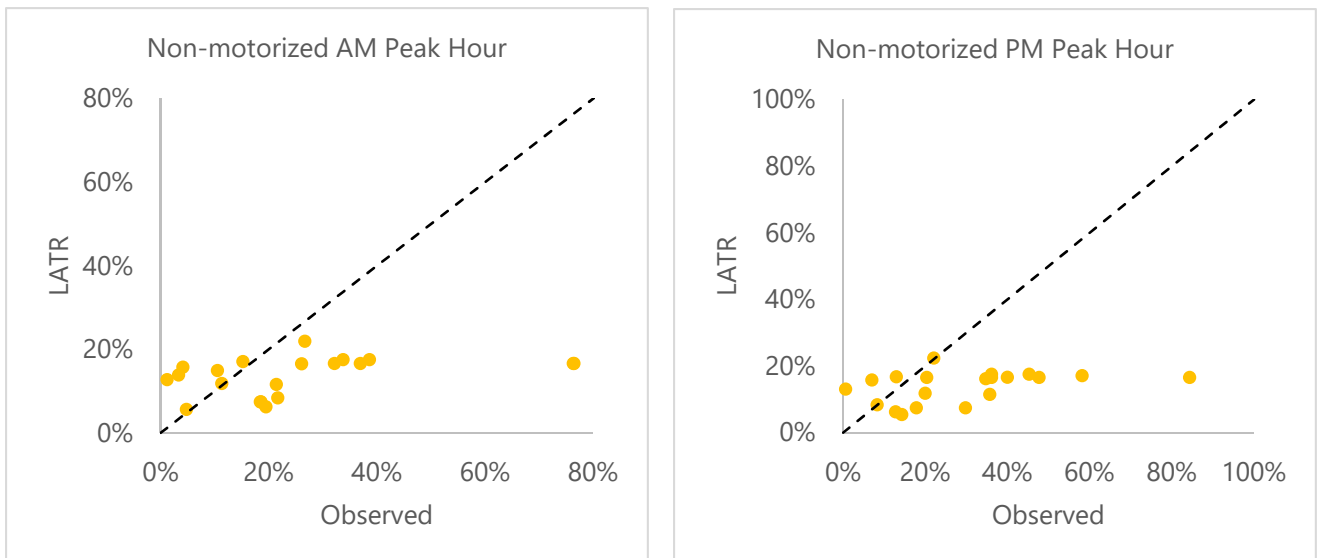
*Transit Mode Share*

**Figure 13 LATR MODE CHOICE COMPARISON – TRANSIT**



*Non-motorized Mode Share*

**Figure 14 LATR MODE CHOICE COMPARISON – NON-MOTORIZED**



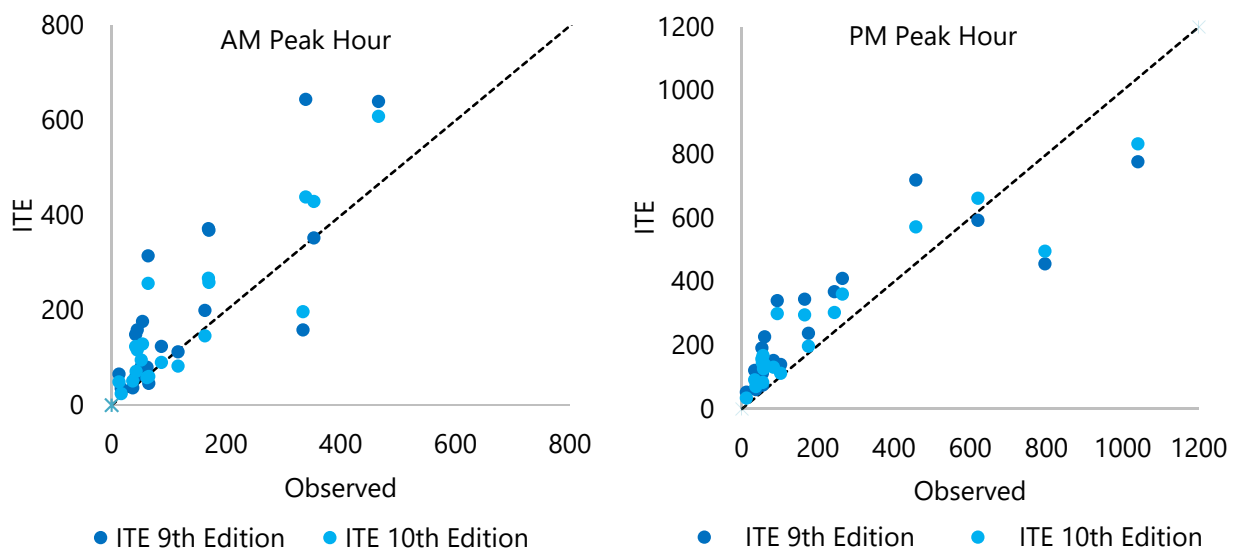


## ITE 9<sup>TH</sup> AND 10<sup>TH</sup> EDITION TRIP GENERATION MANUALS

ITE applies to all sites with residential, retail, and office land uses. To calculate the trips generated by each site, the number of residential units and square feet of commercial and retail land uses were input into the person trip model. The table of results for all sites are included in **Appendix E**, and site-level comparison of ITE results to the observed trips is included in **Appendix F**. ITE 9<sup>th</sup> Edition Trip Generation Manual does not distinguish between person trips and auto trips, so for this edition, it is assumed that the total number of auto trips is equal to the total number of person trips. Given ITE 9<sup>th</sup> Edition Trip Generation Manual does not provide additional modes, external walk, bike and transit trips are only calculated for the ITE 10<sup>th</sup> Edition Trip Generation Manual.

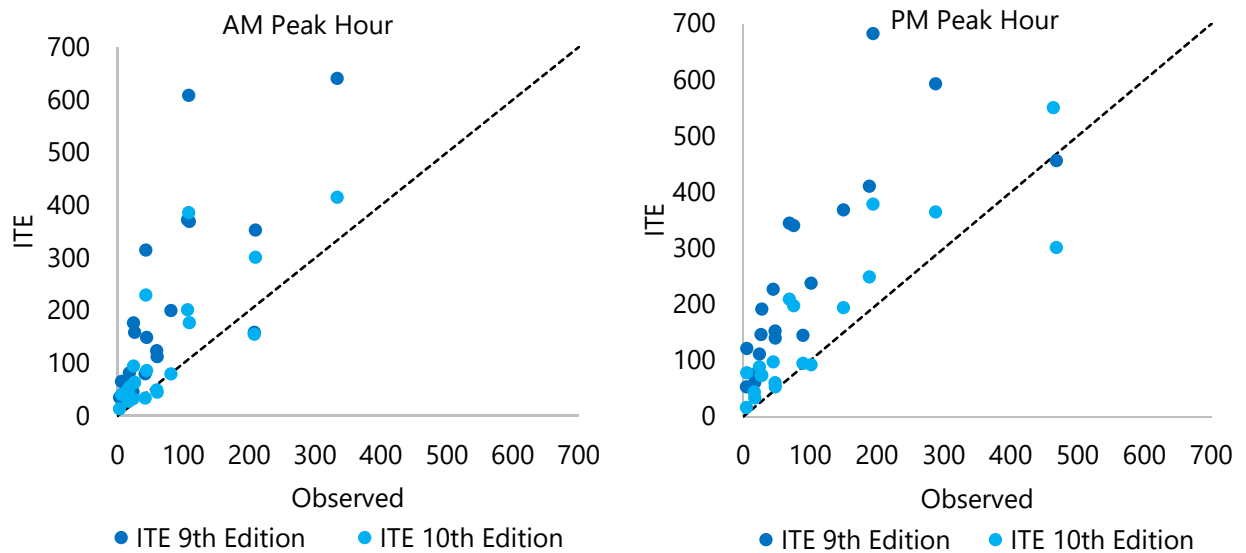
Generally, ITE overestimates person trips and auto trips (**Figure 15** and **Figure 16**, respectively). The results are more mixed for external walk, bike and transit trips. For sites with few observed walk, bike, transit trips, the ITE 10<sup>th</sup> Edition Trip Generation Manual overestimates the number of trips by these modes. However, for sites with more than 50 walk, bike, and transit trips, the ITE 10<sup>th</sup> Edition Trip Generation Manual is more likely to underestimate the number of trips by these modes (**Figure 17**).

**FIGURE 15 ITE PERSON TRIP COMPARISON**

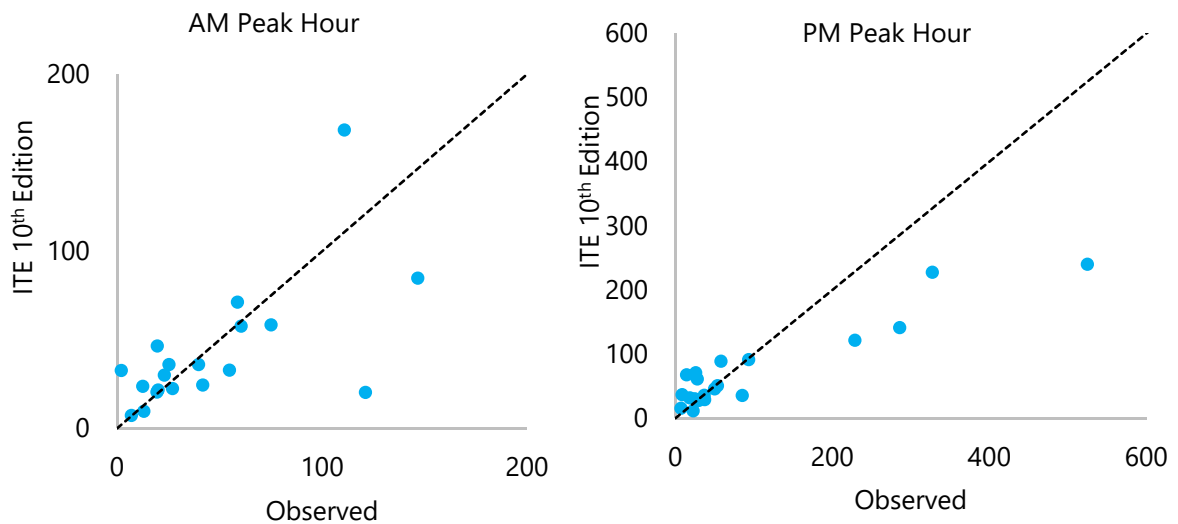




**FIGURE 16 ITE AUTO TRIP COMPARISON**



**FIGURE 17 ITE 10<sup>th</sup> EXTERNAL TRIP COMPARISON**

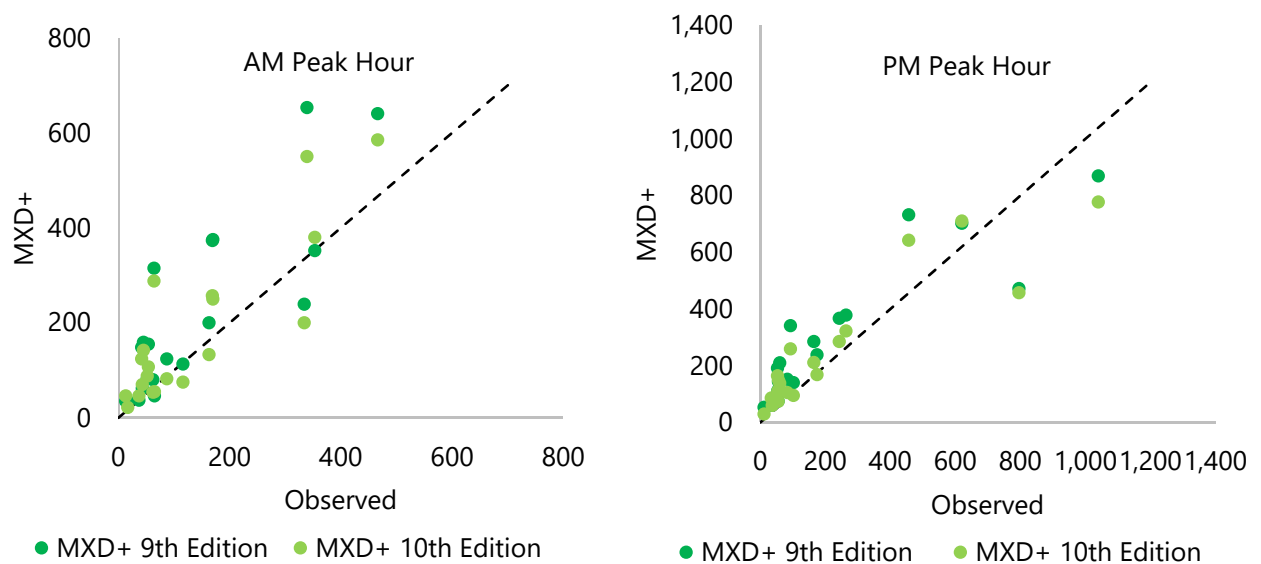




## MXD+

Generally, MXD+ overestimates person trips and auto trips (**Figure 18** and **Figure 19**, respectively) during both the AM and PM peak hour. The results are more mixed for external walk, bike and transit trips (**Figure 20**). Individual site comparisons between MXD+ and the observed trips is included in **Appendix L**.

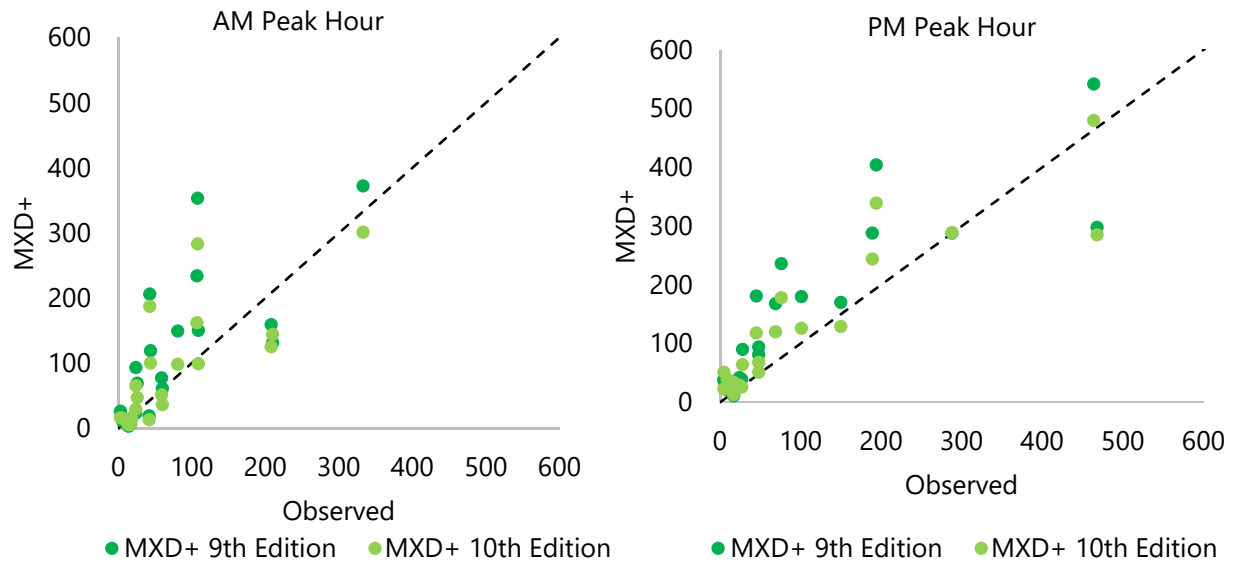
**FIGURE 18 MXD+ PERSON TRIP COMPARISON**



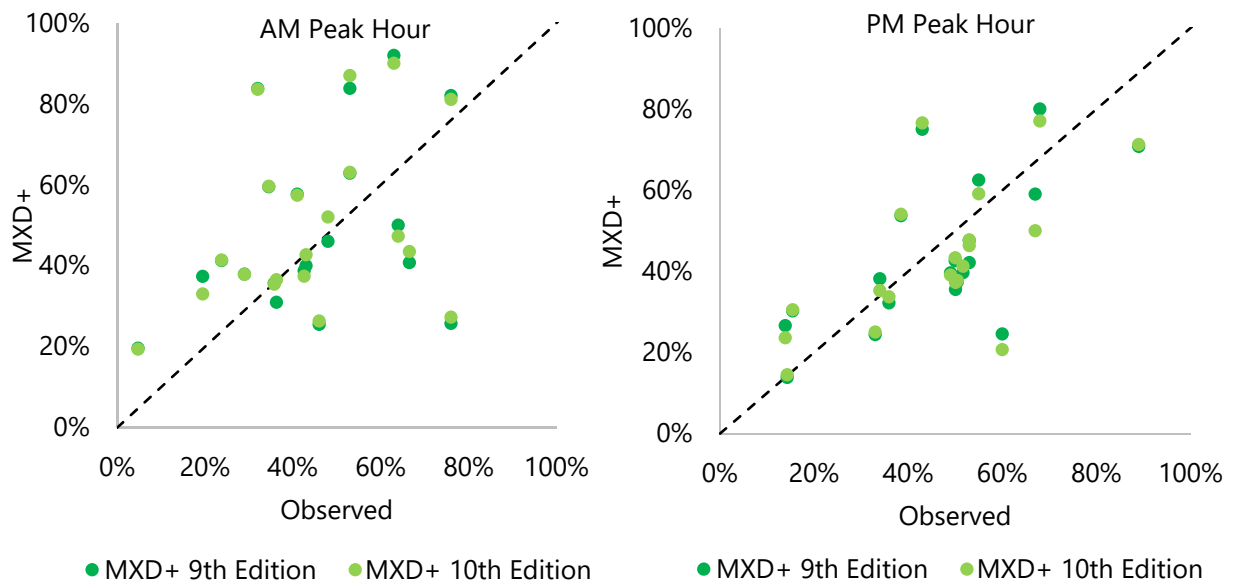




**FIGURE 19 MXD+ AUTO TRIP COMPARISON**



**FIGURE 20 MXD+ EXTERNAL TRIP COMPARISON**



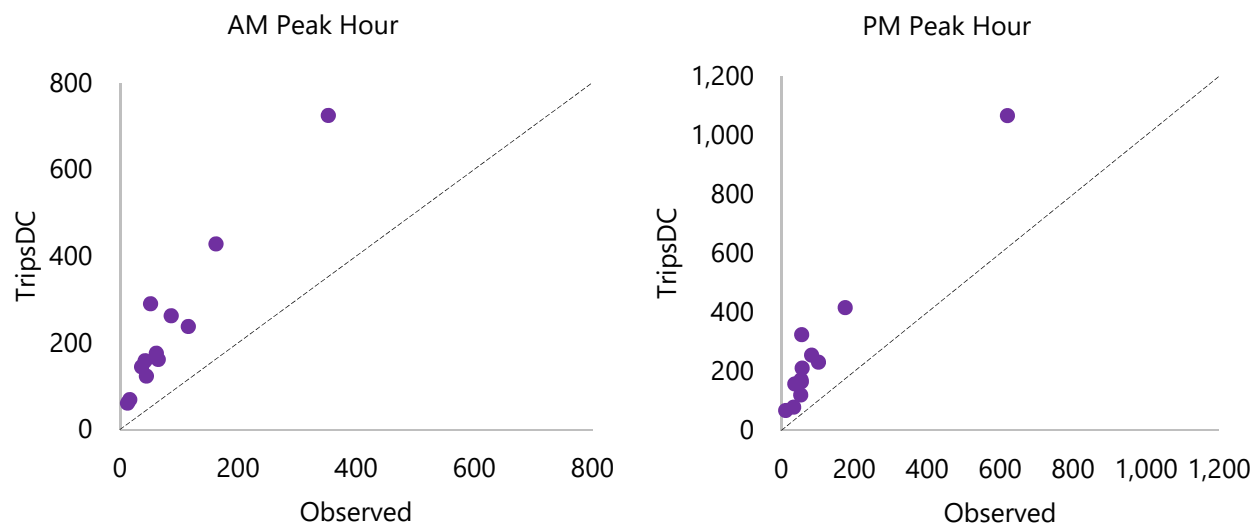


## TRIPSDC

### Person Trip Comparison

**Figure 21** charts the outputs of the TripsDC person trip model against the observed person trip counts at the Montgomery County sites. Generally, the TripsDC person trip model overestimated the number of person trips generated at the sites during the AM and PM peak hour. **Appendix N** includes the comparison between TripsDC and observed trips.

**FIGURE 21 TRIPSDC PERSON TRIP COMPARISON**



### Mode Choice Comparison

The TripsDC mode choice model provides trip generation results for five modes: auto driver, auto passenger, transit, bicycle, and walk. The TripsDC web tool consolidates auto trips into a single output, but detailed results are provided here. Generally, TripsDC underestimated the auto driver mode, while overestimating the walk and bicycle modes. The following sections provide additional detail about the results for each mode.

As discussed previously, because not all TripsDC variables could be directly calculated for the Montgomery County sites, the transit competitiveness and transit service intensity variables were input as a range based on comparable sites. As a result, the model outputs included in the following sections include both a minimum and maximum mode share for each value. This approach assumes

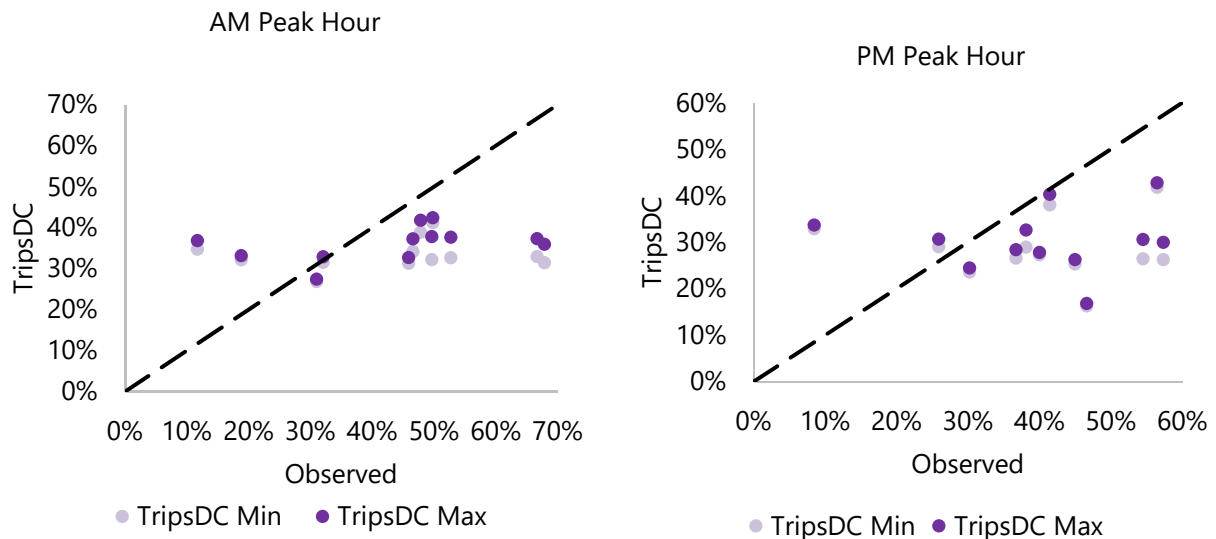


that the transit competitiveness and transit service intensity for the Montgomery County sites is within the range the TripsDC sites. For a more accurate analysis of TripsDC, the outstanding variables could be calculated for the parcels in Montgomery County.

#### *Auto Driver Mode Share*

Auto driver mode share varies across the different sites, with observed values between 20% and 70% during the AM peak hour and between 25% and 60% during the PM peak hour. TripsDC generally underestimates the auto driver mode for the Montgomery County sites. In only one instance during the AM peak hour and two instances during the PM peak hour does the auto driver mode for TripsDC exceed the observed auto driver mode share (**Figure 22**).

**FIGURE 22 TRIPSDC MODE CHOICE COMPARISON – AUTO DRIVER**

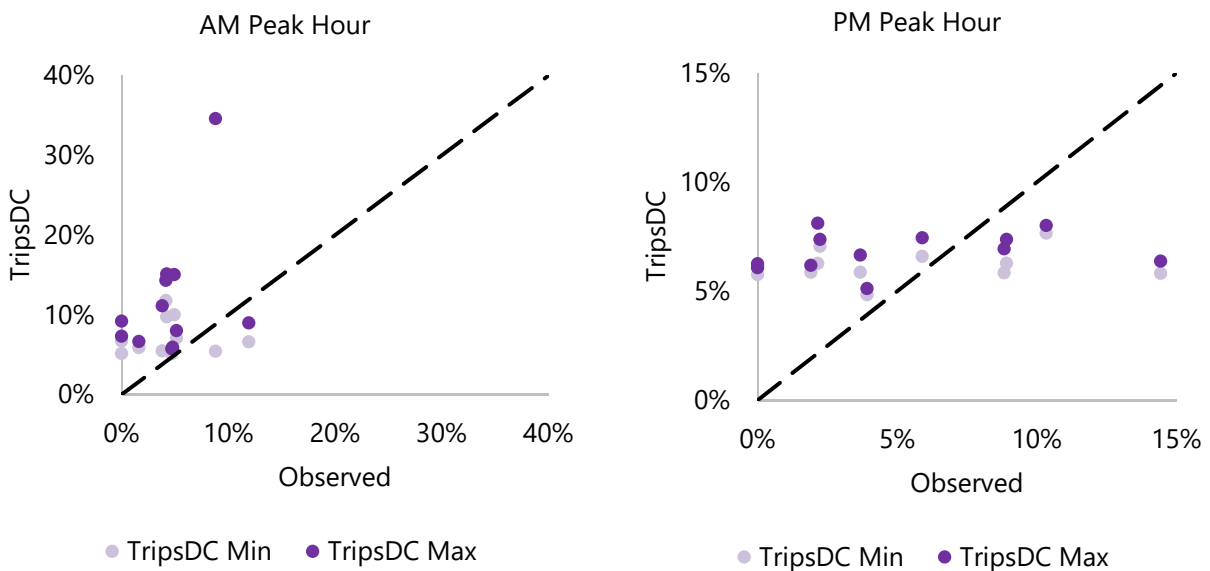


#### *Auto Passenger Mode Share*

Auto passenger mode share has limited variation across the different sites during the AM peak hour, with 10 of 12 sites with between 0% and 5% auto passenger mode share. During the PM peak hour, this mode is more varied, with observed values between 0% and 14% during the PM peak hour. During the AM peak hour, TripsDC generally overestimates the auto passenger mode for the Montgomery County sites (**Figure 23**). During the PM peak hour, the TripsDC results are generally concentrated between five and seven percent, resulting in underestimates of auto passenger mode share for some sites and overestimates for others.



**FIGURE 23 TRIPSDC MODE CHOICE COMPARISON – AUTO PASSENGER**

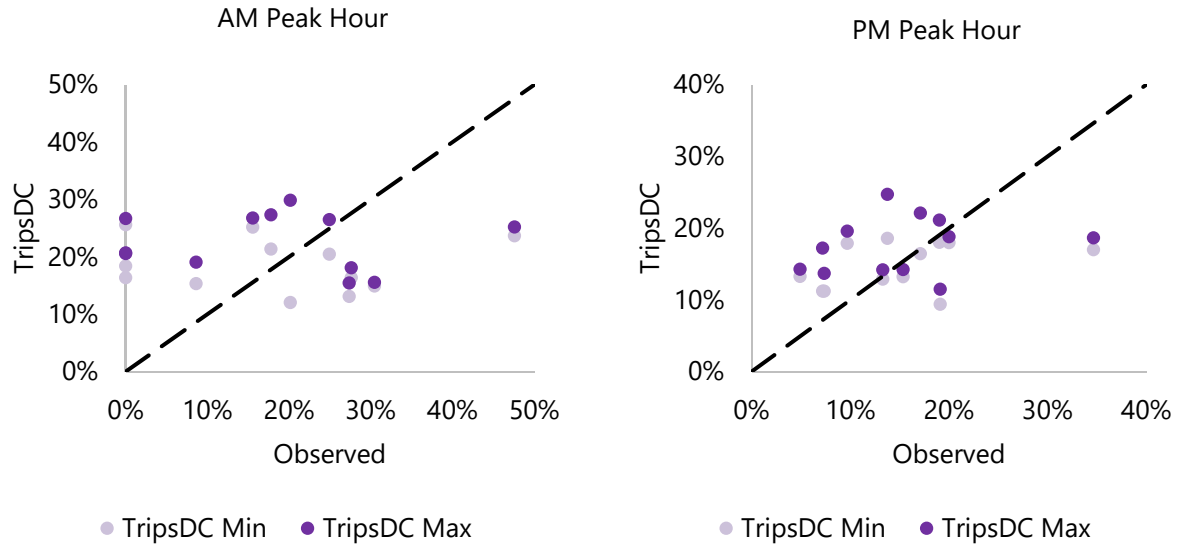


### *Transit Mode Share*

The observed transit mode share varies greatly across the Montgomery County sites during the AM peak hour, ranging from approximately 0% to 50%. The variation in the observed values is contrasted with the relatively concentrated TripsDC model outputs during the AM peak hour (between 12% and 30%). This results in TripsDC outputs providing a mix of underestimation and overestimation, depending on the site (**Figure 24**). During the PM peak hour, the range of observed transit mode shares is narrower, between 7% and 35%. Similar to the AM peak hour, the PM peak hour TripsDC estimates are generally concentrated, and there is a mix of underestimation and overestimation.



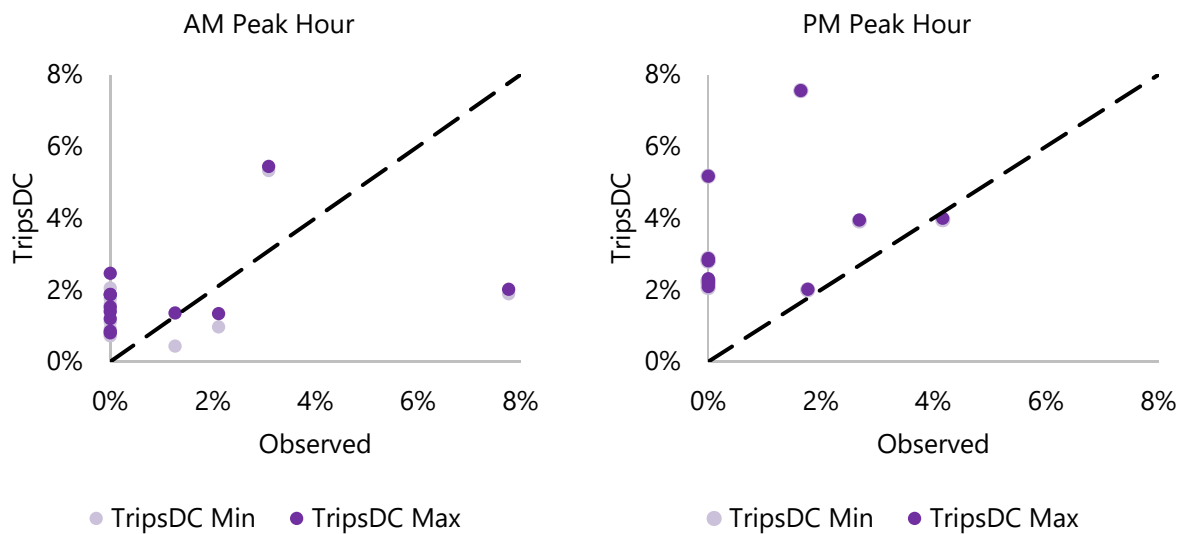
**FIGURE 24 TRIPSDC MODE CHOICE COMPARISON – TRANSIT**



### *Bicycle Mode Share*

Observed bicycle mode share is low across the board, generally less than 3% for both the observed and calculated TripsDC mode share. The observed bicycle mode share is generally less than the bicycle mode share estimated by TripsDC during both the AM and PM peak hours (**Figure 25**).

**FIGURE 25 TRIPSDC MODE CHOICE COMPARISON – BICYCLE**

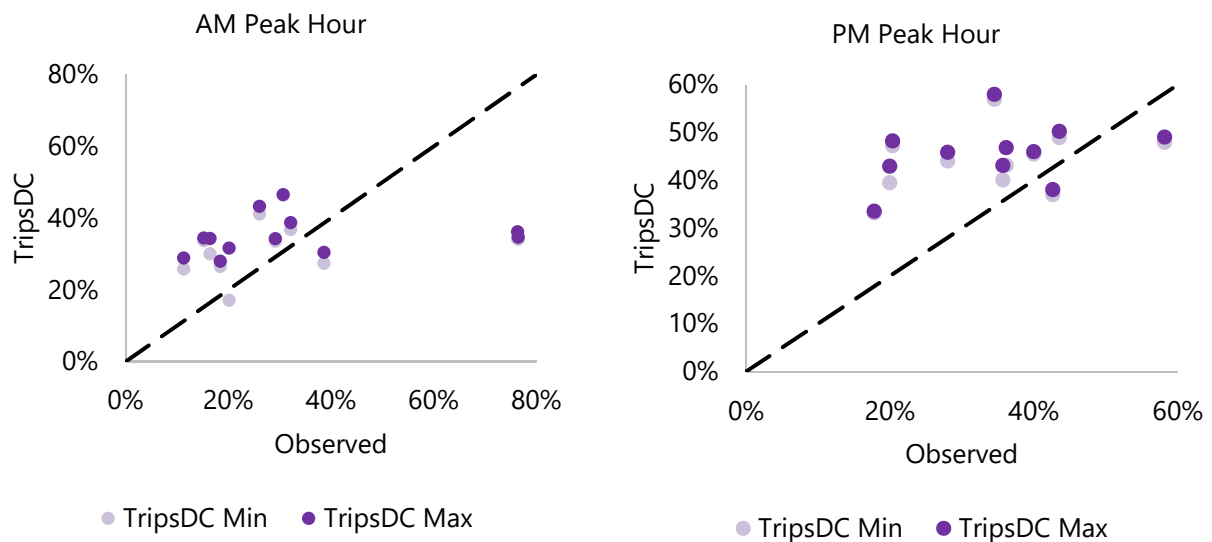




### Walk Mode Share

Observed walk mode share varies across the different Montgomery County sites (generally between 10% and 40% during the AM peak hour and 20% to 60% during the PM peak hour), and TripsDC generally overestimates the walk mode share for these locations during both the AM and PM peak hour (**Figure 26**). There are a few instances during both peak hours with the observed walk mode share exceeds the TripsDC estimation.

