District Department of Transportation

Trip Generation and Data Analysis Study

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District Department of Transportation

Trip Generation and Data Analysis Study

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Executive Summary

Study Overview

Through the Trip Generation and Data Analysis Study, the District of Columbia Department of Transportation (DDOT) is undertaking research to better understand multimodal urban trip generation at mixed-use sites in the District. The study is helping the District further understand the relationship between land use, transportation, and travel demand for specific land use types located in heavily urbanized settings. The information collected in this study will help the District to better assess the likely impacts of new development projects on the transportation system, and to identify appropriate mitigation measures.

The data collected in this and other studies will provide a critical supplement to the use of existing national data sources, including the Institute of Transportation Engineers (ITE) *Trip Generation*, which in the past have primarily been based on vehicle-trip generation in single-use, suburban, auto-dominated environments. It also will help inform national efforts, including efforts by ITE and by other researchers and practitioners, to update and improve trip generation data and methods.

Phase 1 of this study, performed in 2013 and 2014, included development and testing of a data collection methodology for 16 sites in the District. Phase 2, performed in 2015, included data collection at 45 additional sites as well as analysis of the data to develop multimodal trip generation rates. This report summarizes the data collection effort performed in Phase 2 of the study and presents findings from the initial analysis of pooled data collected in both Phase 1 and Phase 2. The report also provides suggestions for additional research, analysis, and outreach activities to better understand trip generation in urban mixed-use contexts.

Data Collection

Multimodal trip generation data were collected for a total of 61 sites in Phases 1 and 2, of which 48 were mixed residential/retail uses (the primary focus of the study). The sites were typically large buildings (over 75 residential units) located in areas with strong transit and walk accessibility and a mix of local land uses.

The data were collected by conducting a single day of peak-period person counts and vehicle counts at all doorway and garage entrances to each property, as well as surveying as many people as possible about their mode of access to or from the site. The counts and surveys were conducted in 15-minute

intervals over a three-hour morning period (7:00-10:00 a.m.) and a three-hour evening period (4:00-7:00 p.m.), with the peak AM and PM hour of trip generation then identified. Total person counts, vehicle counts, trips by mode, and mode shares were then related to characteristics of the site (total dwelling units, retail square footage by type) as well as to environmental variables measuring other characteristics of the neighborhood that may affect trip generation.

Findings

The analysis found strong relationships between size of the land use (number of dwelling units and square feet of retail) and both person- and vehicle-trip generation. Furthermore, the analysis found that trip characteristics are (on average) substantially different than would be predicted from national suburban data. For example, vehicle-trip rates are significantly lower than predicted by ITE relationships, while person-trip rates are higher than would be predicted from ITE vehicle-trip relationships. Less than one-quarter of residents arrived or departed as an automobile driver, while the proportion of retail customers who drove ranged from one-third in the morning to three-fifths in the evening. A large proportion of trips were made by walk or transit. Table ES.1 shows trip rates by mode per dwelling unit (DU) and per 1,000 gross square feet (KGSF) of retail use, estimated from properties containing both types of uses.

Table ES.1 | Trip Generation Rates for Surveyed Residential/Retail Properties in the District of Columbia

Variable	Total Person-Trips	Auto Driver Trips	Auto Passenger Trips	Transit Trips	Walk Trips	Bike Trips
AM Residential Rate (per DU)	1.087**	0.252**	0.046**	0.297**	0.467**	0.025**
AM Retail Rate (per KGSF)	3.081**	1.995**	0.104	-0.147	1.066*	0.063
PM Residential Rate (per DU)	1.124**	0.155**	0.039**	0.199**	0.709**	0.022
PM Retail Rate (per KGSF)	9.150**	3.222**	0.641**	0.847*	3.940**	0.500**
** *Significant at p<0.01.*						
* *Significant at p<0.05.*						

The analysis also examined relationships between person-trip rates, vehicle-trip rates, and mode shares and a number of environmental variables, including:

- Multimodal accessibility scores describing site-specific access to jobs and retail opportunities by driving, transit, and walk;
- Neighborhood auto ownership levels and population density; and
- On-site parking supply.

The analysis, however, was not able to identify a significant relationship between any of these variables and trip rates or mode shares. Also, no significant differences were found in trip rates for different types of retail, including "neighborhood-serving" versus "destination" serving retail, and retail uses that have been found in other studies to result in lower versus higher trip generation. Also, tracking individual retail trip generation sites did not prove to be a promising exercise, due to the variability both of the types of sites in the database and between sites of like types.

Trip generation studies typically find a wide variation in trip rates even for a given type of land use. For example, retail trip rates can vary even for the same type of store, depending upon the local population served, customer characteristics, and other factors (for example, one brand of grocery store in this study showed trip generation rates of two to five times higher than other store brands). Residential trip rates can be affected by the average household size, income, and other demographic factors. The unexplained variation among trip rates at different sites in this study appears to overwhelm any effects of observed environmental variables or of differences in retail type.

Data also were collected on three hotel and three office sites to test data collection methods at these types of uses. Person-trip rates at the hotel sites are much higher than vehicle-trips derived from suburban data compiled by ITE, but vehicle-trip rates are one-half to three-quarters lower that predicted by ITE data. Office person- and vehicle-trip rates are both much lower than predicted by ITE data, even with the inclusion of public parking that may be used by retail customers as well as off-site travelers. Vehicle-trip rates are about 20 to 25 percent of ITE and person-trip rates are around half the ITE vehicle-trip rates compiled from suburban areas. These preliminary findings, while based on a very small sample, suggest that trip characteristics in the District of Columbia are substantially different than characteristics predicted from national databases for other types of uses in suburban areas as well.

While the information presented in this study provides an initial basis for understanding expected trip generation rates by mode for residential mixed-use properties in the District of Columbia, further evaluation is warranted before recommending these rates for use in the District's Comprehensive Transportation Review (CTR) process.

Future Activities

This research has provided an initial step in better understanding multimodal trip generation in urban, mixed-use environments typical of the District of Columbia, to better inform the development review process. Potential near-term activities to continue this research and its application to practice include:

- Conduct outreach and collaboration with other jurisdictions and entities to share and discuss findings and implications;
- Conduct further analysis of the trip generation relationships found here for residential/retail sites and identify any data problems or gaps; and
- Define a procedure for using data from comparable sites to predict trip generation in the development review process.

Once these near-term activities are underway, a better determination may be made regarding the most productive next steps for further data collection, analysis, and method development. Such activities could include, for example, expanded data collection on other types of sites, additional collection and analysis of other site and environmental variables such as travel demand management (TDM) and parking, and development of a tool to assist with trip generation estimation in the CTR process.

1.0 Introduction

1.1 Objectives

Through the Trip Generation and Data Analysis Study, the District of Columbia Department of Transportation (DDOT) is undertaking research to better understand multimodal urban trip generation at mixed-use (residential and retail) sites in the District. The study will help the District further understand the relationship between land use, transportation, and travel demand for specific land use types located in heavily urbanized settings. Phase 2 of this study was completed between March and September 2015.

Vehicle-trip generation estimates are commonly used in development review process to assess impacts on transportation network and identify measures to mitigate impacts (e.g., local safety and congestion concerns) from new land use development. DDOT has relied on a variety of data sources, including Institute of Transportation Engineers (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.

ITE's *Trip Generation Manual*, long relied upon as the industry standard for predicting trip generation, represents vehicle-trip rates in suburban areas with single-use, low-density zoning and land uses, typically with limited or no accessibility by walking, bicycling, and/or transit. Washington, D.C., by contrast, is primarily dense and mixed-use, which, in combination with the availability of walking, biking, and public transit modes, 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. Census data also have limitations in that only journey to work trips are represented. Finally, while the WMATA data provide local multimodal information, the data were collected at limited sites and are becoming out-of-date.

The data collected through this study should allow DDOT to better understand urban travel demand, which in turn allows for a better understanding of the potential transportation impacts of developments in the District. This should lead to more appropriate mitigations and fewer inappropriate mitigations at the site level. By quantifying observed behavior, the data can also assist in addressing traffic impact concerns from residents, decision-makers, and other stakeholders. Similarly, the data could lead to better District-wide policy-making by more closely tying policies about mitigations to how residents make trips.

The data collected by DDOT, and subsequent analysis, also will help inform national efforts to update trip generation data and methods. A number of studies have been undertaken in recent years to better understand multimodal trip generation in mixed-use environments. These include efforts by ITE, the National Cooperative Highway Research Program, U.S. Environmental Protection Agency, and other researchers. Collaboration between DDOT and other local and national entities will help to create an improved framework for understanding trip generation in a wide range of urban contexts.

1.2 Structure of the Study

Phase 1 of this study included development and testing of a data collection methodology for 16 sites in the District. Phase 2 includes data collection at 45 additional sites as well as analysis of the data to develop multimodal trip generation rates. Of the total 61 sites, 48 were mixed residential/retail uses, the primary focus of the study.

Parallel to this study, a residential parking study to develop the web-based Park Right DC tool collected much more detailed site data on 115 properties in the same timeframe.[1] Of these sites, 14 were included in the trip generation study.

This report summarizes Phase 2 data collection activities, as well as analysis results for data collected in both phases of the study, and recommendations and lessons learned for future data collection and analysis efforts.

1.3 Overview of Report

The structure of the remainder of this report is as follows:

- Section 2.0 provides a brief review of Phase 1 activities;
- Section 3.0 documents Phase 2 data collection process, including site screening, data collection, and data processing;
- Section 4.0 describes the data analysis approach and key findings:
- Section 5.0 provides recommendations for future efforts to collect and analyze additional data and refine development review practices;
- Appendix A includes data collection forms;

[1] The tool is available at www.parkrightdc.com.

- Appendix B includes site details, including information on the sites, retail uses, and appended or calculated data including trip generation and environmental variables;
- Appendix C includes metadata for the final data files including site characteristics and raw trip counts;
- Appendix D includes maps of the environmental variables considered in the analysis;
- Appendix E includes output from the regression models; and
- Appendix F contains a list of key assumptions in the data analysis.

2.0 Overview of the Phase 1 Effort

2.1 Summary of Study Findings

Phase 1 of this study, funded by DDOT and the Federal Highway Administration, was conducted between April 2013 and July 2014. The purpose of Phase 1 was to develop and test a methodology for collecting trip generation data in urban, multimodal contexts. The findings are documented in the Phase 1 report.[2] The Phase 1 study included:

- A review of previous research;
- Development of data collection forms and protocols;
- Counts and surveys at 16 sites, including 7 residential-only and 9 residential/retail sites in the District, performed in November-December 2013 and February 2014;
- A comparison of results to predicted trip generation using ITE relationships as well as other methods applying reductions in vehicular trip generation to baseline ITE predictions; and
- Preparation of a field guide for future data collection.

The Phase 1 study found walking to be the dominant mode of travel at the surveyed sites, with transit use high as well. The research team found transit and drive trips to be substitutes while walk trips are complementary to both transit and driving. ITE relationships from suburban data generally under-predicted person trips and over-predicted vehicle trips for the urban study sites. A number of other models were tested, all of which adjust ITE rates based on "urban" characteristics. All of these models provide results closer to the actual trip counts and mode splits observed at the Phase 1 sites. However, variability in calibration led the Phase 1 report authors to suggest that a wholesale new approach, not just applying reduction factors to ITE rates, may be required to best address the issue of predicting trip generation in urban environments. The report also concluded that to get a true representation of multimodal trip generation, particularly in urban areas, will ultimately call for substantially more data collection.

[2] Weinberger, R., K. Ricks, J. Schreiber, and L. Cohen (September 2014). *Trip Generation Data Collection in Urban Areas*. Prepared by Nelson\Nygaard Consulting Associates and Symmetra Design, LLC for District Department of Transportation.

2.2 Phase 2 Revisions to Phase 1 Procedures

The field guide was used as the basis for data collection in Phase 2. However, a few changes were made to the data collection forms and methodology compared to the Phase 1 forms and recommendations (as provided in Appendix B and G of the Phase 1 Report). The key changes included:

- The count/survey form was modified to:
  - Add "hired car (taxi/Uber)" and "carshare (rental)" categories under auto travel mode instead of a single "shared vehicle" column; and
  - Add columns for "recreational trip" (trips with the same origin and destination, such as exercise, dog walking, or smoke breaks), "delivery," and "asked/declined to answer."
- New forms were created to streamline data collection at entrances other than street-level doors and at nonresidential buildings:
  - A garage-specific survey form was added with columns for number of vehicles by number of occupants, along with number of people in carshare, delivery, and service vehicles and on bicycles.
  - A hotel-specific survey form was added with columns for counts of valet, hired car, and hotel shuttle operations by number of passengers. This form could also be used for high-demand restaurants and other locations with valet operations where intercept surveys are not possible.
- Context data collected in Phase 1, including bus shelter quality, bicycle rack availability and utilization, and parking utilization on-street, were ultimately not used in the analysis and were not collected in Phase 2.

3.0 Phase 2 Data Collection

3.1 Site Selection

The primary building type of interest in Phase 2 was larger residential buildings with a retail component. "Retail" is broadly defined in this study to include recreation and entertainment uses such as restaurants, fitness centers, banks, etc.

Three office and three hotel sites were also counted as a starting point for acquiring comparable sites for development review purposes. The number of observations at office and hotel sites is not sufficient to develop reliable trip generation estimates, but the lessons learned from counting these sites provide a starting point for future data collection efforts.

3.1.1 Criteria

The site selection criteria included:

- **Retail Use Criteria –** A mix of different retail types was desired, including both neighborhood-serving retail and destination retail. Neighborhood retail is a business that relies on convenience of location for its customers (such as a convenience store, dry cleaners, or fast-food restaurant), whereas destination retail refers to a particular store that attracts people regardless of its location (including generators with traditionally high ITE rates such as full-service groceries and urban-style big-box stores as well as unique or region-serving retailers such as specialty foods or department stores). The listing of neighborhood-serving and destination retailers was vetted by DDOT during the subsequent selection process.
- **Geographic Criteria –** Properties in a diversity of locations throughout the District were desired. However, most properties meeting size and mixed-use criteria were located in areas with a rich abundance of transportation options including significant bus connections to the central business district (CBD), a grid street layout, bicycle facilities, and often a proximate Metrorail station.
- **Size Criteria –** A target of 75 units or greater was set. The buildings surveyed ranged in size from 40 to 536 units, with an average size of 218 units. The results are generalizable only to these types of buildings and not to all residential development. Specifically, results are not generalizable to row homes or smaller multi-family buildings.

- **Occupancy Criteria –** Buildings were ideally at or near full occupancy. However, a few new properties were included that were not fully leased. For such properties the occupancy rate was determined and considered in the analysis.
- **Separate Parking Facilities –** It was originally desired to find sites where retail and residential parking were separated so that vehicle-trips could be associated with specific uses. However, it was not possible to find enough sites meeting this criterion so a number of sites with shared parking were included.
- Other criteria suggested in the Phase 1 report include a mix of parking alternatives, diversity of ages, and supportive owners or local entity (e.g. a business improvement district).

3.1.2 Selection Process

Candidate sites to be screened based on the above criteria were taken where possible from existing research studies such as the Park Right DC study database. The previous candidate pool from the Phase 1 study, which included sites identified from the Washington, D.C. Economic Partnership development inventory, was also prioritized in the screening process. Various development tracking and development review databases from the D.C. Office of Planning (OP) were also used to identify candidate sites; however, the number of additional sites that met the screening criteria from this pool was limited. Many of the older sites in the OP databases had already been identified in the previous groups, and although the newer sites had received approval many had not been completed or fully leased.

The resulting pool of sites was further augmented using local knowledge of existing mixed-use developments on the part of DDOT staff and the local consultant team. Site visits to major commercial corridors and transit-oriented development nodes were also used to identify additional sites.

The consultant team conducted an initial screening of candidate sites based on the criteria described in the previous section. In all, 68 out of the approximately 185 candidate sites passed this initial screening process, not including 20 nonretail sites that were also screened. A meeting was then held with DDOT and consultant staff to prioritize to the sites based on factors such as:

- Location, to prioritize sites in neighborhoods that are expected to see significant development in the coming years;

- Vehicle access, to prioritize sites where the auto garage was configured in such a way to permit separate counts of retail and residential vehicles and where public parking for nonbuilding retail uses is discouraged;
- Retail tenant mix, to prioritize newer sites with a similar tenant mix to the types of projects that are being submitted today; and
- Retail tenant size, to prioritize sites with substantial amounts of active ground-floor retail and exclude sites with significant vacancies or that only have a small amount of retail space, such as a few sites that only included small, low-intensity tenants like dry cleaners or package stores.

The resulting site list was mapped following this secondary screening process. The 28 neighborhood-serving sites that remained were mapped to ensure that they provided reasonable coverage of District neighborhoods with remaining development potential, and the coverage was determined to be satisfactory. However, only 10 destination sites remained following the secondary screening process, which was short of the initial goal that roughly 30 to 40 percent of the sites include destination retail. This shortcoming stemmed primarily from a discrepancy between expectations and reality, since the study team had expected there to be numerous mixed-use sites with destination retail components; but, when these sites were tabulated, only 12 were found that met the initial screening criteria. As a result, the remaining destination retail sites were given the highest priority in the data collection process in order to ensure that they were captured for use in the study.

3.1.3 Summary of Sites

Since the Phase 1 and 2 sites were combined for the data analysis in this report, summary statistics are presented on all of the sites combined as shown in Tables 3.1 (total site counts) and 3.2 (characteristics). The final list of all Phase 1 and 2 sites is provided in Appendix B and their locations are shown in Figure 3.1.

Table 3.1 | Total Sites by Land Use Type

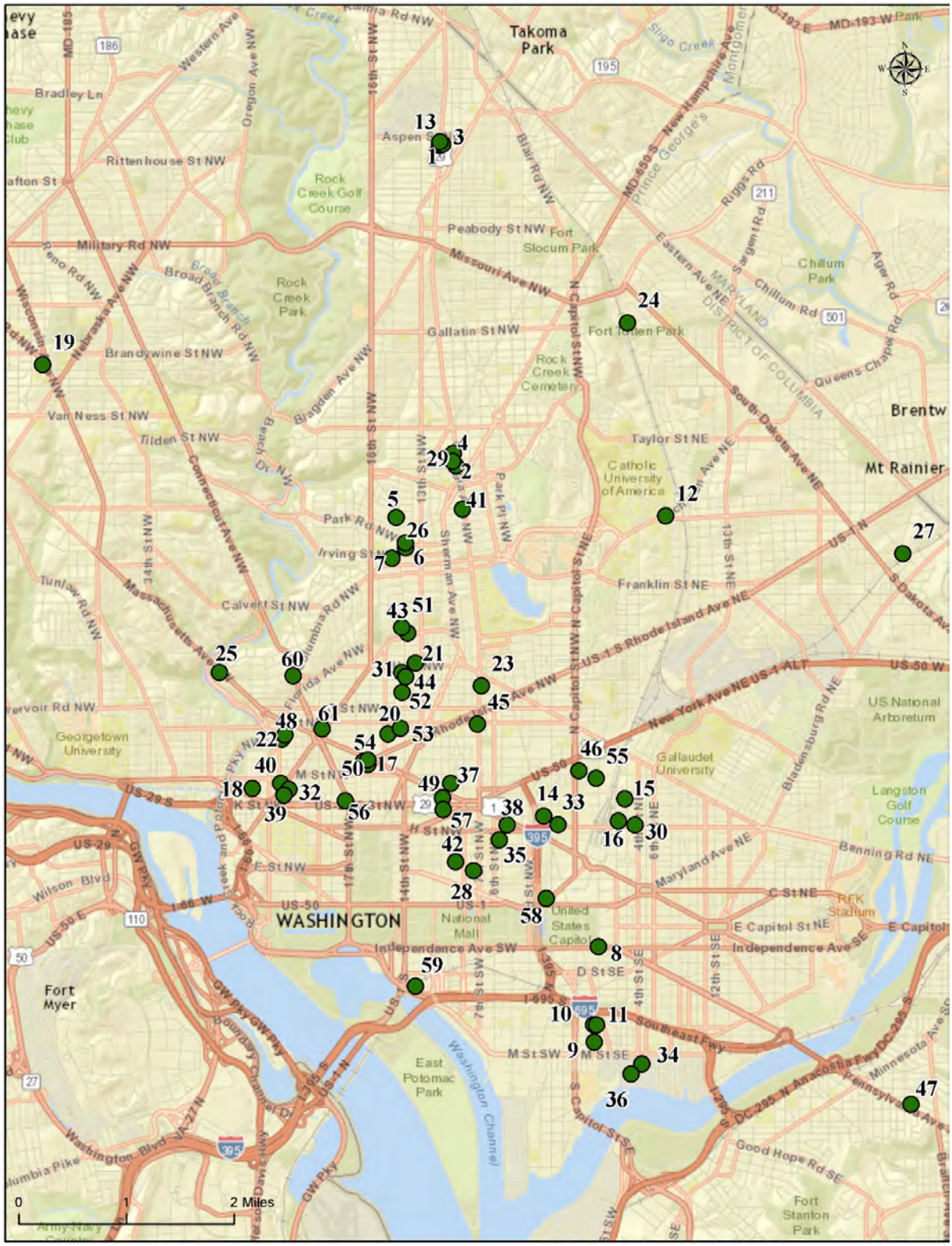
Land Use Type	Phase 1	Phase 2	Total	Neighborhood Retail	Destination Retail
Residential Plus Retail	9	39	48	39	9
Residential Only	7	–	7	–	–
Office Plus Retail	–	3	3	3	–
Hotel (Plus Retail)	–	3	3	1	–

Table 3.2 | Site Characteristics – Residential and Residential Plus Retail

Attribute	Average	Median	Minimum	Maximum
Dwelling Units	218	218	40	536
On-Site Parking Spaces	203	174	0	783
Retail Square Feet[a]	20,707	9,692	1,100	110,405
Residential Occupancy	93.8%	94.4%	78.9%	100.0%

[a] Residential plus retail sites only.

Figure 3-1 | Location of Surveyed Sites



3.2 Data Collection

The data collection effort consisted of on-site counts and surveys to determine person-trips, vehicle-trips, and mode shares by building entrance, as well as collection of data about the site itself.

The counting/surveying hours were 7:00-10:00 a.m. and 4:00-7:00 p.m., with data recorded in 15-minute increments. The counters were provided with hard-copy data collection forms (as shown in Appendix A). Phase 2 data were collected between April 1 and June 19, 2015. It was viewed as essential to complete data collection while District schools were still in session, as travel patterns change markedly when school is not in session.

3.2.1 Counts and Surveys

Site Reconnaissance and Outreach

The research team visited each site prior to the survey day to determine points of entry and where to deploy surveyors. Surveyors were deployed to count and survey persons going in and out of each building entrance, including doors to garages on-site. At high-traffic locations, separate counters and surveyors were deployed to cover the same entrance.

Most counts took place on public property, so explicit permission of property managers was usually not needed for this study. However, the Phase 1 report recommended both general outreach (e.g., to property management associations) and specific outreach to individual building managers to inform them of the study and to reduce resistance and concern about the data collection effort. (Appendices D and E of the Phase 1 report include a sample brochure and email to property managers.)

In Phase 2, property managers usually were not contacted because the data collection effort was under a very tight timeframe. Previous large-scale field data collection efforts undertaken by the consultant team in the District, such as the Park Right DC study, had encountered significant delays in receiving approval from management corporations and property managers, on the order of several months. Some managers contacted in that effort had declined to participate altogether. In order to avoid these issues, the data collection effort was configured such that all data collection would occur in public space, such as on sidewalks and in public alleys. DDOT manages all public space in the District and provided authorization to the consultant team to perform data collection within public space in the form of a signed letter, a copy of which was given to each counter, indicating that count staff are “authorized to use this space regardless of building owner preferences.”

In general, this approach was sufficient. The counters reported the vast majority of retail managers and property managers were satisfied when told about the purpose of the study and shown the DDOT authorization letter. Counters were instructed to comply with reasonable requests from the managers, and in a few instances were asked to move further away from the door in question. The counters would generally comply with this request despite the fact that it would limit the number of people the counters were able to survey, since collecting an accurate count was the top priority of the effort and the team did not want to antagonize the managers. Despite this attempt to accommodate manager requests, there were two sites where managers threatened to call the police on counters at one or more doors, apparently in response to resident complaints about the surveys. In these situations, attempts were made to provide the managers with additional verification of DDOT's approval and the counters' rights to be in public space, but in the short term the counters were instructed to move across the street and switch to counts only in order to ensure the continuity of data collection until an arrangement could be worked out with the managers.

In future efforts, outreach is recommended as a courtesy to property management, to build goodwill in the development community for these types of research efforts, and as an opportunity to collect other site-specific information such as occupancy, parking, and any special events that may be taking place on the day of the count. Additional time should be built into the project schedule to accomplish this task. However, property management will not always be responsive or supportive of the effort, and it should be noted that only counting sites that receive manager approval would likely significantly reduce the number of eligible sites, which would in turn present significant difficulties for future studies in the District since nearly all candidate sites have already been counted.

A trained field supervisor was present during each of the counts of the Phase 2 study. Having a field supervisor proved to be very valuable as they fulfilled several roles during the counts, including ensuring data quality by monitoring the other counters, answering any questions that arose in near-real time, and being on hand to supplement the count staff at unusually busy doors and to cover for lapses in the count contractors stemming from late arrivals, bathroom breaks, and the like.

Person Counts and Surveys

Surveyors intercepted subjects to learn and record the most immediate or recent mode before walking up to the interviewer (besides the act of walking from a parking space, bus stop, etc., to the front door). Surveyors generally asked some variation of the question, "How did you get here today?" or "How are you getting to your next destination?" If the respondent drove, a follow up question probing where

they parked was also asked. Based on lessons learned in Phase 1, the respondent was asked only about their immediate mode (how arrived for inbound, or how departing for outbound) rather than about both arrival and departure mode.

An attempt was made to survey everyone in most locations, but this was not possible at locations with heavy traffic. Generally, one person was stationed at each entrance, and in some cases multiple adjacent entrances could be covered by one person. However, at doors where high levels of traffic was expected, particularly at the destination retail sites and especially at the grocery stores, two staffers were deployed, one to conduct full-time counts in order to ensure that all trips are recorded and one to perform as many intercept surveys as possible. Across all sites, a survey response was recorded for about 62 percent of people observed using doorways in the Phase 2 data collection. The response rates for inbound and outbound people were similar. Techniques such as having a supervisor assist at high-traffic locations can help to maximize survey capture rates, and future efforts should consider deploying one surveyor for inbound traffic and one for outbound traffic to further improve the capture rate.

Garage Counts

For the garage counts, the number of vehicles going in and out of each entrance to on-site parking was recorded, according to the number of occupants of the vehicle. Observed occupancy was also recorded for specific types of vehicles, including carshare, delivery, and service vehicles. Any bicyclists entering or exiting a garage were also recorded.

While preference was given in the site selection process to garages with separate retail and residential garage entrances, when retail parking was provided, this requirement had to be relaxed in order to fill out the full complement of sites. In a few situations, counters were stationed in publicly accessible sections of private garages to conduct unobtrusive garage counts, which like all garage counts did not include intercept surveys, in order to differentiate between retail and residential vehicle-trips where the buildings did not feature separate entrances for the different user groups. However, a substantial percentage of sites featured mixed parking or had the split between retail and residential parking in an inaccessible location within private space and were therefore recorded as mixed parking sites. Still other sites permitted paid public parking and as a result not all vehicle-trips were directly attributable to on-site land uses. These locations were flagged as such on the data collection forms.

Some modifications were made to the Phase 1 survey forms, as described in Section 2.0. For instance, different forms were used for door counts and surveys versus garage counts in order to reduce the amount of time required to record each trip by accounting for the different types of trips expected in

each location. Different forms were also used for single-use and multiuse sites. A supplementary form specific to valet operations was also used at the supplementary hotel sites, and this effort recommends that a separate loading dock form be created for use in future studies. These and other future modifications are recommended in Section 3.6 considering Phase 2 experience.

3.2.2 Site Data

In Phase 2, enough information was collected during the site screening process to verify the site met the selection criteria (e.g., size, occupancy, neighborhood versus destination retail tenants). Due to the compressed timeframe of data collection, other details were collected after trip generation data collection was complete.

Data sources for Phase 1 properties are documented in the Phase 1 report. For the Phase 2 properties, data were obtained from the following data sources:

- Web sites, including project web sites, property developers' web sites, commercial retail and residential property databases, Washington, D.C. Economic Partnership and D.C. Office of Planning development records, D.C. Office of Zoning case records, and news articles;
- Follow up contact with management offices where necessary, e.g., to verify number of units or occupancy;
- Parking information from the Park Right DC tool database for 14 sites included in both studies; and
- For retail uses, the above sources were used to pull tenant square footages where possible. In three cases where these methods failed, square footages were determined using measurement of building footprints on Google Earth, supplemented by professional judgment to allocate total square footage among uses.