**FIGURE 26 TRIPSDC MODE CHOICE COMPARISON – WALK**



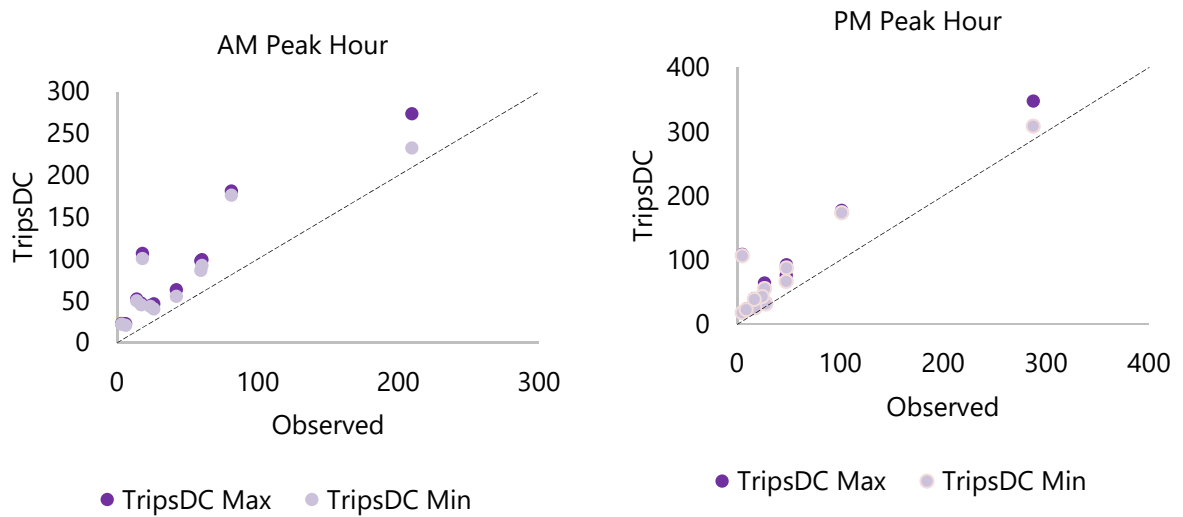
### Modal Trips Comparison

The vehicle trip comparison was conducted by comparing the observed vehicle trips during the AM and PM peak hour to the product of the auto driver mode share and total person trips calculated through TripsDC. As discussed previously, TripsDC overestimated the total number of person trips to the sites but underestimated the auto driver mode share. The vehicle trips comparison demonstrates that this inverse relationship does not produce a balancing effect; there are more TripsDC vehicle trips estimated per site than observed vehicle trips (**Figure 27**).

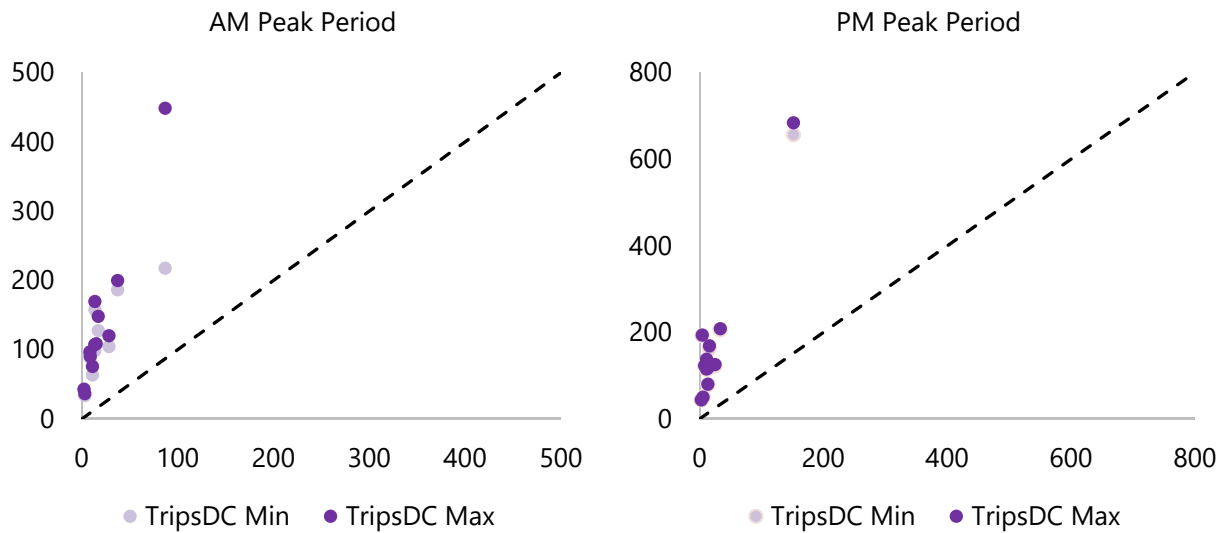
TripsDC also overestimates the number of external walk, bike, and transit trips, as evidenced by the higher person trip generation and the higher mode shares for the non-auto modes. **Figure 28** compares external walk, bike, and transit trips between TripsDC and the observed trips.



**FIGURE 27 TRIPS DC VEHICLE TRIPS COMPARISON**



**FIGURE 28 TRIPS DC EXTERNAL TRIPS COMPARISON**





## AREA-LEVEL COMPARISON

While four different methods were applied for site-level analysis, only MXD+ is available for area-level analysis. Area level analysis provides an assessment of the tool's usefulness for the County's travel demand model at the Transportation Analysis Zone (TAZ) level and the analysis involved in larger-scale studies, such as sector or master plans. To calculate the number and mode of trips generated by each area, the number of dwelling units and the square feet of nonresidential land uses from the Montgomery County Round 8.0 Cooperative Forecast land use data were input into MXD+. In the context of this project, the term "area" refers to a selected TAZ or policy area. A policy area is a central business district (or Metro station policy area) characterized by high-density development and the availability of premium transit service.<sup>6</sup>

In this section, study areas are described, followed by descriptions of the input and outputs of MXD+ analysis. More details of each area are presented in **Appendix P**.

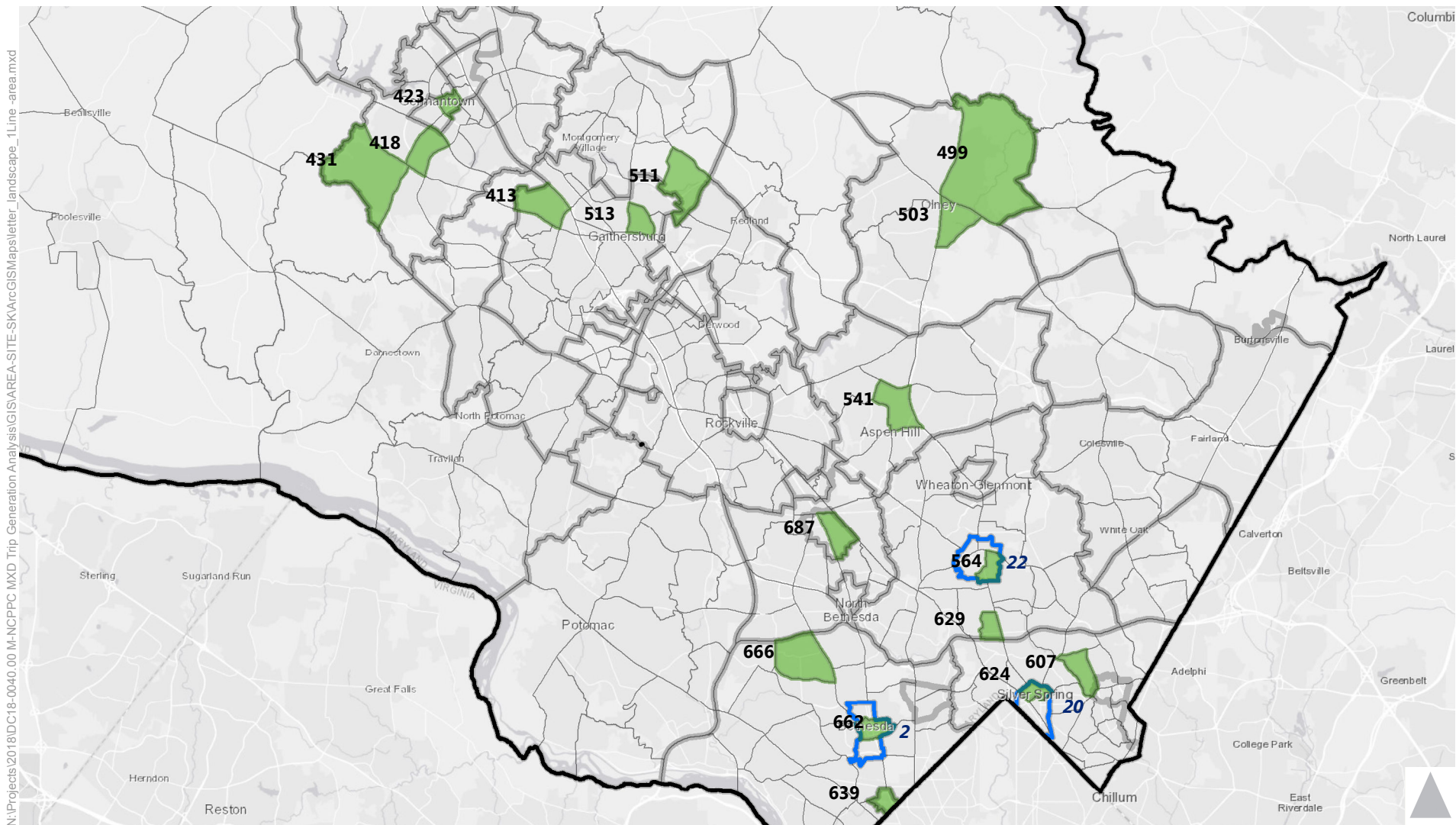
## AREA-LEVEL DATA COLLECTION

A set of 20 areas was selected for analysis using the MXD+ method, including three policy areas that align with groupings of TAZs as well as 17 individual TAZs. The location of selected areas in Montgomery County are shown in **Figure 29**. Policy areas are located in the Bethesda CBD, Silver Spring CBD, and Wheaton CBD. One zone in each policy area is also analyzed separately. TAZs are selected in Gaithersburg, Germantown, Olney, Montgomery Village, Aspen Hill, Friendship Heights, Chevy Chase, and White Flint.

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<sup>6</sup> Local Area Transportation Review Guidelines, (2017) The Maryland-National Capital Park and Planning Commission





## Legend

- Selected TAZ
- TAZ
- Selected Policy Area
- Policy Area



## AREA-LEVEL ANALYSIS

For area-level analysis, MXD+ is the only tool applied. The analysis methodology is similar to the site level approach, with the key difference that rather than collecting observed data from individual sites, we rely on the sources listed below to calculate a survey-based share of internalized trips, external vehicle trips, and external walk, bike, and transit trips:

- **The MWCOG TPB 2007/2008 Household Travel Survey** provides a basis for the origin-destination patterns and mode choice of a sample of household trips.
- **The Montgomery County Round 8.0 Cooperative Forecast** provides household and categorized employment data for years 2005 and 2010, among others.
- **Census Tract data from the American Community Survey** provides additional site demographics and context variables.

For each selected area, residential dwelling units (single family and multifamily) as well as non-residential land uses are reported in the Montgomery County Round 8.0 Cooperative Forecast . As part of the Cooperative Forecasting process, MWCOG and its member jurisdictions assign land uses to four categories: Industrial, Office, Retail, and Other. Industrial, Office, and Retail relationships to ITE codes are shown in **Table 7**. Categorization of “Other” varies, but typically includes agricultural, industrial, and institutional uses that behave similarly to office uses, such as education, public administration, healthcare, and other institutional uses. For purposes of this trip generation analysis, we reviewed aerial imagery, ruled out agricultural and industrial uses in the areas studied, and analyzed “Other” as Office ITE code 710. The data set is TAZ-based; for policy areas, the included TAZ values are aggregated. **Appendix P** presents the characteristics of selected areas’ transit access, area, dwelling units, and commercial space.

**TABLE 7 LAND-USE NAME AND CODE**

MWCOG Land-Use	ITE (9 <sup>th</sup> and 10 <sup>th</sup> Editions)
Office	710 - General Office Building
Retail	820 - Shopping Center
Industrial	110 - General Light Industrial
Other	710 - General Office Building



The MXD+ output is compared with the mode share of trips per TAZ based on the Household Travel Survey. In order to run a comparison, average mode shares by Origin and Destination TAZ are calculated using the sampled data weighting factors. To align with the available 2007/2008 Household Travel Survey year, the 2008 residential and commercial land uses were calculated by interpolation between 2005 and 2010 data. The surveyed mode of transport and detail of observed trips and reduction percentages are included in **Appendix Q**. The MXD+ output table per TAZ and policy area for all selected areas are included in **Appendix R**.

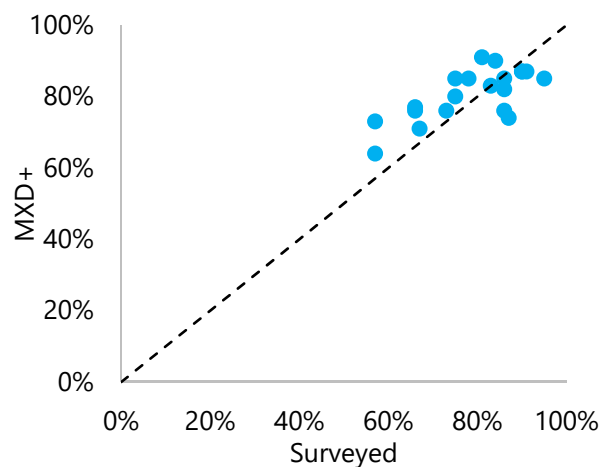
Finally, LATR vehicle trip mode share values are calculated for each area based on the Vehicle Trip Generation Rate Adjustment Factors provided in LATR Appendix 1a. The land-use specific adjustment factors were weighted by the share of residential, office, retail, and other land uses in the analysis area. The LATR reduction percentages are provided in **Appendix G**.

## AREA-LEVEL RESULTS

### EXTERNAL VEHICLE MODE SHARE COMPARISON

**Figure 30** presents a comparison of daily external vehicle trip mode share between estimated and observed (surveyed) values. MXD+ slightly overestimated the daily auto trips for most of the areas; however, for the sites with 80% or higher surveyed vehicle mode shares, the vehicle mode share is underestimated.

**FIGURE 30 AREA-LEVEL DAILY AUTO MODE SHARE – MXD+**

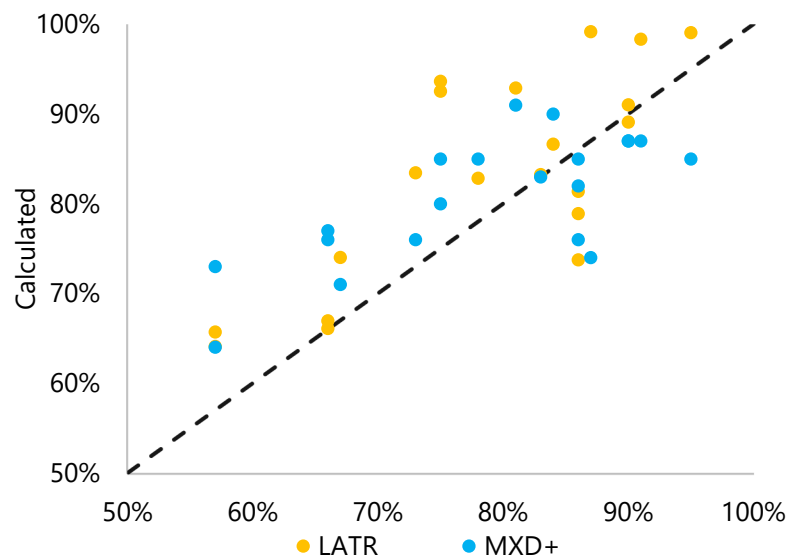




**Figure 31** presents a comparison of the LATR and MXD+ area-level adjustments. Both MXD+ and LATR have a Mean Absolute Percent Error (MAPE) value of 9.2 percent; however, MXD+ has an average percent error of 3.8 percent, while LATR has an average percent error of 6.3 percent, indicating that the errors for MXD+ are slightly more balanced between overestimates and underestimates than the errors for LATR are.

**Appendix S** includes tables and maps summarizing the percent error of vehicle trip percentage estimates from both the LATR and MXD+ methods for all analyzed areas.

**FIGURE 31 AREA-LEVEL DAILY AUTO MODE SHARE – MXD+ AND LATR**



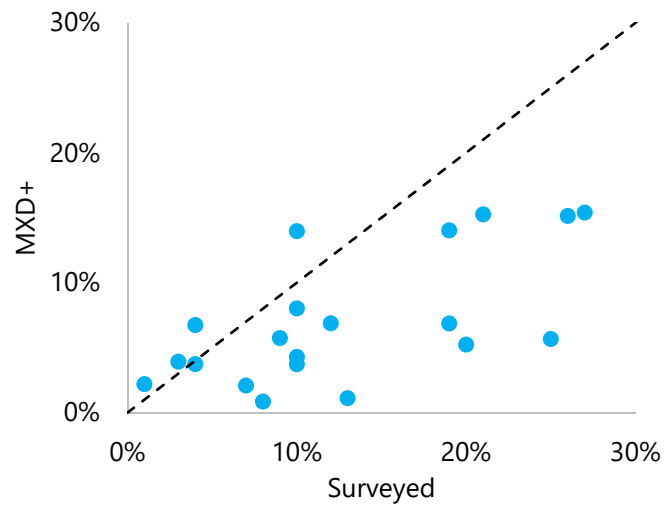
The mixed-use trip generation for both ITE 9<sup>th</sup> and 10<sup>th</sup> Edition Trip Generation Manuals lead to the same percentage reduction. As a result, just the ITE 9<sup>th</sup> Edition Trip Generation Manual was evaluated for this analysis. The estimated auto trip percentage for MXD+ based on ITE 9<sup>th</sup> Edition Trip Generation Manual is compared to the survey data in **Appendix S**.

## EXTERNAL WALK, BIKE, AND TRANSIT MODE SHARE COMPARISON

**Figure 32** presents the external walk, bike, and transit trips comparison between estimated and surveyed rates. In area level analysis, the internal trips values are mostly higher than external trips. In most of the cases, MXD+ overestimated the external trips.



**FIGURE 32 AREA-LEVEL DAILY EXTERNAL WALK, BIKE, AND TRANSIT TRIPS**





## CONCLUSIONS AND RECOMMENDATIONS

Trip generation is not an exact science. Regardless of method, trip generation estimates are based on observed data from comparable sites and statistical relationships to site and area characteristic variables. Across all methods and sites tested, estimates within even 30% of the observed value were the exception, not the rule. Still, findings from this study suggest that trip generation in Montgomery County could be improved over current LATR practice, if not perfected, by implementing either ITE 10<sup>th</sup> Edition Trip Generation Manual trip rates or undertaking one or more of three options directed toward implementing a custom trip generation estimation tool like TripsDC in Montgomery County:

**1. MXD+ 10<sup>th</sup> Edition provides the most accurate estimates of person and vehicle trips,** offering a substantial vehicle trip accuracy improvement over LATR adjustments to ITE 10<sup>th</sup> Edition. Compared with MXD+ 10<sup>th</sup> Edition, the MAPE for LATR is 44% higher for vehicle trips and 39% higher for person trips. LATR provides a more accurate estimate of the number of trips by walking, biking, and transit combined; however, this is generally the result of combining less accurate person trip estimates with less accurate mode share estimates, which balance each other. The overall WMAPE value for walk, bike, and transit mode *share* for MXD+ 10<sup>th</sup> Edition is 29%, compared with 42% for LATR. A key benefit of MXD+ is that it can be used for both site and area-level analysis for a wide range of land use types. In terms of this study's three goals MXD+:

1. Introduces sensitivity to site-specific built environment and demographic characteristics.
2. Is not sensitive to parking supply.
3. Improves upon the ITE 10<sup>th</sup> Edition Trip Generation Manual's estimation of person trips and trips by mode in the sense that site-specific factors sensitive to built environment and demographic characteristics are applied to vehicle trip generation to derive person trips and trips by mode; however, they are still factors of vehicle trip generation and not direct estimates.

MXD+ 10<sup>th</sup> Edition faces several limitations in applicability to the Montgomery County study sites. In particular, the developed "footprints" of the sites in this study (ranging from 0.3 acres to 2.3 acres) are smaller than the footprints of the sites used to develop MXD+ (ranging from 3 acres to 3,500 acres). At this scale, MXD+ is highly sensitive to the size of the site, and highly urban site boundaries (e.g., how much of the driveways, green space, plazas etc. to include in the site area),



are not well defined. This may result in substantial variations in the calculation of activity density on the site.

**Recommendation:** Consider applying MXD+ 10<sup>th</sup> Edition to improve prediction accuracy for person trips and especially vehicle trips relative to LATR and the ITE 10<sup>th</sup> Edition Trip Generation Manual. MXD+ 10<sup>th</sup> Edition accuracy might be further improved by exploring limits on the effect of activity density and "site footprint"-related variables to ensure they do not exceed the range used to develop MXD+. MXD+ 10<sup>th</sup> Edition could also be re-estimated, maintaining similar variables, but including data collected in Montgomery County.

**2. TripsDC is not calibrated to Montgomery County conditions, but indicates potential for a custom tool.** Although results from the minimum end of the TripsDC range are comparable in accuracy to the MXD+ 10<sup>th</sup> Edition results for vehicle trips for the PM peak hour, all other trip estimates overstate trip generation by approximately 140% to 240%. These inaccuracies can be attributed to at least two causes. First, two key TripsDC variables, Transit Competitiveness and Transit Service Intensity, were custom-calculated for the geography covered by the District of Columbia and were not available in Montgomery County. Instead, this analysis examined the range of possible values for comparable sites in the District and calculated the minimum and maximum range of trip generation estimates based on those possible values of the variables. More accurate values of those input variables could improve the accuracy of the TripsDC trip generation estimates. Second, TripsDC was developed for an inherently different range of contexts than observed in Montgomery County; the observed variables may have a different relationship to trip generation in Montgomery County than they have in the District, or other unmeasured factors (cultural, demographic, or other built environment characteristics) could be influencing trip generation. When applied to sites in D.C., TripsDC has WMAPE values of approximately 34% for person trips and vehicle trips and 38% for combined walk, bike, and transit trips, which would be an improvement over all other methods tested. In terms of the study's three goals:

1. TripsDC does introduce sensitivity to site-specific built environment and demographic characteristics.
2. TripsDC is sensitive to parking supply.
3. TripsDC does enable direct estimation of person trips and trips by mode, including auto, transit, and active modes; however, as currently calibrated to Washington, DC residential over retail sites, these estimates are highly inaccurate for Montgomery County. When applied in the District, TripsDC had transit trip WMAPE values of 45-55%, walk trip WMAPE



values of approximately 40%, and bike trip WMAPE values of 48-55%, depending on the peak hour; direct estimates from Montgomery County or comparable context data could provide more accurate, direct estimates of each mode.

**Recommendation:** Consider developing a TripsDC-style custom tool for Montgomery County. It is uncertain how well a custom tool would perform. However, if a Montgomery County custom tool could achieve the same local performance as TripsDC, switching from LATR to a custom tool could reduce person trip error from approximately 59% to 34%, vehicle trip error from 65% to 34%, and combined walk, bike, and transit trip error from 41% to 38%. Developing a complete custom tool is a resource-intensive process; potential mitigation strategies include:

- a. First take an incremental step to test the complete range of possible values of Transit Competitiveness and Transit Service Intensity on the 20 sites in this study to see if accuracy could be improved.
- b. If that proves promising, calculate values of Transit Competitiveness and Transit Service Intensity for Montgomery County and re-test application of TripsDC.
- c. To reduce Montgomery County's burden in developing a custom tool, consider collaborating with neighboring jurisdictions to share the cost of data collection and tool development



## **APPENDIX LIST**

Appendix A - Data Collection Plan

Appendix B - Site Level Site Information

Appendix C – Site-Level Observations

Appendix D - ITE Site Inputs

Appendix E - ITE Site Level Results

Appendix F - ITE Comparison to Observed

Appendix G - LATR Policy Area Reductions

Appendix H - LATR Site Level Results

Appendix I - LATR Comparison to Observed

Appendix J - MXD+ Trip Reductions

Appendix K - MXD+ Site Level Results

Appendix L - MXD+ Comparison to Observed

Appendix M - TripsDC Mode Choice Inputs

Appendix N - TripsDC Comparison to Observed

Appendix O – Comparison to Observed for All Tools

Appendix P - Area Level Site Information

Appendix Q - Travel Survey Mode Share

Appendix R - MXD+ Area Level Outputs

Appendix S - Area Level Results

## **APPENDIX A - DATA COLLECTION PLAN**



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### **Mixed-Use Trip Generation Tool Testing – Data Collection Plan**

This memo summarizes the data collection protocol for Mixed-Use Trip Generation Tool Testing for Montgomery County. Data collection will include the total number of persons arriving and departing the site (collected through counts), their mode of access (collected through intercept surveys and observations), and site and parking supply data (collected through online research on on-site data collection). It is important to understand how many trips are made to and from the sites, and the mode of access for those trips.

For this data collection effort, it is not necessary to identify which on-site land use the traveler is visiting (residential or retail, or the specific on-site retailer). TripsDC outputs are at the site level; the tool does not provide land-use-specific trip generation and mode split. While ITE and MXD+ provide land-use-specific information, this can be combined for the purposes of this project.

Site selection criteria and assessments are included in a different memo, titled Site Selection Protocol (to be included once site selection is complete).

### **TERM DEFINITIONS**

For this project, the term “site” will refer to the entire mixed-used or residential development; it is inclusive of all land uses on the property. “Trips” are defined as any time a person enters or exits one of the doors of this site. “Doors” are entrances to the building that provide direct access to an interior land use, including individual retailers, a residential lobby, or residential units themselves. “External doors” provide access between the interior land use the sidewalk or street, while “internal doors” are accessed through a lobby or parking garage. Driveways and parking access doors (that provide connection between the parking garage and the street) will not be counted as doors or observed for this study.

Total site activity is the sum of trips counted at all of the doors. With this approach, person visiting multiple retailers within a site will be recorded as multiple trips (an entrance and/or exit from each door they walk through).

### **DATA COLLECTION TIMING**

Data will be collected during two-hour peak commute periods, 7:00-9:00 AM and 4:00-6:00 PM, and data collection will occur mid-week (Tuesdays, Wednesdays, and Thursdays). Data will be collected in dry weather



conditions on a day without a holiday, early school release, a significant regional vehicular crash, transit system shutdown, or other event that would cause irregular behavior and bias the data.

## COUNT AND SURVEY PREPARATION

For each selected site, Fehr & Peers DC will review the site plan to understand how visitors access the site including access through both internal and external doors.

### Property Considerations

Prior to conducting data collection, Fehr & Peers DC will confirm the property manager approves of data collection being conducted on their property, as well as the business hours of on-site retailers.

- **Property Access and Permission:** Fehr & Peers DC will contact the property manager to inform them of the study and to obtain permission to stand on the property. If this permission is not granted, the study coordinator should determine the extent of the property line and plan to position surveyors in the public right-of-way. If permission is not obtained and the site proves too difficult to survey from the sidewalk, a substitute site may need to be considered.
- **Business Hours:** Establishments such as banks and restaurants have very different hours of operation. Staffing plans will take account of open and closed hours.

### Staffing Plan

Each site will have a staffing plan, including a markup of the site, the number of surveyors needed, and their door assignments.

- **Staff Level:** Information from the preliminary site survey will dictate how many counters and surveyors will be required at a given site for the time periods to be studied. During the very busiest times, it may not be possible for an individual to both count and survey. Two surveyors, i.e. a counter and an interceptor, should be stationed at high volume locations. At low-volume areas, or where doors are close to one another, one staff member may be able to count and survey multiple doors.
- **Staff Location/Vantage Point:** Staff will be directed to stand in an appropriate place for accurate data collection. Optimal location will be determined primarily based on the site survey but may also rely on input from the property manager.
- **Supervisor:** For quality control, the staffing plan will also incorporate a supervisor who is able to travel between count sites and answer questions and confirm the field staff are correctly soliciting and recording data. At particularly large or complex sites, one supervisor will be on-site for the duration of the data collection period.



## PERSON COUNTS

Person counts will be conducted at all doors to the building (see definition of doors provided on page 1). Surveyors will tally the number of person trips entering and exiting each building by door. If the same person makes multiple trips through a door (such as entering and exiting a store), each trip will be recorded individually. All counts will be recorded in 15-minute intervals during the collection period. The goal is a full 2-hour dataset in each peak to capture the highest 60-minute period.

## INTERCEPT SURVEYS

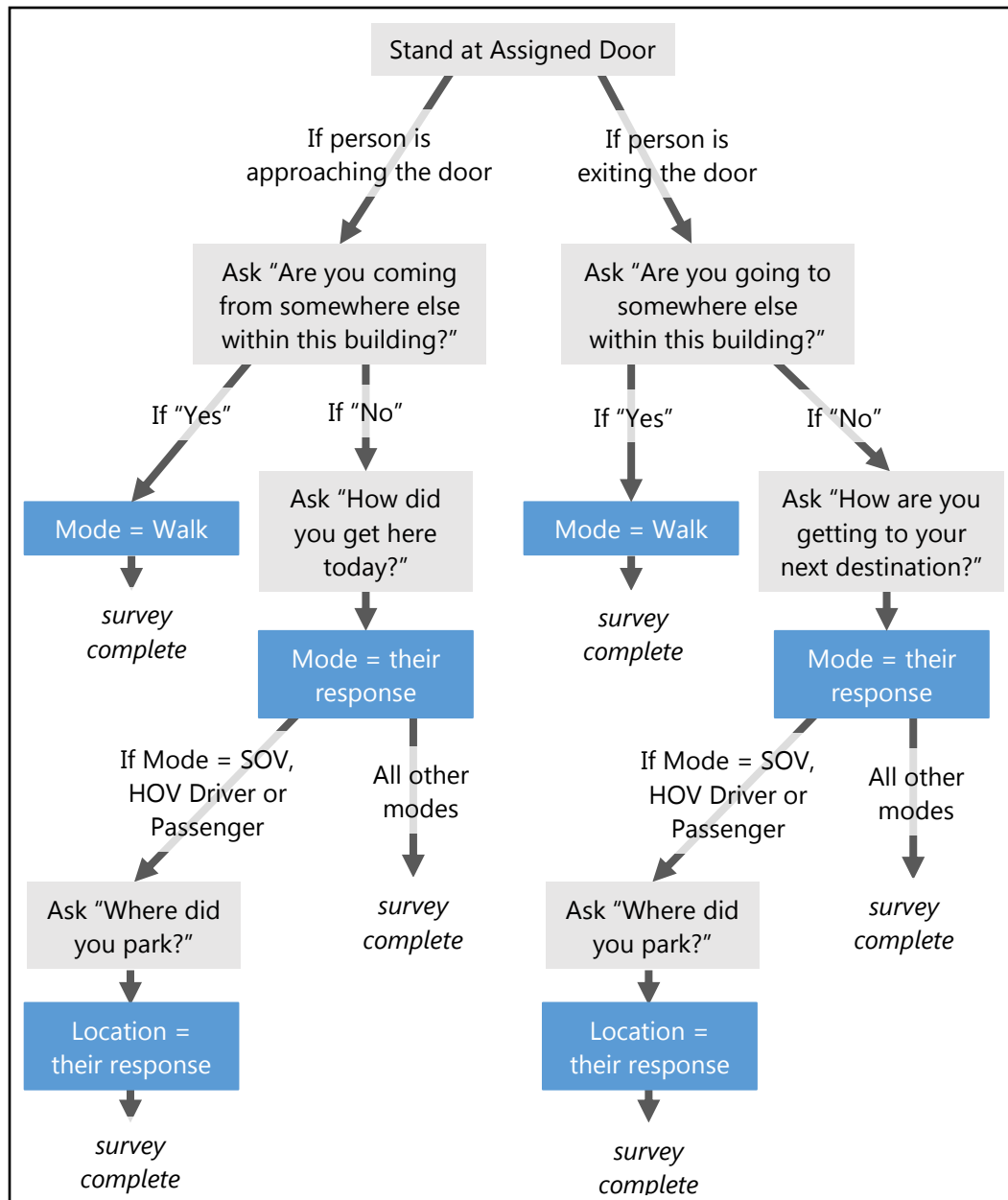
People will be intercepted as they enter or exit the building. Participants will be verbally asked the survey questions, and the surveyor will tally their responses. Interviewers will survey quickly and efficiently, with each survey limited to approximately 20 seconds. Surveyors and counters will indicate which doorway is being surveyed to ensure the samples and counts are clearly matched. The survey generally consists of three questions:

- 1) Internalization:** People will be asked if they have visited or are headed to another retailer within the building. If so, the participant's mode will be recorded as walk, and the survey is complete.
- 2) Mode of Access:** If the participant is not traveling to or from another location within the building, they will be asked their mode of access. The intent of this question is to capture the primary mode of access. For example, if someone took the bus to an adjacent intersection, then walked to the building, their primary mode would be considered bus. For those who did not travel to the site in a personal vehicle, the survey is complete.
- 3) Parking Location:** If respondents arrived at the site in a personal vehicle, they will be asked where they parked, either in an on-site garage, on the street, or another location. For those responding "other", surveyors will discern if the person is traveling to the site on foot from another nearby site (in which case the accurate mode for this trip would be walking), or parked in a public lot and walked over (where the accurate mode would still be the originally recorded vehicle mode).