The primary purpose of collecting occupancy data was to verify that the building was at or near full occupancy (over 90 percent). Nearly all buildings met this criteria except for a few that were opened very recently and had not fully leased out.

The type of residential building (apartment or renter-occupied), and condominium or owner-occupied) was also recorded.

Collecting a full set of site-level data (such as parking or other site variables in addition to DU and square feet) was not originally envisioned as part of the study effort. Therefore, these data were collected only

where they could be obtained from readily available sources. Collecting these data should be more explicitly planned for in future data collection efforts.

3.3 Data Entry and Database Development

3.3.1 Count/Survey Data

The firms that collected the data provided basic digitization. This included entering data from the forms into Excel templates and transcribing field notes and flagging any relevant notes for follow up by the analysis team. The hard-copy forms were kept on file throughout the analysis process in order to provide clarification on ambiguous count issues as needed through the hand-written count notes and to double-check the digitization at locations where count data seemed inconsistent. Rudimentary data verification, such as ensuring that the total number of surveys was consistent with the raw counts, was performed during the digitization process; however, significant validation of the data was not performed during this phase because a trained field supervisor was present during each of the counts of the Phase 2 study.

The data analysis was not performed by the same firms responsible for data collection. The format in which the data were provided to the team members responsible for analysis was not consistent across contractors and phases of the study. In particular, the Phase 1 data were prepared in a single Excel workbook with one worksheet per site. The Phase 2 data by one contractor were prepared in multiple Excel workbooks, one for each site, containing a sheet for each door or garage entrance. The Phase 2 data by the other contractor were digitized directly into to a single "flat file" (one record per door, time period, and in/out) compatible with a relational database format.

The project team ultimately determined that the flat file format was preferable for analysis and archival purposes, and converted the other data formats into the same flat file. The flat file data can easily be summarized using the pivot table functions in Excel, or imported into a relational database for linking with site-level data. Development of a standard data entry template that is provided to any data collection contractor, along with any templates or scripts necessary to read the data into a flat file, is recommended to expedite future data analysis efforts.

The flat file database of surveys and counts includes the following information:

- A site identifier that can be linked to a file containing site characteristics. In this study, a sequential number was assigned (1…n) according to the date of the first count at the site;

- A retail use identifier that can be linked to a file containing characteristics of the retail use (square footage, tenant, type) accessed by the door or garage entrance that was counted. Note that one entrance may serve multiple uses;
- The type of use served by that doorway or garage entrance (e.g., residential, retail, office, hotel, mixed – serving multiple use types);
- The time period in which the count/survey was conducted (one-hour and 15-minute interval);
- Whether the counts or surveys were of inbound or outbound traffic;
- Total persons counted using the doorway;
- Number of persons responding to the survey by mode of access/egress;
- Total vehicles using garage entrance, by occupancy; and
- Number of "special" vehicles using garage entrance by type (e.g., delivery, service, carshare).

To support QA/QC and analysis efforts, calculated fields were also added to the database. These included:

- Total number of people responding to survey by five high-level modes: vehicle driver, vehicle occupant, walk, bike, and transit;
- Total number of persons counted not in vehicles;
- Total number of persons observed in vehicles by driver and occupant; and
- Total number of vehicles observed.

A complete set of metadata for the raw data flat file is provided in Appendix C.

3.3.2 Site Data

In parallel with the raw count/survey data, two site-level data files were developed:

1. A site summary file containing overall characteristics for each site, such as location, dwelling units, retail square footage, parking, and occupancy; and
2. A retail summary file containing square footage and tenant information on each retail tenant or set of tenants.

To allow flexibility to incorporate uses other than residential/retail, the site summary file notes "primary" and "secondary" uses and associated trip generation information.

In the retail summary file, multiple tenants accessed by shared doorways are considered as one record. This is because there is no way to distinguish the trips generated by one retailer versus another and

therefore no reason to separate the square footage of each retailer accessed by a common doorway. ITE land use codes were assigned to the retail uses. The ITE code 820 (shopping center) was used for multitenant records unless they were all the same code.

There may be more than one set of counts/surveys in the raw data file associated with the same use. A garage entrance/exit will serve either the residential use, all the retail uses on the site, or the entire site.

Vacant retail sites were recorded to help track the allocation of retail square footage where a total square footage estimate was available for the site. However, vacant retail square footage was not included in the trip generation analysis.

In some cases different data sources provided different values and the best source had to be determined. For example:

- The initial screening might have identified a different number of dwelling units or retail square footage than the later, more detailed data collection. In this case the best available information from the detailed data collection was used.
- Parking estimates from a web source might have been different than in the Park Right DC tool database. In this case the Park Right database was used since this included a careful, site-specific data collection effort focused on parking supply and use.
- In a few cases, details on Phase 1 sites differed between the spreadsheet obtained from the contractor and the final report. The spreadsheet was assumed to be more accurate.

In most cases, differences were small. Differences of less than 5 percent were assumed to have negligible impact on the study results and were not investigated extensively although the source believed to be most accurate was used. Large differences were investigated to ensure that the most accurate data were being used.

Older buildings may be assumed to be fully leased if they are in a strong market. However, it is best to confirm this with the property manager in case there is an unusual condition such as a renovation. For the purposes of this analysis, anything higher than 90 percent occupancy was assumed to be “fully” leased as there is normally a small amount of vacancy in rental properties. The average rental

occupancy rate in the district at the time of the study was reported to be around 95 to 96 percent;[3] the average for sites in the Park Right DC study was 94 percent.

Obtaining detail on number of parking spaces assigned by use may require the cooperation of the property manager, which cannot always be obtained. Building permit information may also obtain parking details, but it is best to verify this information with a field survey where possible.

3.4 Additional Data Preparation

After the three basic databases of site data, retail data, and count/survey data were developed, additional work was undertaken in preparation for data processing. This work included:

- Determination of the highest volume AM and PM hours and associated trip rates and modal shares; and
- Appending additional environmental or contextual variables to the site-level data.

3.4.1 Peak-Hour Data

While three hours of data were collected in both the morning and evening peak periods, it is conventional in trip generation studies to focus on only the peak hour (defined as the highest-volume four consecutive 15-minute periods) in each period. The peak hour will vary by site. It may also vary by mode for the same site, although variations in peak hour by mode were not considered in this initial analysis. Directionality is not considered – ins and outs are added together.

In the Phase 1 analysis, mode shares were computed based on all surveys over the three-hour period and then applied to peak-hour counts to estimate person-trips by mode. In Phase 2, it was determined to use the mode share for the site peak hour as defined by person-trips, since the mode share may vary over the three-hour period. The specific procedure used to estimate peak-hour person-trips by mode was therefore as follows:

- Determine the site person-trip peak hour (the highest four consecutive 15-minute periods) based on doorway and garage person counts;

[3] The American Community Survey reported a 5.1 percent apartment vacancy rate in 2013. A Delta Associates report showed a rate of just over 5 percent in 2014 and just under 4 percent in 2015. See: Delta Associates, State of the Mid-Atlantic Class A Apartment Market: Second Quarter 2015, http://www.deltaassociates.com/reports-and-publications.

- For doorway counts, compute estimated person-trips by mode by applying the mode share from the site peak hour for that door to the total counted persons during that period at that door (noting assumed single-passenger-occupancy for shared vehicles like carshare and taxi); and
- Add the auto-drive, auto-passenger, and bicycle estimates from the door counts/surveys to the observed auto driver, auto passenger, and bicycle trips using the garage (for sites with on-site parking) or valet (hotel sites).

In this analysis, the driver of a hired vehicle was counted as two person-trips (one inbound and one outbound). Future analysis could also look at different peak hours by mode, or trip generation during the peak hour of street or transit system traffic in the District.

3.4.2 Other Environmental or Contextual Variables

Environmental or contextual variables describe the characteristics of the urban environment where the site is located, as opposed to the site itself. This may include proximate characteristics (e.g., bicycle infrastructure, transit access) as well as geographically broader characteristics such as access to jobs. The goal of the analysis is to relate person- and vehicle- trip-generation rates and mode shares not only to site characteristics but also to important environmental variables that may influence trip generation.

The selected approach in Phase 2 was to use the multimodal accessibility (MMA) measures concept from National Cooperative Highway Research Program (NCHRP) Report 770 to represent environmental factors. The MMA measures accessibility from a specific point considering roadway networks and drive times, transit networks and travel times, and pedestrian networks. Accessibility is computed separately to jobs and to retail establishments. A “decay function” is used to discount opportunities that are farther away.

Two other approaches were considered for including environmental variables:

1. The Metropolitan Washington Council of Governments (MWCOG) travel demand model data, which includes traffic analysis zone (TAZ) level “D” variables representing density, diversity, and design; and
2. The U.S. Environmental Protection Agency (EPA) Smart Location Database, which includes variables related to density, diversity, design, and other factors for every Census block group in the country.

The NCHRP 770 MMA approach was selected because it uses the most disaggregate measures of land use and multimodal accessibility, allowing the use of site-specific measures rather than area-level measures (TAZ or Census geography), and incorporating accessibility by various modes as a key predictor of trip generation. The MMA platform development effort consists of using InfoUSA, NAVTEQ (HERE), and general transit feed specification (GTFS) databases in conjunction with the MWCOG model to establish MMA scores for each relevant submode and for both employment and retail accessibility. InfoUSA estimates of jobs were normalized to match 2010 MWCOG TAZ jobs totals. MMA scores were computed for each census block containing a survey site and appended to the site-level database.

Six MMA scores were computed for each property: two types of accessibility (job access and retail access) for three modes (auto, transit, and walk). **Job accessibility** is defined as the number of jobs available as decayed by friction factors derived from the MWCOG Household Travel Survey for each mode. **Retail accessibility** is defined as the number of retail establishments available from InfoUSA data on Standard Industrial Classification (SIC) codes related to non-work travel (primarily SIC codes for retail trade and non-commercial banking in 52-61, but with selected services and institutions from the services categories such as entertainment and doctors' offices) as decayed by friction factors derived from the MWCOG Household Travel Survey for each mode.

The development of separate scores reflecting employment and retail activity in the MMA platform reflects the fact that auto or transit accessibility to jobs is expected to be a more sensitive predictor of work trip mode choice, while walk accessibility to retail is expected to be a stronger predictor of home-based nonwork mode choices. While this study did not develop trip generation models by trip purpose due to lack of data on trip purposes, both the employment and retail scores were tested as these may both influence overall trip rates.

In addition to MMA scores, the following other environmental variables were tested:

- Auto ownership for the census block group (proportion of households with zero or one car); and
- Population density of the census block group.

A variety of other environmental variables could be considered for future analysis. For example:

- The Phase 1 study collected data on presence of bus shelter quality, bike rack availability and utilization, and on-street parking utilization, within a quarter-mile radius of each site.
- The Park Right DC study evaluated variables, including population and job densities, transit level of service, and proximity to bike share station. Block size (a proxy for street connectivity) was

included in the final model as the most significant environmental variable, and meaningful interactions were also found between some on-site variables and transit service availability indicators. (However, parking supply – measured in spaces per unit – was by far the most significant of all the on-site and environmental variables in predicting parking demand.)

3.5 Final Database

The data collection development effort included assembly of Phase 1 and 2 data into the same database. The final database contains three related files:

1. **Raw Data (Count/Survey) File –** A file with the complete, disaggregate count and survey data, including "in" and "out" counts and mode survey results for each doorway or garage entrance and each 15-minute time interval;
2. **Site Summary File –** A file with one record per site, including site characteristics (e.g., location dwelling units, retail square footage, vehicular parking information), summary trip generation data, and key environmental variables; and
3. **Retail Summary File –** A file with details of retail uses by site, including one record per retail use listing the estimated size and type of the use.

The data were kept in Excel files but the final databases were set up with unique and consistent record identifiers so that they can be linked in a relational database format such as Access. Metadata for the final data files is provided in Appendix C.

A "garage classification" file was also developed to assist in associating uses with garage entrances. This file notes the tenants and use type(s) associated with each garage entrance.

3.6 Summary of Experiences and Lessons Learned

In general, the Phase 1 methodology worked well, but a few modifications to data collection forms were made to account for "other" modes such as hired, carshare, delivery, and service vehicles. The following additional modifications are recommended after reviewing Phase 2 experience:

- For the garage data collection, counters should be instructed to record carshare, delivery, and service vehicles in the vehicles by occupancy columns, with the carshare, delivery, and service

columns modified to show the number of vehicles of each type, not the number of occupants.[4] (A carshare vehicle, for example, would be counted in two columns, so the "special" vehicle columns would not be added to the other columns when determining total vehicle-trips.)

- Land uses with valet parking operations, such as hotels, have the potential to bring count staff into conflict with site managers or valet operators if their guests are asked to complete intercept surveys. For this reason, the Phase 2 effort created valet-specific forms for use at the supplementary hotel sites so that trips at the valet stands could be recorded from a distance without the need for surveys. Results taken from these forms were understood to be assumed data like the garage counts, not surveyed data as was collected using the door forms, during the subsequent analyses. The Phase 2 team would recommend that a similar approach be taken at loading docks, with a unique data entry form created for use at these locations in future studies, owing to the fact that most loading docks are shared between multiple uses and have the potential to feature both vehicle and nonvehicle-trips in a location where intercept surveys are not always feasible.

The level of effort for data collection is important to consider in planning future data collection efforts. The Phase 1 report suggested a "loaded" cost estimate of approximately $800 per door, including a site visit, data collection, site coordination, and basic digitization of written data. The Phase 2 sites required an average of approximately 7 counters per site (in each time period – AM and PM) for the 33 sites counted by one team, and 9 counters per site for the 12 sites counted by the other data collection team, which was assigned the largest sites. A review of Phase 2 costs suggests a "loaded" cost of about $900 per counter per site (including both AM and PM), slightly higher than suggested by the Phase 1 estimate. The Phase 2 costs included contractor involvement in team study coordination meetings, site screening, and collection of basic site data, including number of dwelling units, parking spaces, and vehicle occupancy where these items could be readily obtained. However, it did not include gaining property manager approval or collecting additional site data. In the future, the use of tablet computers should be investigated to reduce data collection costs and expedite compiling data in the preferred format.

[4] This approach assumes that we are more concerned with recording total vehicle and person-trips than with determining the occupancy of these special types of vehicles. Analysis can then assume that the average occupancy of these vehicles is the same as for other vehicles.

Future data collection efforts should give early consideration to collecting site-specific data. Some data items are absolutely essential while others are strongly recommended and still others may depend upon study objectives and budget. The key site-level data items include:

- **Number of Dwelling Units** (essential). This should be obtainable from published sources, building management, or building permits.
- **Residential Type – apartment or condominium.** The ITE Trip Generation Manual provides different trip generation rates for apartments versus condominiums, so knowing the type of use may be important in comparing rates.
- **Residential Occupancy** (essential for new buildings). New buildings may not be fully leased so occupancy must be determined from the property manager. For buildings at least two years old, it is still best to confirm that they are fully leased.
- **Retail Square Footage** (essential). When a source of square footage by use information cannot be located, estimates may be required, e.g., using measurements of the building footprint, or a site visit to verify the approximate breakout by use.
- **Retail Uses** (essential). The specific tenants should be recorded so that ITE land use codes, or other retail type descriptors, can be assigned later. Any vacant retail spaces should be noted and should not be included in the retail square footage for the site.
- **Parking.** The basic ITE trip generation equations do not include on-site parking as a predictor. However, the amount of parking, its pricing, and its configuration (e.g., shared versus exclusive use), may be important factors affecting vehicle-trip generation. The amount of parking and assignment to building uses may sometimes be obtainable from public sources, but in other cases may need to be obtained from building management and/or verified through field surveys (which require the permission of building management for private parking areas). In the future, it is suggested that parking information with a detailed breakdown between uses be collected at all sites where feasible. Additionally, details on access to the garages, and the number of doors in/out, should be included. The Park Right DC study provides additional lessons on collecting parking data.
- **Other Site Characteristics.** A host of other site characteristics, such as the size of the building's units, off-site parking availability, parking cost, and rents, may relate to both vehicle and person-trip generation. The Park Right DC study included extensive site-level data collection to include in analysis to develop a model to predict parking demand. The site-level characteristics ultimately included in the tool were bedrooms per unit, average rent, whether parking was

bundled, fraction affordable units, parking price, parking supply per unit, and average unit size, and whether transit information was provided on-site. If it desired to collect additional site-level data in future trip generation studies, the time and effort required should be considered in the budgeting, scoping, and schedule development for the data collection process. Also it should be recognized that data items requiring the cooperation of the property manager will limit the number of sites that can be considered.

Development of a standard data entry template that is provided to any data collection contractor, along with any templates or scripts necessary to read the data into a flat file, is recommended to expedite future data analysis efforts.

Consideration should also be given in the study development to collection of appropriate environmental variables. These may include variables determined from previous analysis to have a significant impact on trip generation, or new variables that the project sponsor wishes to test.

4.0 Data Analysis and Findings

4.1 Objectives

The primary objective of the analysis was to develop modal trip generation rates for residential mixed-use (with retail) buildings that could be applied in the District's Comprehensive Transportation Review (CTR) process. A secondary objective was to identify both potential site design and environmental variables that would help explain variances among sites and identify potential areas for future study.

The following relationships were developed:

- AM and PM peak-hour person-trip generation rates (total and by mode – auto drive and passenger, walk, bike, transit);
- AM and PM peak-hour vehicle-trip generation rates; and
- Peak-hour mode shares (percent of person-trips arriving or departing by vehicle driver, vehicle passenger, walk, bike, or transit).

These dependent variables were predicted as a function of the number of dwelling units, retail square footage, and site or neighborhood environmental variables.

4.2 Process

An iterative analysis process was taken to test relationships, explore candidate independent variables, and share and discuss results with the project team. The following section presents the findings as organized by most significant to least significant findings, using final variables and values.

This process included the following elements:

- Scatterplots to show relationships between key variables such as observed trips or trip rates as compared to independent variables (e.g. dwelling units), observed and forecasted trip generation by site, and relationships between potential independent variables such as MMA scores;
- Simple regressions to predict dependent variables (trips and mode shares) as a function of dwelling units and retail square footage;
- Exploration of different ways of treating retail (e.g., separating neighborhood and destination retail, or separating lower and higher trip generating uses);

- Exploration of additional site-level environmental variables, including MMA scores, parking, auto ownership and proximity to residential population;
- Selection of best-fit models, using t-statistics and R-square values, to include no-collinear variables making a significant explanatory contribution in expected directions; and
- Comparison of predicted trip generation rates using these models with rates predicted using ITE relationships.

4.2.1 Stage 1 – Basic Trip Generation with MMA

In this first stage, the most straightforward regression models and consideration of logical groupings of sites into "bins" were applied to correlate the observed person-trip and vehicle-trip-generation totals against the following independent variables:

- **Number of dwelling units –** Under the hypothesis that the presence of neighborhood-serving retail could be considered a defining element of the land use without being considered independently, much as the size or rent/purchase value of the units are not considered independently. The regression was conducted on all 55 sites with residential use including residential-only sites, and a dummy variable was tested to represent presence of retail. This approach was found to have poor relationships to person-trip generation and initial estimates of vehicle-trip generation.
- **Number of dwelling units and gross square feet (GSF) retail –** Under the hypothesis that the amount of retail may be a significant variable. This approach was found to provide good relationships to person-trip generation and initial estimates of vehicle-trip generation. These relationships were maintained as the study progressed through quality control and site screening processes, and are ultimately recommended for consideration in the CTR process, as described in Section 4.3.1.
- **Number of dwelling units and GSF retail by type –** To consider neighborhood and destination retail divisions as previously defined, and to consider higher-rate versus lower-rate categories. This approach was found to have a number of technical challenges, primarily relating to the number of discrete land use categories and variability in retail space types. A positive relationship was found by disaggregating sites between those with at least one high-trip-generation use and those without, as described in Section 4.3.2.

4.2.2 Stage 2 – Augmented Variable Adjustments

Stage 2 repeated the regression model elements of Stage 1, but with either modified or otherwise refined variable adjustments to reflect the findings of Stage 1. These modifications included consideration of the following elements:

- **Removal of Sites Without Retail –** A total of nine sites were removed from the residential category as they either had no retail space (seven sites) or their secondary use was office as opposed to retail (two sites).
- **Parking Availability –** The number of on-site parking spaces was examined as a potential independent variable but not found to have a high explanatory value for either total number of person-trips, total number of vehicle-trips, or vehicular mode share. This approach and its concerns are described in Section 4.3.3.
- **Trip Purpose/Destination Disaggregation –** The separation of person-trip and vehicle-trip rates by observed entrance (segregating retail entrances from residential/garage entrances) may be a way to develop a reasonable estimate of retail-oriented trips as opposed to residential-oriented trips; the data suggests the amount and type of retail often disproportionately affects site trip rates. For example, for Phase 1 Site No. 6, the 21,000 GSF retail represents 9 percent of the square footage but 82 percent of the PM peak period person-trip generation.
- **Testing of Environmental Variables –** To consider local characteristics that would explain why two identical sites might have different trip generation results (e.g., if one were located in a highly urban environment and another were located in a less urban environment). Ultimately, while these variables occasionally resulted in positive R-square values, they were not found to have strong relationships, by virtue of low t-statistics and high p-values. This approach and its concerns are described in Section 4.3.4. The environmental variables considered included:
    - MMA job access auto, transit, and walk scores (three separate variables);
    - MMA retail access auto, transit, and walk scores (three separate variables);
    - Census block group auto ownership; and
    - Proximity to residential population.

In addition to total person- and vehicle-trips, ability to predict nonauto drive-alone mode share (NADMS) using the same independent variables was also tested. Under this approach, total person-trips and NADMS could be combined to estimate vehicle-trip generation.

Scatterplots were used to review the data and confirm expectations for simple relationships. Regression models were developed to start with all of the above independent variables and examine which are most relevant in defining potential AM and PM person-trip and vehicle-trip-generation totals (four outcomes).

4.2.3 Stage 3 – Refined Adjustments and Consideration of Binning

The third stage considered refinements to the adjustments and modifications made in Stage 2, with continued refinements to input data.

4.3 Results

The relationship between total estimated person-trips was found to have the strongest relationship to the number of dwelling units (DU) plus the retail square footage (expressed as thousands of retail square feet, or KGSF).

4.3.1 Basic DU and Retail KGSF

The relationship between residential DU and retail KGSF as two independent variables and person-trips as the dependent variable is the strongest relationship identified during the study. The relationship of DU and retail KGSF with each of the modal person-trip totals is not quite as strong, but remains valuable as a potential data source to support estimates of modal shares in the Comprehensive Transportation Review process.

Table 4.1 shows the R-square, dependent variable coefficients, and p-values for total person-trips and each of the five individual modes. Three of the columns show very strong relationships with p-values less than 0.05 for both independent variable in both the AM and PM peak hours:

1. Total person-trips;
2. Auto driver trips; and
3. Walk trips.

The remaining three relationships are less strong, with lower R-square values and at least one p-value greater than 0.05. The AM transit trip rate also has a counterintuitive result with a negative coefficient for retail KGSF, suggesting that total transit trips would be expected to decrease with larger retail footprints.

The relationships in the prior table also have potential utility in defining mode shares for the CTR assessment of individual modal impacts. In this type of regression analysis, the individual mode rates sum to the person-trip rate. The use of these rates is complicated by the weaker relationships. However, a relationship could be developed by assuming that the negative value for transit should be set to zero and proportionally reallocating the rates. An estimated set of modal shares based on the regressions on the surveyed site data is shown in Table 4.2.

While statistically significant relationships could not be determined from this dataset, modal shares might be expected to vary based on differences in locational characteristics such as proximity to transit. Further research and/or other data sources (such as the ACS or MWCOG Household Travel Survey) would be needed to evaluate such differences. Further analysis is also warranted of the survey data, for example, to explore reasons for the high estimated auto mode share for AM retail.

Table 4.1 | Trip Generation Rates for Surveyed Residential/Retail Sites by Mode[a]

Variable	Total Person-Trips	Auto Driver Trips	Auto Passenger Trips	Transit Trips	Walk Trips	Bike Trips
AM Residential Rate (per DU)	1.087	0.252	0.046	0.297	0.467	0.025
AM Retail Rate (per KGSF)	3.081	1.995	0.104	-0.147	1.066	0.063
AM R-Square	0.856	0.786	0.499	0.606	0.825	0.624
AM DU P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AM KGSF P	<0.001	<0.001	0.229	0.672	0.011	0.096
PM Residential Rate (per DU)	1.124	0.155	0.039	0.199	0.709	0.022
PM Retail Rate (per KGSF)	9.150	3.222	0.641	0.847	3.940	0.500
PM R-Square	0.886	0.860	0.621	0.595	0.808	0.652
PM DU P	<0.001	0.002	0.005	<0.001	<0.001	0.103
PM KGSF P	<0.001	<0.001	<0.001	0.025	<0.001	<0.001

[a]Preliminary findings; not recommended for use in CTR process.

Table 4.2 | Estimated Mode Shares by Use Type for Surveyed Sites[a]

Variable	Auto Driver	Auto Passenger	Transit	Walk	Bike
AM Residential	23%	4%	27%	43%	2%
AM Retail	62%	3%	0%	33%	2%
PM Residential	14%	4%	18%	63%	2%
PM Retail	35%	7%	9%	43%	5%

[a]Preliminary findings; not recommended for use in CTR process.

Therefore, for a hypothetical development of 100 DU and 10,000 GSF retail, the PM total person-trip-generation estimate would be estimated using the relationships in Table 4.1:

$$T = 1.124*100+9.150*10 = 204$$

The estimated mode shares would be built up by residential and retail types, with total person-trips estimated using relationships in Table 4.2. The results for this example are shown in Table 4.3.

Table 4.3 | Application of Assumed PM Person-Trips by Mode for Hypothetical Site

	Total Persons (from Table 4.1)	Persons by Mode (from Table 4.2)				
Variable		**Auto Driver**	**Auto Passenger**	**Transit**	**Walk**	**Bike**
PM Residential	112	15	4	20	71	2
PM Retail	92	32	6	9	40	5
PM Total	**204**	**47**	**10**	**29**	**111**	**7**

The classic "ITE Trip Generation" scatterplot is not readily produced since we have an equation with two independent variables. However, as a surrogate we can compare the total number of person-trips observed against the total number of person-trips predicted by the regression equations in Table 4.1. Figures 4.1 and 4.2 provide this comparison for the AM and PM peak hours, respectively, and provide visual confirmation that the equations produce a reasonable result.

Figure 4-1 | AM Observed and Forecast Person-Trip Comparison for DU and Retail KGSF