Questions will vary slightly based on whether a person is entering or exiting the building. The survey will ask only about the access or egress that was in progress when the subject is approached – i.e. someone entering the building is only asked about their arrival and not about their hypothetical departure, someone leaving is asked only about their departure and not about how they had earlier arrive. **Figure 2** (next page) shows the sequence of questions asked during the intercept survey. A sample survey form is included in Attachment A.



**Figure 2. Intercept Survey Plan**





Based on observations during DDOT's data collection for TripsDC, people are generally more receptive to the surveyors upon exiting a retail location than entering.<sup>1</sup> Surveyors will approach people both entering and exiting a retail establishment, but will primarily focus on those exiting.

### Intercept Survey Considerations

A DDOT report, Trip Generation Data Collection in Urban Areas, cites several key considerations for data collection. Some have been included below, and will be part of the data collection protocol for M-NCPPC.

- **Time of Day:** During the morning collection period, a significant number of individuals were in a hurry, and did not want to be stopped for a survey, however brief. This does not affect counting but will yield a higher refusal rate for the survey portion of the study. Survey subjects were more willing to stop and answer questions in the evening.
- **Weather/season:** Darkness/early sunset was an obstacle during the evening data collection. Data collectors should position themselves in well-lit areas to ensure adequate comfort to subjects. Some subjects responded with fear when approached to answer the survey in the evening hours with waning daylight. Reflective vests or other measures to increase visibility may be a benefit for both survey administrators and respondents. Provisions should be made to ensure the safety of data collectors (e.g. pairing if necessary).
- **Not Imputing Mode:** Even when the surveyor sees a person unlocking and riding away on a bicycle, if they have not been surveyed or they were surveyed and refused to answer, this information will not be recorded; recording this information would result in over counting the modes that are obvious. To further illustrate: a person walking may be walking all the way to the final destination, walking to a transit stop, or walking to a car that is parked nearby, thus their mode cannot be inferred and they cannot be recorded; if all obvious bicycle trips were imputed and recorded, this would result in more bicycle trips recorded than other modes that could not be imputed.
- **Groups:** One person per group will be surveyed. If people are traveling together their responses are not independent. It is also important to note that some modes may accommodate groups better than others. For example, relative to a person traveling by bicycle, a person traveling by car is more likely to be with someone else. Therefore, a car trip is likely to be reported more frequently than it should simply because the same car trip is twice as likely to be selected.

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<sup>1</sup> DDOT Trip Generation Data Collection in Urban Areas – Final Report (September 2014).



## LAND USE AND PARKING SUPPLY DATA

Fehr & Peers DC will collect land use data through existing development review studies and other available online information. Total number of units, square feet of retail will be confirmed by M-NCPPC. Surveyors will count the number of off-street parking spaces provided at with each site, and they will confirm if on-site parking is solely permitted for visitors and residents of the site, or if it is public parking that may be used by visitors and residents of adjacent or nearby buildings.

## CALCULATING MODE SPLIT

Combining the count and survey data consists of three steps:

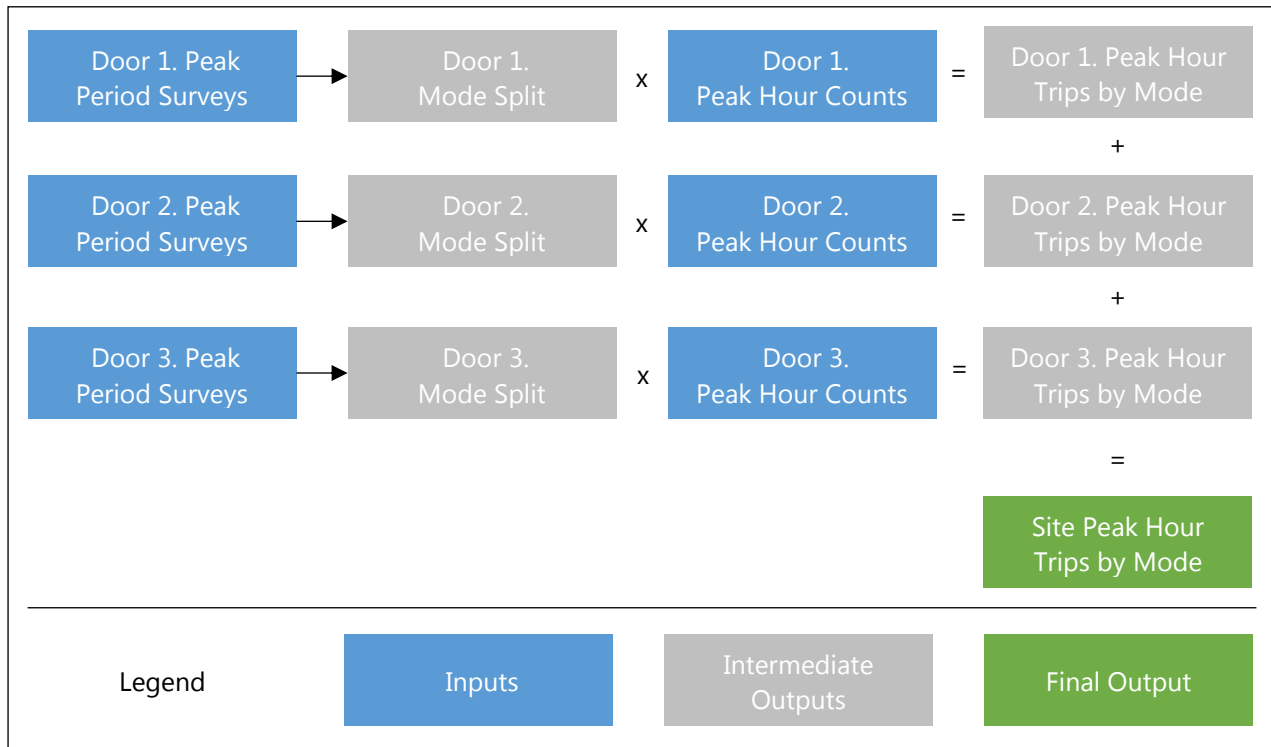
- 1. Mode Share by Door:** Determine the surveyed mode share by door for the entire period of morning and afternoon data collection. Using the two-hour period helps to account for time periods with relatively few surveys that could otherwise skew the results.
- 2. Apply Door Mode Share to Door Counts:** This mode share is applied to the peak hour counts by door to calculate a weighted mode split for each door. Calculating this by door mitigates potential data skewing from the location of doors – for example a door leading to a garage may have extremely high vehicle mode share while another door right in front of a bus stop would have a high proportion of transit riders. It is important to apply the survey mode share by door to the counts by door to accurately represent these differences.
- 3. Aggregate to Site-Level Trips:** Combine the counts by door to determine the mode split for the site overall.

The door mode shares, calculated over the entire peak period are applied to the peak hour counts to determine the site-level mode splits. Using the mode share for the peak period, rather than the hour, accounts for many potential irregularities in mode share that could be due to unobserved factors. These steps are summarized in **Figure 3**.





**Figure 3. Mode Split Calculation Example**



## **APPENDIX B - SITE INFORMATION**

### RESIDENTIAL OVER RETAIL SITE INFORMATION

Mapped ID	Site	Address	Residential	Retail	Units	Retail SF	Retail Use	Parking
1	The Exchange Wheaton	11215 Georgia Avenue, Wheaton	x	x	500	59,500	Safeway, Fine Wines (Grocery Stores)	566
4	Solaire Wheaton	10914 Georgia Avenue, Wheaton	x		245		N/A	199
7	Bainbridge at Shady Grove Metro	15955 Frederick Road, Rockville	x		400		N/A	483
12	The Americana Finnmark	9900 Georgia Avenue, Forest Glen	x		115		N/A	167
19	Solaire Bethesda	7077 Woodmont Avenue, Bethesda	x	x	145	6,500	True Food (Restaurant)	84
22	The Lauren	4910 Hampden Lane, Bethesda	x		64		N/A	70
24	The Citron	815 Pershing Drive, Silver Spring	x		222		N/A	147
25	MICA Condos	1302 Blair Mill Road	x		151		N/A	96
38	Stonehall	8302 Woodmont Avenue, Bethesda	x	x	47	3,200	Wells Fargo (Bank)	69
39	4900 Fairmont	4900 Fairmont Avenue, Bethesda	x	x	250	7,000	Medium Rare (Restaurant)	177
40	Element 28	100 Commerce Lane, Bethesda	x	x	120	5,000	Sun Trust (Bank)	72
41	The Crescent	930 Wayne Street, Silver Spring	x	x	143	1,700	Asian Cuisine (Restaurant)	100

### OFFICE OVER RETAIL SITES INFORMATION

Site ID	Name & Address	Land Uses			Land Area	Parking
		Retail	Office	Restaurant		
2 / ID 10	10400 Connecticut Avenue, Kensington	x	x		1,815 SF: Hair Salon 2,723 SF: Pharmacy 2,723 SF: Tag and Title 3,631 SF: Opticians 42,482 SF+ 11,982 SF: Lobby	210
3 / ID 14	Century Blvd and Pinnacle Dr, Germantown	x	x	x	20,500 SF: Lobby B 20,500 SF: Lobby A 3,500 SF: Strive Martial Arts 3,500 SF: Nail Spa, Bubbles Salon 18,750 SF: Coldstone, Sabai Sabai, Panda Express, Moby Dick House of Kabob, Five Guys 8,250 SF: Vacant	198
4 / ID 26	World Building, 8101 Georgia Avenue, Silver Spring	x	x	x	59,520 SF: World Building Lobby 12,000 SF: Pacci's, Fire Station Restaurant 6,000 SF: AAMCO 2,250 SF: Golf Ultra Lounge 1,700 SF: Next Door Coffee/Sashelvis Hair Salon 1,700 SF: All State	0

Site ID	Name & Address	Land Uses			Land Area	Parking
		Retail	Office	Restaurant		
5 / ID 27	19 Wisconsin Circle, Friendship Heights	x	x	x	18,500 SF: Giant 5,000 SF: Zen Acupressure, Luxoptics 8,000 SF: Merritt Gallery, Clothing store 1,500 SF: Capital One 3,000 SF: Busy bees 6,000 SF: Potomac Pizza 2,000 SF: Sweet Teensy Bakery 4,000 SF: Sushiko 138,646 SF: Lobby 8,000 SF: Vacant	1086
6 / ID 28	7101 Wisconsin Avenue, Bethesda	x	x		6,000 SF: Gartenhaus 2,500 SF: Solidcore 2,500 SF: For eyes 219,904 SF: Lobby	388
7 / ID 29	8505 Fenton Street, Silver Spring	x	x		35,002 SF: Whole Foods 3,301 SF: Sprint 12,768 SF: Lobby 25,535 SF: Escape Room	269
8 / ID 30	Chevy Chase Building at 5530 Wisconsin Avenue, Friendship Heights	x	x		5,005 SF: Bank 5,005 SF: Pharmacy 5,005 SF: Block Advisors 5,005 SF: US Post Office 5,005 SF: National Retina Institute 159,514 SF + 120,335 SF: Lobby	345
9 / ID 43	5635 Fishers Lane, Rockville	x	x		178,750 SF: Lobby 6,250 SF: Sprouts	278

## **APPENDIX C – SITE-LEVEL OBSERVATIONS**

## Peak Hour Trips by Mode

AM

Site ID	SOV		HOV Passenger		HOV Driver		Shared vehicle		Taxi/Rideshare		Walk		Metrorail		Bus		Bicycle		Other (specify)		Total	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
1	51	110	4	11	3	7	5	0	1	15	37	34	12	37	5	18	0	4	0	0	117	236
4	8	47	1	2	1	2	0	0	0	1	5	4	0	14	0	2	0	0	0	0	15	72
7	12	63	1	6	1	6	0	0	0	0	1	29	0	45	0	0	0	0	0	0	14	149
12	7	17	0	1	0	0	0	0	0	1	3	4	0	10	0	1	0	1	0	0	10	35
19	19	23	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	19	43
22	0	2	0	1	0	1	0	0	0	0	4	9	0	0	0	0	0	0	0	0	4	13
24	9	42	0	4	0	3	1	1	0	2	6	38	0	6	0	4	0	0	0	0	16	100
25	2	16	0	1	0	2	0	0	0	2	6	14	0	19	0	1	0	2	0	0	8	57
38	3	4	0	0	0	0	0	0	0	0	3	1	0	4	0	0	0	0	0	0	5	8
39	0	3	0	0	0	0	1	2	0	6	18	22	0	0	0	0	0	0	0	0	19	33
40	6	11	0	1	0	1	0	0	0	0	1	10	0	6	0	0	0	3	0	0	7	30
41	0	12	0	2	0	2	0	0	0	0	2	5	0	11	0	9	0	0	0	0	2	41
10	25	8	2	0	0	0	1	4	0	0	2	0	0	0	0	0	0	0	0	0	30	12
14	27	8	8	1	6	1	0	0	0	0	4	8	0	0	0	0	0	0	0	0	45	19
26	6	3	7	4	5	3	1	1	0	0	2	2	9	0	8	1	1	0	0	0	40	14
27	73	23	2	6	3	4	1	1	0	0	2	4	76	42	63	34	3	2	0	0	223	116
28	93	8	5	0	3	0	1	1	0	0	6	1	11	1	39	1	0	0	0	0	159	11
29	103	80	4	8	3	8	5	1	0	0	31	50	5	5	22	0	8	0	0	0	182	152
30	288	20	22	3	16	3	1	2	0	0	2	1	46	10	43	7	2	1	0	0	420	46
43	76	17	7	1	3	1	4	0	0	0	12	25	14	2	7	1	0	0	0	0	123	46

## Peak Hour Trips by Mode

PM

Site ID	SOV		HOV Passenger		HOV Driver		Shared vehicle		Taxi/Rideshare		Walk		Metrorail		Bus		Bicycle		Other (specify)		Total	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
1	137	71	16	13	13	15	0	0	16	9	97	124	48	15	20	23	0	0	1	0	349	271
4	24	16	5	3	5	3	0	0	0	0	11	5	9	2	1	0	0	0	0	0	55	28
7	51	32	7	10	6	9	0	0	0	1	18	13	24	3	1	0	0	0	0	0	107	68
12	14	5	4	1	1	0	0	0	3	0	7	8	8	1	2	0	1	0	0	0	39	14
19	16	6	1	0	6	2	1	0	0	0	15	6	0	1	3	0	0	0	0	0	42	15
22	2	2	0	0	0	0	0	0	0	0	1	4	2	0	0	0	0	0	0	0	6	6
24	21	21	2	2	0	0	0	0	2	0	25	19	0	5	2	0	1	2	0	0	53	49
25	9	7	0	1	0	1	0	0	0	0	8	5	3	1	1	0	1	0	0	0	22	15
38	3	5	0	1	0	1	0	0	0	0	5	10	4	3	0	0	0	1	1	0	13	21
39	4	1	1	0	0	0	0	0	0	0	19	28	3	0	0	0	0	0	0	0	27	29
40	18	7	0	0	0	0	0	0	0	0	7	4	7	12	0	0	0	0	0	0	32	22
41	12	4	1	0	1	0	0	0	0	0	16	16	3	0	3	0	0	0	0	0	35	20
10	7	23	3	8	2	6	1	2	0	0	3	6	0	0	0	0	0	0	0	0	16	44
14	67	72	15	34	13	22	1	3	0	0	13	20	0	0	0	3	0	0	0	0	109	155
26	11	10	14	25	7	1	0	13	0	0	24	29	0	12	8	8	0	4	0	0	65	100
27	63	80	26	23	17	13	4	1	0	0	21	10	29	86	12	69	0	1	0	0	173	284
28	30	109	0	4	0	3	1	3	0	0	8	4	0	21	7	34	0	20	0	0	45	198
29	175	223	26	29	19	29	10	0	0	0	43	107	17	24	69	0	26	0	0	0	384	412
30	66	354	16	34	11	29	3	2	0	0	1	5	124	184	95	116	0	0	0	0	316	724
43	9	53	2	6	2	3	0	3	0	0	2	5	0	5	0	1	0	1	0	0	15	78



## **APPENDIX D – ITE SITE INPUTS**

## RESIDENTIAL OVER RETAIL LAND USES

### LAND USE ITE 9<sup>TH</sup> EDITION

ID	Site	Category	ITE land use		Daily	AM	PM
1	The Exchange Wheaton	Residential	222	High-Rise	logarithmic	logarithmic	linear
		Retail	850	Supermarket	average	average	logarithmic
4	Solaire Wheaton	Residential	220	Apartment	linear	linear	linear
7	Bainbridge at Shady Grove Metro	Residential	220	Apartment	linear	linear	linear
12	The Americana Finnmark	Residential	220	Apartment	linear	linear	linear
19	Solaire Bethesda	Residential	220	Apartment	linear	linear	linear
		Service	931	Quality Restaurant	average	average	average
22	The Lauren	Residential	220	Apartment	linear	linear	linear
24	The Citron	Residential	220	Apartment	linear	linear	linear
25	MICA Condos	Residential	222	High-Rise	logarithmic	logarithmic	linear
38	Stonehall	Residential	220	Apartment	linear	linear	linear
		Services	912	Drive-in Bank	average	average	average
39	4900 Fairmont	Residential	222	High-Rise	logarithmic	logarithmic	linear
		Service	931	Quality Restaurant	average	average	average
40	Element 28	Residential	222	High-Rise	logarithmic	logarithmic	linear
		Service	911	Walk in Bank	average	average	average
41	The Crescent	Residential	222	High-Rise	logarithmic	logarithmic	linear

		Service	932	High Turnover Restaurant	average	average	average
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#### LAND USE ITE 10<sup>TH</sup> EDITION

	Site	Category	ITE land use		Daily	AM	PM
1	The Exchange Wheaton	Residential	222	High-Rise	linear	linear	linear
		Retail	850	Supermarket	average	average	logarithmic
4	Solaire Wheaton	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
7	Bainbridge at Shady Grove Metro	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
12	The Americana Finnmark	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
19	Solaire Bethesda	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
		Service	931	Quality Restaurant	average	average	average
22	The Lauren	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
24	The Citron	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
25	MICA Condos	Residential	222	High-Rise	average	linear	linear
38	Stonehall	Residential	221	Mid-Rise	linear	logarithmic	logarithmic
		Services	912	Drive in Bank	linear	average	average
39	4900 Fairmont	Residential	222	High-Rise	average	linear	linear

		Service	931	Quality Restaurant	average	average	average
40	Element 28	Residential	222	High-Rise	average	linear	linear
		Service	911	Walk in Bank	average	average	average
41	The Crescent	Residential	222	High-Rise	average	linear	linear
		Service	932	High-Turnover Restaurant	average	average	average

## OFFICE OVER RETAIL LAND USES

### Office over Retail Sites

Site ID	ITE Land Use	Land Use Code		ITE 9th Method		ITE 10th Edition	
		ITE 9th	ITE 10th	AM	PM	AM	PM
2 / ID 10	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	Medical-Dental Office Building	720	720	average	average	average	average
	Pharmacy/Drugstore without Drive-Through Window	880	880	average	average	average	average
	Hair Salon	918	918	average	average	NA	average
3 / ID 14	Health/Fitness Club	492	492	average	logarithmic	average	average*
	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	Medical-Dental Office Building	720	720	average	average	average	average
	Hair Salon	918	918	average	average	NA	average
	High-Turnover (Sit-Down) Restaurant	932	932	average	average	average	average
4 / ID 26	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	Single Tenant Office Building	715	715	linear	linear	linear	linear
	Walk-in Bank	918	918	average	average	No data	average
	Drinking Place	925	925	No data	average	No data	average
	Quality Restaurant	931	931	average*	average	average*	average
	Automobile Care Center	942	942	average	linear	average*	linear

5 / ID 27	Day Care Center	565	565	linear	linear	linear	linear
	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	Medical-Dental Office Building	720	720	average	average	average	average
	Supermarket	850	850	average	logarithmic	average	logarithmic
	Apparel Store	876	876	No data	average	No data	average
	Walk-in Bank	911	911	No data	average	No data	average
	Quality Restaurant	931	931	average*	average	average*	average
	High-Turnover (Sit-Down) Restaurant	932	932	average	average	average*	average
	Coffee/Donut Shop without Drive-Through Window	936	936	average	average	average	average
6 / ID 28	Health/Fitness Club	492	492	average	logarithmic	average	average*
	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	Medical-Dental Office Building	720	720	average	average	average	average
	Apparel Store	876	876	No data	average	No data	average
7 / ID 29	Bowling Alley	437	437	No data	average	No data	linear
	Medical-Dental Office Building	720	720	average	average	average	average
	Supermarket	850	850	average	average*	average	logarithmic
	Copy, Print, and Express Ship Store	920	920	average	No data	average	average
8 / ID 30	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	Medical-Dental Office Building	720	720	average	average	average	average
	US Post Office	732	732	average*	average*	average	average
	Pharmacy/Drugstore without Drive-Through Window	880	880	average	average	average	average
	Walk-in Bank	911	911	NA	average	NA	average
9 / ID 43	General Office Building	710	710	logarithmic	linear	linear	logarithmic
	High-Turnover (Sit-Down) Restaurant	932	932	average	average	average	average

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**Baseline Weekday AM Peak Modeshare and Vehicle Occupancy**

Land Use	Inbound				Outbound			
	Modeshares			Vehicle Occupancy	Modeshares			Vehicle Occupancy
	% Auto	% Transit	% Non-Motorized		% Auto	% Transit	% Non-Motorized	
All Other	100%	0%	0%	1.00	100%	0%	0%	1.00
Entertainment (Bowling Alley)	97%	0%	3%	1.13	100%	0%	0%	1.00
Hotel (Motel)	100%	0%	0%	1.00	100%	0%	0%	1.00
Office	99%	1%	0%	1.06	100%	0%	0%	1.06
Residential (Apartment)	95%	1%	4%	1.13	98%	0%	2%	1.09
Restaurant	100%	0%	0%	1.00	100%	0%	0%	1.00
Retail (Shopping Center)	100%	0%	0%	1.17	100%	0%	0%	1.16

**Baseline Weekday PM Peak Modeshare and Vehicle Occupancy**

Land Use	Inbound				Outbound			
	Modeshares			Vehicle Occupancy	Modeshares			Vehicle Occupancy
	% Auto	% Transit	% Non-Motorized		% Auto	% Transit	% Non-Motorized	
All Other	100%	0%	0%	1.00	1	0%	0%	1.00
Entertainment (Bowling Alley)	100%	0%	0%	1.27	1	0%	0%	1.33
Hotel (Motel)	100%	0%	0%	1.00	1	0%	0%	1.00
Office	100%	0%	0%	1.11	0.99	0%	1%	1.07
Residential (Apartment)	96%	1%	3%	1.15	0.96	4%	0%	1.21
Restaurant	98%	0%	2%	1.41	0.98	0%	2%	1.39
Retail (Shopping Center)	100%	0%	0%	1.21	1	0%	0%	1.18

**Infill Weekday AM and PM Non-Directional Peak Period Mode Share and Vehicle Occupancy**

Land Use	AM				PM			
	Modeshares			Vehicle Occupancy	Modeshares			Vehicle Occupancy
	% Auto	% Transit	% Non-Motorized		% Auto	% Transit	% Non-Motorized	
All Other	100%	0%	0%	1.00	100%	0%	0%	1.00
Entertainment (Bowling Alley)	97%	0%	3%	1.13	100%	0%	0%	1.27
Hotel (Motel)	100%	0%	0%	1.00	100%	0%	0%	1.00
Office	72%	16%	12%	1.11	69%	17%	14%	1.12
Residential (Apartment)	60%	15%	25%	1.16	55%	13%	32%	1.22
Restaurant	100%	0%	0%	1.00	98%	0%	2%	1.41
Retail (Shopping Center)	93%	6%	1%	1.00	68%	16%	16%	1.00

## **APPENDIX E – ITE SITE LEVEL RESULTS**



# ITE 9<sup>TH</sup>

## PERSON TRIP

Site ID	ITE 9th Edition Persons Trips					
	Total	AM In	Out	Total	PM In	Out
1	353	163	190	593	321	272
4	124	25	99	152	99	53
7	200	40	160	238	154	83
12	159	32	127	191	124	67
19	80	18	62	146	96	50
22	35	7	28	53	34	18
24	113	23	90	140	91	49
25	46	11	34	61	37	24
38	65	27	38	121	67	54
39	81	22	60	145	91	53
40	37	9	27	111	58	54
41	62	21	41	75	45	29
ID 10	149	126	23	227	57	170
ID 14	315	204	110	410	173	237
ID 26	176	149	27	345	129	216
ID 27	645	434	210	719	289	430
ID 28	369	323	46	368	75	293
ID 29	159	105	54	456	225	231
ID 30	640	518	122	777	220	557
ID 43	372	305	67	340	84	256

## VEHICLE TRIP

Site ID	ITE 9th Edition Vehicle Trips					
	Total	AM In	Out	Total	PM In	Out
1	353	163	190	593	321	272
4	124	25	99	152	99	53
7	200	40	160	238	154	83
12	159	32	127	191	124	67
19	80	18	62	146	96	50
22	35	7	28	53	34	18
24	113	23	90	140	91	49
25	46	11	34	61	37	24
38	65	27	38	121	67	54
39	81	22	60	145	91	53
40	37	9	27	111	58	54
41	62	21	41	75	45	29
ID 10	149	126	23	227	57	170
ID 14	315	204	110	410	173	237
ID 26	176	149	27	345	129	216
ID 27	608	434	210	682	289	430
ID 28	369	323	46	368	75	293
ID 29	159	105	54	456	225	231
ID 30	640	518	122	777	220	557
ID 43	372	305	67	340	84	256

## ITE 10<sup>TH</sup>

### PERSON AND MODE TRIP

Site ID	ITE 10th Edition - AM										
	Total Trips	Total Trips In	Auto-driver	In Auto-passenger	Transit	Non-motorized	Total Trips Out	Auto-driver	Out Auto-passenger	Transit	Non-motorized
1	430	199	148	24	16	12	230	153	20	25	33
4	90	24	13	2	4	6	66	37	3	10	17
7	146	39	21	3	6	10	107	59	5	16	27
12	116	32	17	2	5	8	85	47	4	13	21
19	58	16	10	1	2	4	42	24	2	6	10
22	25	6	3	0	1	2	19	10	1	3	5
24	82	22	12	2	3	6	60	33	3	9	15
25	60	15	8	1	2	4	46	25	2	7	12
38	49	23	21	0	1	1	26	20	1	2	3
39	95	24	14	2	3	6	71	40	3	10	17
40	51	13	7	1	2	3	38	21	2	6	10
41	71	21	15	1	2	4	50	31	2	6	11
ID 10	124	104	72	4	16	12	20	14	1	3	2
ID 14	257	176	150	4	12	9	81	79	0	1	1
ID 26	129	107	77	4	15	11	22	17	1	2	2
ID 27	439	297	249	10	22	16	142	137	3	2	0
ID 28	259	221	150	9	35	26	38	26	1	6	4
ID 29	197	127	99	14	10	4	70	56	8	5	1
ID 30	609	480	327	20	76	57	129	88	6	20	15
ID 43	267	211	154	7	28	21	57	47	1	5	3

Site ID	ITE 10th Edition - PM										
	Total Trips	Total Trips In	Auto	In Auto-passenger	Transit	Non-motorized	Total Trips Out	Auto	Out Auto-passenger	Transit	Non-motorized
1	662	362	198	40	56	69	300	166	31	46	56
4	131	79	37	6	11	26	53	23	5	7	17
7	197	118	56	8	15	38	79	36	8	10	25
12	157	94	45	7	12	30	63	29	6	8	20
19	126	82	48	15	5	14	44	25	8	3	8
22	34	20	10	1	3	6	14	6	1	2	4
24	112	67	32	5	9	21	45	21	4	6	14
25	70	43	21	3	5	13	28	13	3	4	9
38	91	48	40	1	2	5	43	38	1	1	3
39	168	109	63	18	8	21	59	32	9	5	12
40	145	74	44	14	5	12	71	44	15	3	8
41	83	51	27	6	5	12	32	16	4	3	8
ID 10	140	37	27	2	4	4	103	71	4	15	13
ID 14	361	187	129	47	4	6	174	119	30	13	12
ID 26	295	139	100	33	3	4	156	109	18	15	13
ID 27	572	247	163	40	21	22	325	216	32	40	37
ID 28	303	64	40	6	10	8	239	154	12	40	33
ID 29	496	249	150	29	35	35	246	152	24	36	35
ID 30	833	248	163	16	37	31	585	388	26	93	78
ID 43	300	90	60	18	6	6	210	137	17	30	25

## VEHICLE TRIP

ITE 10th Edition- Vehicle Trip					
Total Vehicle Trips	AM In	Out	Total Vehicle Trips	PM In	Out
301	148	153	364	198	166
49	13	37	60	37	23
80	21	59	92	56	36
64	17	47	73	45	29
34	10	24	73	48	25
14	3	10	16	10	6
45	12	33	53	32	21
33	8	25	33	21	13
41	21	20	78	40	38
54	14	40	95	63	32
28	7	21	89	44	44
46	15	31	44	27	16
86	72	14	97	27	71
229	150	79	249	129	119
95	77	17	209	100	109
386	249	137	378	163	216
177	150	26	194	40	154
155	99	56	301	150	152
415	327	88	550	163	388
201	154	47	197	60	137

## **APPENDIX F – ITE COMPARISON TO OBSERVED**

### ITE 9<sup>th</sup> Person Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	ITE	% Diff	Observed	ITE	% Diff
1	The Exchange Wheaton	353	353	0%	620	593	-4%
4	Solaire Wheaton	87	124	42%	83	152	84%
7	Bainbridge at Shady Grove	163	200	23%	175	238	36%
12	The Americana Finnmark	45	159	252%	53	191	261%
19	Solaire Bethesda	62	80	29%	57	146	156%
22	The Lauren	17	35	106%	12	53	340%
24	The Citron	116	113	-3%	102	140	37%
25	MICA Condos	65	46	-29%	37	61	64%
38	Stonehall	13	65	403%	34	121	257%
39	4900 Fairmont	<b>52</b>	81	56%	<b>56</b>	145	158%
40	Element 28	37	37	-1%	54	111	106%
41	The Crescent	43	62	44%	55	75	36%
2 / ID 10	10400 Connecticut Avenue	42	149	255%	60	227	278%
3 / ID 14	Century Blvd and Pinnacle Dr	64	315	392%	264	410	55%
4 / ID 26	World Building	54	176	227%	165	345	109%
5 / ID 27	19 Wisconsin Circle	339	645	90%	457	719	57%
6 / ID 28	7101 Wisconsin Avenue	170	369	117%	243	368	52%
7 / ID 29	8505 Fenton Street	334	159	-52%	796	456	-43%
8 / ID 30	Chevy Chase Building	466	640	37%	1040	777	-25%
9 / ID 43	5635 Fishers Lane, Rockville	169	372	120%	93	340	266%