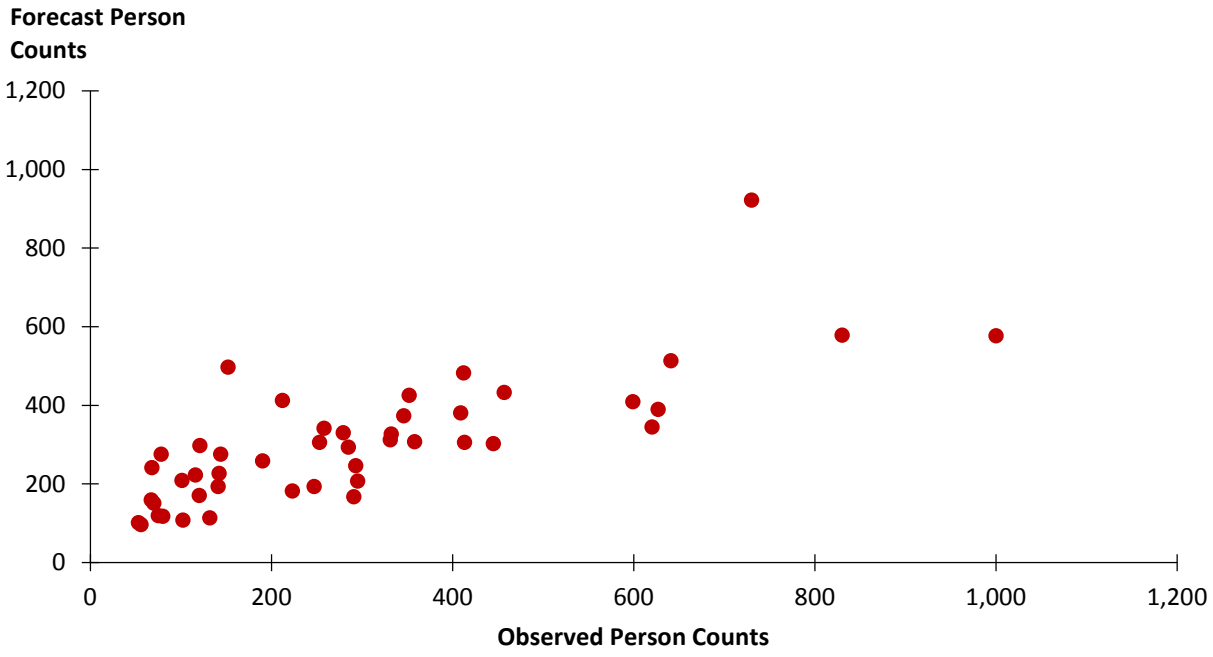
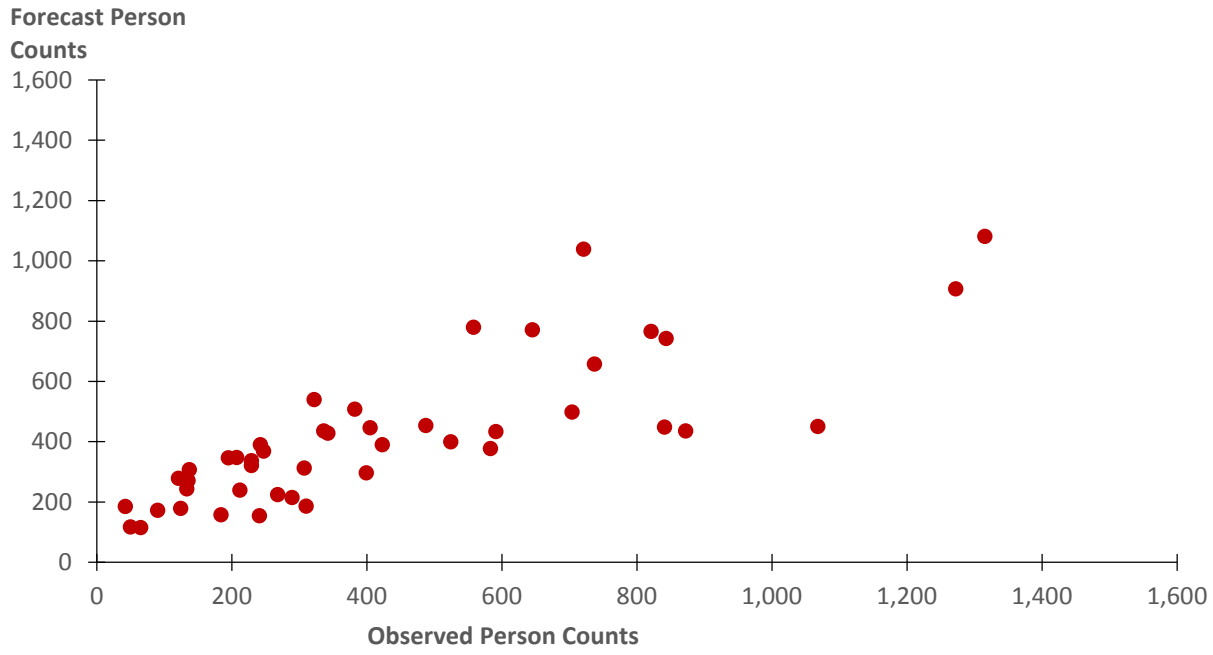


Figure 4-2 | PM Observed and Forecast Person-Trip Comparison for DU and Retail KGSF



4.3.2 Disaggregating Retail Types

Potential differences in trip generation among retail types were examined in three different ways:

1. Identifying individual retail type trip generation rates;
2. Creating two "bins" of neighborhood-serving retail and destination-serving retail; and
3. Creating two "bins" of high-generating and low-generating retail.

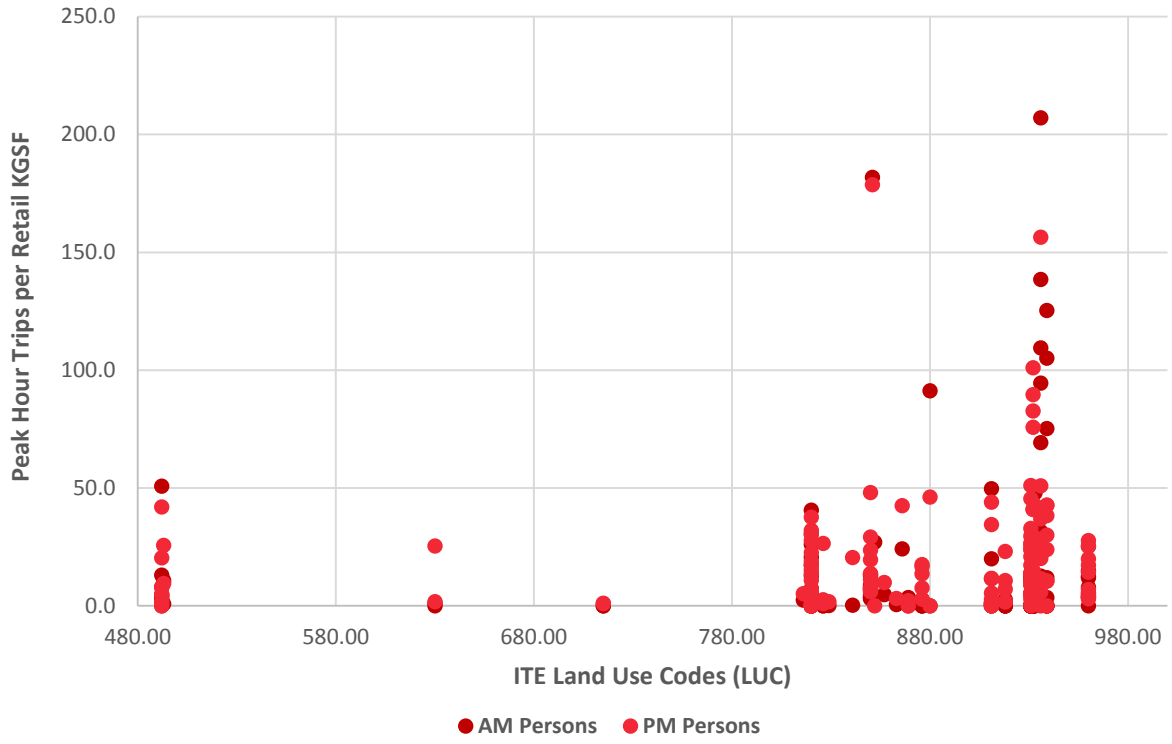
Individual Retail Trip Generation Rates

During the data collection process, each individual doorway that was surveyed was identified according to tenant, and estimates were made regarding the amount of retail space for each tenant. Appendix F describes and references assumptions and data sources for these estimates and Appendix B contains a listing of this information, including estimated trips by mode by retail doorway.

Ultimately, tracking individual retail trip generation sites did not prove to be a promising exercise, due to the variability both of the types of sites in the database and between sites of like types. For example, one brand of grocery store in this study showed trip generation rates of two to five times higher than other grocery stores.

Figure 4.3 demonstrates the range of observed person-trip rates by sites organized by their ITE land use codes. The purpose of this analysis is to demonstrate the high range of individual tenant trip generation rates even within a given land use code; for each column of dots, the observations typically span the range of rates from near zero to the high end, even after accounting for AM versus PM peak characteristics. Sometimes, individual tenants show a wide variety in performance. For example, one Trader Joe's store (site No. 31) had 721 PM peak-hour trip ends whereas a sister store (site No. 18) had only 345 PM peak-hour trip ends. Four Starbucks locations were included in the data collection; their AM peak-hour person-trip counts were 141, 154, 216, and 220. And out of 152 retail doorways, 18 were shared among different types of retail so were not attributable to any specific retail type.

Figure 4-3 | Range of Observed Person-Trips by ITE Land Use Code



The examination of retail trip rate types led to the concept of aggregating sites into bins based on typically "high-generating" or "low-generating" (based on ITE national rates for vehicle-trips) bins, as discussed in a later section of the report.

Neighborhood and Destination Sites

One study hypothesis was that neighborhood-oriented retail sites that cater to pass-by traffic and linked trip-making or trip-chaining would have a different trip generation pattern than destination retail sites that more typically form the basis for a discrete trip to and from home. A total of nine sites were identified as destination sites based on their being anchored by a grocery store (seven sites) or other large retailer (Walmart and Best Buy).

However, the separation of nine destination sites into their own "bin" proved a poor relationship between person-trips and DU and KGSF. While R-square values were good, the AM peak-hour relationship, in fact, had a negative coefficient for retail square footage:

Neighborhood Sites (37)

AM: Person-Trips = 0.939*DU + 5.914*KGSF

PM: Person-Trips = 0.905*DU + 14.116*KGSF

Destination Sites (9)

AM: Person-Trips = 2.456*DU – 3.289*KGSF

PM: Person-Trips = 2.767*DU + 1.089*KGSF

Of course, no retail use can generate "negative" trips. Still, the retail coefficient for destination sites might be expected to be much smaller in the morning (compared to the afternoon, or to the neighborhood coefficient), if in the morning people primarily frequent small retail establishments (e.g., coffee shops, dry cleaners), while doing activities such as grocery shopping in the afternoon. The retail coefficients for destination sites might also be expected to be generally smaller than for neighborhood sites if these sites generate fewer trips per square foot (despite more total trips). However, the coefficients on DU for the destination sites are much higher than for the neighborhood sites, obviously a spurious result. The relationships for destination sites shown here are probably, therefore, due mostly to anomalies in the small data set. For example, two relatively small, specialty grocery stores showed especially high trip rates compared to larger grocery stores in this category. Smaller grocery stores may bridge the gap between a neighborhood convenience store and a full-service grocery store serving a broader population.

High-Generation and Low-Generation Sites

The concept of individual doorway counts by different land use codes described in Section 4.3.1 led to the development of bins for "high-trip-generation" and "low-trip-generation" sites. Figure 4.4 provides a comparison of ITE suburban vehicle-trip rates using the same scatterplot of land use codes shown previously. (Tables 4.4 and 4.5 provides the observed and ITE data for each land use code in tabular format, for person-trips and vehicle-trips, respectively.) This assessment, although limited to vehicle-trips for suburban land uses, nonetheless shows much more clearly an expectation that a few land use types are expected to be high peak-hour trip generators, a pattern more evident than the observed data on person-trips due both to the fact that these are averages, not individual sites, and that the averages are based on a much larger sample size.

Figure 4-4 | ITE Vehicle-Trip Generation Rates by ITE Land Use Code

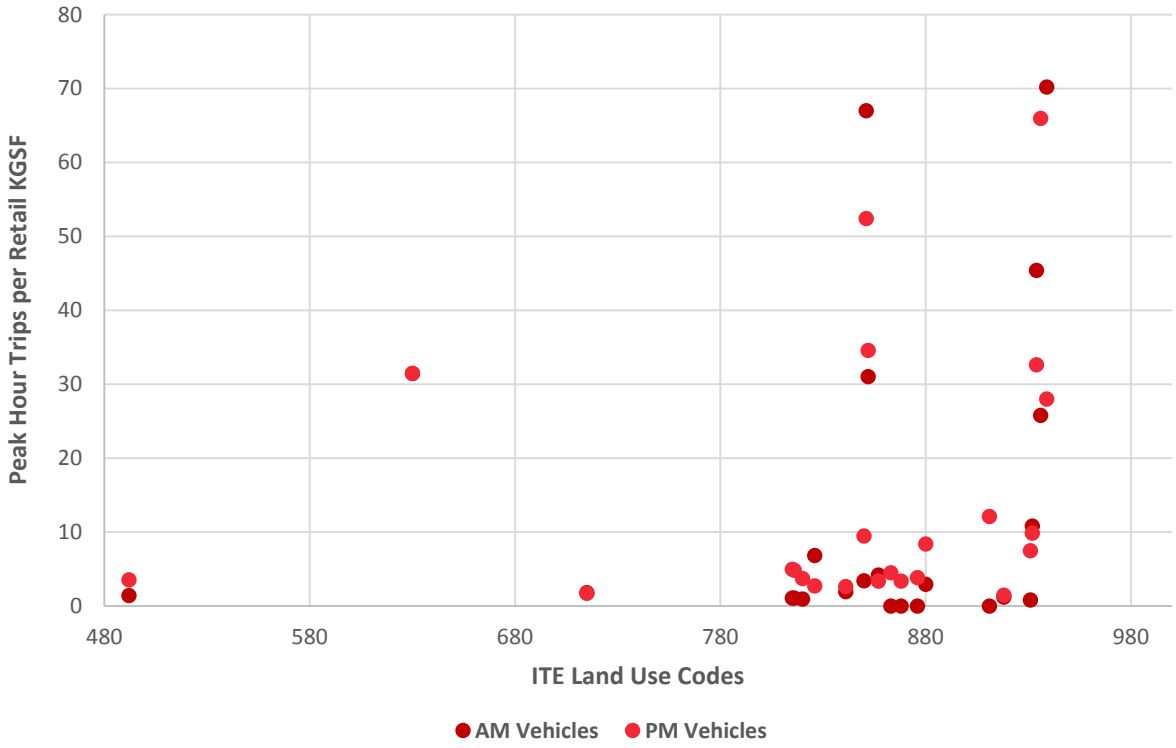


Table 4.4 | Observed Person Trip Rates by Land Use Code

ITE Land Use Code	Door Count	AM - Minimum	AM - Maximum	AM - Average	PM - Minimum	PM - Maximum	PM - Average
0	2	0.00	18.50	9.25	13.67	30.50	22.08
492	8	0.00	13.03	4.23	0.07	20.42	6.78
493	2	0.68	10.80	5.74	9.50	25.76	17.63
630	1	1.20	1.20	1.20	1.80	1.80	1.80
715	2	0.00	0.00	0.00	1.09	1.87	1.48
816	1	2.53	2.53	2.53	5.16	5.16	5.16
820	19	0.00	30.44	6.30	1.47	53.04	13.09
826	4	0.00	0.30	0.18	0.90	26.59	8.35
841	1	0.00	0.00	0.00	20.52	20.52	20.52
850	10	3.41	13.56	7.47	5.45	48.07	17.19
851	1	32.43	181.80	107.12	178.80	178.80	178.80
857	1	4.67	4.67	4.67	10.00	10.00	10.00
863	1	0.65	0.65	0.65	2.26	2.26	2.26
866	1	18.16	18.16	18.16	42.58	42.58	42.58
876	7	0.00	3.53	1.82	2.23	17.55	10.58
880	2	29.18	78.30	53.74	39.60	51.76	45.68
911	9	0.00	49.78	8.40	2.19	44.00	21.80
918	5	2.74	2.74	2.74	1.64	17.43	7.59
925	1	0.00	0.00	0.00	189.19	189.19	189.19
931	21	0.00	14.04	2.03	4.00	58.00	20.20
932	18	0.00	30.00	4.93	0.93	101.02	31.17
933	4	0.00	48.00	13.52	8.14	42.67	22.15
936	10	12.71	207.14	71.66	4.75	156.43	40.58
939	9	0.00	157.61	68.88	10.48	73.48	32.98
960	9	3.84	21.96	11.29	3.02	27.78	13.98

Table 4.5 | Observed Vehicle Trip Rates and ITE Vehicle Trip Rates by Land Use Code

ITE Land Use Code	Door Count	AM – Minimum	AM – Maximum	AM – Average	AM – ITE Average	PM – Minimum	PM – Maximum	PM – Average	PM – ITE Average
0	2	0.00	0.00	0.00	5.38	4.44	5.45	4.94	5.51
492	8	0.00	2.90	0.78	1.43	0.00	5.45	1.21	4.06
493	2	0.00	3.15	1.57	3.19	1.73	2.53	2.13	5.84
630	1	0.60	0.60	0.60	5.18	1.20	1.20	1.20	5.18
715	2	0.00	0.00	0.00	1.80	0.00	0.47	0.23	1.74
816	1	0.16	0.16	0.16	4.91	0.59	0.59	0.59	4.74
820	19	0.00	5.27	1.19	0.96	0.00	3.62	1.18	3.71
826	4	0.05	0.30	0.17	6.84	0.30	3.58	2.02	5.02
841	1	0.00	0.00	0.00	0.67	0.00	8.43	1.80	8.37
850	10	0.16	3.16	1.23	7.07	5.69	5.69	5.69	53.42
851	1	0.00	13.22	6.61	73.10	2.02	2.02	2.02	4.63
857	1	0.67	0.67	0.67	3.37	0.86	0.86	0.86	2.19
863	1	0.22	0.22	0.22	3.46	0.00	2.74	1.15	4.20
866	1	1.14	1.14	1.14	2.19	0.97	1.99	1.48	11.07
876	7	0.00	0.00	0.00	4.80	0.54	10.62	3.35	12.13
880	2	4.17	5.04	4.60	7.71	0.00	3.27	1.04	1.93
911	9	0.00	6.87	1.43	12.13	4.20	4.20	4.20	15.49
918	5	0.00	0.00	0.00	1.21	0.00	38.67	5.43	9.02
925	1	0.00	0.00	0.00	11.34	0.00	30.76	6.39	18.49
931	21	0.00	1.17	0.61	5.57	1.36	8.35	4.91	52.40
932	18	0.00	6.43	2.43	13.33	0.00	40.27	7.04	25.81
933	4	0.56	15.12	5.65	63.50	0.00	6.46	2.37	28.00
936	10	0.00	50.31	12.60	64.21	0.00	5.20	1.64	26.69
939	9	0.00	11.12	4.30	70.22	4.44	5.45	4.94	5.51
960	9	0.00	5.49	1.54	17.57	0.00	5.45	1.21	4.06

Based on the person-trip rates, the following ITE LUCs were assessed as "high-trip-generation" uses (note that sites were only assigned one type of code, not subdivided by elements such as the presence of a drive-thru or operating hours; the list below describes the basic land use type):

- **851 –** Convenience Market;
- **880 –** Pharmacy/Drugstore;
- **932 –** High-Turnover (Sit-Down) Restaurant;

- **933 –** Fast Food Restaurant;
- **936 –** Coffee/Donut Shop; and
- **939 –** Bread/Donut/Bagel Shop.

The presence of any one of these tenants was used to define a site as "high-trip-generation" and the absence of any one of these types of tenants was used to define a site as "low-trip-generation." Further analysis could examine whether the relationships are similar for vehicle and person trip generation.

The 46 sites divided fairly evenly into 22 high-trip-generation sites and 24 low-trip-generation sites. Both types of sites showed strong relationships with R-square values of 0.755 to 0.919 and significant p-values below 0.05 in all cases except for retail KGSF for low-trip-generation sites in the AM peak, where the p-value was 0.078.

High-Trip-Generation Sites (22)

- AM: Person-Trips = 1.167*DU + 3.134*KGSF
- PM: Person-Trips = 1.087*DU + 9.831*KGSF

Low-Trip-Generation Sites (24)

- AM: Person-Trips = 0.994*DU + 2.691*KGSF
- PM: Person-Trips = 1.151*DU + 8.158*KGSF

However, there are two limitations to this analysis that influence the decision to ***not*** recommend it as an organizing principle for CTR application:

- While the high-trip-generation sites do have a higher retail coefficient, the differences in rates for full sites (about 20 percent) are not tremendous (at least in comparison to the twofold to fivefold differences suggested in the ITE trip generation manual shown in the graphic above); and
- Perhaps more important, while this finding is of potential interest to researchers, it is less valuable to development review practitioners, where the specific use types identified as "high-generation" are not necessarily predictable at time of site development (i.e., what starts as a sit-down restaurant could be converted later to a fast-food restaurant in an urban environment where drive-throughs are not of value), so the application of these rates has little practical value.

An earlier test had attempted to identify high-trip-generation sites based on the actual observed data. This test demonstrated a weaker relationship and also indicated that the retail trip generation component was lower for high-trip-generation sites than for low-trip-generation sites, a counterintuitive result.

4.3.3 Considering Parking Availability

Parking supply management has been shown in prior studies to influence parking demand, and by extension, vehicle-trip generation and mode share. Parking management can take many forms that affect the supply, cost, or convenience of parking for a variety of durations (e.g., short- or long-term parking), trip purposes, locations, or times of day. The Park Right DC study found a strong relationship between on-site parking supply and parking demand at residential properties in the District.

Parking for residential and retail sites was therefore expected to provide insight to vehicle-trip generation, and perhaps even person-trip generation, whether through affecting demand via over-parking or under-parking conditions or through reflecting a market response to demand via provision and assignment of parking spaces.

Parking Spaces and Vehicle-Trips

An assessment of parking spaces was examined, along with MMA variables, as independent variables to explain total peak-hour vehicle-trips. The p-values for the parking spaces variable were, at 0.59 for the AM peak hour and 0.54 for the PM peak hour, not indicative of a strong relationship.

Parking Ratio and Auto Driver Mode Shares

Parking ratios (number of available spaces divided by DU+KGSF) were examined, along with MMA variables, as independent variables to explain auto driver mode share. The p-values for the parking rate variable was, at 0.21 for the AM peak hour and 0.11 for the PM peak hour, better than for any of the MMA variables, but still less indicative of a strong relationship than the desired <0.05 threshold.

A number of factors may explain the lack of correlation found in this study between trip generation and parking inventory:

- The study sites have a range of options for segregating or blending retail and residential parking. While the total number of spaces on site was available for most of the study sites, a complete picture of the number of spaces available for residential-only, retail-only, or both/shared was only available for the sites that were also included in the Park Right DC study.

- The relationship of vehicle trip generation and mode choice to parking supply is strongest when potential demand exceeds supply, since demand must then adjust itself (through mode shift, trip reduction, off-site parking, etc.) to match supply. Further analysis might explore parking utilization rates, such as those obtained for the parking study sites, as an indication of where demand approaches or exceeds supply.
- Parking demand is not directly linked to vehicular trip generation, due in large part to time-of-day issues (e.g., one parking spot may be used to satisfy demand for multiple short-term parking events). For residential sites, parking demand may include spaces for cars that are used only during the weekend, for instance.
- Parking demand may also be satisfied by off-site parking, whether on-street or in other lots or garages, particularly in the shared-parking environment typical of much of the D.C. urban core. Further analysis might consider public parking cost as a surrogate for off-site parking availability.

4.3.4 Examination of Environmental Variables

A key study hypothesis was that environmental variables, such as proximity to other types of land activity (the MMA variables and a population proximity factor) or socioeconomic variables like the percentage of zero or one-car households, would explain the trip generation rates or auto driver mode shares. However, several tests failed to prove these hypotheses, as the environmental variables did not have a strong causative relationship as measured by t-statistics or p-values.

There may be three primary explanations for the lack of explanatory value for the environmental variables:

1. The magnitude of retail trip generation tends to dominate the relationships between the site trip generation and any independent variable. While most of the residential trips could more likely be explained (all excepting visitor/delivery trips) by home-based trip-oriented environmental variables, there are some complex nonhome-based trip purposes.
2. While the environmental characteristics do vary from site to site, nearly all the sites are still representative of the Washington, D.C. urban fabric at its finest, with high levels of trip-making opportunity by all modes in a robust and walkable street grid with nearby access to Metrorail, bus transit, and bikesharing. The differences in environmental variables could be explored further by including more sites beyond the urban core or by coordinating with adjacent jurisdictions with a greater range of urban fabrics.

3. The level of variability both within and across retail sites may be due to a number of market conditions not evident from the available environmental variables. For instance, the range of rates associated with the Trader Joe's and Starbucks sites noted above could have more to do with the proximity of the nearest grocery store or coffee shop than with the overall preponderance of retail opportunities measured by the MMA variables.

Multimodal Accessibility Scores

The consideration of MMA scores was performed in a series of tests during Stage 2 that examined all six basic MMA scores. Appendix D shows the MMA scores for all census blocks in the District with the sites identified.

In Stage 3 an assessment of a "reverse" set of MMA scores looking at residential population proximity (considering the decay curves for both HBW and HBO) was added, bringing the total number of MMA variables to eight.

The first set of tests examined the ability of the MMA scores to improve the relationship of the basic DU and KGSF relationship. None of the eight variables had p-values lower than 0.200, indicating relatively poor explanatory value. ANOVA results are provided in Appendix E.

The second set of tests examine the ability of the MMA scores and the number of parking spaces to explain auto-driver-mode-share. This is a case where the number of independent variables produced a strong R-square value (0.894 in the AM and 0.906 in the PM), yet none of the independent variables had a p-value lower than 0.67 in the AM, and only one variable – walk HBW – had a p-value lower than 0.29 in the PM. ANOVA results are provided in Appendix E.

Residential Proximity

The MMA scores are designed to address proximity of a site to total employment and to retail establishments. The scores have a high relationship to mode shares for home-based travel. A Stage Two hypothesis was that the MMA scores do not "look backwards" towards population sources, reflecting the mantra that if "retail follows rooftops" then perhaps retail trips also follow rooftop residents. Appendix B shows the range of residential proximity scores for each site.

The study examined adding the population within a quarter-mile radius of each site as an independent variable to the basic DU and KGSF relationship for total person-trips and total walk trips. The resulting

p-values range from 0.245 to 0.736, indicating a poor relationship of residential proximity to person-trips. The ANOVA results are included in Appendix E.

Auto Ownership

One hypothesis was that person-trip rates might be affected by auto ownership. Prior research has indicated that car-free households tend to make a greater number of person-trips from their homes rather than fewer, more focused trips. In other words, a car-free household might make three individual trips to the bakery, the grocery store, and/or a convenience market to buy items that can readily be carried home via walking, biking, or transit. In contrast, those with cars may be more likely to make fewer trips but with a larger load of parcels requiring a car to conveniently take them home. Appendix D includes a map of zero-car and one-car household percentages throughout the District of Columbia.

The EPA Smart Location Database was used to identify zero-car and one-car household percentages (at a census block group level) as potential independent variables for person-trips in addition to DU and KGSF. The resulting four p-values for the zero-car and zero-or-one-car households ranged from 0.428 to 0.768, indicating a poor relationship of auto ownership to person-trips. The ANOVA results are included in Appendix E.

The EPA Smart Location Database was also used to identify zero-car and one-car households as potential independent variables for vehicle-trips in addition to DU and KGSF. The resulting four p-values for the zero-car and zero-or-one-car households ranged from 0.292 to 0.841, indicating a poor relationship of auto ownership to vehicle-trips. The ANOVA results are included in Appendix E.

4.3.5 Comparison with ITE Predicted Rates

Table 4.6 provides a comparison of observed person-trips, estimated vehicle- trips, and the ITE-based vehicle-trip estimates during the AM and PM peak hours for each of the 55 residential or residential+retail sites. The number of vehicle-trips generated by study sites is substantially lower than that estimated using ITE data. As indicated in the last line of the table, vehicle-trips generated by the universe of sites are 39 percent of the ITE calculated totals for the AM peak hour and 38 percent of the ITE calculated totals for the PM peak hour. This is expected due to the high proportion of non-auto-driver travel at the urban study sites in contrast to the relatively low proportion of non-auto-driver travel expected based on the suburban ITE sites.

It appears that the total number of *person-trips* generated by the study sites may be slightly higher in the AM peak than predicted by the ITE suburban site data, and possibly significantly higher in the PM peak, although this hypothesis cannot be fully confirmed. The study site person-trip generation totals are 23 percent higher than the ITE-based vehicle-trip generation totals in the AM peak hour, and 61 percent higher than the ITE-based vehicle-trip generation totals in the PM peak hour. While non-auto-driver travel information is not available for the ITE sites, Tables C-1 through C-3 of the 3rd Edition of the Trip Generation Handbook suggests that typical "baseline", or suburban, apartment mode shares might reflect about 10 to 15 percent non-auto-driver trips in the AM peak period and 15 to 20 percent non-auto-driver trips in the PM peak period. For retail, these non-auto-driver rates are also about 10 to 15 percent in the AM peak period but more like 25 to 30 percent in the PM peak period. The fact that the ratio of site person-trips to ITE-based vehicle-trips is higher than these suggested figures is supportive of the hypothesis that travelers in urban environments make a greater number of person-trips than those in suburban environments (where a higher amount of vehicle-trip chaining is expected). However, there is significant variation in person-trip rates across the surveyed properties and not all of them exceed the ITE vehicle-trip estimates.