### ITE 10<sup>th</sup> Person Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	ITE	% Diff	Observed	ITE	% Diff
1	The Exchange Wheaton	353	430	22%	620	662	7%
4	Solaire Wheaton	87	90	4%	83	131	58%
7	Bainbridge at Shady Grove	163	146	-10%	175	197	13%
12	The Americana Finnmark	45	116	159%	53	157	196%
19	Solaire Bethesda	62	58	-6%	57	126	121%
22	The Lauren	17	25	44%	12	34	184%
24	The Citron	116	82	-29%	102	112	10%
25	MICA Condos	65	60	-7%	37	70	90%
38	Stonehall	13	49	277%	34	91	169%
39	4900 Fairmont	52	95	83%	56	168	200%
40	Element 28	37	51	38%	54	145	168%
41	The Crescent	43	71	66%	55	83	52%
2 / ID 10	10400 Connecticut Avenue	42	124	195%	60	140	133%
3 / ID 14	Century Blvd and Pinnacle Dr	64	257	301%	264	361	37%
4 / ID 26	World Building	54	129	139%	165	295	79%
5 / ID 27	19 Wisconsin Circle	339	439	29%	457	572	25%
6 / ID 28	7101 Wisconsin Avenue	170	259	52%	243	303	25%
7 / ID 29	8505 Fenton Street	334	197	-41%	796	496	-38%
8 / ID 30	Chevy Chase Building	466	609	31%	1040	833	-20%
9 / ID 43	5635 Fishers Lane, Rockville	169	267	58%	93	300	222%



### ITE 9<sup>th</sup> Auto Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	ITE	% Diff	Observed	ITE	% Diff
1	The Exchange Wheaton	210	353	68%	288	593	106%
4	Solaire Wheaton	59	124	108%	48	152	220%
7	Bainbridge at Shady Grove	81	200	146%	101	238	134%
12	The Americana Finnmark	26	159	510%	28	191	587%
19	Solaire Bethesda	42	80	90%	27	146	449%
22	The Lauren	3	35	997%	5	53	1001%
24	The Citron	60	113	87%	48	140	192%
25	MICA Condos	24	46	94%	17	61	251%
38	Stonehall	6	65	980%	5	121	2156%
39	4900 Fairmont	18	81	352%	89	145	62%
40	Element 28	17	37	115%	24	111	359%
41	The Crescent	14	62	349%	17	75	350%
2 / ID 10	10400 Connecticut Avenue	44	149	236%	45	227	405%
3 / ID 14	Century Blvd and Pinnacle Dr	43	315	631%	189	410	118%
4 / ID 26	World Building	24	176	625%	69	345	400%
5 / ID 27	19 Wisconsin Circle	108	608	463%	194	682	252%
6 / ID 28	7101 Wisconsin Avenue	109	369	238%	150	368	146%
7 / ID 29	8505 Fenton Street	208	159	-24%	468	456	-3%
8 / ID 30	Chevy Chase Building	333	640	92%	464	777	67%
9 / ID 43	5635 Fishers Lane, Rockville	107	372	249%	76	340	350%

### ITE 10<sup>th</sup> Auto Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	ITE	% Diff	Observed	ITE	% Diff
1	The Exchange Wheaton	210	301	44%	288	364	27%
4	Solaire Wheaton	59	49	-17%	48	60	26%
7	Bainbridge at Shady Grove	81	80	-2%	101	92	-9%
12	The Americana Finnmark	26	64	144%	28	73	163%
19	Solaire Bethesda	42	34	-20%	27	73	176%
22	The Lauren	3	14	324%	5	16	234%
24	The Citron	60	45	-25%	48	53	10%
25	MICA Condos	24	33	38%	17	33	93%
38	Stonehall	6	41	575%	5	78	1352%
39	4900 Fairmont	18	54	202%	89	95	6%
40	Element 28	17	28	63%	24	89	264%
41	The Crescent	14	46	232%	17	44	164%
2 / ID 10	10400 Connecticut Avenue	44	86	94%	45	97	117%
3 / ID 14	Century Blvd and Pinnacle Dr	43	229	432%	189	249	32%
4 / ID 26	World Building	24	95	289%	69	209	203%
5 / ID 27	19 Wisconsin Circle	108	386	257%	194	378	95%
6 / ID 28	7101 Wisconsin Avenue	109	177	62%	150	194	29%
7 / ID 29	8505 Fenton Street	208	155	-25%	468	301	-36%
8 / ID 30	Chevy Chase Building	333	415	24%	464	550	19%
9 / ID 43	5635 Fishers Lane, Rockville	107	201	89%	76	197	161%

## **APPENDIX G – LATR SITE LEVEL REDUCTIONS**

## VIII. Appendices

### Appendix 1a: Institute of Transportation Engineers Vehicle-Trip Generation Rate Adjustment Factors

Appendix Table 1a: ITE Vehicle-Trip Generation Rate Adjustment Factors					
Policy Area #		Residential	Office	Retail	Other
1	Aspen Hill	97%	98%	99%	97%
2	Bethesda CBD	79%	63%	61%	62%
3	Bethesda/Chevy Chase	87%	81%	85%	79%
4	Burtonsville Town Center	96%	96%	99%	97%
5	Chevy Chase Lake	87%	81%	85%	79%
6	Clarksburg	100%	101%	100%	100%
7	Clarksburg Town Center	100%	101%	100%	100%
8	Cloverly	99%	101%	100%	101%
9	Damascus	101%	100%	100%	100%
10	Derwood	94%	94%	87%	94%
11	Fairland/Colesville	96%	96%	99%	97%
12	Friendship Heights	78%	70%	73%	70%
13	Gaithersburg City	88%	86%	76%	85%
14	Germantown East	95%	95%	97%	91%
15	Germantown Town Center	89%	91%	89%	90%
16	Germantown West	93%	90%	92%	88%
17	Glenmont	90%	91%	96%	91%
18	Grosvenor	81%	84%	75%	80%
19	Kensington/Wheaton	91%	92%	96%	92%
20	Long Branch	91%	92%	96%	92%
21	Montgomery Village/Airpark	93%	102%	93%	102%
22	North Bethesda	83%	87%	71%	82%
23	North Potomac	97%	100%	100%	100%
24	Olney	99%	100%	99%	100%
25	Potomac	97%	98%	96%	98%
26	R&D Village	89%	88%	80%	90%
27	Rockville City	88%	94%	87%	98%
28	Rockville Town Center	79%	80%	70%	79%
29	Rural East	99%	99%	98%	100%
30	Rural West	100%	100%	100%	100%
31	Shady Grove Metro Station	89%	88%	77%	88%
32	Silver Spring CBD	77%	65%	58%	65%
33	Silver Spring/Takoma Park	83%	83%	82%	84%
34	Takoma/Langley	83%	83%	82%	84%
35	Twinbrook	81%	80%	74%	79%
36	Wheaton CBD	85%	85%	76%	84%
37	White Flint	79%	78%	72%	78%
38	White Oak	89%	90%	91%	88%

Appendix Table 1b: Mode Split Assumptions by Policy Area						
Policy Area #	Development Type	Auto Driver	Auto Passenger	Transit	Non-Motorized	Total
1 Aspen Hill	Residential	62.5%	25.8%	5.3%	6.4%	100%
	Office	74.2%	18.2%	2.9%	4.7%	100%
	Retail	72.1%	23.4%	1.3%	3.2%	100%
	Other	74.0%	18.2%	2.5%	5.2%	100%
2 Bethesda CBD	Residential	50.9%	20.8%	11.7%	16.6%	100%
	Office	47.9%	12.6%	23.8%	15.7%	100%
	Retail	44.2%	16.9%	10.9%	27.9%	100%
	Other	47.3%	13.2%	23.0%	16.5%	100%
3 Bethesda/Chevy Chase	Residential	56.1%	23.6%	7.6%	12.6%	100%
	Office	61.8%	17.4%	11.5%	9.3%	100%
	Retail	61.6%	24.7%	3.2%	10.5%	100%
	Other	60.5%	17.1%	12.6%	9.9%	100%
4 Burtonsville Town Center	Residential	62.3%	25.9%	4.9%	6.9%	100%
	Office	73.0%	19.8%	2.8%	4.3%	100%
	Retail	71.6%	24.3%	1.0%	3.1%	100%
	Other	73.9%	19.4%	2.5%	4.2%	100%
5 Chevy Chase Lake	Residential	56.1%	23.6%	7.6%	12.6%	100%
	Office	61.8%	17.4%	11.5%	9.3%	100%
	Retail	61.6%	24.7%	3.2%	10.5%	100%
	Other	60.5%	17.1%	12.6%	9.9%	100%
6 Clarksburg	Residential	64.5%	27.1%	2.5%	5.9%	100%
	Office	76.5%	20.0%	0.0%	3.5%	100%
	Retail	72.3%	25.7%	0.0%	2.0%	100%
	Other	76.2%	20.3%	0.0%	3.5%	100%
7 Clarksburg Town Center	Residential	64.5%	27.1%	2.5%	5.9%	100%
	Office	76.5%	20.0%	0.0%	3.5%	100%
	Retail	72.3%	25.7%	0.0%	2.0%	100%
	Other	76.2%	20.3%	0.0%	3.5%	100%
8 Cloverly	Residential	64.1%	26.4%	3.5%	5.9%	100%
	Office	76.8%	19.0%	0.7%	3.5%	100%
	Retail	72.8%	25.1%	0.2%	2.0%	100%
	Other	76.5%	19.2%	0.8%	3.4%	100%
9 Damascus	Residential	65.4%	26.6%	2.2%	5.8%	100%
	Office	76.1%	20.3%	0.1%	3.5%	100%
	Retail	72.5%	25.5%	0.0%	1.9%	100%
	Other	76.1%	20.4%	0.1%	3.5%	100%
10 Derwood	Residential	61.0%	26.6%	5.6%	6.8%	100%
	Office	71.4%	20.4%	3.6%	4.5%	100%
	Retail	63.4%	28.7%	2.2%	5.7%	100%
	Other	71.3%	20.4%	3.7%	4.6%	100%
11 Fairland/Colesville	Residential	62.3%	25.9%	4.9%	6.9%	100%
	Office	73.0%	19.8%	2.8%	4.3%	100%
	Retail	71.6%	24.3%	1.0%	3.1%	100%
	Other	73.9%	19.4%	2.5%	4.2%	100%
12 Friendship Heights	Residential	50.3%	19.4%	15.4%	14.8%	100%
	Office	53.0%	9.9%	24.5%	12.6%	100%
	Retail	52.8%	15.4%	11.8%	19.9%	100%
	Other	53.4%	9.7%	23.9%	13.0%	100%
13 Gaithersburg City	Residential	56.7%	26.8%	5.4%	11.1%	100%
	Office	65.4%	23.5%	4.1%	7.1%	100%
	Retail	55.0%	32.7%	2.4%	10.0%	100%
	Other	64.4%	24.5%	3.8%	7.3%	100%

Appendix Table 1b: Mode Split Assumptions by Policy Area						
Policy Area #	Development Type	Auto Driver	Auto Passenger	Transit	Non-Motorized	Total
14 Germantown East	Residential	61.5%	26.9%	4.3%	7.4%	100%
	Office	72.1%	21.1%	1.8%	5.0%	100%
	Retail	70.1%	25.3%	1.1%	3.5%	100%
	Other	69.5%	23.2%	2.5%	4.8%	100%
15 Germantown Town Center	Residential	57.7%	27.0%	5.4%	9.9%	100%
	Office	69.2%	20.4%	4.5%	5.8%	100%
	Retail	64.5%	26.5%	2.5%	6.4%	100%
	Other	68.2%	20.1%	5.3%	6.4%	100%
16 Germantown West	Residential	60.4%	26.9%	4.1%	8.6%	100%
	Office	68.2%	22.9%	3.2%	5.8%	100%
	Retail	66.4%	27.6%	1.2%	4.8%	100%
	Other	67.0%	23.5%	3.3%	6.2%	100%
17 Glenmont	Residential	58.4%	24.8%	10.0%	6.8%	100%
	Office	69.5%	16.8%	8.2%	5.6%	100%
	Retail	69.5%	22.7%	4.0%	3.9%	100%
	Other	69.1%	16.9%	8.4%	5.6%	100%
18 Grosvenor	Residential	52.3%	25.8%	11.9%	10.0%	100%
	Office	63.4%	16.5%	13.3%	6.8%	100%
	Retail	54.7%	27.5%	8.4%	9.5%	100%
	Other	61.0%	17.2%	15.4%	6.3%	100%
19 Kensington/Wheaton	Residential	59.1%	25.4%	8.1%	7.4%	100%
	Office	69.6%	18.6%	6.1%	5.7%	100%
	Retail	69.8%	23.8%	2.1%	4.3%	100%
	Other	69.8%	18.7%	5.6%	5.9%	100%
20 Long Branch	Residential	54.0%	21.0%	10.1%	14.9%	100%
	Office	63.0%	10.7%	15.1%	11.2%	100%
	Retail	59.5%	17.2%	6.9%	16.4%	100%
	Other	63.8%	10.5%	14.0%	11.6%	100%
21 Montgomery Village/Airpark	Residential	59.9%	26.8%	4.6%	8.6%	100%
	Office	77.7%	15.1%	2.9%	4.3%	100%
	Retail	67.7%	25.1%	1.7%	5.4%	100%
	Other	77.4%	15.1%	2.8%	4.7%	100%
22 North Bethesda	Residential	53.8%	25.9%	8.0%	12.3%	100%
	Office	65.8%	18.4%	8.6%	7.3%	100%
	Retail	51.6%	28.4%	6.1%	14.0%	100%
	Other	62.4%	19.5%	9.4%	8.7%	100%
23 North Potomac	Residential	63.0%	27.1%	3.0%	7.0%	100%
	Office	75.7%	18.6%	0.8%	4.8%	100%
	Retail	72.4%	24.1%	0.6%	2.9%	100%
	Other	75.8%	18.8%	1.0%	4.4%	100%
24 Olney	Residential	64.3%	26.4%	3.3%	6.1%	100%
	Office	76.3%	19.4%	0.7%	3.6%	100%
	Retail	72.1%	24.8%	0.5%	2.6%	100%
	Other	76.3%	19.5%	0.7%	3.5%	100%
25 Potomac	Residential	62.6%	26.8%	4.1%	6.5%	100%
	Office	74.4%	19.3%	2.2%	4.1%	100%
	Retail	69.8%	25.7%	1.8%	2.7%	100%
	Other	74.8%	19.5%	2.1%	3.7%	100%
26 R&D Village	Residential	57.3%	27.3%	5.7%	9.7%	100%
	Office	66.7%	23.5%	4.4%	5.4%	100%
	Retail	58.0%	34.1%	2.0%	6.0%	100%
	Other	68.8%	22.4%	3.8%	5.1%	100%

Appendix Table 1b: Mode Split Assumptions by Policy Area						
Policy Area #	Development Type	Auto Driver	Auto Passenger	Transit	Non-Motorized	Total
27 Rockville City	Residential	56.8%	26.6%	6.3%	10.2%	100%
	Office	71.7%	17.4%	5.4%	5.5%	100%
	Retail	62.8%	25.6%	3.3%	8.2%	100%
	Other	74.7%	15.3%	4.8%	5.1%	100%
28 Rockville Town Center	Residential	51.3%	25.3%	8.9%	14.5%	100%
	Office	60.5%	16.7%	12.3%	10.5%	100%
	Retail	51.0%	26.5%	6.8%	15.6%	100%
	Other	59.9%	16.9%	12.4%	10.8%	100%
29 Rural East	Residential	64.0%	28.2%	2.6%	5.3%	100%
	Office	75.4%	20.6%	0.3%	3.7%	100%
	Retail	71.2%	26.8%	0.1%	1.9%	100%
	Other	75.8%	20.2%	0.5%	3.6%	100%
30 Rural West	Residential	64.8%	28.2%	1.8%	5.2%	100%
	Office	76.0%	20.4%	0.0%	3.6%	100%
	Retail	72.6%	25.7%	0.0%	1.7%	100%
	Other	76.1%	20.3%	0.1%	3.5%	100%
31 Shady Grove Metro Station	Residential	57.7%	26.4%	8.7%	7.1%	100%
	Office	67.0%	20.6%	6.8%	5.5%	100%
	Retail	55.9%	29.2%	3.8%	11.1%	100%
	Other	66.9%	20.6%	7.2%	5.2%	100%
32 Silver Spring CBD	Residential	50.1%	18.8%	13.6%	17.5%	100%
	Office	49.6%	9.0%	26.6%	14.9%	100%
	Retail	42.4%	12.6%	20.9%	24.0%	100%
	Other	49.2%	8.7%	26.8%	15.2%	100%
33 Silver Spring/Takoma Park	Residential	54.0%	21.0%	10.1%	14.9%	100%
	Office	63.0%	10.7%	15.1%	11.2%	100%
	Retail	59.5%	17.2%	6.9%	16.4%	100%
	Other	63.8%	10.5%	14.0%	11.6%	100%
34 Takoma/Langley	Residential	54.0%	21.0%	10.1%	14.9%	100%
	Office	63.0%	10.7%	15.1%	11.2%	100%
	Retail	59.5%	17.2%	6.9%	16.4%	100%
	Other	63.8%	10.5%	14.0%	11.6%	100%
35 Twinbrook	Residential	52.3%	26.2%	9.7%	11.8%	100%
	Office	60.8%	17.2%	13.7%	8.3%	100%
	Retail	53.6%	27.8%	7.2%	11.4%	100%
	Other	60.2%	17.5%	13.9%	8.5%	100%
36 Wheaton CBD	Residential	55.3%	24.9%	11.6%	8.2%	100%
	Office	64.3%	15.0%	13.1%	7.5%	100%
	Retail	54.8%	25.2%	7.6%	12.4%	100%
	Other	64.2%	15.1%	13.1%	7.6%	100%
37 White Flint	Residential	51.4%	26.3%	10.7%	11.6%	100%
	Office	59.2%	17.8%	14.4%	8.5%	100%
	Retail	52.2%	28.3%	8.2%	11.3%	100%
	Other	59.5%	17.9%	14.0%	8.6%	100%
38 White Oak	Residential	57.9%	25.8%	7.8%	8.5%	100%
	Office	68.7%	22.6%	3.3%	5.4%	100%
	Retail	65.7%	28.0%	2.0%	4.3%	100%
	Other	66.9%	23.9%	3.4%	5.8%	100%

## **APPENDIX H – LATR SITE-LEVEL RESULTS**



## PERSON TRIP

Montgomery County LATR- AM										
Site ID	Total Trips In	Auto-driver	In			Total Trips Out	Auto-driver	Out		
			Auto-passenger	Transit	Non-motorized			Auto-passenger	Transit	Non-motorized
1	243	130	67	19	28	303	160	81	26	35
4	33	17	9	3	4	94	49	25	9	11
7	53	31	13	4	4	151	89	38	12	11
12	42	25	11	3	3	121	71	31	10	9
19	23	11	4	3	4	59	30	12	7	10
22	9	5	2	1	2	26	13	5	3	4
24	30	15	6	4	5	85	43	16	12	15
25	20	10	4	3	4	64	32	12	9	11
38	30	15	4	6	5	36	18	6	6	6
39	34	17	7	4	6	100	51	21	12	17
40	17	9	4	2	3	55	28	11	6	9
41	30	15	5	5	5	69	34	12	11	12
ID 10	132	92	25	8	7	23	16	4	1	1
ID 14	217	149	44	11	13	115	78	23	6	7
ID 26	135	67	12	36	20	19	9	2	5	3
ID 27	323	172	34	73	44	193	103	20	43	27
ID 28	274	131	35	65	43	47	22	6	11	7
ID 29	150	67	17	34	32	84	37	10	18	19
ID 30	649	344	65	158	82	109	58	11	26	14
ID 43	264	160	46	36	22	72	44	13	10	6

Montgomery County LATR- PM										
Site ID	Total Trips In	Auto-driver	In Auto-passenger	Transit	Non-motorized	Total Trips Out	Auto-driver	Out Auto-passenger	Transit	Non-motorized
1	415	221	114	32	48	368	197	101	28	42
4	103	54	27	10	12	66	35	17	6	8
7	158	93	40	13	12	101	60	26	8	7
12	125	74	32	10	9	80	47	20	6	6
19	91	45	16	15	15	52	26	9	8	9
22	28	14	6	3	5	18	9	4	2	3
24	90	45	17	12	16	57	29	11	8	10
25	57	28	11	8	10	36	18	7	5	6
38	64	31	10	12	11	56	27	8	11	9
39	123	61	22	19	20	72	36	13	11	12
40	83	41	15	14	14	76	37	12	14	13
41	62	31	11	10	11	40	20	7	6	7
ID 10	38	27	8	2	2	136	95	26	8	7
ID 14	171	117	34	9	11	199	137	41	10	12
ID 26	128	63	11	34	20	191	92	18	49	32
ID 27	247	131	31	44	41	333	177	40	66	51
ID 28	73	34	10	15	13	294	140	38	68	48
ID 29	282	123	34	62	64	288	126	34	64	64
ID 30	204	108	22	46	28	816	433	82	196	105
ID 43	92	56	16	13	8	250	152	43	34	21

## VEHICLE TRIP

Site ID	Montgomery County LATR					
		AM			PM	
	Total Vehicle Trips	In	Out	Total Vehicle Trips	In	Out
1	290	130	160	418	221	197
4	67	17	49	89	54	35
7	121	31	89	153	93	60
12	96	25	71	121	74	47
19	41	11	30	71	45	26
22	18	5	13	23	14	9
24	58	15	43	74	45	29
25	42	10	32	47	28	18
38	32	15	18	58	31	27
39	68	17	51	97	61	36
40	37	9	28	78	41	37
41	49	15	34	51	31	20
ID 10	108	92	16	121	27	95
ID 14	227	149	78	253	117	137
ID 26	76	67	9	155	63	92
ID 27	275	172	103	308	131	177
ID 28	154	131	22	175	34	140
ID 29	103	67	37	249	123	126
ID 30	402	344	58	541	108	433
ID 43	204	160	44	207	56	152

## **APPENDIX I – LATR COMPARISON TO OBSERVED**

### LATR Person Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	LATR	% Diff	Observed	LATR	% Diff
1	The Exchange Wheaton	353	546	55%	620	783	26%
4	Solaire Wheaton	87	127	46%	83	169	104%
7	Bainbridge at Shady Grove	163	204	25%	175	258	48%
12	The Americana Finnmark	45	163	263%	53	205	287%
19	Solaire Bethesda	62	82	32%	57	143	151%
22	The Lauren	17	35	106%	12	45	277%
24	The Citron	116	115	0%	102	147	44%
25	MICA Condos	65	84	29%	37	93	151%
38	Stonehall	13	66	409%	34	120	254%
39	4900 Fairmont	52	134	-60%	56	195	-22%
40	Element 28	37	72	94%	54	159	195%
41	The Crescent	43	99	130%	55	102	86%
2 / ID 10	10400 Connecticut Avenue	42	155	269%	60	174	190%
3 / ID 14	Century Blvd and Pinnacle Dr	64	332	419%	264	370	40%
4 / ID 26	World Building	54	153	184%	165	319	93%
5 / ID 27	19 Wisconsin Circle	339	516	52%	457	581	27%
6 / ID 28	7101 Wisconsin Avenue	170	321	89%	243	367	51%
7 / ID 29	8505 Fenton Street	334	235	-30%	796	570	-28%
8 / ID 30	Chevy Chase Building	466	758	63%	1040	1020	-2%
9 / ID 43	5635 Fishers Lane, Rockville	169	336	99%	93	342	268%

### LATR Auto Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	LATR	% Diff	Observed	LATR	% Diff
1	The Exchange Wheaton	210	290	38%	288	418	45%
4	Solaire Wheaton	59	67	12%	48	89	86%
7	Bainbridge at Shady Grove	81	121	49%	101	153	50%
12	The Americana Finnmark	26	96	271%	28	121	335%
19	Solaire Bethesda	42	41	-1%	27	71	166%
22	The Lauren	3	18	458%	5	23	380%
24	The Citron	60	58	-4%	48	74	54%
25	MICA Condos	24	42	78%	17	47	170%
38	Stonehall	6	32	432%	5	58	561%
39	4900 Fairmont	18	68	-55%	89	97	8%
40	Element 28	17	37	115%	24	78	222%
41	The Crescent	14	49	258%	17	51	207%
2 / ID 10	10400 Connecticut Avenue	44	108	143%	45	121	170%
3 / ID 14	Century Blvd and Pinnacle Dr	43	227	428%	189	253	34%
4 / ID 26	World Building	24	76	212%	69	155	124%
5 / ID 27	19 Wisconsin Circle	108	275	154%	194	308	59%
6 / ID 28	7101 Wisconsin Avenue	109	154	41%	150	175	17%
7 / ID 29	8505 Fenton Street	208	103	-50%	468	249	-47%
8 / ID 30	Chevy Chase Building	333	402	20%	464	541	17%
9 / ID 43	5635 Fishers Lane, Rockville	107	204	91%	76	207	174%

## **APPENDIX J – MXD+ SITE-LEVEL REDUCTIONS**

**MXD+ Daily Site Level Trip Reductions**

NO	Location	MXD+ - ITE 9 <sup>th</sup>			MXD+ - ITE 10 <sup>th</sup>		
		Raw Trips	Reduction %	Net Trips	Raw Trips	Reduction %	Net Trips
1	The Exchange Wheaton	8,201	45%	4,530	8,578	45%	4,740
4	Solaire Wheaton	1,608	33%	1,072	1,334	32%	907
7	Bainbridge at Shady Grove Metro	2,548	23%	1,958	2,178	23%	1,675
12	The Americana Finnmark	2,039	38%	1,266	2,348	39%	1,430
19	Solaire Bethesda	1,587	74%	410	1,334	74%	346
22	The Lauren	511	21%	404	347	21%	274
24	The Citron	1,469	37%	921	1,208	41%	713
25	MICA Condos	784	48%	410	672	48%	351
38	Stonehall*	408	67%	136	636	56%	277
39	4900 Fairmont	1821	67%	604	1,700	67%	566
40	Element 28	648	74%	166	534	74%	137
41	The Crescent	965	76%	231	827	76%	198
2 / ID 10	10400 Connecticut Avenue, Kensington	1,525	12%	1,346	1,261	12%	1,111
3 / ID 14	Century Blvd and Pinnacle Dr, Germantown	3,634	21%	2,861	3,135	22%	2,454
4 / ID 26	World Building, 8101 Georgia Avenue, Silver Spring	1,984	33%	1,333	1,666	33%	1,110
5 / ID 27	19 Wisconsin Circle, Friendship Heights	5,630	29%	3,975	5,218	31%	3,620



6 / ID 28	7101 Wisconsin Avenue, Bethesda	2,959	44%	1,659	2,685	45%	1,488
7 / ID 29	8505 Fenton Street, Silver Spring	4,736	24%	3,606	4,140	27%	3,031
8 / ID 30	Chevy Chase Building at 5530 Wisconsin Avenue	7,434	28%	5,320	7,050	28%	5,042
9 / ID 43	5635 Fishers Lane, Rockville	2,836	25%	2,128	2,565	25%	1,929

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### LATR Auto Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	ITE	% Diff	Observed	ITE	% Diff
1	The Exchange Wheaton	210	271	30%	288	447	55%
4	Solaire Wheaton	59	100	69%	48	123	159%
7	Bainbridge at Shady Grove	81	182	124%	101	216	113%
12	The Americana Finnmark	26	144	455%	28	174	525%
19	Solaire Bethesda	42	62	48%	27	107	303%
22	The Lauren	3	28	766%	5	42	770%
24	The Citron	60	87	44%	48	108	125%
25	MICA Condos	24	35	50%	17	47	171%
38	Stonehall	6	45	645%	5	83	1436%
39	4900 Fairmont	18	63	252%	89	105	18%
40	Element 28	17	29	70%	24	78	220%
41	The Crescent	14	45	230%	17	56	234%
2 / ID 10	10400 Connecticut Avenue	44	137	210%	45	210	369%
3 / ID 14	Century Blvd and Pinnacle Dr	43	284	560%	189	371	96%
4 / ID 26	World Building	24	115	371%	69	223	223%
5 / ID 27	19 Wisconsin Circle	108	428	296%	194	485	150%
6 / ID 28	7101 Wisconsin Avenue	109	232	113%	150	231	54%
7 / ID 29	8505 Fenton Street	208	95	-54%	468	272	-42%
8 / ID 30	Chevy Chase Building	333	449	35%	464	545	18%
9 / ID 43	5635 Fishers Lane, Rockville	107	297	179%	76	272	260%

## **APPENDIX K – MXD+ SITE-LEVEL RESULTS**

## SITE 1

### SITE 1-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(850) - Supermarket (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8502	59.5	6,083	125	77	202	270	260	530
(222) - High-Rise Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2223	500	2,118	38	113	150	105	67	172
Net Raw Project Trips				8,201	163	190	352	375	327	702
Reductions										
Internal Capture				-212	-8	-10	-18	-43	-37	-80
External Walk, Bike, and Transit				-3,459	-94	-110	-203	-178	-156	-334
Total Reductions				-3,671	-102	-119	-221	-221	-193	-414
Net New Project Trips				4,530	61	71	131	154	134	288

# **SITE 1-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(222) - Multifamily Housing High-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2222	500	2,225	37	116	153	109	70	179
(850) - Supermarket (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8503	59.5	6,353	136	91	227	271	260	531
Net Raw Project Trips				8,578	173	207	380	380	330	710
Reductions										
Internal Capture				-220	-8	-10	-18	-44	-38	-82
External Walk, Bike, and Transit				-3,618	-99	-119	-218	-181	-158	-339
Total Reductions				-3,838	-107	-129	-236	-225	-196	-421
Net New Project Trips				4,740	66	78	144	155	134	289

## SITE 4

### SITE 4-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	245	1,608	25	99	124	99	53	152
Net Raw Project Trips				1,608	25	99	124	99	53	152
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-532	-9	-38	-47	-38	-20	-58
Total Reductions				-536	-9	-38	-47	-38	-20	-58
Net New Project Trips				1,072	16	61	77	61	33	94

**SITE 4-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(221) - Multifamily Housing Mid-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2212	245	1,334	21	61	82	64	41	105
Net Raw Project Trips				1,334	21	61	82	64	41	105
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-425	-8	-23	-31	-23	-14	-37
Total Reductions				-427	-8	-23	-31	-23	-14	-37
Net New Project Trips				907	13	38	51	41	27	68

## SITE 7

### SITE 7-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	400	2,548	40	160	200	155	83	238
Net Raw Project Trips				2,548	40	160	200	155	83	238
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-586	-10	-41	-51	-38	-20	-58
Total Reductions				-590	-10	-41	-51	-38	-20	-58
Net New Project Trips				1,958	30	119	149	117	63	180



# **SITE 7-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(221) - Multifamily Housing Mid-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2212	400	2,178	35	98	133	102	66	168
Net Raw Project Trips				2,178	35	98	133	102	66	168
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-499	-9	-26	-35	-25	-17	-42
Total Reductions				-503	-9	-26	-35	-25	-17	-42
Net New Project Trips				1,675	26	72	98	77	50	126

## SITE 12

### SITE 12-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	316	2,039	32	127	159	124	67	191
Net Raw Project Trips				2,039	32	127	159	124	67	191
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-771	-14	-55	-69	-52	-28	-80
Total Reductions				-773	-14	-55	-69	-52	-28	-80
Net New Project Trips				1,266	18	72	90	72	39	111

SITE 12-10<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Multifamily Housing Low Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	316	2,348	33	109	142	103	61	164
Net Raw Project Trips				2,348	33	109	142	103	61	164
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-914	-15	-48	-63	-44	-26	-70
Total Reductions				-918	-15	-48	-63	-44	-26	-70
Net New Project Trips				1,430	18	61	79	59	35	94

## SITE 19

### SITE 19-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9312	6.5	585	3	2	5	33	16	49
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	145	1,002	15	60	75	63	34	97
Net Raw Project Trips				1,587	18	62	80	96	50	146
Reductions										
Internal Capture				-40	0	0	0	-8	-4	-12
External Walk, Bike, and Transit				-1,137	-16	-55	-71	-74	-38	-112
Total Reductions				-1,177	-16	-55	-71	-82	-42	-124
Net New Project Trips				410	2	7	9	14	8	22

# **SITE 19-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9312	6.5	545	0	0	5	34	17	51
(221) - Multifamily Housing Mid-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2213	145	789	13	36	49	38	25	63
Net Raw Project Trips				1,334	13	36	54	72	42	114
Reductions										
Internal Capture				-36	0	0	0	-6	-4	-10
External Walk, Bike, and Transit				-952	-11	-31	-47	-54	-32	-86
Total Reductions				-988	-11	-31	-47	-61	-35	-96
Net New Project Trips				346	2	5	7	11	7	18

## SITE 22

### SITE 22-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	64	511	7	28	35	34	19	53
Net Raw Project Trips				511	7	28	35	34	19	53
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-105	-2	-7	-9	-8	-5	-13
Total Reductions				-107	-2	-7	-9	-8	-5	-13
Net New Project Trips				404	5	21	26	26	14	40

# **SITE 22-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(221) - Multifamily Housing Mid-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2212	64	347	6	16	22	18	11	29
Net Raw Project Trips				347	6	16	22	18	11	29
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-71	-2	-4	-6	-4	-2	-6
Total Reductions				-73	-2	-4	-6	-4	-2	-6
Net New Project Trips				274	4	12	16	14	9	23

## SITE 24

### SITE 24-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	222	1,469	23	90	113	91	49	140
Net Raw Project Trips				1,469	23	90	113	91	49	140
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-544	-11	-41	-52	-38	-21	-59
Total Reductions				-548	-11	-41	-52	-38	-21	-59
Net New Project Trips				921	12	49	61	53	28	81