Table 4.6 | Observed Person and Vehicle Trips and ITE Predicted Vehicle Trips by Site

Database #	AM Peak Person Counts	AM Estimated Drive Count	ITE Expected Trip Gen Forecast - AM Peak	AM: Ratio of Site Vehicle Trips to ITE Expected Vehicle Trips	AM: Ratio of Site Person Trips to ITE Expected Vehicle Trips	PM Peak Person Counts	PM Estimated Drive Counts	ITE Expected Trip Gen Forecast - PM Peak	PM: Ratio of Site Vehicle Trips to ITE Expected Vehicle Trips	PM: Ratio of Site Person Trips to ITE Expected Vehicle Trips
1	142	30	71	0.42	2.00	229	43	127	0.34	1.80
2	42	0	26	0.00	1.65	38	4	30	0.14	1.27
3	30	8	17	0.45	1.80	17	1	20	0.06	0.87
4	95	56	44	1.27	2.15	78	33	52	0.64	1.50
5	258	46	101	0.46	2.55	242	38	119	0.32	2.04
6	331	82	335	0.24	0.99	841	101	321	0.31	2.62
7	358	70	104	0.68	3.44	591	80	202	0.40	2.93
8	201	96	90	1.07	2.22	172	63	106	0.59	1.62
9	116	42	79	0.53	1.47	133	41	98	0.42	1.36

Database #	AM Peak Person Counts	AM Estimated Drive Count	ITE Expected Trip Gen Forecast - AM Peak	AM: Ratio of Site Vehicle Trips to ITE Expected Vehicle Trips	AM: Ratio of Site Person Trips to ITE Expected Vehicle Trips	PM Peak Person Counts	PM Estimated Drive Counts	ITE Expected Trip Gen Forecast - PM Peak	PM: Ratio of Site Vehicle Trips to ITE Expected Vehicle Trips	PM: Ratio of Site Person Trips to ITE Expected Vehicle Trips
10	258	81	152	0.53	1.69	242	89	179	0.50	1.35
11	177	71	84	0.85	2.12	118	39	98	0.39	1.20
12	1000	281	484	0.58	2.07	1272	196	572	0.34	2.22
13	132	55	106	0.52	1.25	310	113	125	0.90	2.48
14	144	44	81	0.54	1.79	229	68	95	0.71	2.42
15	68	11	92	0.12	0.74	135	37	117	0.32	1.15
16	404	96	147	0.65	2.75	422	88	173	0.51	2.44
17	457	142	619	0.23	0.74	821	353	698	0.51	1.18
18	332	101	805	0.13	0.41	704	142	735	0.19	0.96
19	152	75	505	0.15	0.30	721	321	499	0.64	1.44
20	295	60	99	0.61	2.99	342	52	225	0.23	1.52
21	190	39	109	0.36	1.74	247	64	163	0.39	1.52
22	253	40	248	0.16	1.02	336	27	219	0.12	1.54
23	329	37	636	0.06	0.52	200	23	390	0.06	0.51
24	620	177	227	0.78	2.74	583	154	221	0.70	2.64
25	212	60	129	0.47	1.64	405	83	160	0.52	2.53
26	223	52	295	0.18	0.76	399	99	259	0.38	1.54
27	730	240	932	0.26	0.78	1340	291	1,139	0.26	1.18
28	413	64	203	0.32	2.03	872	169	320	0.53	2.72
29	409	256	505	0.51	0.81	645	182	597	0.30	1.08
30	346	157	380	0.41	0.91	737	221	474	0.47	1.55
31	445	146	277	0.53	1.61	1068	166	309	0.54	3.46
32	352	125	276	0.46	1.28	558	129	404	0.32	1.38
33	830	464	495	0.94	1.68	1315	472	559	0.85	2.35
34	599	298	477	0.63	1.26	843	298	573	0.52	1.47
35	293	90	113	0.80	2.60	137	17	155	0.11	0.88
36	78	34	112	0.30	0.69	195	39	159	0.24	1.23
37	291	72	350	0.21	0.83	268	17	209	0.08	1.28

Database #	AM Peak Person Counts	AM Estimated Drive Count	ITE Expected Trip Gen Forecast - AM Peak	AM: Ratio of Site Vehicle Trips to ITE Expected Vehicle Trips	AM: Ratio of Site Person Trips to ITE Expected Vehicle Trips	PM Peak Person Counts	PM Estimated Drive Counts	ITE Expected Trip Gen Forecast - PM Peak	PM: Ratio of Site Vehicle Trips to ITE Expected Vehicle Trips	PM: Ratio of Site Person Trips to ITE Expected Vehicle Trips
38	412	83	202	0.41	2.04	382	65	197	0.33	1.94
39	120	51	91	0.56	1.33	289	57	116	0.49	2.49
40	80	35	64	0.54	1.25	184	55	90	0.61	2.04
41	56	13	36	0.38	1.57	65	15	47	0.31	1.39
42	247	88	279	0.31	0.89	212	34	264	0.13	0.80
43	121	66	165	0.40	0.73	207	40	311	0.13	0.67
44	67	17	50	0.34	1.34	90	11	62	0.19	1.46
45	279	55	113	0.48	2.47	423	44	151	0.29	2.80
46	627	160	544	0.29	1.15	487	88	306	0.29	1.59
47	109	49	57	0.87	1.93	164	39	86	0.45	1.90
48	53	6	30	0.19	1.77	50	0	35	0.00	1.42
49	101	46	107	0.43	0.95	121	25	147	0.17	0.82
50	102	40	121	0.33	0.84	241	64	162	0.40	1.49
51	285	95	254	0.37	1.12	524	109	244	0.45	2.15
52	141	35	77	0.46	1.82	307	81	184	0.44	1.67
53	75	23	54	0.42	1.39	124	23	55	0.42	2.24
54	70	21	77	0.27	0.91	42	12	98	0.12	0.43
55	641	204	249	0.82	2.57	322	99	224	0.44	1.44
TOTALS	15,191	4884	12,371	0.39	1.23	22,039	5215	13,680	0.38	1.61

4.4 Preliminary Analysis of Hotel and Office Data

While not the main focus of this study, data were collected on three hotel and three office sites as well (three office and one hotel site also included retail uses). A simple comparison was done of peak-hour person- and vehicle-trip rates against rates predicted by equations for the primary use from the ITE manual. Because the office buildings included public or shared parking, observed trip rates are shown with and without the public parking. It is likely that most of the on-site parking is used by tenants of the site, but that cannot be guaranteed if the garage is open to the public. The ITE rates based on suburban

area data are shown in Table 4.5, and results for the District sites are shown in Table 4.6 (hotels) and 4.7 (office/retail sites).

Table 4.7 | ITE Trip Generation Rates for Hotel and Office Uses

		AM Peak Hour				PM Peak Hour			
Land Use Code	**(Unit)**	**Average Rate**	**Range**		**Weighted Std. Dev.**	**Average Rate**	**Range**		**Weighted Std. Dev.**
Hotel, Rooms, Weekday	(per room)	0.52	0.16	1.42	0.22	0.61	0.20	1.23	0.41
General Office Building, Weekday	(per 1,000 square feet)	1.56	0.60	5.98	0.63	1.49	0.49	6.39	0.64

Source: ***Institute of Transportation Engineers, Trip Generation, 9th Edition, and Trip Generation Handbook, 3rd Edition.***

Table 4.8 | Hotel Trip Rates

Site No.	Rooms	Person-Trips	Vehicle-Trips	Vehicle-/ Person-Trips	ITE Vehicle-Trips	Vehicle-Trips, Percent of ITE	Person-Trips, Percent of ITE Vehicle-Trips	ITE Vehicle Trips Range	
AM Peak Hour									
59	397	305	141	0.46	206	69%	148%	64	564
60	147	126	49	0.39	76	64%	165%	24	209
61	327	365	96	0.26	170	56%	215%	52	464
PM Peak Hour									
59	397	559	152	0.27	242	73%	271%	79	488
60	147	110	34	0.31	90	44%	144%	29	181
61	327	358	101	0.28	199	59%	211%	65	402

Table 4.9 | Office/Retail Trip Rates

Site No.	Rooms	Person-Trips	Vehicle-Trips	Vehicle-/Person-Trips	ITE Vehicle-Trips	Vehicle-Trips, Percent of ITE	Person-Trips, Percent of ITE Vehicle-Trips	ITE Vehicle-Trips Range	
Not Including Shared/Public Parking									
AM Peak Hour									
56	259,633	95	58	0.61	402	14%	24%	156	1,553
57	136,572	96	12	0.12	212	6%	45%	82	817
58	491,000	237	12	0.05	761	2%	31%	295	2,936
PM Peak Hour									
56	259,633	191	7	0.04	387	2%	47%	127	1,659
57	136,572	71	10	0.14	203	5%	34%	67	873
58	491,000	257	9	0.03	732	1%	34%	241	3,137
Including Shared/Public Parking									
AM Peak Hour									
56	259,633	136	99	0.73	402	25%	34%	156	1,553
57	136,572	122	38	0.31	212	18%	58%	82	817
58	491,000	375	142	0.38	761	19%	49%	295	2,936
PM Peak Hour									
56	259,633	244	53	0.22	387	13%	61%	127	1,659
57	136,572	121	45	0.37	203	21%	57%	67	873
58	491,000	431	167	0.39	732	22%	57%	241	3,137

A few preliminary findings can be drawn:

- Hotel person-trip rates are much higher than the ITE predicted vehicle-trips for suburban settings, but vehicle-trip rates are one-half to three-quarters lower that predicted by ITE.
- Office person- and vehicle-trip rates are both much lower than predicted by ITE for suburban settings. Vehicle-trip rates are about 20 to 25 percent of ITE and person-trips rates are around half the ITE vehicle-trip rates. This is true even when including shared/public parking.
- A wide range of variation is seen in the ITE data. Vehicle-trips generated by hotels in the District fall within this range. However, vehicle-trip rates for some of the office buildings and time periods fall outside even the lower end of the ITE range.

- The inclusion of public parking can make a significant difference in rates. In future data collection efforts, it is recommended that sites with parking designated by use be prioritized, or that consideration be given to methods of differentiating vehicle-trips by their destination.

4.5 Establishing Trip Generation Rates

To summarize the key findings of the analysis, the following questions were considered:

- What do the D.C. data indicate about person- and vehicle-trip-generation rates? What are the recommended equations for predicting trip generation?

The equations for predicting trip generation based on the surveyed sites are identified in Section 4.3.1. Further evaluation is warranted before recommending these for application in the development review process. However, the study also suggests that the use of ITE rates – without adjustment – in the District of Columbia is inappropriate.

- To what extent do environmental variables add to the predictive capability of the models?

During the course of this study, the environmental variables did not add significant predictive capability to the models.

- How do the predicted rates compared to ITE-predicted suburban rates for the same land use categories?

A comparison of person and vehicle trip rates by retail land use code shows that vehicle-trip rates were almost always substantially lower than predicted by ITE (typically in the range of 10 to 50 percent of ITE rates). For combined residential and retail uses, observed vehicle trips averaged just under 40 percent of the trips predicted by ITE data. In contrast, person trip-rates were of similar magnitude in the AM peak (after considering vehicle occupancy) but were greater than ITE predicted rates in the PM peak. Considerable variability was also observed across sites in the dataset. The presence of shared and/or public parking at many sites makes any direct comparison with ITE rates imperfect.

5.0 Future Efforts

5.1 Summary

This section identifies future trip generation research and analysis activities to further DDOT's objectives in creating a sustainable multimodal transportation system through both the Comprehensive Transportation Review activities as well as through investigation of land use and transportation relationships that support broader planning and zoning objectives and activities. The top priority recommended near-term activities are:

- Conduct outreach and collaboration with other jurisdictions and entities to share and discuss findings and implications;
- Conduct further analysis of the trip generation relationships found here for residential/retail sites and identify any data problems or gaps; and
- Define a procedure for using data from comparable sites to predict trip generation in the development review process.

Once these near-term activities are underway, a better determination may be made regarding the most productive next steps for further data collection, analysis, and method development.

5.2 Overview of Potential Activities

General activities are summarized in Table 5.1. The activities are discussed in more detail in the following sections and are organized into three categories:

1. Collaboration and outreach;
2. Additional data collection, analysis, and tool development; and
3. Updating development review procedures and methods.

Three possible funding levels are assigned:

1. Modest – Can be done with in-house staff time or modest consulting resources, <$50,000;
2. Moderate – Estimated cost of $50,000-$150,000; and
3. High – Estimated cost of over $150,000.

Table 5.1 | Summary of Potential Future Activities

	Activity	Justification	Potential Funding Requirement
1	Collaboration and Outreach		
1.1	Conduct outreach and collaboration with other jurisdictions and entities.	Share data/results from similar environments and develop changes to practices that can be applied nationally.	Moderate
1.2	Present and publish analysis and findings at conferences, industry meetings, and publications, including Transportation Research Board.	Work with other practitioners to develop changes to practices that can be applied nationally.	Modest
1.3	Work to find an organization to permanently house the data.	Developing an expanded dataset that includes other cities will require a centralized entity responsible for maintaining the data.	Modest
2	**Additional Data Collection, Analysis, and Tool Development**		
2.1	Further mining of this dataset – e.g., comparing trip generation estimation methods with other industry standards and research approaches; examining different peak hours by mode; looking at on-site versus off-site parking location.	Determine approach to estimating trip generation that is both effective and practical to apply in development review process; obtain maximum value from data already collected.	Modest to Moderate depending on extent of analysis
2.2	Explore collection of additional trip generation data at further sites and for other land use types in District or supplementary data collection at existing sites.	Expand database and trip generation rates for uses other than residential/ retail and for more residential/retail sites or allow additional analysis for current sites.	Moderate to High – $6,000-$8,000 per new site, less for supplementary data
2.3	Consider surrogate information for trip purpose.	Examine amount of nonhome-based travel in vicinity of study sites to consider degree to which more information on nonhome-based trip elements might help explain variances in the data.	Modest
2.4	Evaluate whether other site-specific or environmental variables (e.g., those found significant in Park Right study) might improve estimates.	Information such as DU types (number of bedrooms), parking details, transit level of service, etc., could potentially improve fit; also consider consistency with parking variables and collection of TDM information.	Moderate, but depends on variables collected
2.5	Develop new tool for predicting trip generation at District sites.	Use best relationships determined from DDOT data collection and other sources as basis for a tool to assist in predicting trip generation rates.	Moderate

	Activity	Justification	Potential Funding Requirement
3	**Application to Development Review and Permitting**		
3.1	Determine comparable site procedures.	Determine a process for using data from comparable sites to estimate trip generation from proposed developments.	Modest
3.2	Test and apply new trip generation estimation procedures in development review process.	Test new tool and work with various Applicants to test the tool on their projects.	Modest; primarily internal

5.3 Collaboration and Outreach with Other Jurisdictions and Entities

The goals of collaboration and outreach activities are to work with other jurisdictions and professional entities, such as ITE, NACTO, and TRB, to: develop a common protocol for data collection and analysis in urban mixed-use environments that can be applied across cities; share data and results from similar environments; and develop changes to practices that can be applied nationally.

Informal working groups may be created, including:

- A peer city group (including research agency representatives) to support and expand the data analysis; and
- A broader group, including representatives of professional organizations and consultants and academics involved in trip generation research and application, to guide methodological development.

These groups can meet via webinar and at professional meetings and conferences. The objectives of this webinar would be to:

- Share results and key findings and implications with respect to predicting mixed-use trip generation in urban contexts;
- Obtain feedback on whether the proposed approach as something that could be more broadly useful for predicting mixed-use trip generation, and consistency with existing approaches (ITE *Trip Generation Handbook*); and
- Obtain feedback on how DDOT and other organizations and jurisdictions might collaborate on future data collection and model development to improve the state of practice in mixed-use trip generation.