# **SITE 24-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(221) - Multifamily Housing Mid-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2212	222	1,208	20	56	75	58	37	95
Net Raw Project Trips				1,208	20	56	75	58	37	95
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-491	-10	-29	-39	-27	-17	-44
Total Reductions				-495	-10	-29	-39	-27	-17	-44
Net New Project Trips				713	10	27	36	31	20	51

## SITE 25

### SITE 25-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(222) - High-Rise Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2222	151	784	12	35	46	37	24	61
Net Raw Project Trips				784	12	35	46	37	24	61
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-372	-6	-18	-23	-16	-10	-26
Total Reductions				-374	-6	-18	-23	-16	-10	-26
Net New Project Trips				410	6	18	23	21	14	35

# **SITE 25-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(222) - Multifamily Housing High-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2222	151	672	13	42	55	37	23	60
Net Raw Project Trips				672	13	42	55	37	23	60
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-319	-6	-20	-26	-16	-10	-26
Total Reductions				-321	-6	-20	-26	-16	-10	-26
Net New Project Trips				351	7	22	29	21	13	34

## SITE 38

### SITE 38-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(912) - Drive-in Bank (Adj Streets, 7-9A, 4-6P)	employees	9122	3.2	0	5	3	8	8	9	17
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	47	408	5	22	27	29	15	44
Net Raw Project Trips				408	10	25	35	37	24	61
Reductions										
Internal Capture				-4	-1	-1	-2	-2	-2	-4
External Walk, Bike, and Transit				-268	-6	-16	-22	-22	-14	-36
Total Reductions				-272	-7	-17	-24	-24	-16	-40
Net New Project Trips				136	3	8	11	13	8	21

# **SITE 38-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
Net New Uses										
(221) - Multifamily Housing Mid-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2212	47	254	4	12	16	13	8	21
(912) - Drive-in Bank (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9123	3.2	382	17	13	30	33	33	65
Net Raw Project Trips				636	21	25	46	46	41	86
Reductions										
Internal Capture				-26	-1	-1	-2	-2	-2	-4
External Walk, Bike, and Transit				-333	-13	-16	-29	-23	-21	-43
Total Reductions				-359	-14	-17	-31	-25	-22	-47
Net New Project Trips				277	7	8	15	21	19	39

## SITE 39

### SITE 39-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(222) - High-Rise Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2222	250	1,191	19	57	76	56	36	92
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9313	7	630	3	3	6	35	17	52
Net Raw Project Trips				1,821	22	60	82	91	53	144
Reductions										
Internal Capture				-36	-1	-1	-2	-8	-4	-12
External Walk, Bike, and Transit				-1,181	-17	-48	-65	-63	-36	-99
Total Reductions				-1,217	-18	-49	-67	-71	-40	-111
Net New Project Trips				604	4	11	15	20	13	33

# **SITE 39-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(222) - Multifamily Housing High-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2222	250	1,113	20	63	83	57	37	94
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9313	7	587	0	0	5	37	18	55
Net Raw Project Trips				1,700	20	63	88	94	55	149
Reductions										
Internal Capture				-34	0	0	0	-6	-4	-10
External Walk, Bike, and Transit				-1,100	-15	-49	-68	-65	-38	-103
Total Reductions				-1,134	-15	-49	-68	-71	-42	-113
Net New Project Trips				566	5	14	20	23	13	36

## SITE 40

### SITE 40-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(911) - Walk-in Bank (Adj Streets, 4-6P)	1000 sq ft gross floor area	9112	5	0	0	0	0	27	34	61
(222) - High-Rise Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2223	120	648	9	28	37	31	20	51
Net Raw Project Trips				648	9	28	37	58	54	112
Reductions										
Internal Capture				-2	0	0	0	0	0	0
External Walk, Bike, and Transit				-480	-8	-23	-31	-36	-34	-70
Total Reductions				-482	-8	-23	-31	-36	-34	-70
Net New Project Trips				166	1	5	6	22	20	42



SITE 40-10<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(222) - Multifamily Housing High-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2222	120	534	11	35	46	30	19	49
(911) - Walk-In Bank (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9113	5	0	0	0	0	27	34	61
Net Raw Project Trips				534	11	35	46	57	53	110
Reductions										
Internal Capture				-2	0	0	0	-8	-8	-16
External Walk, Bike, and Transit				-395	-10	-30	-40	-34	-31	-65
Total Reductions				-397	-10	-30	-40	-42	-39	-81
Net New Project Trips				137	1	5	6	15	14	29

## SITE 41

### SITE 41-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(932) - High-Turnover Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9322	1.7	216	10	8	18	10	7	17
(222) - High-Rise Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2223	143	749	11	33	44	35	23	58
Net Raw Project Trips				965	21	41	62	45	30	75
Reductions										
Internal Capture				-14	-1	-1	-2	-2	-2	-4
External Walk, Bike, and Transit				-720	-19	-38	-57	-36	-24	-60
Total Reductions				-734	-20	-39	-59	-38	-26	-64
Net New Project Trips				231	1	2	3	7	4	11

# **SITE 41-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(932) - High-Turnover (Sit-Down) Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9322	1.7	191	9	8	17	11	6	17
(222) - Multifamily Housing High-Rise (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2223	143	636	13	40	53	35	22	57
Net Raw Project Trips				827	22	48	70	46	28	74
Reductions										
Internal Capture				-12	-1	-1	-2	-2	-2	-4
External Walk, Bike, and Transit				-617	-20	-43	-63	-35	-22	-57
Total Reductions				-629	-20	-45	-65	-38	-23	-61
Net New Project Trips				198	2	3	5	8	5	13

## SITE 2-10

### SITE 2-10-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(918) - Hair Salon (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9182	1.8	0	2	0	2	1	2	3
(710) - General Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7103	45.2	718	89	12	101	22	107	129
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7204	15.6	564	29	8	37	15	40	55
(880) - Pharmacy/Drugstore without Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8805	2.7	243	5	3	8	11	12	23
Net Raw Project Trips				1,525	125	23	148	49	161	210
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-175	-24	-5	-29	-7	-22	-29
Total Reductions				-179	-24	-5	-29	-7	-22	-29
Net New Project Trips				1,346	101	18	119	42	139	181

**SITE 2-10-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(918) - Hair Salon (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9182	1.8	0	0	0	2	1	2	3
(712) - Small Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7123	2.7	44	4	1	5	2	5	7
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7104	42.48	462	57	9	66	8	42	50
(880) - Pharmacy/Drugstore Without Drive-Through Window (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8805	2.7	243	5	3	8	11	12	23
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7206	15.6	512	34	9	43	15	40	55
Net Raw Project Trips				1,261	100	22	124	37	101	138
Reductions										
Internal Capture				-4	0	0	0	0	0	0
External Walk, Bike, and Transit				-146	-19	-4	-24	-5	-15	-20
Total Reductions				-150	-19	-4	-24	-5	-15	-20
Net New Project Trips				1,111	81	18	100	32	86	118

## SITE 3-14

### SITE 3-14-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(932) - High-Turnover Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9322	18.75	2,384	112	91	203	111	74	185
(710) - General Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7103	20.5	394	48	6	54	17	84	101
(492) - Health/Fitness Club (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	4924	3.5	115	3	3	5	8	6	14
(918) - Hair Salon (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9185	3.5	0	4	0	4	1	4	5
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7206	20.5	741	39	10	49	20	53	73
Net Raw Project Trips				3,634	206	110	315	157	221	378
Reductions										
Internal Capture				-8	-5	-3	-8	-2	-4	-6
External Walk, Bike, and Transit				-765	-66	-35	-101	-35	-49	-84
Total Reductions				-773	-71	-38	-109	-37	-53	-90
Net New Project Trips				2,861	135	72	206	120	168	288

### SITE 3-14-10<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(712) - Small Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7122	20.5	332	32	7	39	16	34	50
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7203	20.5	700	42	12	54	20	52	72
(492) - Health/Fitness Club (Adj Streets, 7-9A, 4-6P)	Avg. 1,000 Square Feet Gross Floor Area	4924	3.5	0	3	2	5	7	5	12
(918) - Hair Salon (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9185	3.5	0	0	0	4	1	4	5
(932) - High-Turnover (Sit-Down) Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9326	18.75	2,103	102	84	186	113	70	183
Net Raw Project Trips				3,135	179	105	288	157	165	322
Reductions										
Internal Capture				-6	-4	-2	-6	-1	-1	-2
External Walk, Bike, and Transit				-675	-59	-35	-95	-37	-39	-76
Total Reductions				-681	-63	-37	-101	-38	-40	-78
Net New Project Trips				2,454	116	68	187	119	125	244

### SITE 4-26

### SITE 4-26-9<sup>TH</sup>

Land Use	Units				AM Peak Hour		PM Peak Hour	
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		ITE Code	Quantity	Daily Trips	In	Out	Total	In	Out	Total
(710) - General Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7102	59.52	885	111	15	126	25	120	145
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9313	12	1,079	6	5	10	60	30	90
(925) - Drinking Place (Adj Streets, 4-6P)	1000 sq ft gross floor area	9254	2.25	0	0	0	0	17	9	26
(918) - Hair Salon (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9185	1.7	0	2	0	2	0	2	2
(715) - Single Tenant Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7156	1.7	20	3	0	3	0	3	3
(942) - Automobile Care Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft Occ. Gr. Leasable Area	9427	6	0	9	5	14	9	10	19
Net Raw Project Trips				1,984	131	25	155	111	174	285
Reductions										
Internal Capture				-8	-2	0	-2	-2	-2	-4
External Walk, Bike, and Transit				-643	-51	-10	-60	-44	-69	-113
Total Reductions				-651	-52	-10	-62	-46	-71	-117
Net New Project Trips				1,333	79	15	93	65	103	168

#### SITE 4-26-10<sup>TH</sup>

Land Use	Units				AM Peak Hour	PM Peak Hour
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		ITE Code	Quantity	Daily Trips	In	Out	Total	In	Out	Total
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7102	59.52	641	71	11	82	11	59	70
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9313	12	1,006	0	0	9	63	31	94
(925) - Drinking Place (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9254	2.25	0	0	0	0	17	9	26
(918) - Hair Salon (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9185	1.7	0	0	0	2	0	2	2
(715) - Single Tenant Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7156	1.7	19	0	0	0	0	0	0
(942) - Automobile Care Center (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9427	6	0	9	5	14	9	10	19
Net Raw Project Trips				1,666	80	16	107	100	111	211
Reductions										
Internal Capture				-6	-1	0	-2	-2	-2	-4
External Walk, Bike, and Transit				-550	-30	-6	-40	-41	-46	-87
Total Reductions				-556	-31	-6	-42	-43	-48	-91
Net New Project Trips				1,110	49	10	65	57	63	120

## SITE 5-27

### SITE 5-27-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(850) - Supermarket (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8502	18.5	1,891	39	24	63	114	109	223
(932) - High-Turnover Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9323	6	763	36	29	65	35	24	59
(936) - Coffee/Donut Shop without Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9364	2	0	111	106	217	41	41	82
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9315	4	360	2	1	3	20	10	30
(710) - General Office Building (Pk Hr of Generator)	1000 sq ft gross floor area	7106	138.6	1,682	218	30	248	40	194	234
(565) - Day Care Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	5657	3	222	20	17	37	17	20	37
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7208	5	181	9	3	12	5	13	18
(911) - Walk-in Bank (Adj Streets, 4-6P)	1000 sq ft gross floor area	9119	1.5	0	0	0	0	8	10	18

(876) - Apparel Store (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	87610	8	531	6	2	8	16	16	31
Net Raw Project Trips				5,630	441	212	653	296	437	732
Reductions										
Internal Capture				-38	-23	-11	-34	-27	-41	-68
External Walk, Bike, and Transit				-1,617	-180	-86	-266	-105	-155	-260
Total Reductions				-1,655	-203	-97	-300	-133	-196	-328
Net New Project Trips				3,975	238	115	353	163	241	404

**SITE 5-27-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(850) - Supermarket (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8502	18.5	1,975	43	28	71	113	108	221
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7203	5	104	12	4	16	5	14	19

(876) - Apparel Store (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8764	8	531	6	2	8	17	16	33
(911) - Walk-In Bank (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9115	1.5	0	0	0	0	8	10	18
(565) - Day Care Center (Adj Streets, 7-9A, 4-6P)	Avg. 1,000 Square Feet Gross Floor Area	5656	3	143	17	16	33	16	17	33
(932) - High-Turnover (Sit-Down) Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9327	6	673	33	27	60	37	22	59
(936) - Coffee/Donut Shop without Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9368	2	0	103	99	202	37	37	73
(931) - Quality Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9319	4	335	0	0	3	21	10	31
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	71010	138.65	1,457	135	22	157	25	130	155
Net Raw Project Trips				5,218	349	198	550	279	364	642
Reductions										
Internal Capture				-36	-18	-10	-28	-28	-36	-64
External Walk, Bike, and Transit				-1,562	-152	-86	-239	-104	-136	-239
Total Reductions				-1,598	-169	-96	-267	-132	-172	-303
Net New Project Trips				3,620	180	102	283	147	192	339

Net New Project Trips	3,620	182	103	287	153	199	351
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## SITE 6-28

### SITE 6-28-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(876) - Apparel Store (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8762	6	398	5	1	6	12	12	23
(492) - Health/Fitness Club (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	4923	2.5	82	2	2	4	6	4	10
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7204	2.5	-113	5	1	6	3	8	11
(710) - General Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7105	219.9	2,389	316	43	359	55	270	325
Net Raw Project Trips				2,756	328	47	375	76	294	369
Reductions										
Internal Capture				-12	-2	0	-2	0	0	0
External Walk, Bike, and Transit				-1,203	-195	-28	-223	-41	-158	-198
Total Reductions				-1,215	-197	-28	-225	-41	-158	-198
Net New Project Trips				1,541	131	19	150	35	136	171

**SITE 6-28-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(876) - Apparel Store (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8762	6	398	5	1	6	13	12	25
(492) - Health/Fitness Club (Adj Streets, 7-9A, 4-6P)	Avg. 1,000 Square Feet Gross Floor Area	4923	2.5	0	2	1	3	5	4	9
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7204	2.5	8	6	2	8	3	7	10
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7105	219.9	2,279	200	33	233	39	202	241
Net Raw Project Trips				2,685	213	37	250	60	225	285
Reductions										
Internal Capture				-12	-2	0	-2	0	-2	-2
External Walk, Bike, and Transit				-1,185	-127	-22	-149	-32	-122	-154
Total Reductions				-1,197	-129	-22	-151	-33	-123	-156
Net New Project Trips				1,488	84	15	99	27	102	129

## SITE 7-29

### SITE 7-29-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(850) - Supermarket (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8502	35	3,578	74	45	119	183	175	358
(920) - Copy, Print and Express Ship Store (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9203	3.3	0	7	2	9	11	13	24
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7204	12.77	307	24	7	31	13	33	46
(437) - Bowling Alley (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	4375	25.53	851	48	32	80	27	17	44
Net Raw Project Trips				4,736	153	86	239	234	238	472
Reductions										
Internal Capture				-16	-4	-2	-6	-11	-11	-22
External Walk, Bike, and Transit				-1,114	-47	-27	-74	-75	-77	-152
Total Reductions				-1,130	-51	-29	-80	-86	-88	-174
Net New Project Trips				3,606	102	57	159	148	150	298



**SITE 7-29-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(850) - Supermarket (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8502	35	3,737	80	54	134	182	175	357
(920) - Copy, Print, and Express Ship Store (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9203	3.3	0	7	2	9	11	13	24
(437) - Bowling Alley (Adj Streets, 7-9A, 4-6P)	Avg. 1,000 Square Feet Gross Floor Area	4374	25.5	0	20	1	21	20	11	31
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7205	12.77	403	28	8	36	13	32	45
Net Raw Project Trips				4,140	135	65	200	226	231	457
Reductions										
Internal Capture				-16	-1	-1	-2	-9	-9	-18
External Walk, Bike, and Transit				-1,093	-49	-24	-73	-76	-78	-154
Total Reductions				-1,109	-51	-24	-75	-85	-87	-172
Net New Project Trips				3,031	84	41	125	141	144	285

## SITE 8-30

### SITE 8-30-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(911) - Walk-in Bank (Adj Streets, 4-6P)	1000 sq ft gross floor area	9112	5	0	0	0	0	27	34	61
(732) - United States Post Office (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7323	5	541	21	20	41	29	27	56
(880) - Pharmacy/Drugstore without Drive-Through Window (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8804	5	450	10	5	15	21	21	42
(710) - General Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7105	164.5	1,916	251	34	285	45	218	263
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	7206	125.3	4,527	236	63	299	125	322	447
Net Raw Project Trips				7,434	518	122	640	247	622	869
Reductions										
Internal Capture				-28	-3	-1	-4	-1	-1	-2
External Walk, Bike, and Transit				-2,086	-214	-50	-264	-92	-233	-325
Total Reductions				-2,114	-217	-51	-268	-93	-234	-327
Net New Project Trips				5,320	301	71	372	154	388	542

**SITE 8-30-10<sup>TH</sup>**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(911) - Walk-In Bank (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9112	5	0	0	0	0	27	34	61
(732) - United States Post Office (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7323	5	520	21	20	41	29	27	56
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7104	164.5	1,720	156	25	181	29	154	183
(880) - Pharmacy/Drugstore Without Drive-Through Window (Adj Street, 7-9A, 4-6P)	1000 Sq. Ft.	8805	5	450	10	5	15	21	22	43
(720) - Medical-Dental Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7206	125.3	4,360	271	77	348	122	312	434
Net Raw Project Trips				7,050	458	127	585	228	549	777
Reductions										
Internal Capture				-26	-3	-1	-4	-1	-1	-2
External Walk, Bike, and Transit				-1,982	-189	-53	-242	-86	-207	-293
Total Reductions				-2,008	-193	-53	-246	-87	-208	-295
Net New Project Trips				5,042	265	74	339	141	341	482

## SITE 9-43

### SITE 9-43-9<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(710) - General Office Building (Pk Hr, AM & PM)	1000 sq ft gross floor area	7102	178.75	2,041	268	37	305	47	232	279
(932) - High-Turnover Restaurant (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	9323	6.25	795	37	31	68	37	25	62
Net Raw Project Trips				2,836	305	68	373	84	257	341
Reductions										
Internal Capture				-10	-5	-1	-6	0	-2	-2
External Walk, Bike, and Transit				-698	-109	-24	-133	-25	-78	-103
Total Reductions				-708	-114	-25	-139	-26	-79	-105
Net New Project Trips				2,128	191	43	234	58	178	236

SITE 9-43-10<sup>TH</sup>

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(710) - General Office Building (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	7102	178.75	1,864	168	27	195	32	166	198
(932) - High-Turnover (Sit-Down) Restaurant (Adj Streets, 7-9A, 4-6P)	1000 Sq. Ft. FLA	9323	6.25	701	34	28	62	38	23	61
Net Raw Project Trips				2,565	202	55	257	70	189	259
Reductions										
Internal Capture				-8	-3	-1	-4	-1	-1	-2
External Walk, Bike, and Transit				-628	-72	-19	-91	-21	-58	-79
Total Reductions				-636	-75	-20	-95	-22	-59	-81
Net New Project Trips				1,929	127	35	162	48	130	178

## **APPENDIX L – MXD+ COMPARISON TO OBSERVED**

### MXD+ 9<sup>th</sup> Edition Person Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	MXD+	% Diff	Observed	MXD+	% Diff
1	The Exchange Wheaton	353	352	0%	620	702	13%
4	Solaire Wheaton	87	124	43%	83	152	83%
7	Bainbridge at Shady Grove	163	200	23%	175	238	36%
12	The Americana Finnmark	45	159	253%	53	191	260%
19	Solaire Bethesda	62	80	29%	57	146	156%
22	The Lauren	17	35	106%	12	53	342%
24	The Citron	116	113	-3%	102	140	37%
25	MICA Condos	65	46	-29%	37	61	65%
38	Stonehall	13	35	169%	34	61	79%
39	4900 Fairmont	52	82	58%	56	144	157%
40	Element 28	37	37	0%	54	112	107%
41	The Crescent	43	62	44%	55	75	36%
2 / ID 10	10400 Connecticut Avenue	42	148	252%	60	210	250%
3 / ID 14	Century Blvd and Pinnacle Dr	64	315	392%	264	378	43%
4 / ID 26	World Building	54	155	187%	165	285	73%
5 / ID 27	19 Wisconsin Circle	339	653	93%	457	732	60%
6 / ID 28	7101 Wisconsin Avenue	170	375	121%	243	367	51%
7 / ID 29	8505 Fenton Street	334	239	-28%	796	472	-41%
8 / ID 30	Chevy Chase Building	466	640	37%	1040	869	-16%
9 / ID 43	5635 Fishers Lane, Rockville	169	373	121%	93	341	267%

### MXD+ 10<sup>th</sup> Edition Person Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	MXD+	% Diff	Observed	MXD+	% Diff
1	The Exchange Wheaton	353	380	8%	620	710	15%
4	Solaire Wheaton	87	82	-6%	83	105	27%
7	Bainbridge at Shady Grove	163	133	-18%	175	168	-4%
12	The Americana Finnmark	45	142	216%	53	164	209%
19	Solaire Bethesda	62	54	-13%	57	114	100%
22	The Lauren	17	22	29%	12	29	142%
24	The Citron	116	75	-35%	102	95	-7%
25	MICA Condos	65	55	-15%	37	60	62%
38	Stonehall	13	46	254%	34	86	153%
39	4900 Fairmont	52	88	69%	56	149	166%
40	Element 28	37	46	24%	54	110	104%
41	The Crescent	43	70	63%	55	74	35%
2 / ID 10	10400 Connecticut Avenue	42	124	195%	60	138	130%
3 / ID 14	Century Blvd and Pinnacle Dr	64	288	350%	264	322	22%
4 / ID 26	World Building	54	107	98%	165	211	28%
5 / ID 27	19 Wisconsin Circle	339	550	62%	457	642	40%
6 / ID 28	7101 Wisconsin Avenue	170	250	47%	243	285	17%
7 / ID 29	8505 Fenton Street	334	200	-40%	796	457	-43%
8 / ID 30	Chevy Chase Building	466	585	26%	1040	777	-25%
9 / ID 43	5635 Fishers Lane, Rockville	169	257	52%	93	259	178%



### MXD+ 9<sup>th</sup> Edition External Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	MXD+	% Diff	Observed	MXD+	% Diff
1	The Exchange Wheaton	42%	58%	39%	53%	48%	-10%
4	Solaire Wheaton	29%	38%	30%	34%	38%	13%
7	Bainbridge at Shady Grove	46%	26%	-45%	33%	24%	-27%
12	The Americana Finnmark	43%	43%	0%	49%	42%	-14%
19	Solaire Bethesda	32%	89%	176%	43%	77%	77%
22	The Lauren	76%	26%	-66%	60%	25%	-59%
24	The Citron	47%	46%	-3%	53%	42%	-20%
25	MICA Condos	64%	50%	-22%	49%	43%	-14%
38	Stonehall	53%	63%	18%	67%	59%	-12%
39	4900 Fairmont	77%	79%	3%	89%	69%	-23%
40	Element 28	52%	84%	60%	55%	63%	14%
41	The Crescent	63%	92%	46%	68%	80%	18%
2 / ID 10	10400 Connecticut Avenue	5%	20%	311%	14%	14%	-3%
3 / ID 14	Century Blvd and Pinnacle Dr	19%	32%	65%	14%	22%	60%
4 / ID 26	World Building	43%	39%	-9%	52%	40%	-23%
5 / ID 27	19 Wisconsin Circle	67%	41%	-39%	50%	36%	-29%
6 / ID 28	7101 Wisconsin Avenue	35%	59%	72%	38%	54%	40%
7 / ID 29	8505 Fenton Street	36%	31%	-15%	36%	32%	-10%
8 / ID 30	Chevy Chase Building	24%	41%	73%	50%	37%	-26%
9 / ID 43	5635 Fishers Lane, Rockville	36%	36%	0%	15%	30%	95%

### MXD+ 10<sup>th</sup> Edition External Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	MXD+	% Diff	Observed	MXD+	% Diff
1	The Exchange Wheaton	42%	57%	38%	53%	48%	-10%
4	Solaire Wheaton	29%	38%	30%	34%	35%	4%
7	Bainbridge at Shady Grove	46%	26%	-43%	33%	25%	-25%
12	The Americana Finnmark	43%	44%	2%	49%	43%	-13%
19	Solaire Bethesda	32%	87%	171%	43%	75%	74%
22	The Lauren	76%	27%	-64%	60%	21%	-66%
24	The Citron	47%	52%	10%	53%	46%	-12%
25	MICA Condos	64%	47%	-26%	49%	43%	-12%
38	Stonehall	53%	63%	18%	67%	50%	-25%
39	4900 Fairmont	77%	77%	0%	89%	69%	-23%
40	Element 28	52%	87%	66%	55%	59%	7%
41	The Crescent	63%	90%	43%	68%	77%	13%
2 / ID 10	10400 Connecticut Avenue	5%	19%	306%	14%	14%	1%
3 / ID 14	Century Blvd and Pinnacle Dr	19%	33%	69%	14%	24%	70%
4 / ID 26	World Building	43%	37%	-12%	52%	41%	-20%
5 / ID 27	19 Wisconsin Circle	67%	43%	-35%	50%	37%	-26%
6 / ID 28	7101 Wisconsin Avenue	35%	60%	73%	38%	54%	40%
7 / ID 29	8505 Fenton Street	36%	37%	1%	36%	34%	-6%
8 / ID 30	Chevy Chase Building	24%	41%	74%	50%	38%	-25%
9 / ID 43	5635 Fishers Lane, Rockville	36%	35%	-1%	15%	31%	97%

### MXD+ 9<sup>th</sup> Edition Auto Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	MXD+	% Diff	Observed	MXD+	% Diff
1	The Exchange Wheaton	210	131	-37%	288	289	0%
4	Solaire Wheaton	59	77	30%	48	68	97%
7	Bainbridge at Shady Grove	81	149	84%	101	126	77%
12	The Americana Finnmark	26	90	246%	28	111	298%
19	Solaire Bethesda	42	9	-79%	27	22	-17%
22	The Lauren	3	26	713%	5	23	733%
24	The Citron	60	61	1%	48	51	69%
25	MICA Condos	24	23	-3%	17	34	103%
38	Stonehall	6	11	82%	5	39	291%
39	4900 Fairmont	18	15	-17%	89	37	-63%
40	Element 28	17	6	-65%	24	29	73%
41	The Crescent	14	3	-78%	17	13	-34%
2 / ID 10	10400 Connecticut Avenue	44	119	168%	45	118	303%
3 / ID 14	Century Blvd and Pinnacle Dr	43	206	378%	189	288	53%
4 / ID 26	World Building	24	93	282%	69	120	144%
5 / ID 27	19 Wisconsin Circle	108	353	227%	194	339	108%
6 / ID 28	7101 Wisconsin Avenue	109	150	37%	150	129	13%
7 / ID 29	8505 Fenton Street	208	159	-23%	468	285	-36%
8 / ID 30	Chevy Chase Building	333	372	12%	464	480	17%
9 / ID 43	5635 Fishers Lane, Rockville	107	234	120%	76	178	212%

### MXD+ 10<sup>th</sup> Edition Auto Trip Summary

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	MXD+	% Diff	Observed	MXD+	% Diff
1	The Exchange Wheaton	210	144	-31%	288	289	0%
4	Solaire Wheaton	59	51	-14%	48	68	43%
7	Bainbridge at Shady Grove	81	98	21%	101	126	24%
12	The Americana Finnmark	26	79	204%	28	94	237%
19	Solaire Bethesda	42	7	-83%	27	18	-32%
22	The Lauren	3	16	400%	5	23	379%
24	The Citron	60	36	-40%	48	51	7%
25	MICA Condos	24	29	23%	17	34	97%
38	Stonehall	6	15	148%	5	39	626%
39	4900 Fairmont	18	20	11%	89	36	-60%
40	Element 28	17	6	-65%	24	29	19%
41	The Crescent	14	5	-64%	17	13	-22%
2 / ID 10	10400 Connecticut Avenue	44	100	126%	45	118	163%
3 / ID 14	Century Blvd and Pinnacle Dr	43	187	334%	189	244	29%
4 / ID 26	World Building	24	65	167%	69	120	74%
5 / ID 27	19 Wisconsin Circle	108	283	162%	194	339	75%
6 / ID 28	7101 Wisconsin Avenue	109	99	-9%	150	129	-14%
7 / ID 29	8505 Fenton Street	208	125	-40%	468	285	-39%
8 / ID 30	Chevy Chase Building	333	301	-10%	464	480	4%
9 / ID 43	5635 Fishers Lane, Rockville	107	162	52%	76	178	136%

## **APPENDIX M – TRIPSDC MODE CHOICE INPUTS**

### TripsDC Mode Choice Inputs

ID	Site	Employment within 1 mile	Neighborhood Population Density	Distance to Transit	Parking per Capita	Transit Competitiveness		Transit Service Intensity	
						Minimum	Maximum	Minimum	Maximum
1	The Exchange Wheaton	1,816	7,163	1	0.41	0.07	0.28	4	17
4	Solaire Wheaton	5,339	7,163	1	0.32	0.19	0.23	11	24
7	Bainbridge at Shady Grove	8,205	1,745	0	0.48	0.18	0.20	4	7
12	The Americana Finnmark	3,505	16,550	1	0.58	0.20	0.27	10	17
19	Solaire Bethesda	30,848	17,704	0	0.22	0.26	0.28	10	28
22	The Lauren	16,344	12,535	1	0.44	0.28	0.29	13	15
24	The Citron	6,908	5,497	0	0.26	0.19	0.23	0	8
25	MICA Condos	9,439	49,530	0	0.25	0.29	0.29	25	29
38	Stonehall	54,961	22,924	0	0.56	0.25	0.28	7	15
39	4900 Fairmont	16,344	12,759	0	0.28	0.25	0.28	11	14
40	Element 28	16,344	12,759	1	0.23	0.28	0.29	13	17
41	The Crescent	20,903	15,561	1	0.28	0.26	0.27	17	21

## **APPENDIX N – TRIPSDC COMPARISON TO OBSERVED**

**TripsDC Person Trip Summary**

ID	Site	AM Peak Hour			PM Peak Hour		
		Observed	ITE	% Diff	Observed	ITE	% Diff
1	The Exchange Wheaton	353	724	105%	620	1,066	72%
4	Solaire Wheaton	87	262	201%	83	254	206%
7	Bainbridge at Shady Grove	163	427	162%	175	415	137%
12	The Americana Finnmark	45	123	173%	53	119	125%
19	Solaire Bethesda	62	176	183%	57	210	269%
22	The Lauren	17	68	302%	12	66	454%
24	The Citron	116	237	105%	102	230	126%
25	MICA Condos	65	161	148%	37	157	324%
38	Stonehall	13	60	365%	34	78	130%
39	4900 Fairmont	52	289	457%	56	324	478%
40	Element 28	37	144	290%	54	171	216%
41	The Crescent	43	158	268%	55	164	198%



### TripsDC Auto Driver Mode Choice Model Results

ID	Site	AM Peak Hour					PM Peak Hour				
		TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint	TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint
1	The Exchange Wheaton	32%	38%	50%	No	30%	29%	33%	38%	No	19%
4	Solaire Wheaton	33%	37%	67%	No	47%	26%	30%	57%	No	51%
7	Bainbridge at Shady Grove	41%	42%	50%	No	16%	42%	43%	56%	No	25%
12	The Americana Finnmark	33%	38%	53%	No	33%	27%	28%	37%	No	25%
19	Solaire Bethesda	31%	36%	68%	No	50%	26%	31%	54%	No	48%
22	The Lauren	32%	33%	19%	No	73%	27%	28%	40%	No	31%
24	The Citron	39%	42%	48%	No	16%	38%	40%	41%	No	6%
25	MICA Condos	27%	27%	31%	No	13%	16%	17%	47%	No	64%
38	Stonehall	34%	37%	47%	No	23%	29%	31%	26%	No	15%
39	4900 Fairmont	35%	37%	12%	No	205%	33%	34%	8%	No	292%
40	Element 28	31%	33%	46%	No	30%	25%	26%	45%	No	43%
41	The Crescent	32%	33%	32%	Yes	0%	24%	24%	30%	No	21%

### TripsDC Auto Passenger Mode Choice Model Results

ID	Site	AM Peak Hour					PM Peak Hour				
		TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint	TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint
1	The Exchange Wheaton	5%	35%	9%	Yes	127%	6%	7%	9%	No	28%
4	Solaire Wheaton	10%	15%	4%	No	194%	6%	7%	9%	No	23%
7	Bainbridge at Shady Grove	12%	14%	4%	No	215%	8%	8%	10%	No	24%
12	The Americana Finnmark	5%	11%	4%	No	118%	6%	6%	14%	No	58%
19	Solaire Bethesda	7%	9%	0%	No	N/A	6%	8%	2%	No	234%
22	The Lauren	5%	6%	5%	No	15%	6%	6%	0%	No	N/A
24	The Citron	10%	15%	5%	No	154%	7%	7%	6%	No	19%
25	MICA Condos	6%	6%	5%	No	22%	5%	5%	4%	No	27%
38	Stonehall	5%	7%	0%	No	N/A	6%	7%	4%	No	70%
39	4900 Fairmont	7%	9%	12%	No	35%	7%	7%	2%	No	223%
40	Element 28	6%	7%	2%	No	286%	6%	6%	0%	No	N/A
41	The Crescent	7%	8%	5%	No	47%	6%	6%	2%	No	216%

### TripsDC Transit Mode Choice Model Results

ID	Site	AM Peak Hour					PM Peak Hour				
		TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint	TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint
1	The Exchange Wheaton	12%	30%	20%	Yes	4%	16%	22%	17%	Yes	12%
4	Solaire Wheaton	21%	27%	18%	No	37%	19%	25%	14%	No	57%
7	Bainbridge at Shady Grove	16%	18%	28%	No	38%	13%	14%	15%	No	11%
12	The Americana Finnmark	20%	26%	25%	Yes	6%	18%	21%	19%	Yes	3%
19	Solaire Bethesda	16%	21%	0%	No	N/A	11%	17%	7%	No	97%
22	The Lauren	26%	27%	0%	No	N/A	18%	19%	20%	No	8%
24	The Citron	15%	19%	9%	No	99%	11%	14%	7%	No	69%
25	MICA Condos	15%	16%	30%	No	50%	13%	14%	13%	Yes	2%
38	Stonehall	13%	15%	27%	No	48%	9%	11%	19%	No	46%
39	4900 Fairmont	13%	15%	27%	No	N/A	9%	11%	19%	No	180%
40	Element 28	25%	27%	16%	No	67%	17%	19%	35%	No	49%
41	The Crescent	24%	25%	48%	No	49%	18%	20%	10%	No	93%

### TripsDC Bicycle Mode Choice Model Results

ID	Site	AM Peak Hour					PM Peak Hour				
		TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint	TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Middpoi nt
1	The Exchange Wheaton	0%	1%	1%	Yes	30%	2%	2%	0%	No	N/A
4	Solaire Wheaton	1%	1%	0%	No	N/A	2%	2%	0%	No	N/A
7	Bainbridge at Shady Grove	1%	1%	0%	No	N/A	3%	3%	0%	No	N/A
12	The Americana Finnmark	1%	1%	2%	No	46%	2%	2%	2%	No	13%
19	Solaire Bethesda	2%	2%	0%	No	N/A	5%	5%	0%	No	N/A
22	The Lauren	1%	2%	0%	No	N/A	2%	2%	0%	No	N/A
24	The Citron	1%	1%	0%	No	N/A	4%	4%	3%	No	46%
25	MICA Condos	5%	5%	3%	No	74%	8%	8%	2%	No	359%
38	Stonehall	2%	2%	0%	No	N/A	4%	4%	4%	No	5%
39	4900 Fairmont	2%	2%	0%	No	N/A	4%	4%	0%	No	N/A
40	Element 28	2%	2%	8%	No	75%	3%	3%	0%	No	N/A
41	The Crescent	2%	2%	0%	No	N/A	3%	3%	0%	No	N/A

### TripsDC Walk Mode Choice Model Results

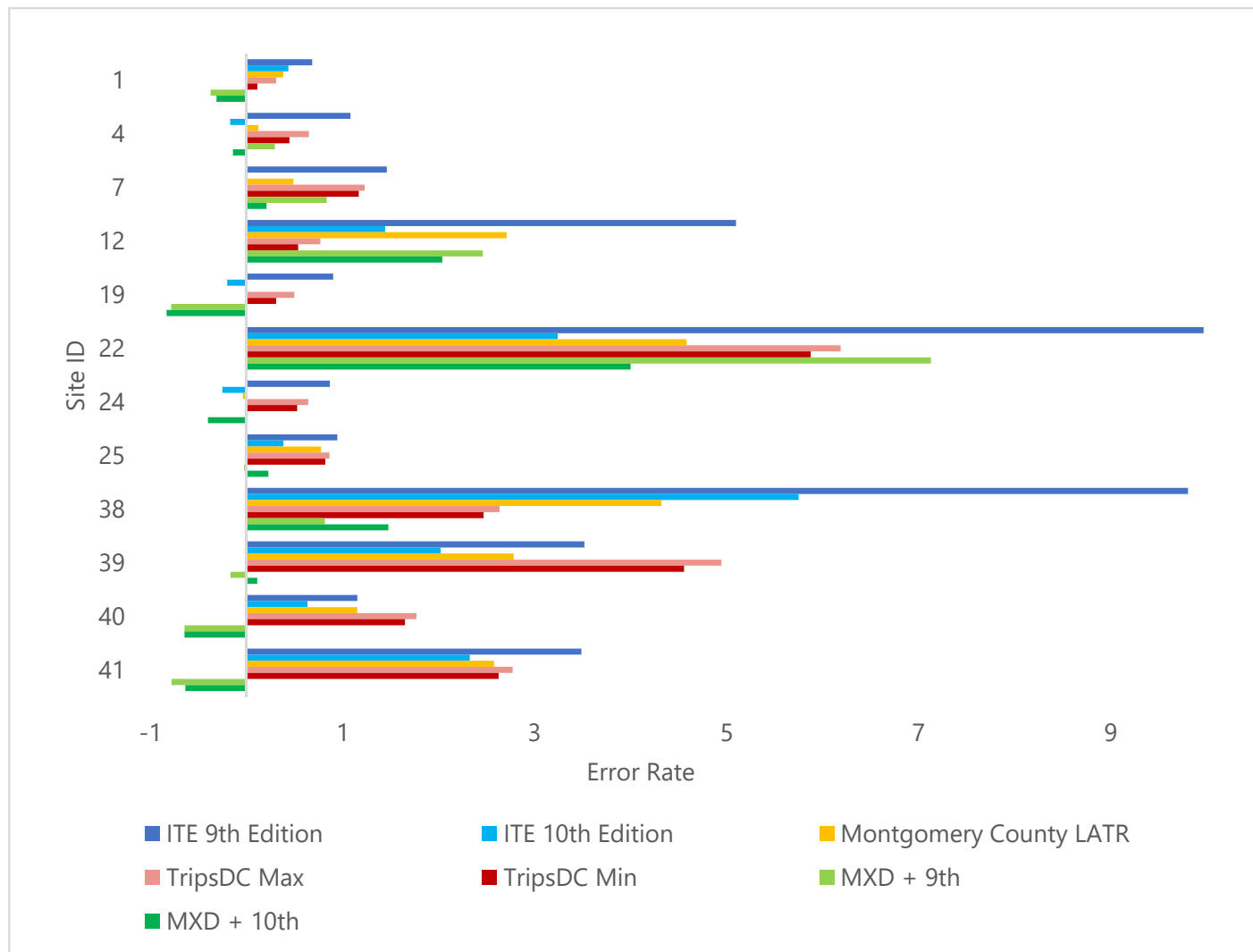
ID	Site	AM Peak Hour					PM Peak Hour				
		TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint	TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Middpoi nt
1	The Exchange Wheaton	17%	32%	20%	Yes	21%	40%	43%	36%	No	16%
4	Solaire Wheaton	26%	29%	11%	No	142%	39%	43%	20%	No	106%
7	Bainbridge at Shady Grove	26%	28%	18%	No	48%	33%	34%	18%	No	87%
12	The Americana Finnmark	30%	34%	16%	No	96%	44%	46%	28%	No	60%
19	Solaire Bethesda	37%	39%	32%	No	18%	43%	47%	36%	No	24%
22	The Lauren	34%	35%	76%	No	55%	45%	46%	40%	No	14%
24	The Citron	27%	30%	39%	No	25%	37%	38%	43%	No	12%
25	MICA Condos	46%	47%	31%	No	52%	57%	58%	35%	No	66%
38	Stonehall	41%	43%	26%	No	62%	49%	50%	44%	No	14%
39	4900 Fairmont	34%	36%	76%	No	54%	41%	42%	84%	No	51%
40	Element 28	34%	34%	29%	No	16%	47%	48%	20%	No	134%
41	The Crescent	34%	34%	15%	No	124%	48%	49%	58%	No	17%

### TripsDC Vehicle Trips Results

ID	Site	AM Peak Hour					PM Peak Hour				
		TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint	TripsDC Min	TripsDC Max	Obs.	In Range?	% Diff. from Midpoint
1	The Exchange Wheaton	233	274	210	No	21%	308	348	288	No	14%
4	Solaire Wheaton	86	98	59	No	55%	67	76	48	No	50%
7	Bainbridge at Shady Grove	176	181	81	No	120%	174	178	101	No	73%
12	The Americana Finnmark	40	46	26	No	66%	32	34	28	No	18%
19	Solaire Bethesda	55	63	42	No	41%	56	64	27	No	125%
22	The Lauren	22	23	3	No	598%	18	18	5	No	281%
24	The Citron	92	99	60	No	59%	88	93	48	No	89%
25	MICA Condos	43	44	24	No	85%	26	26	17	No	50%
38	Stonehall	21	22	6	No	256%	23	24	9	No	165%
39	4900 Fairmont	100	107	18	No	475%	107	109	5	No	2056%
40	Element 28	45	47	17	No	171%	43	45	24	No	81%
41	The Crescent	50	52	14	No	269%	39	40	17	No	137%

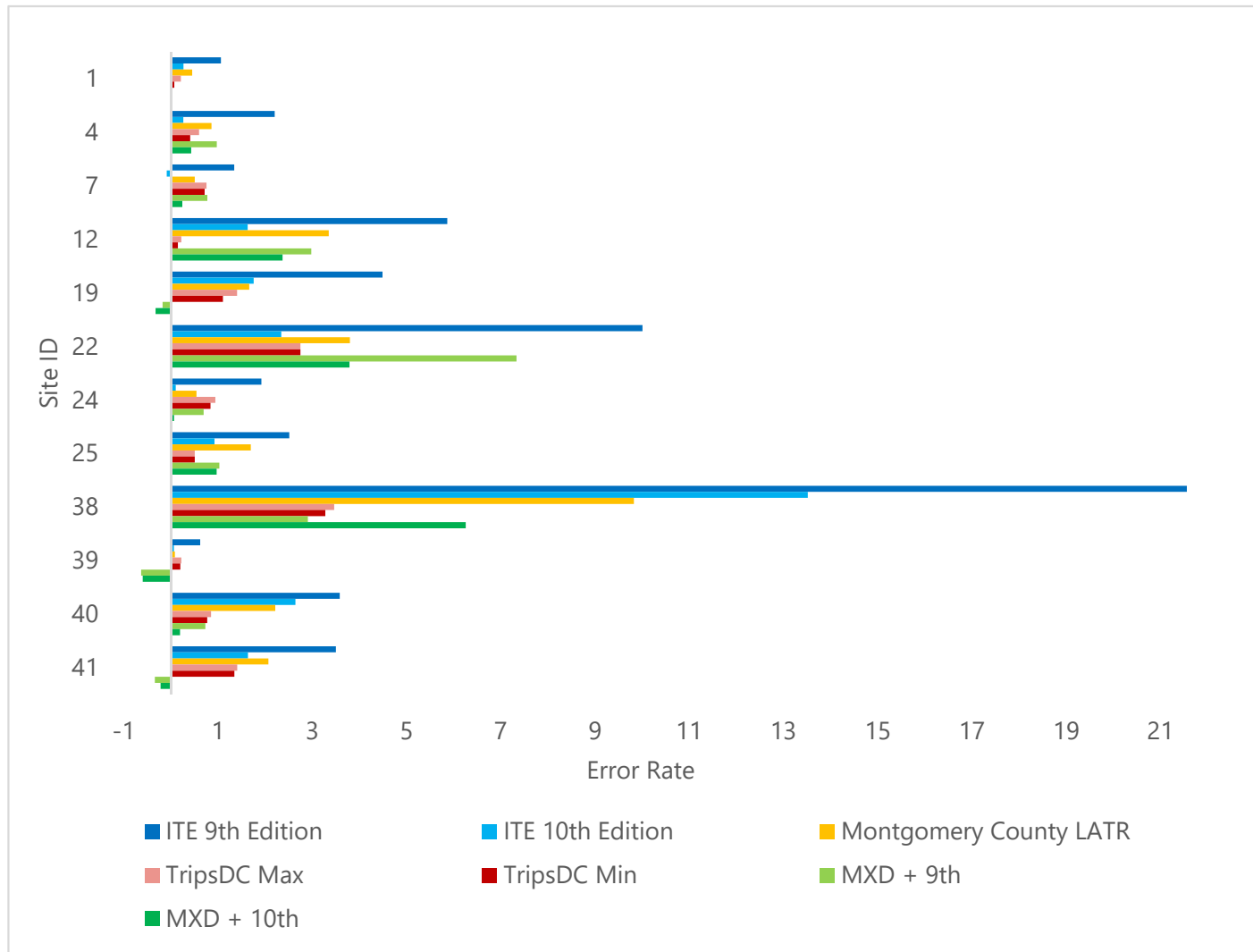
## **APPENDIX O – COMPARISON TO OBSERVED FOR ALL TOOLS**

**Vehicle Trip Comparison**  
**AM Peak Hour**  
**Residential over Retail**

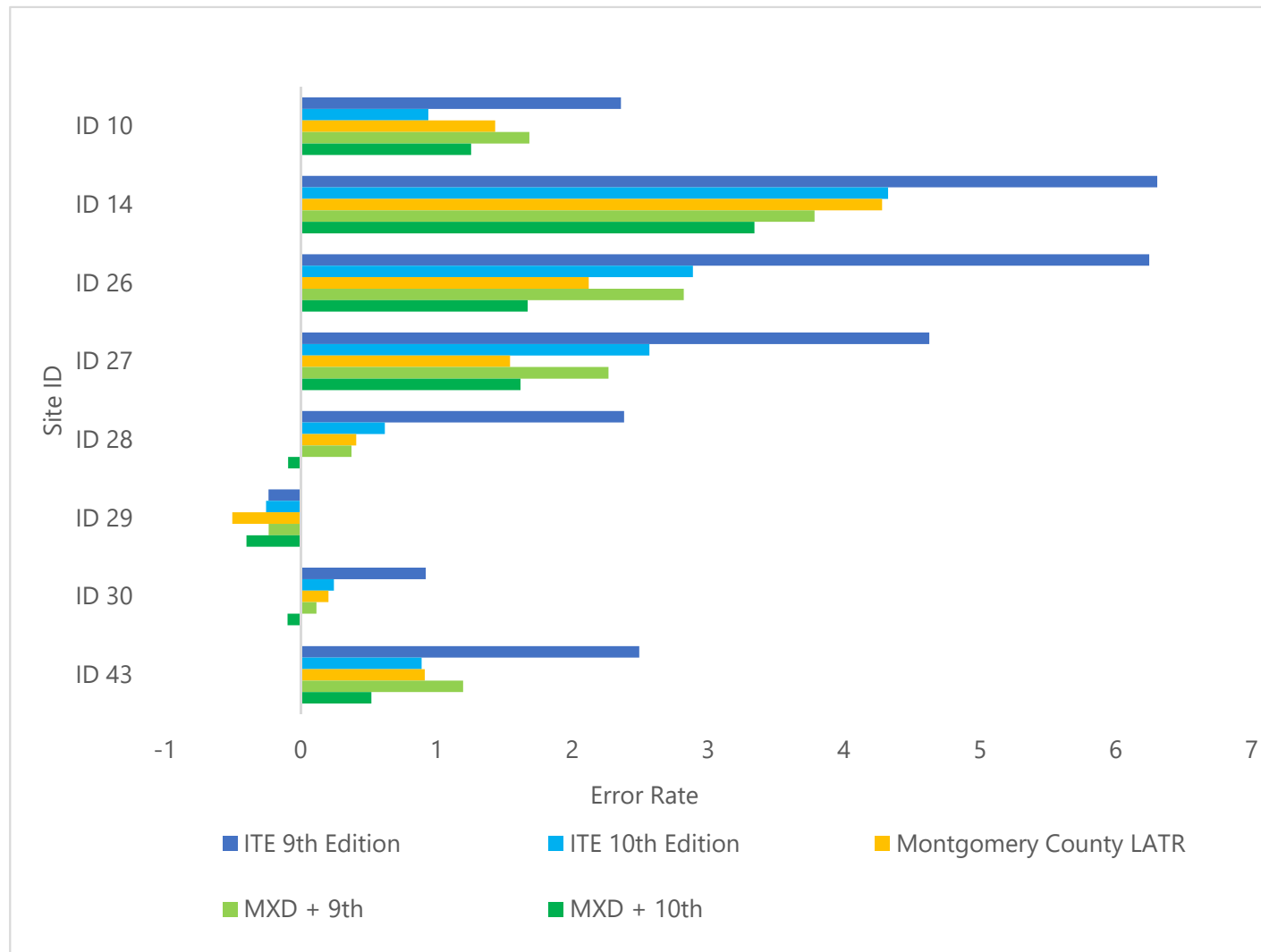




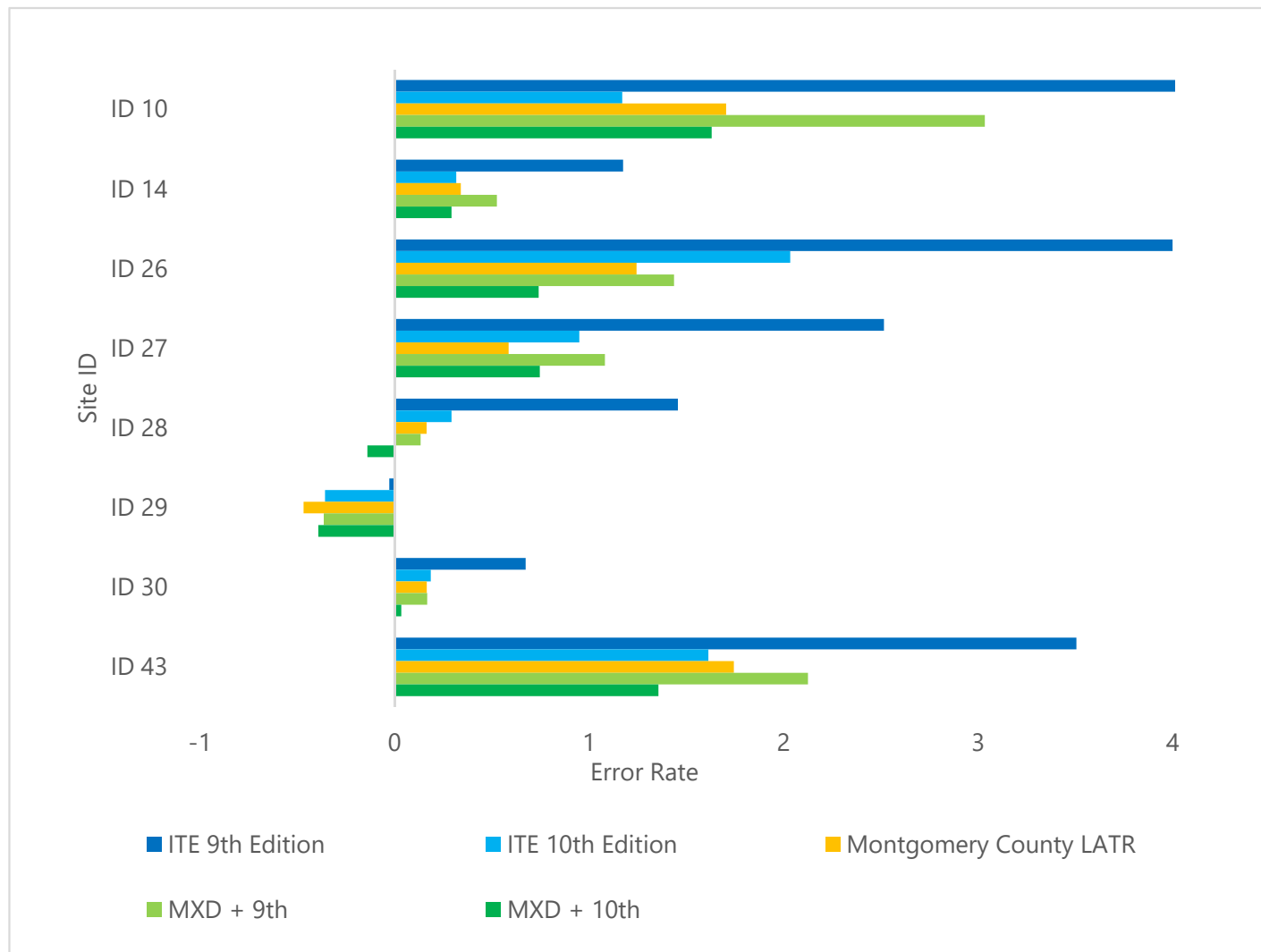
**Vehicle Trip Comparison**  
**PM Peak Hour**  
**Residential over Retail**



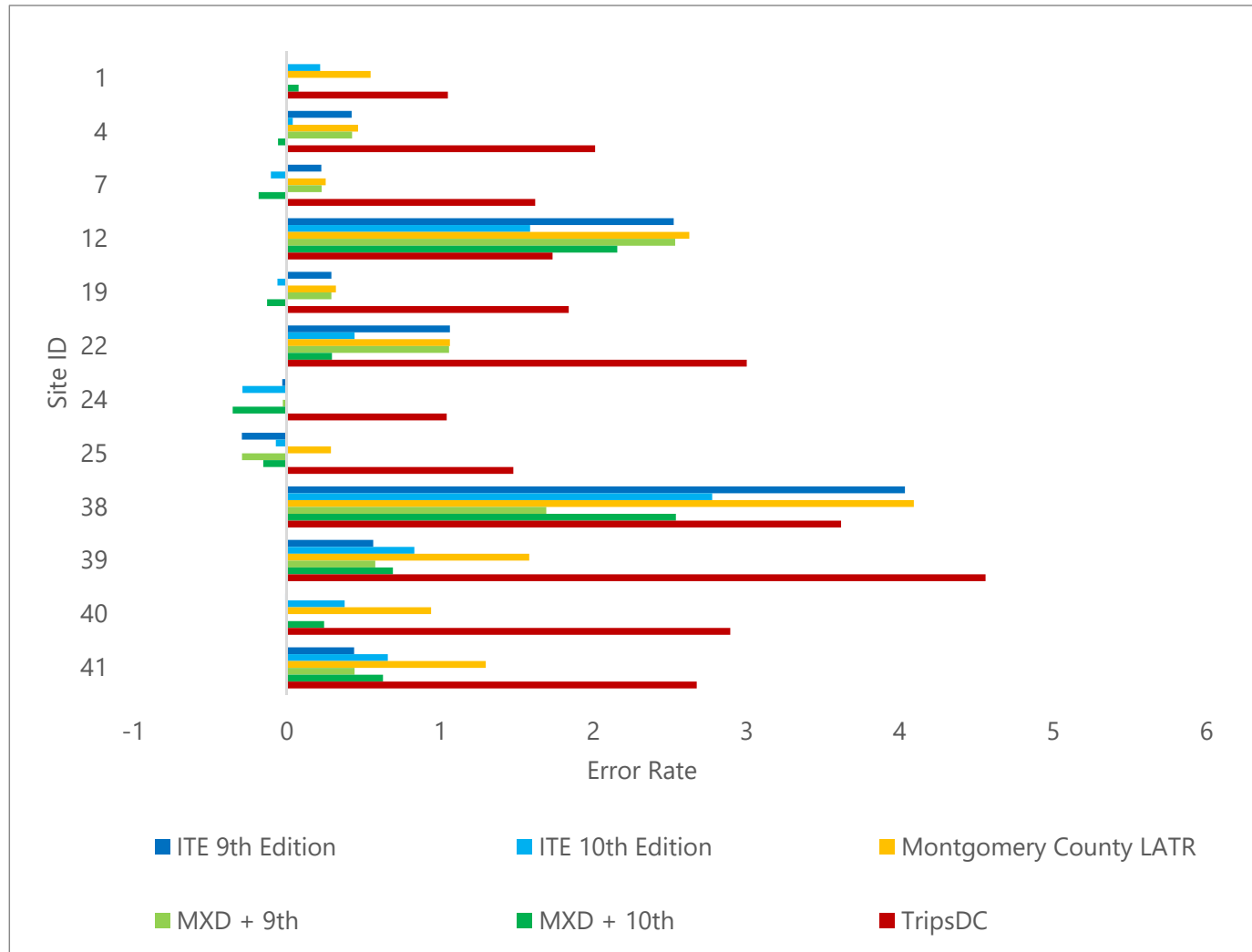
**Vehicle Trip Comparison**  
**AM Peak Hour**  
**Office with Retail**



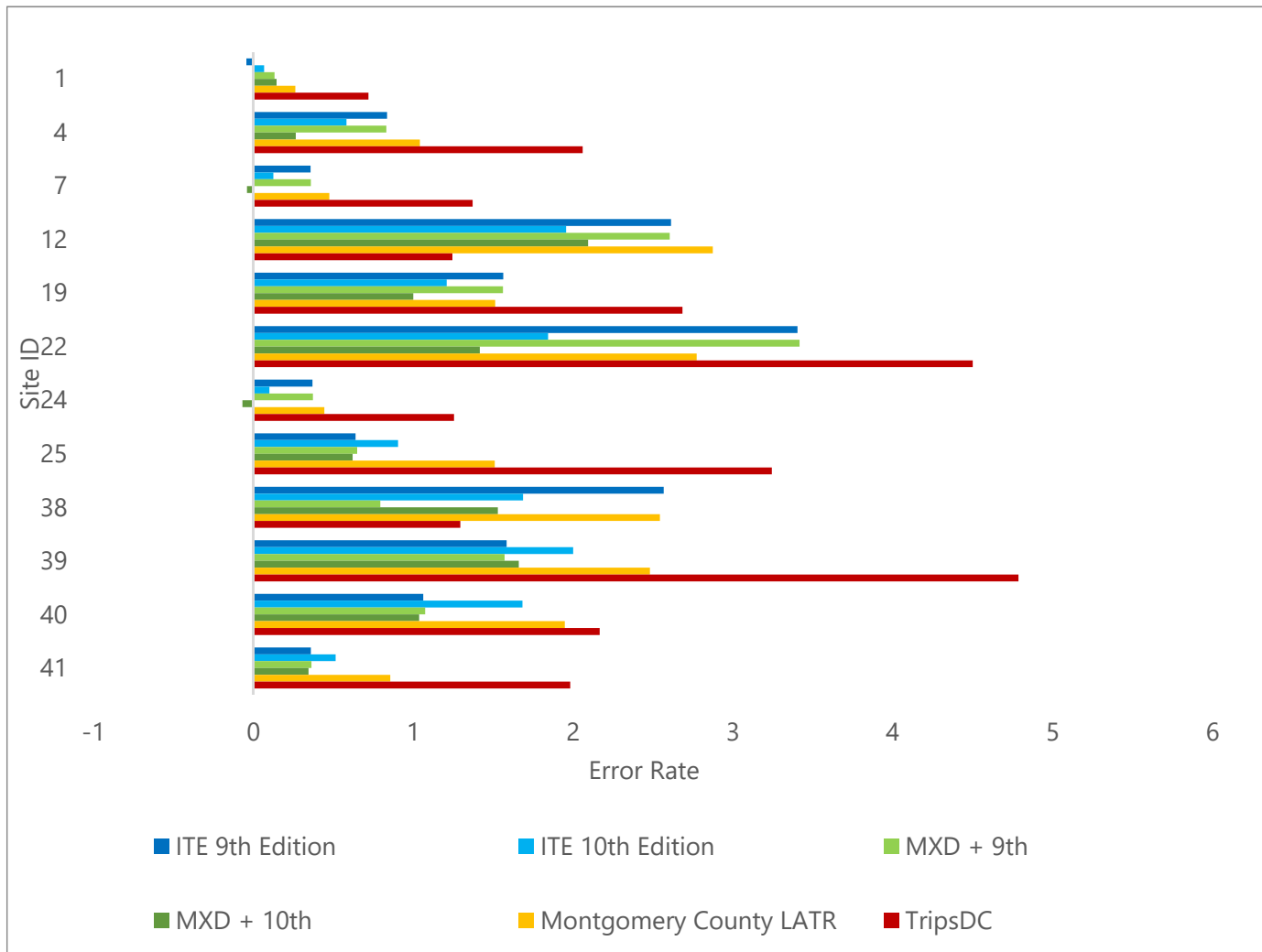
**Vehicle Trip Comparison**  
**PM Peak Hour**  
**Office with Retail**



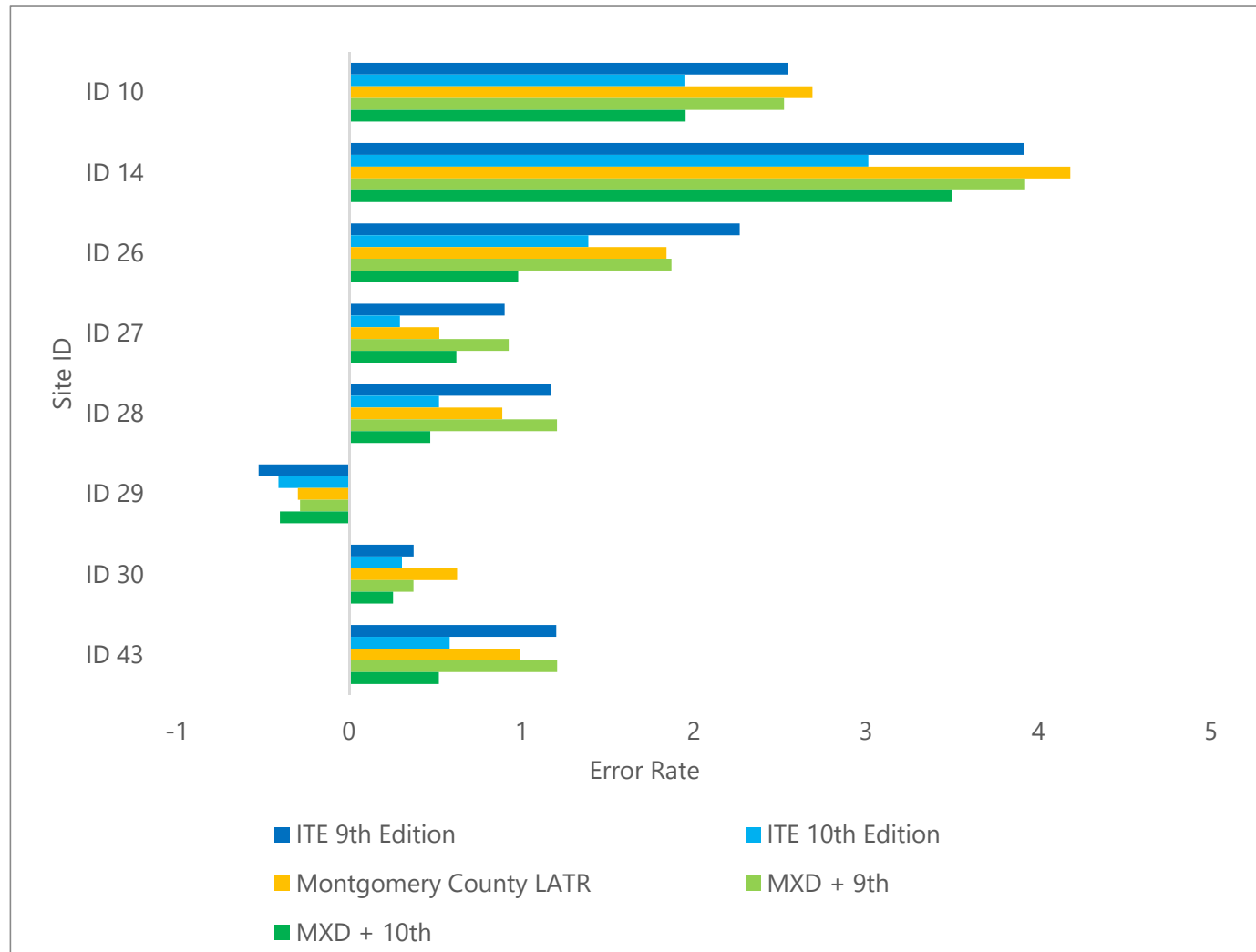
**Person Trip Comparison**  
**AM Peak Hour**  
**Residential over Retail**



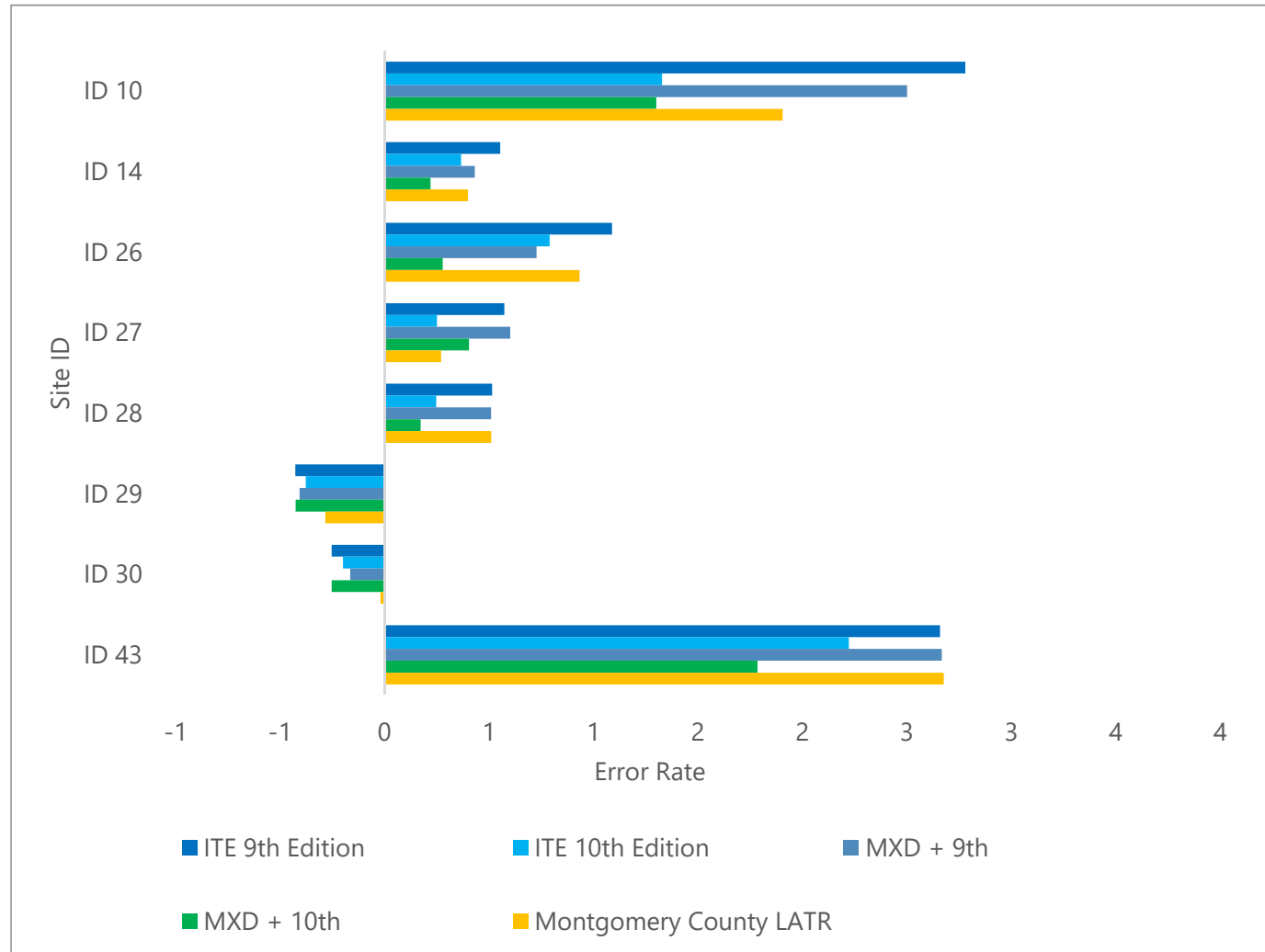
**Person Trip Comparison  
PM Peak Hour  
Residential over Retail**



Person Trip Comparison  
AM Peak Hour  
Office with Retail



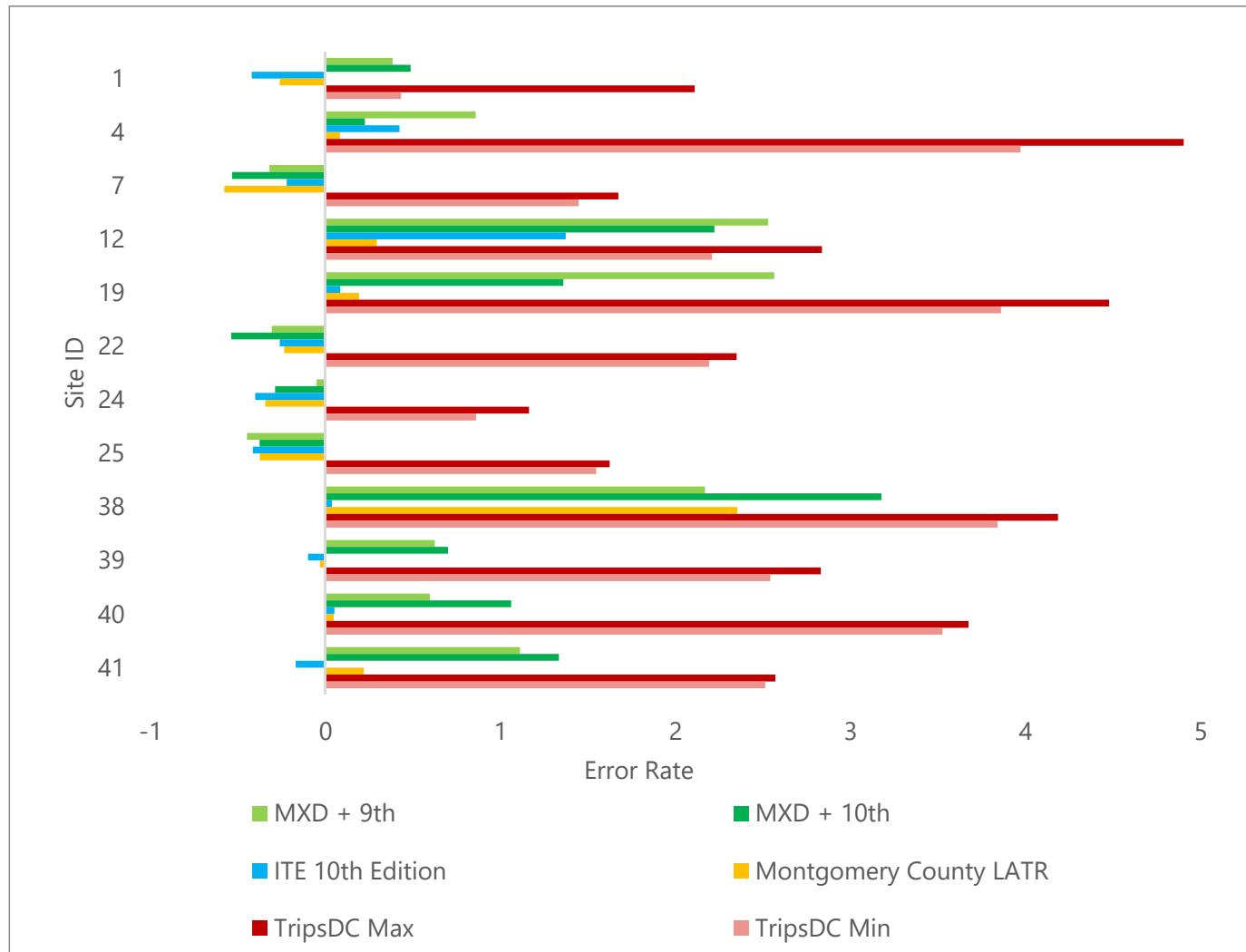
**Person Trip Comparison**  
**PM Peak Hour**  
**Office with Retail**



# Walk, Bike, & Transit Trip Comparison

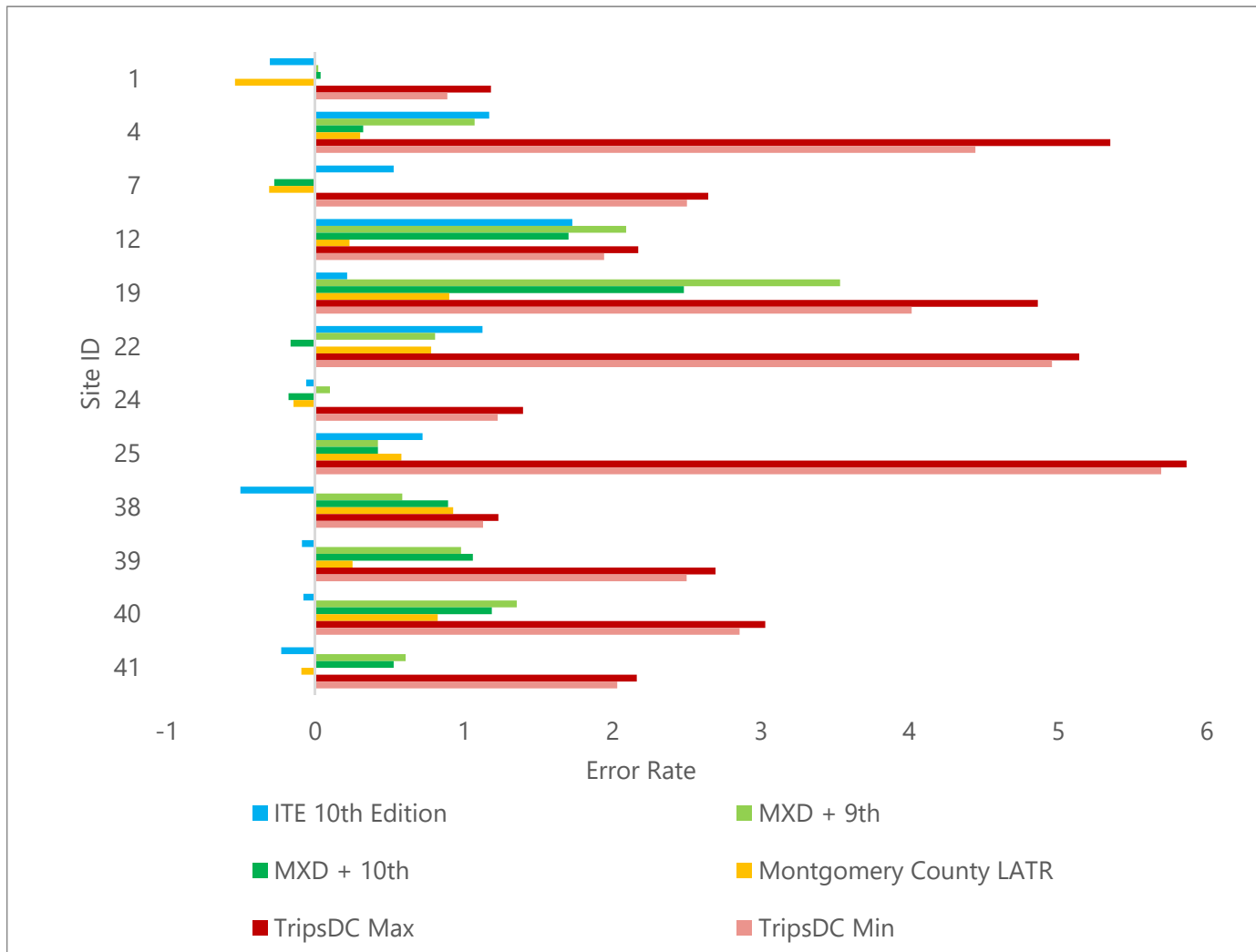
## AM Peak Hour

### Residential over Retail

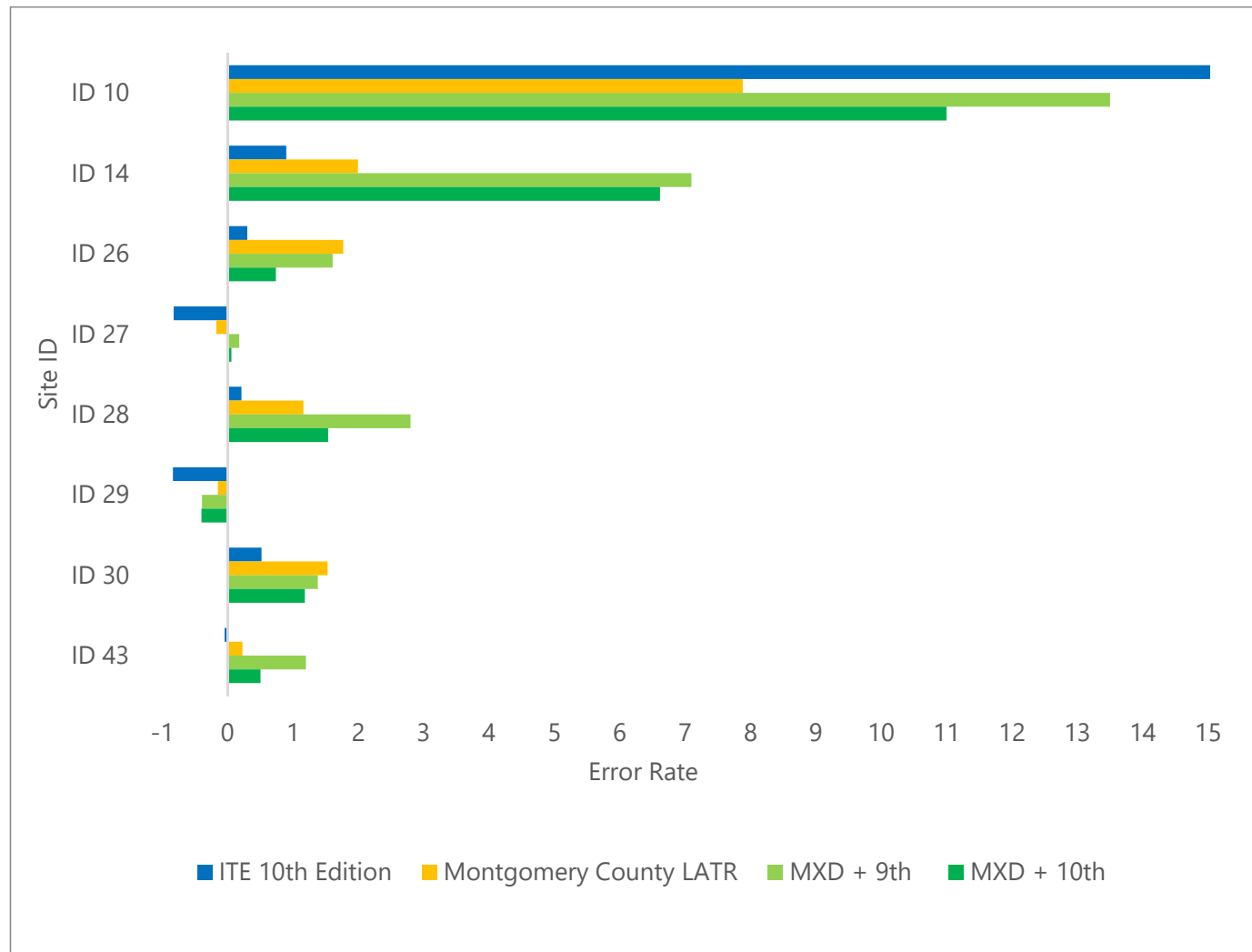




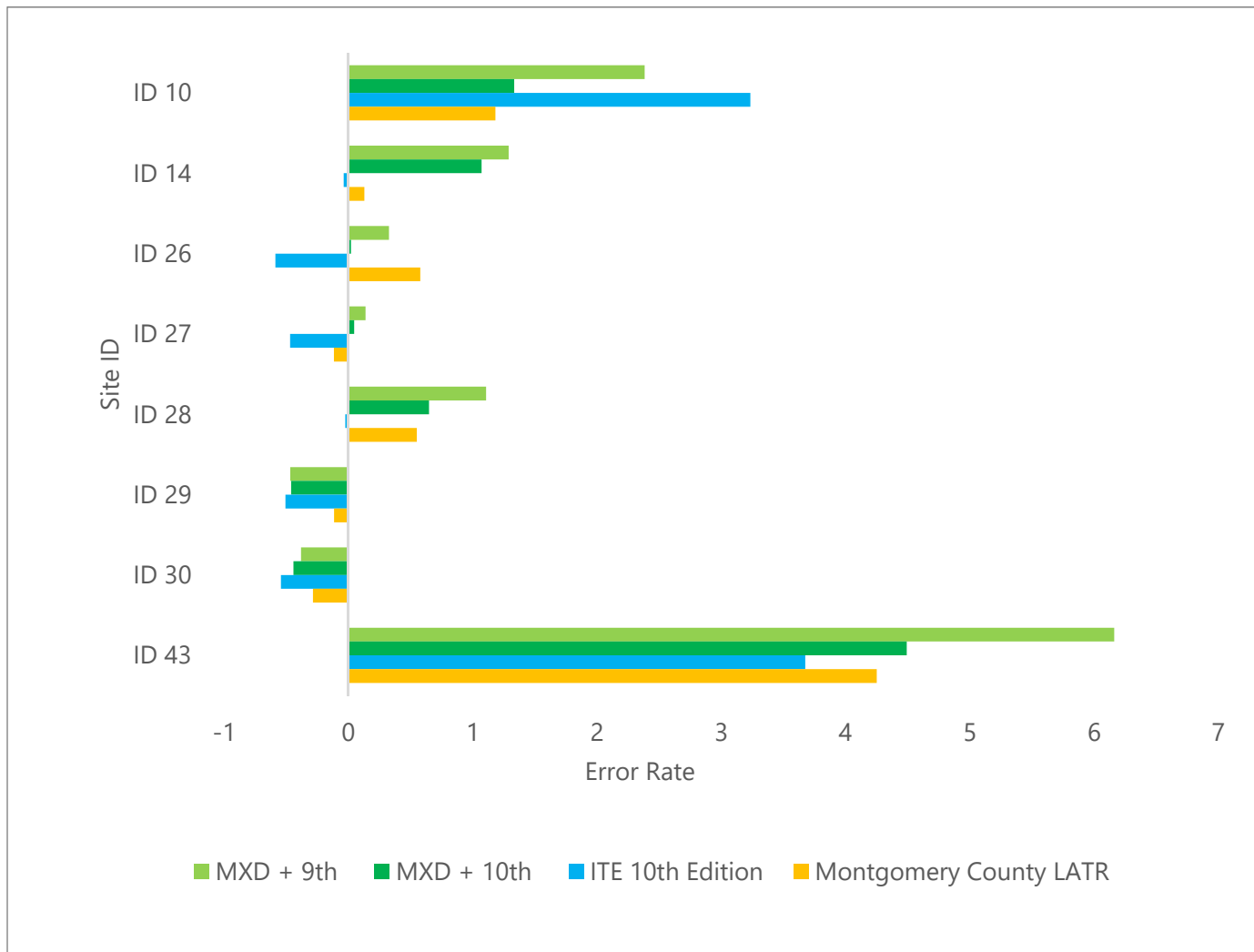
# Walk, Bike, & Transit Trip Comparison PM Peak Hour Residential over Retail

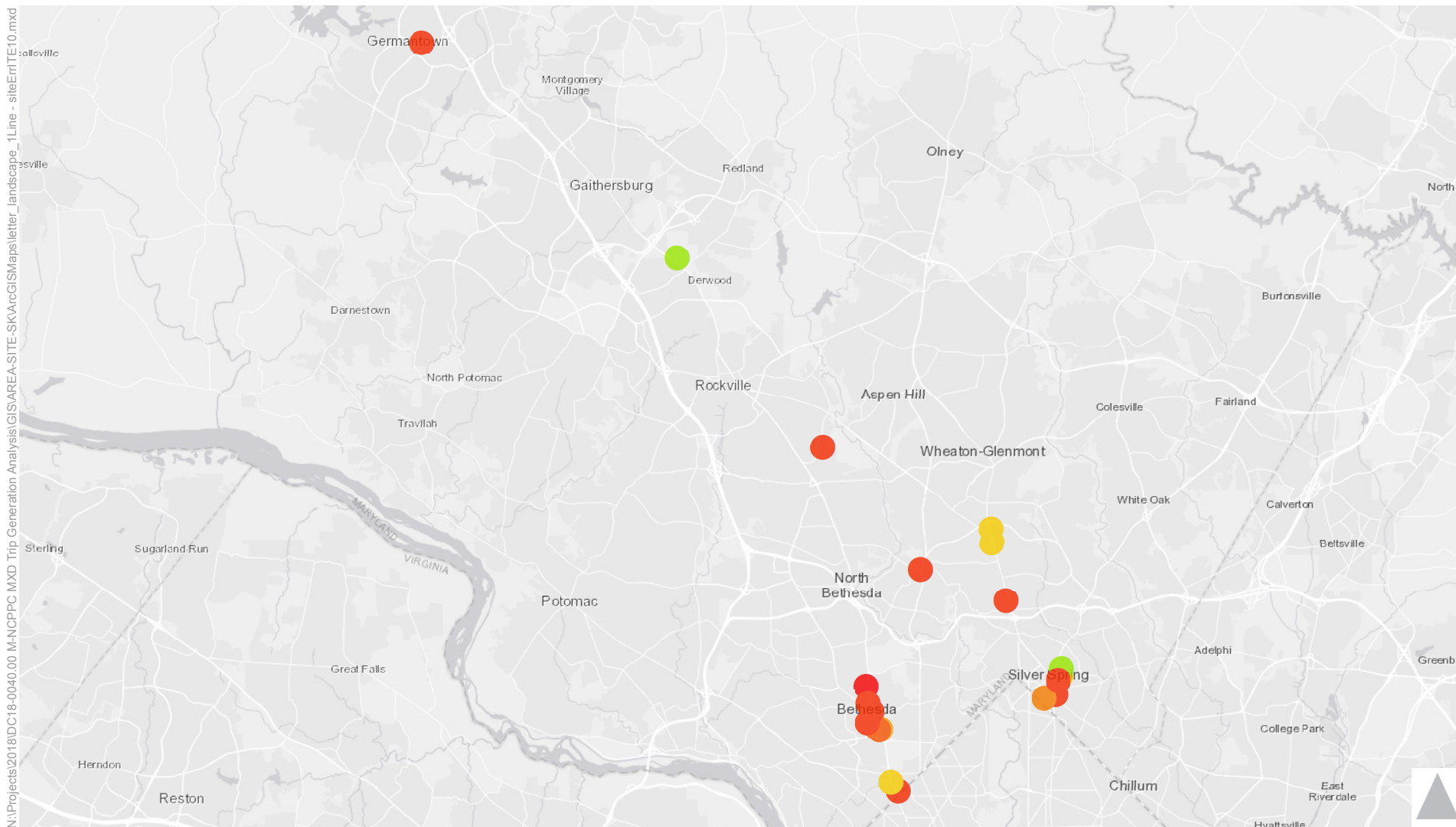


Walk, Bike, & Transit Trip Comparison  
AM Peak Hour  
Office with Retail



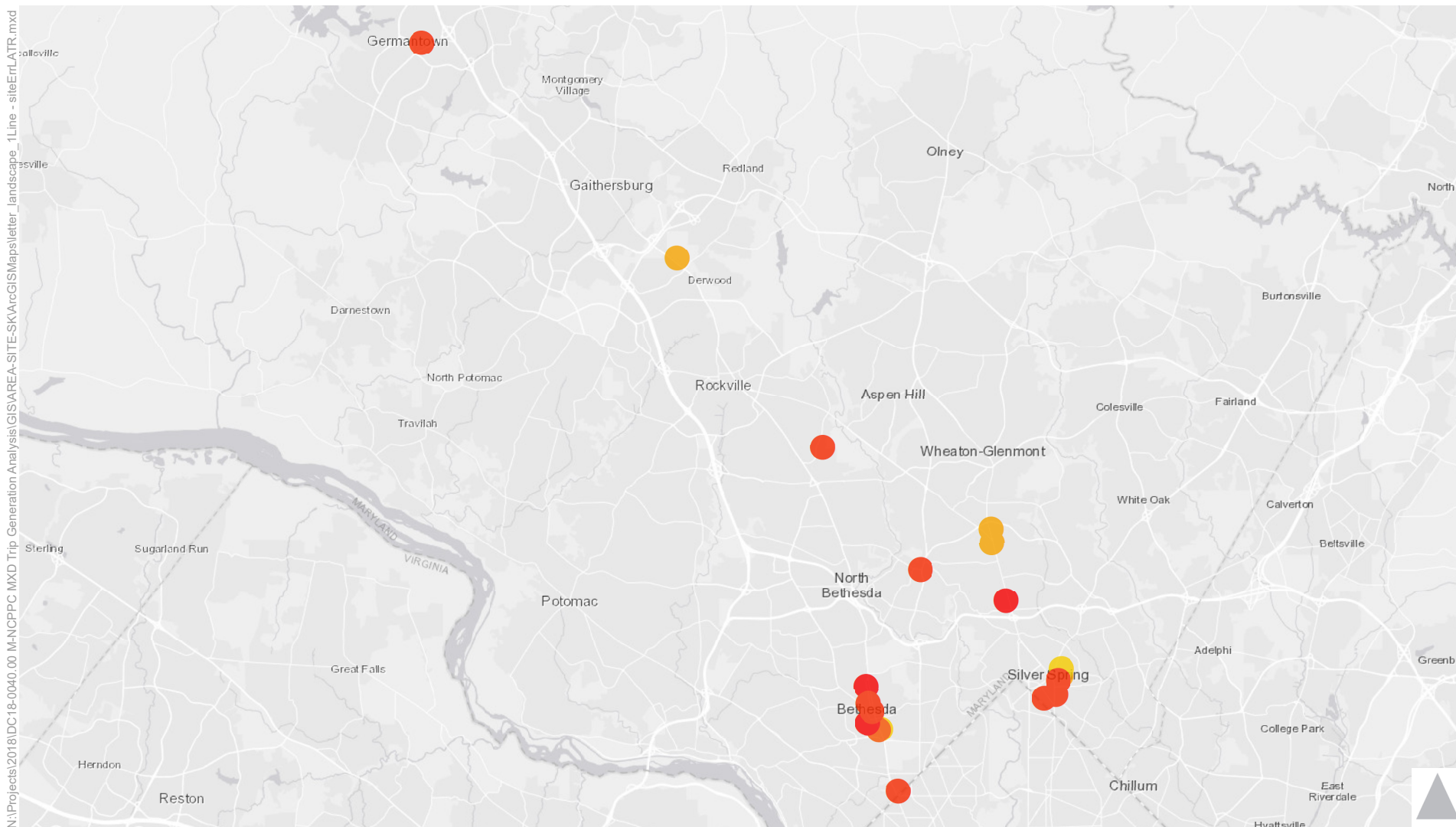
**Walk, Bike, & Transit Trip Comparison**  
**PM Peak Hour**  
**Office with Retail**





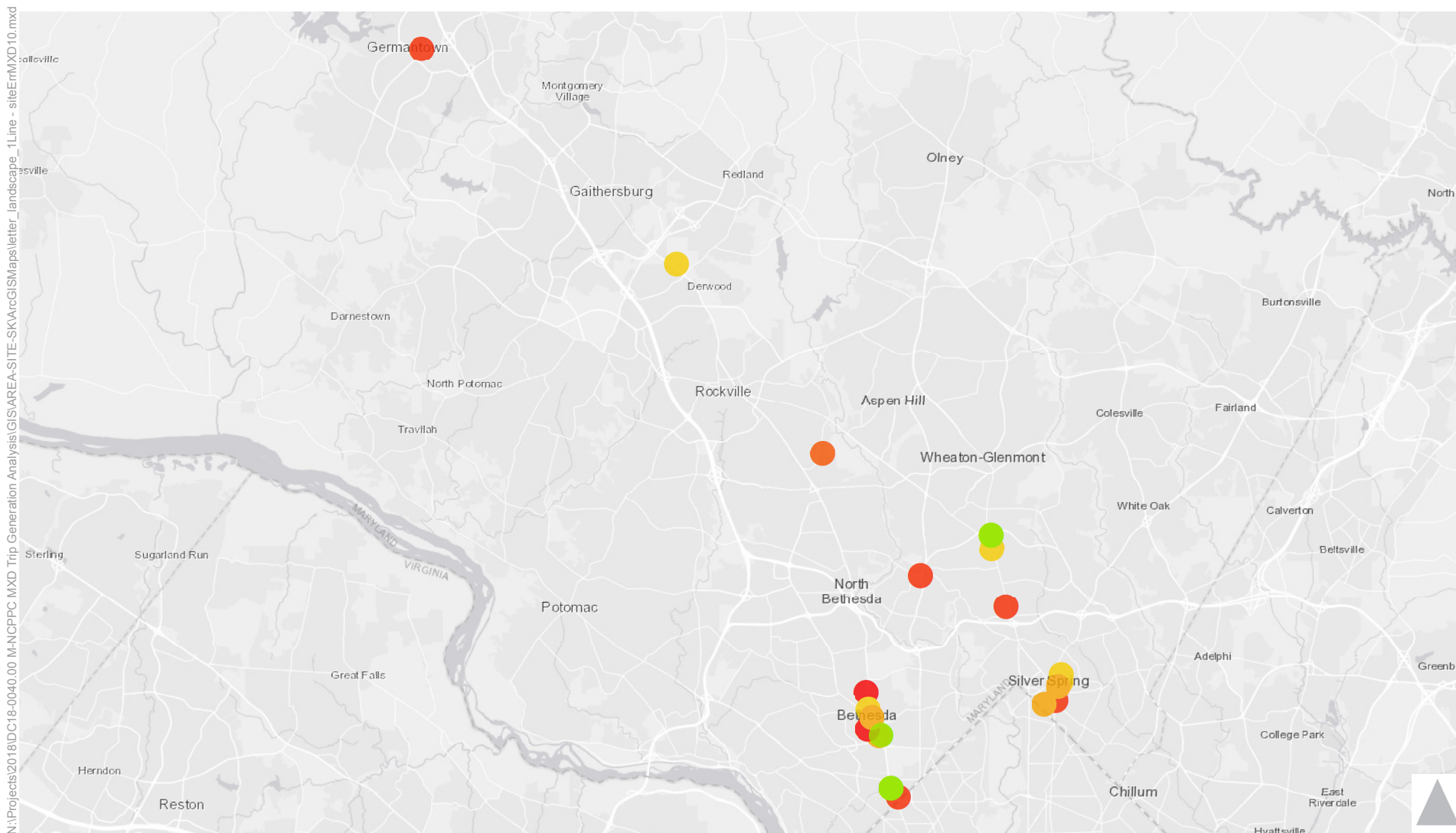
## Legend

<b>Absolute % Error</b>	<span style="color: orange;">●</span> 40%-60%	<span style="color: red;">●</span> 100%-300%
<span style="color: green;">●</span> <20%	<span style="color: orange;">●</span> 60%-80%	<span style="color: red;">●</span> >300%
<span style="color: yellow;">●</span> 20%-40%	<span style="color: orange;">●</span> 80%-100%	



## Legend

<b>Absolute % Error</b>	<span style="color: yellow;">●</span> 40%-60%	<span style="color: red;">●</span> 100%-300%
<span style="color: green;">●</span> <20%	<span style="color: orange;">●</span> 60%-80%	<span style="color: darkred;">●</span> >300%
<span style="color: gold;">●</span> 20%-40%	<span style="color: red-orange;">●</span> 80%-100%	

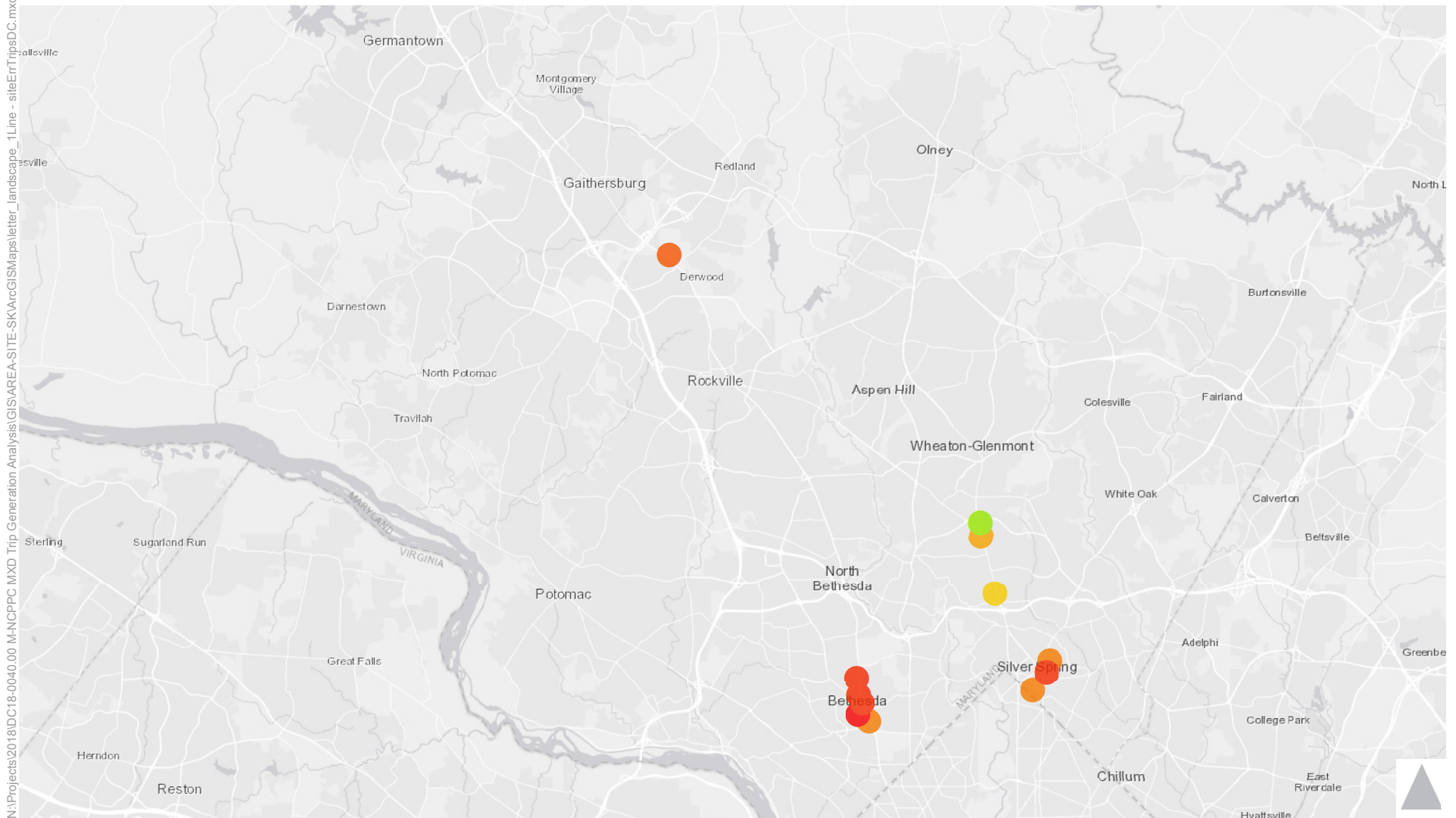


## Legend

<b>Absolute % Error</b>	<span style="color: orange;">●</span> 40%-60%	<span style="color: red;">●</span> 100%-300%
<span style="color: green;">●</span> <20%	<span style="color: orange;">●</span> 60%-80%	<span style="color: red;">●</span> >300%
<span style="color: yellow;">●</span> 20%-40%	<span style="color: orange;">●</span> 80%-100%	



N:\Projects\2018\DC18-0040.00 M-NCPPC MXD Trip Generation Analysis\GIS\AREA-SITE-SK\ArcGISMaps\letter\_landscape\_1Line - siteTripsDC.mxd



## Legend

<b>Absolute % Error</b>	40%-60%	100%-300%
<20%	60%-80%	>300%
20%-40%	80%-100%	

FEHR PEERS DC

TripsDC Absolute Percent Error - Vehicle Trips

## **APPENDIX P – AREA-LEVEL SITE INFORMATION**



### SELECTED AREAS FOR AREA-LEVEL ANALYSIS

POLICY AREA/TAZ	Name	Included TAZs
2	Bethesda CBD	637 662 663
20	Silver Spring CBD	623 624 625
22	Wheaton CBD	559 560 561 564
413	Gaithersburg City	
418	Germantown West	
423	Germantown Town Center	
431	Germantown West	
499	Olney	
503	Olney	
511	Montgomery Village	
513	Gaithersburg City	
541	Aspen Hill	
564	Wheaton CBD	
607	Silver Spring/Takoma Park	
624	Silver Spring CBD	
629	Kensington/Wheaton	
639	Friendship Heights	
662	Bethesda CBD	
666	Bethesda/Chevy Chase	
687	White Flint	

# RESIDENTIAL AND NON-RESIDENTIAL LAND USES

NAME	TRANSIT ACCESS (%)	AREA (ACRES)	DWELLING UNITS		NON-RESIDENTIAL EMPLOYEES			
			SINGLE FAMILY	MULTI FAMILY	RETAIL	OFFICE	INDUSTRIAL	OTHER
2	100	456	710	6278	4431	30507.5	134.5	1617
20	100	376	57	6239	4585	24665	829.5	1139
22	100	484	1070	1313	5057	2717.5	388.5	277
413	90*	427	356	705	0	28	2,010	235
418	100	292	961	212	66	0	8	125
423	100	106	221	237	571	287	6	111
431	70*	1269	2,115	51	0	0	0	193
499	50*	2566	2,492	563	188	877	4	1,524
503	100	352	857	185	333	431	0	71
511	100	571	1,502	551	264	215	0	281
513	100	180	256	1,373	276	189	728	284
541	100	382	864	0	895	986	0	110
564	100	148	584	514	207	125	247	160
607	100	247	861	1,447	61	0	0	137
624	100	117	57	2,321	2,540	11,663	83	679
629	90	142	378	673	0	0	0	52
639	100	115	2	3,701	1,238	6,782	26	328
662	100	168	141	2,617	1,138	18,035	88	934
666	98*	618	2,054	0	0	160	0	393
687	100	268	0	1,039	4,216	4,131	539	157

## **APPENDIX Q – TRAVEL SURVEY MODE SHARE**

# **MODES OF TRANSPORTATION**

Code	Description
0	Subway
1	Transit
2	Auto D
3	Auto P
4	Taxi/Limo
5	Motorcycle
6	Walk
7	Bike
8	School Bus
9	Heavy Truck
41	Local Bus
50	Commuter Rail
51	Commuter Bus
60	Inter-City Rail
61	Inter-city Bus
81	Airplane
90	Light Rail
91	Metro Access/DAR
92	Shuttle Bus
96	Other Subway
97	Other
99	INTERNAL

Mode 99 was created for the purposes of this study to indicate internal trips to and from the same TAZ. For a Policy Area, trips between different TAZs within the same Policy Area were also considered for internal mode. External (Walk, Bike, and Transit) trips are calculated using codes {0, 6, 7, 41, 50, 51, 91, 92}.

### Area Level Household Survey Mode Share

POLICY/TAZ	Internal	External Walk, Bike, and Transit	Total Reductions
2	14%	20%	34%
20	16%	27%	43%
22	4%	9%	14%
413	6%	10%	16%
418	21%	4%	25%
423	6%	4%	10%
431	6%	13%	19%
499	5%	8%	13%
503	4%	1%	5%
511	21%	3%	25%
513	5%	12%	17%
541	2%	7%	9%
607	3%	19%	22%
629	0%	10%	10%
637	7%	21%	28%
639	7%	25%	33%
662	9%	26%	34%
663	8%	19%	27%
666	18%	10%	27%
687	3%	10%	14%

Total Reduction is calculated based on internal trips plus external walk, bike, and transit trips. Reduction Percentage is the total reduction divided by the total number of trips. Access to transit was calculated using a quarter-mile buffer around transit stations. The percentage transit access is modified for zones with large vacant areas such as parks or golf courses to improve the accuracy of the transit access value.

## **APPENDIX R – MXD+ AREA LEVEL OUTPUTS**

**POLICY AREA 2**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(850) - Supermarket (Adj Streets, 7-9A, 4-6P)	1000 sq ft gross floor area	8502	59.5	6,083	125	77	202	270	260	530
(222) - High-Rise Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2223	500	2,118	38	113	150	105	67	172
Net Raw Project Trips				8,201	163	190	352	375	327	702
Reductions										
Internal Capture				-212	-8	-10	-18	-43	-37	-80
External Walk, Bike, and Transit				-3,459	-94	-110	-203	-178	-156	-334
Total Reductions				-3,671	-102	-119	-221	-221	-193	-414
Net New Project Trips				4,530	61	71	131	154	134	288

**POLICY AREA 20**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	57	626	13	38	50	40	23	63
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	6,239	37,932	612	2,449	3,061	2,242	1,207	3,449
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	24,665	45,480	6,698	913	7,611	1,562	7,624	9,186
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	2,292.5	52,016	653	400	1,053	2,345	2,541	4,886
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	829.5	2,478	244	50	294	63	236	299
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	1,139	3,435	476	65	541	82	400	482
Net Raw Project Trips				141,967	8,696	3,915	12,610	6,334	12,031	18,365
Reductions										
Internal Capture				-28,734	-2,364	-1,064	-3,428	-1,440	-2,736	-4,176
External Walk, Bike, and Transit				-21,848	-1,946	-876	-2,822	-1,303	-2,476	-3,779
Total Reductions				-50,582	-4,310	-1,940	-6,250	-2,744	-5,211	-7,955
Net New Project Trips				91,385	4,386	1,975	6,360	3,590	6,820	10,410



**POLICY AREA 22**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	1,070	9,296	190	569	759	559	328	887
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7103	2,717.5	7,131	1,005	137	1,142	181	885	1,066
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8204	2,528.5	55,437	693	425	1,118	2,504	2,713	5,217
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2205	1,313	8,080	129	518	647	481	259	740
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	388.5	1,177	145	30	175	36	135	171
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	277	1,048	141	19	160	28	135	163
Net Raw Project Trips				82,169	2,303	1,698	4,001	3,789	4,455	8,244
Reductions										
Internal Capture				-15,316	-576	-424	-1,000	-782	-920	-1,702
External Walk, Bike, and Transit				-4,711	-214	-158	-372	-347	-407	-754
Total Reductions				-20,027	-790	-582	-1,372	-1,129	-1,327	-2,456
Net New Project Trips				62,142	1,513	1,116	2,629	2,660	3,128	5,788

**TAZ 413**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	356	3,378	65	194	259	207	122	329
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	705	4,396	70	279	349	263	142	405
(710) - General Office Building (Pk Hr of Generator)	Employees	7104	28	153	19	3	22	12	58	70
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1105	2,010	5,960	509	104	613	135	506	641
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7106	235	912	122	17	139	25	122	147
Net Raw Project Trips				14,799	785	597	1,382	642	950	1,592
Reductions										
Internal Capture				-988	-68	-52	-120	-47	-69	-116
External Walk, Bike, and Transit				-550	-45	-35	-80	-34	-50	-84
Total Reductions				-1,538	-114	-86	-200	-81	-119	-200
Net New Project Trips				13,261	671	511	1,182	561	831	1,392

**TAZ 418**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	356	3,378	65	194	259	207	122	329
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	705	4,396	70	279	349	263	142	405
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	125	537	71	10	81	18	88	106
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	32.75	3,287	49	30	79	136	148	284
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	8	54	61	12	73	13	47	60
Net Raw Project Trips				11,652	316	525	841	637	547	1,184
Reductions										
Internal Capture				-1,360	-45	-75	-120	-80	-68	-148
External Walk, Bike, and Transit				-434	-18	-31	-49	-35	-30	-65
Total Reductions				-1,794	-64	-105	-169	-115	-98	-213
Net New Project Trips				9,858	252	420	672	522	449	971

**TAZ 423**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	237	1,560	24	96	120	96	52	148
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7103	287	1,079	145	20	165	28	138	166
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2104	221	2,178	41	123	164	135	80	215
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	285.5	13,430	184	112	296	581	629	1,210
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	6	48	60	12	72	13	47	60
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	111	486	64	9	73	17	84	101
Net Raw Project Trips				18,781	518	372	890	870	1,030	1,900
Reductions										
Internal Capture				-1,242	-63	-45	-108	-65	-77	-142
External Walk, Bike, and Transit				-1,265	-51	-37	-88	-80	-95	-175
Total Reductions				-2,507	-114	-82	-196	-145	-172	-317
Net New Project Trips				16,274	404	290	694	725	858	1,583

**TAZ 431-AVG**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	2,115	20,135	397	1,190	1,586	1,332	783	2,115
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	51	339	5	21	26	21	11	32
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	193	641	82	11	93	15	74	89
Net Raw Project Trips				21,115	484	1,222	1,705	1,368	868	2,236
Reductions										
Internal Capture				-1,652	-42	-106	-148	-111	-71	-182
External Walk, Bike, and Transit				-234	-8	-20	-28	-28	-17	-45
Total Reductions				-1,886	-50	-126	-176	-139	-88	-227
Net New Project Trips				19,229	434	1,096	1,529	1,229	780	2,009

**TABLE 8 TAZ 499**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	2,492	20,235	439	1,316	1,754	1,196	702	1,898
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	563	3,535	56	224	280	213	114	327
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	877	2,758	380	52	432	65	320	385
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	94	6,523	93	57	150	276	299	575
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	4	42	60	12	72	12	47	59
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	1,524	4,387	611	83	694	106	518	624
Net Raw Project Trips				37,480	1,639	1,744	3,382	1,868	2,000	3,868
Reductions										
Internal Capture				-9,252	-463	-493	-956	-492	-526	-1,018
External Walk, Bike, and Transit				-316	-21	-22	-43	-28	-30	-58
Total Reductions				-9,568	-484	-515	-999	-520	-556	-1,076
Net New Project Trips				27,912	1,155	1,229	2,383	1,348	1,444	2,792

**TAZ 503**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	857	7,579	153	458	610	457	269	726
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	185	1,245	19	75	94	77	42	119
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	431	1,519	206	28	234	37	183	220
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	166.25	9,450	132	81	213	404	438	842
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7106	71	334	44	6	50	15	71	86
Net Raw Project Trips				20,127	554	648	1,201	990	1,003	1,993
Reductions										
Internal Capture				-2,538	-92	-108	-200	-137	-139	-276
External Walk, Bike, and Transit				-441	-19	-22	-41	-35	-35	-70
Total Reductions				-2,979	-111	-130	-241	-172	-174	-346
Net New Project Trips				17,148	443	518	960	818	829	1,647

**TAZ 511**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	1,502	12,700	265	796	1,061	759	445	1,204
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	551	3,463	55	219	274	209	112	321
(710) - General Office Building (Pk Hr of Generator)	Employees	7104	215	847	114	15	129	24	116	140
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7105	281	1,060	143	19	162	28	136	164
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8206	131.75	8,124	114	70	184	346	375	721
Net Raw Project Trips				26,194	691	1,119	1,810	1,366	1,184	2,550
Reductions										
Internal Capture				-4,158	-132	-214	-346	-235	-203	-438
External Walk, Bike, and Transit				-1,025	-42	-69	-111	-78	-67	-145
Total Reductions				-5,183	-174	-283	-457	-312	-271	-583
Net New Project Trips				21,011	517	836	1,353	1,054	913	1,967



**TAZ 513**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	256	2,494	47	142	189	154	91	245
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	1,373	8,444	135	542	677	502	271	773
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	189	760	101	14	115	22	108	130
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	138	8,373	118	72	190	357	386	743
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	728	2,178	222	45	267	56	213	269
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	284	1,070	144	20	164	28	137	165
Net Raw Project Trips				23,319	767	835	1,602	1,119	1,206	2,325
Reductions										
Internal Capture				-2,372	-109	-119	-228	-128	-138	-266
External Walk, Bike, and Transit				-1,602	-78	-85	-163	-107	-115	-222
Total Reductions				-3,974	-187	-204	-391	-235	-253	-488
Net New Project Trips				19,345	580	631	1,211	884	953	1,837

**TAZ 541**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	864	7,636	154	461	615	461	271	732
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7103	986	3,043	420	57	477	72	353	425
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8204	447.5	17,987	241	148	389	785	850	1,635
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7105	110	482	63	9	72	17	84	101
Net Raw Project Trips				29,148	878	675	1,553	1,335	1,558	2,893
Reductions										
Internal Capture				-3,202	-138	-106	-244	-163	-191	-354
External Walk, Bike, and Transit				-606	-29	-22	-51	-52	-61	-113
Total Reductions				-3,808	-167	-128	-295	-216	-251	-467
Net New Project Trips				25,340	711	547	1,258	1,119	1,307	2,426

**TAZ 564**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	584	5,326	105	314	419	324	190	514
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	514	3,238	51	205	256	195	105	300
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	125	537	71	10	81	18	88	106
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	103.5	6,945	99	60	159	294	319	613
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	247	759	114	23	137	27	103	130
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	160	661	88	12	100	20	99	119
Net Raw Project Trips				17,466	528	624	1,152	878	904	1,782
Reductions										
Internal Capture				-2,028	-85	-101	-186	-112	-116	-228
External Walk, Bike, and Transit				-1,198	-54	-64	-118	-83	-86	-169
Total Reductions				-3,226	-139	-165	-304	-196	-201	-397
Net New Project Trips				14,240	389	459	848	682	703	1,385

**TAZ 607**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	861	7,612	153	459	612	459	270	729
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	1,447	8,892	143	570	713	529	285	814
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8204	30.25	3,122	47	29	75	129	140	269
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7105	137	580	77	10	87	19	92	111
Net Raw Project Trips				20,206	420	1,068	1,487	1,136	787	1,923
Reductions										
Internal Capture				-2,192	-54	-136	-190	-135	-93	-228
External Walk, Bike, and Transit				-866	-29	-75	-104	-77	-54	-131
Total Reductions				-3,058	-83	-211	-294	-212	-147	-359
Net New Project Trips				17,148	337	857	1,193	924	640	1,564

**TAZ 624**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	57	626	13	38	50	40	23	63
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	2,321	14,189	228	913	1,141	841	453	1,294
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	11,663	24,244	3,517	480	3,997	744	3,631	4,375
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7105	679	2,225	304	42	346	53	258	311
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8206	1,269.75	35,429	456	279	735	1,579	1,710	3,289
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1107	83	275	77	16	93	17	65	82
Net Raw Project Trips				76,988	4,595	1,768	6,362	3,274	6,140	9,414
Reductions										
Internal Capture				-9,146	-816	-314	-1,130	-440	-826	-1,266
External Walk, Bike, and Transit				-11,745	-1,015	-391	-1,406	-693	-1,301	-1,994
Total Reductions				-20,891	-1,832	-705	-2,536	-1,134	-2,126	-3,260
Net New Project Trips				56,097	2,763	1,063	3,826	2,140	4,014	6,154

**TAZ 629**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	378	3,569	69	206	274	219	129	348
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	673	4,202	67	267	334	252	136	388
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	52	257	33	5	38	13	66	79
Net Raw Project Trips				8,028	169	478	646	484	331	815
Reductions										
Internal Capture				-626	-15	-43	-58	-40	-28	-68
External Walk, Bike, and Transit				-454	-15	-42	-57	-41	-28	-69
Total Reductions				-1,080	-30	-85	-115	-81	-56	-137
Net New Project Trips				6,948	139	393	531	403	275	678

**TAZ 639**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	2	29	3	8	11	2	1	3
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	3,701	22,552	363	1,454	1,817	1,334	719	2,053
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	6,782	15,375	2,206	301	2,507	437	2,132	2,569
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	618.75	22,204	294	180	474	975	1,057	2,032
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	26	107	64	13	77	14	52	66
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	328	1,207	163	22	185	31	150	181
Net Raw Project Trips				61,474	3,093	1,978	5,071	2,793	4,111	6,904
Reductions										
Internal Capture				-8,816	-626	-400	-1,026	-453	-667	-1,120
External Walk, Bike, and Transit				-9,302	-662	-424	-1,086	-563	-828	-1,391
Total Reductions				-18,118	-1,288	-824	-2,112	-1,016	-1,495	-2,511
Net New Project Trips				43,356	1,805	1,154	2,959	1,777	2,616	4,393

**TAZ 662**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	141	1,441	27	81	108	90	53	143
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	2,617	15,983	257	1,029	1,286	947	510	1,457
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	18,035	34,963	5,116	698	5,814	1,145	5,588	6,733
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8205	568.75	21,020	279	171	450	922	998	1,920
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	88	290	78	16	94	18	66	84
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	934	2,908	401	55	456	69	337	406
Net Raw Project Trips				76,605	6,158	2,050	8,208	3,191	7,552	10,743
Reductions										
Internal Capture				-7,388	-839	-279	-1,118	-478	-1,132	-1,610
External Walk, Bike, and Transit				-10,740	-1,251	-416	-1,667	-568	-1,344	-1,912
Total Reductions				-18,128	-2,089	-696	-2,785	-1,046	-2,476	-3,522
Net New Project Trips				58,477	4,069	1,354	5,423	2,145	5,076	7,221



**TAZ 666**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
Net New Uses										
(210) - Single-Family Detached Housing (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2102	141	1,441	27	81	108	90	53	143
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2203	2,617	15,983	257	1,029	1,286	947	510	1,457
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7104	18,035	34,963	5,116	698	5,814	1,145	5,588	6,733
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft	8205	568.75	21,020	279	171	450	922	998	1,920
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1106	88	290	78	16	94	18	66	84
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7107	934	2,908	401	55	456	69	337	406
Net Raw Project Trips				76,605	6,158	2,050	8,208	3,191	7,552	10,743
Reductions										
Internal Capture				-7,388	-867	-289	-1,156	-352	-832	-1,184
External Walk, Bike, and Transit				-10,696	-1,239	-413	-1,652	-590	-1,398	-1,988
Total Reductions				-18,084	-2,107	-701	-2,808	-942	-2,230	-3,172
Net New Project Trips				58,521	4,051	1,349	5,400	2,249	5,322	7,571

**TAZ 687**

Land Use	Units	ITE Code	Quantity	Daily Trips	AM Peak Hour			PM Peak Hour		
					In	Out	Total	In	Out	Total
(220) - Apartment (Adj Streets, 7-9A, 4-6P)	Dwelling Units	2202	1,039	6,420	103	410	513	383	206	589
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7103	4,131	10,138	1,441	196	1,637	270	1,319	1,589
(820) - Shopping Center (Adj Streets, 7-9A, 4-6P)	1000 sq ft leasable area	8204	2,108	49,255	621	380	1,001	2,217	2,402	4,619
(110) - General Light Industrial (Adj Streets, 7-9A, 4-6P)	Employees	1105	539	1,621	179	37	216	45	169	214
(710) - General Office Building (Pk Hr, AM & PM)	Employees	7106	157	650	86	12	98	20	98	118
Net Raw Project Trips				68,084	2,430	1,035	3,465	2,935	4,194	7,129
Reductions										
Internal Capture				-5,000	-299	-127	-426	-241	-345	-586
External Walk, Bike, and Transit				-5,457	-295	-126	-421	-340	-486	-826
Total Reductions				-10,457	-594	-253	-847	-581	-831	-1,412
Net New Project Trips				57,627	1,836	782	2,618	2,354	3,363	5,717

## **APPENDIX S – AREA-LEVEL RESULTS**

**MXD+ Area Level Auto Trips**

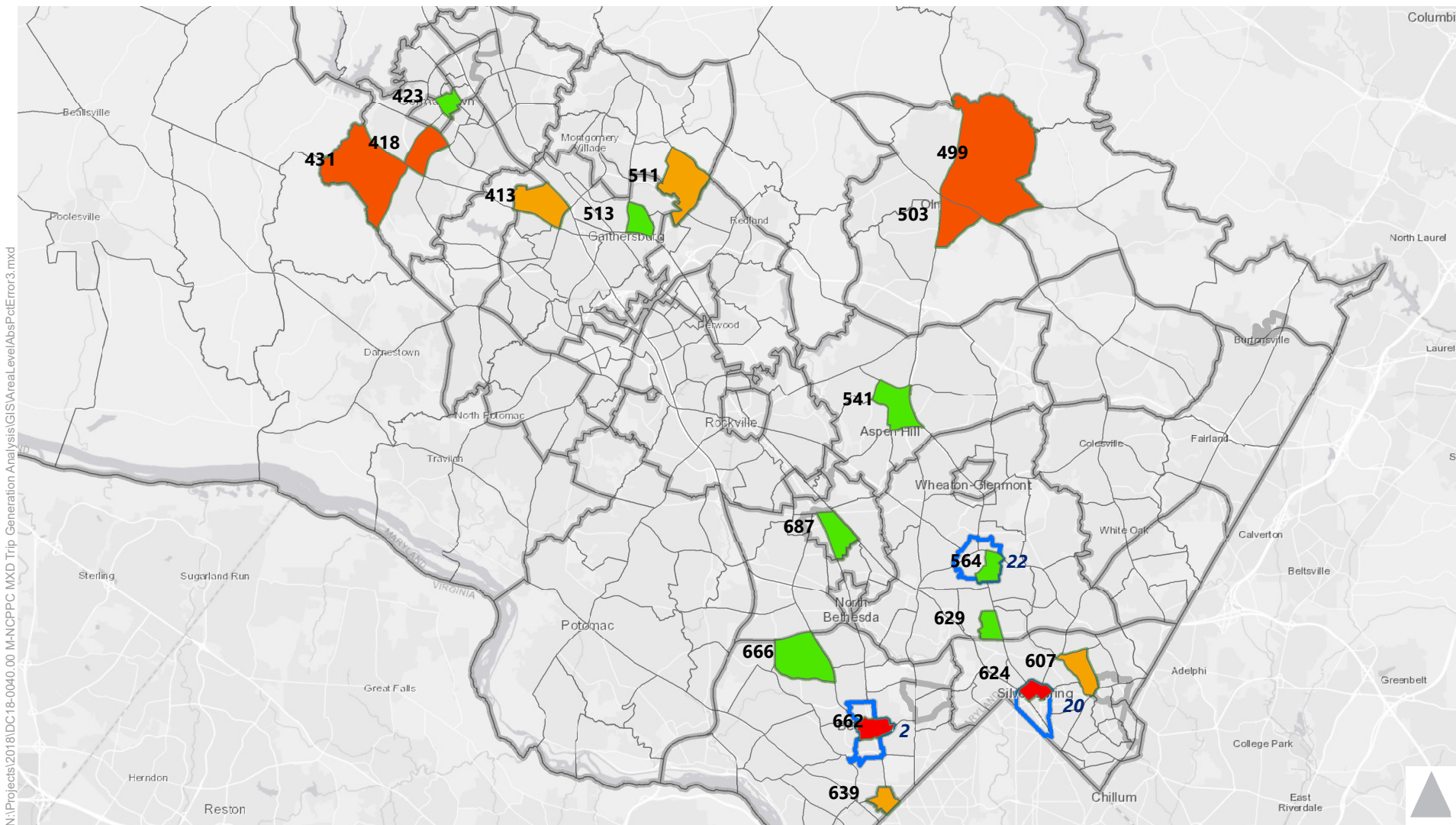
Site ID	Location	MXD+ - Mixed Use		Total Reduction HH	External Vehicle Trip %	Percent Deviation
		Reduction Percentage	Net Trip%			
2	Bethesda CBD	23%	77%	34%	66%	17%
20	Silver Spring CBD	36%	64%	43%	57%	12%
22	Wheaton CBD	24%	76%	14%	86%	-12%
413	Gaithersburg City	10%	90%	16%	84%	7%
418	Germantown West	15%	85%	25%	75%	13%
423	Germantown Town Center	13%	87%	10%	90%	-3%
431	Germantown West	9%	91%	19%	81%	12%
499	Olney	26%	74%	13%	87%	-15%
503	Olney	15%	85%	5%	95%	-11%
511	Montgomery Village	20%	80%	25%	75%	7%
513	Gaithersburg City	17%	83%	17%	83%	0%
541	Aspen Hill	13%	87%	9%	91%	-4%
564	Wheaton CBD	18%	82%	14%	86%	-5%
607	Silver Spring/Takoma Park	15%	85%	22%	78%	9%
624	Silver Spring CBD	27%	73%	43%	57%	28%
629	Kensington/Wheaton	13%	87%	10%	90%	-3%
639	Friendship Heights	29%	71%	33%	67%	6%
662	Bethesda CBD	24%	76%	34%	66%	15%
666	Bethesda/Chevy Chase	24%	76%	27%	73%	4%
687	White Flint	15%	85%	14%	86%	-1%

**MXD+ Area Level External Walk, Bike, and Transit Trips**

ID	Site	Daily Trips		
		Observed	MXD+	% Diff
2	Bethesda CBD	20%	5.2%	-74%
20	Silver Spring CBD	27%	15.4%	-43%
22	Wheaton CBD	9%	5.7%	-37%
413	Gaithersburg City	10%	3.7%	-63%
418	Germantown West	4%	3.7%	-8%
423	Germantown Town Center	4%	6.7%	68%
431	Germantown West	13%	1.1%	-92%
499	Olney	8%	0.8%	-90%
503	Olney	1%	2.2%	120%
511	Montgomery Village	3%	3.9%	30%
513	Gaithersburg City	12%	6.9%	-43%
541	Aspen Hill	7%	2.1%	-70%
564	Wheaton CBD	19%	6.9%	-64%
607	Silver Spring/Takoma Park	10%	4.3%	-57%
624	Silver Spring CBD	21%	15.3%	-27%
629	Kensington/Wheaton	25%	5.7%	-77%
639	Friendship Heights	26%	15.1%	-42%
662	Bethesda CBD	19%	14.0%	-26%
666	Bethesda/Chevy Chase	10%	14.0%	40%
687	White Flint	10%	8.0%	-20%

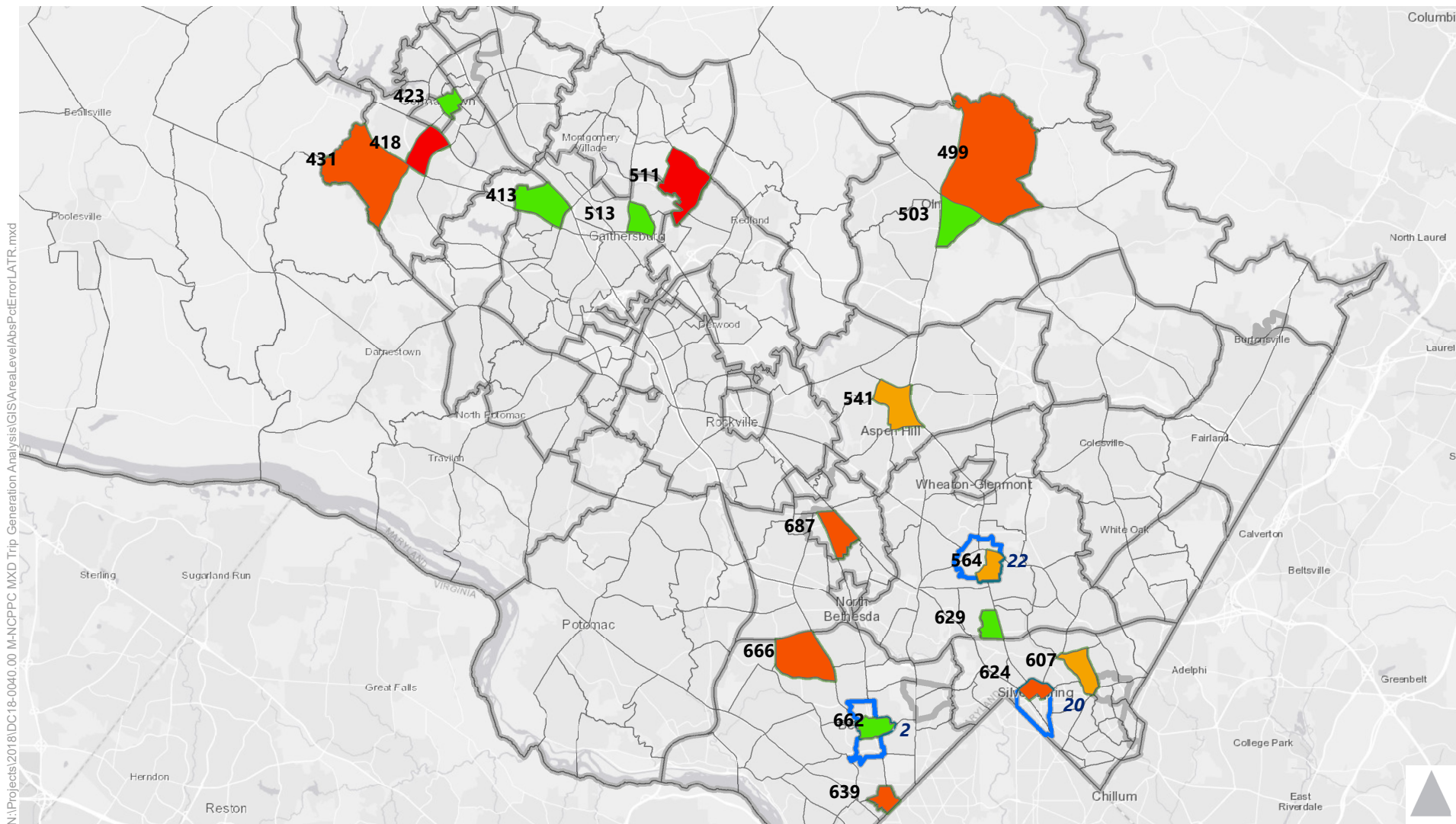
**LATR Area Level Vehicle Mode Share**

Site ID	Location	LATR	Household Travel Survey		Percent Deviation
		Vehicle Trip Generation Rate Adjustment Factor	Reduction Percentage	Net External Vehicle Trip%	
2	Bethesda CBD	67%	34%	66%	1%
20	Silver Spring CBD	66%	43%	57%	15%
22	Wheaton CBD	79%	14%	86%	-8%
413	Gaithersburg City	87%	16%	84%	3%
418	Germantown West	93%	25%	75%	23%
423	Germantown Town Center	89%	10%	90%	-1%
431	Germantown West	93%	19%	81%	15%
499	Olney	99%	13%	87%	14%
503	Olney	99%	5%	95%	4%
511	Montgomery Village	94%	25%	75%	25%
513	Gaithersburg City	83%	17%	83%	0%
541	Aspen Hill	98%	9%	91%	8%
564	Wheaton CBD	81%	14%	86%	-5%
607	Silver Spring/Takoma Park	83%	22%	78%	6%
624	Silver Spring CBD	64%	43%	57%	12%
629	Kensington/Wheaton	91%	10%	90%	1%
639	Friendship Heights	74%	33%	67%	10%
662	Bethesda CBD	66%	34%	66%	0%
666	Bethesda/Chevy Chase	83%	27%	73%	14%
687	White Flint	74%	14%	86%	-14%



## Legend





## Legend