Findings can also be documented and shared via papers and presentations at conferences and professional society meetings, such as the Transportation Research Board annual meeting and the ITE Annual Meeting.

Over the longer term, the following objectives should guide outreach and collaboration activities:

- Agreeing on common protocols (data collection procedures, database format, analysis method, etc.) to make it easier to pool data for analysis;
- Agreeing on what site-specific data should be included in the data collection and analysis;
- Discussing how we can research and agree upon common contextual/environmental variables that are both significant and practical to collect across cities;
- Identifying other jurisdictions or entities that want to sponsor their own data collection and/or cross-city analysis;
- Determining who should be responsible for pooling and maintaining data collected from different sources; and
- Discussing how these data can eventually be incorporated into the ITE Trip Generation Manual and potentially other national resources and guidance.

5.4 Additional Data Collection and Analysis

5.4.1 Further Mining of the Phase 1 and 2 Dataset

The Phase 1 and 2 dataset could not be fully explored in the timeframe of this study. Additional activities making use of this data could include (for example):

- Re-evaluating the impact of parking supply considering the best available information on parking availability by use at each site (additional information was obtained on some properties after the analysis was complete);
- Comparing observed mode shares from counts and surveys with those estimated from the regression coefficients;
- Comparing trip generation estimation methods with other industry standards and research approaches (as done in the Phase 1 report);
- Examining different peak hours by mode;
- Further investigation of differences in trip generation for different types of retail uses (including those in the same land use category);

- Examination of recreational vs. utilitarian walk trip rates;
- Examination of information on trips by special vehicles (carshare, hired, and delivery); and
- Looking at the data collected on parking location from surveyed people who drove.

5.4.2 Additional Trip Generation Data

The data collected in Phase 1 and 2 of this study represent a strong starting point for understanding residential mixed-use trip generation. However, additional observations on residential/retail sites could help to improve the level of confidence in estimates and could also ensure that a broader range of buildings (e.g., in different neighborhoods) are included in the sample. Additional data collection will also be needed to develop new trip generation estimates for other types of uses, including office, hotel, commercial mixed-use buildings, and schools.

There is no simple answer to the question of how many sites at which to collect data. The number of sites that need to be collected will depend upon:

- The unexplained variability in trip rates across sites;
- The number of independent variables that are desired to be included in the analysis; and
- The level of confidence desired in the trip generation estimates.

A common rule of thumb is at least 30 sites of any given use. However, this number will vary depending upon the above factors. Also, fewer sites may be needed if there is a limited pool of properties of any given type. Some sensitivity analysis should be done in future work to help answer the question about "how right do we need to be?" Essentially, how much do variations in trip rates impact the final development review process – e.g., development fees collected, performance evaluation (particularly LOS) and mitigation required?

Multi-day data collection could also be conducted for several sites to test the question whether the variation within a site (on multiple days) is less than the variation across sites. This would help address the question of whether the relationships observed here just an artifact of the chosen day of study, and whether more days of data collection would yield significantly different results or more robust findings. Similarly, 24-hour counts to examine patterns during off-peak hours – such as the lunch hour – may reveal interesting trends in the peak hour of some generators (particularly in more employment rich contexts).

Data collection on any type of site may be constrained for practical reasons, i.e., if enough suitable sites cannot be found in the District. Also, less data collection may be needed in the District if data collection in other cities suggests transferability of findings across cities. A higher priority should probably placed on buildings that are more commonly permitted at present or anticipated in the near future. Therefore, an incremental approach to data collection is recommended to test variability and significance of variables and to begin to build up a database covering common types of development.

5.4.3 Considering Surrogate Information for Trip Purpose

The lack of significance of the independent environment variables examined led to the conclusion that most of these variables address home-based travel (for work purposes or other purposes) and little information is available on other trip ends for retail trips (notably work-based other trips and other types of nonhome-based trips). It is quite likely that compounding factors explain the failure of the MMA and residential proximity variables to show a good relationship to person-trips:

- The MMA HBW-walk metric measures relative proximity to the total number of employees, which should be a surrogate for work-based other trips to retail.
- The MMA HBO-walk metric measures relative proximity to the total number of retail establishments, which may be adversely affected by retail saturation. In other words, a coffee shop far away from other retailers may generate more traffic than one located in a rich retail environment with many options to choose among.
- The residential proximity metric would only affect home-based travel.

The study team discussed the data collection challenges that make collecting trip purpose information through intercept surveys impractical. An initial next step would be to query the MWCOG household travel survey to examine the proportion of travel in the vicinity of study sites that is nonhome-based. This step would at least identify the magnitude of the problem and degree to which more information on nonhome-based trip elements might help explain variances in the data.

5.4.4 Testing of Additional Site and Environmental Variables

This activity would involve evaluating whether other site-specific or environmental variables (e.g., those found significant in the Park Right DC study) might improve trip generation estimates. Examples of variables to test could include unit types (number of bedrooms), parking details, transit level of service, and provision of TDM services. Only 14 of the sites in the trip generation study were also part of the Park Right DC study, not enough to provide significant data to support analysis. However, the variables

found to be most useful in the Park Right study would be logical candidates for testing for trip generation impacts. Trip generation data collection activities in New York City and elsewhere have included information on the number of units by type, which should relate to the number of people in the units and therefore to trip generation.

Additional variables could be tested in four ways:

1. Collecting additional data for the sites where trip generation data has already been collected. Environmental variables could be translated from Park Right DC data and methods, but site-specific variables would require the cooperation of the property manager, which might not be obtainable at all sites.
2. Collecting trip generation data at other Park Right DC sites. A plethora of site and environmental variables have already been collected for these sites so it would be easy to do some testing of what might be significant.
3. Identifying and evaluating additional parking management variables describing site environment citywide (as opposed to only for specific sites). The development of the Park Right DC tool variables would be an initial first step. Assessment of parking scarcity through a systemic evaluation of parking cost (through sources such as parkingpanda.com) would be another approach not explicitly incorporated into the parking model.
4. Folding collection of additional variables into data collection efforts on additional buildings.

Before testing variables that require significant additional data collection efforts, it is recommended that outreach be conducted (see Section 5.2) to discuss which (if any) site or environmental variables it might be feasible and practical to consider as part of a more broadly applicable trip generation methodology. Consideration should also be given to what variables can and cannot be easily determined during the development review process. Finally, consideration should especially be given to collecting data on the types of activities typically recommended as mitigation measures, to assist in determining the extent to which baseline trip rates do or do not reflect the provision of TDM measures.

5.4.5 Develop New Tool for Predicting Trip Generation at District Sites

This activity would involve selecting the best set of relationships from DDOT collected data and/or other sources and embedding them in a tool to predict multimodal trip generation based on site data entered by the user. For example, this could be a spreadsheet tool that references DDOT rates for sites with sufficient data (e.g., residential/retail) or other rates for sites with insufficient DDOT observations. The tool could also show and compare rates predicted by multiple methods, and uncertainty ranges.

5.5 Applying Trip Generation Estimation Procedures in Development Review Process

This set of tasks involves taking the findings from the data collection and analysis and using them to inform and update the District's development review process.

5.5.1 Determine Comparable Site Procedures

This study has demonstrated that residential/retail sites in the District generate significantly lower numbers of vehicle-trips and higher person-trips compared to traditional trip generation methods. It would follow that other land uses are also likely to have different characteristics. Prior to having a full set of data to conduct a similar evaluation at other sites, a procedure could be developed for using data from comparable sites to estimate trip generation rates considering District-specific conditions. For example, the three hotel and office sites in this study showed vehicle-trip generation rates in the range of 50 to 80 percent lower than ITE rates. Residential/retail and residential-only sites from the dataset could also be selected as comparable sites for new proposed developments. This is a step that could be taken in the short term.

5.5.2 Test and Apply New Trip Generation Estimation Procedures

DDOT can start doing this by using the residential/retail site procedures described in Section 4.0 of this report on a trial basis to estimate trip generation for new proposed developments. Issues to consider include:

- Can the data be readily obtained to develop the trip generation estimates (e.g., type of retail, MMA scores)? This will be a consideration in the future if significant relationships with other variables can be identified, but it is not a consideration at present.
- How different are estimates compared to current procedures, including ITE rates and other estimates? Is this having implications (positive or negative) for the review and approval process?

- Do developers and staff believe estimates are reasonable?
- Is site-specific consideration of issues being requested (e.g., factors supporting a higher or lower trip generation estimate)?
- What mitigation measures are being suggested as a result of the revised estimates?
- Is there a relationship between trip generation estimates and parking requirements?
- Are the estimates of nonauto trips useful for identifying potential impacts and mitigation measures for nonauto modes?

Over time, further data collection efforts can help to validate trip generation estimation tools and can be used as a basis for updating the tools as needed.

Appendix A. Data Collection Forms

MULTI MODAL TRIP GENERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: (circle one) 7am-8am 4pm-5pm

Address: _____ Tue Wed Thu 8am-9am 5pm-6pm

Door(s): _____ **Counter**: _____ 9am-10am 6pm-7pm

Time *after hour*	**In or Out** *of Building*	**Raw Count** *all persons crossing building threshold*		**Travel Mode** *only count those responding to survey, do not make assumptions based on observations*													**IF AUTO:** Where Parked?		
				Auto					**Transit**										
		Door A:	Door B:	Drive Alone	Carpool Driver	Carpool Passngr	Hired Car *(taxi/Uber)*	Carshare *(rental)*	Bus	Metro (rail)	Train	**Walk Only**	**Bike Only**	**Rec. Trip***	**Deliv-ery**	**Asked; Declined to Answer**	**Lot/ Garage**	**On Street**	**Other**
:00 to **:15**	Inbound																		
	Outbound																		
:15 to **:30**	Inbound																		
	Outbound																		
:30 to **:45**	Inbound																		
	Outbound																		
:45 to **:00**	Inbound																		
	Outbound																		

**Recreational trip – trip origin is same as destination (e.g. dog walker, smoker, jogger, etc…)*

In case of emergency, call 911.

In the event of issues during data collection, please call team coordinator _____ at (_____) _____-_____.

form revised April 15, 2015

MULTI MODAL TRIP GENERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: *(circle one)* 7am-8am 4pm-5pm

Address: _____ Tue Wed Thu 8am-9am 5pm-6pm

Door(s): _____ **Counter**: _____ 9am-10am 6pm-7pm

Time *after hour*	**Land Use**	**In or Out** *of Building*	**Raw Count** *all persons crossing building threshold*	**Travel Mode** *only count those responding to survey, do not make assumptions based on observations*													**IF AUTO:** Where Parked?		
				Auto					**Transit**			**Walk Only**	**Bike Only**	**Rec. Trip***	**Deliv-ery**	**Asked; Declined to Answer**	**Lot/ Garage**	**On Street**	**Other**
				Drive Alone	Carpool Driver	Carpool Passngr	Hired Car *(taxi/Uber)*	Carshare *(rental)*	Bus	Metro (rail)	Train								
:00 to **:15**	Residential	Inbound																	
		Outbound																	
	Retail	Inbound																	
		Outbound																	
:15 to **:30**	Residential	Inbound																	
		Outbound																	
	Retail	Inbound																	
		Outbound																	

**Recreational trip – trip origin is same as destination (e.g. dog walker, smoker, jogger, etc…)*

NOTE: second half of hour on rear of sheet!

In case of emergency, call 911.

In the event of issues during data collection, please call team coordinator_____ at (_____) _____-_____.

form revised April 15, 2015

MULTI MODAL **TRIP GEN**ERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: *(circle one)* 7am-8am 4pm-5pm

Address: _____ Tue Wed Thu 8am-9am 5pm-6pm

Door(s): _____ **Counter**: _____ 9am-10am 6pm-7pm

Time *after hour*	**Land Use**	**In or Out** *of Building*	**Raw Count** *all persons crossing building threshold*	**Travel Mode** *only count those responding to survey, do not make assumptions based on observations*													**IF AUTO:** Where Parked?		
				Auto					**Transit**			**Walk Only**	**Bike Only**	**Rec. Trip***	**Deliv-ery**	**Asked; Declined to Answer**	**Lot/ Garage**	**On Street**	**Other**
				Drive Alone	Carpool Driver	Carpool Passngr	Hired Car *(taxi/Uber)*	Carshare *(rental)*	Bus	Metro (rail)	Train								
:30 to **:45**	Residential	Inbound																	
		Outbound																	
	Retail	Inbound																	
		Outbound																	
:45 to **:00**	Residential	Inbound																	
		Outbound																	
	Retail	Inbound																	
		Outbound																	

**Recreational trip – trip origin is same as destination (e.g. dog walker, smoker, jogger, etc…)*

NOTE: first half of hour on front of sheet!

In case of emergency, call 911.

In the event of issues during data collection, please call team coordinator _____ at (_____) _____-_____.

form revised April 15, 2015

MULTI MODAL TRIP GENERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: *(circle one)* 7am-8am 4pm-5pm

Address: _____ Tue Wed Thu 8am-9am 5pm-6pm

Door(s): _____ **Counter**: _____ 9am-10am 6pm-7pm

Time *after hour*	**In or Out** *of Building*	**Raw Count** *tally of vehicles (for typical, privately-owned passenger cars; left side) or tally of vehicle occupants (right side)*								
		Vehicles with 1 occupant *# of vehicles*	Vehicles with 2 occupants *# of vehicles*	Vehicles with 3 occupants *# of vehicles*	Vehicles with 4 occupants *# of vehicles*	Vehicles with 5 occupants *# of vehicles*	Carshare Vehicle* *# of people including driver*	Delivery *# of people inc. driver*	Service *# of people inc. driver*	Bicycles *# of people*
:00 to **:15**	Inbound									
	Outbound									
:15 to **:30**	Inbound									
	Outbound									
:30 to **:45**	Inbound									
	Outbound									
:45 to **:00**	Inbound									
	Outbound									

** Carshare vehicles are rental cars leased on an hourly basis. Carshare vehicles are available from Zipcar, Car2Go, Enterprise to Go, etc and will have the company name on or near the front doors.*

In case of emergency, call 911.

In the event of issues during data collection, please call team coordinator _____ at (_____) _____-_____.

form revised April 23, 2015

MULTI MODAL TRIP GENERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: *(circle one)* 7am-8am 4pm-5pm

Address: _____ Tue Wed Thu 8am-9am 5pm-6pm

Door(s): _____ **Counter**: _____ 9am-10am 6pm-7pm

Time *after hour*	**Land Use**	**In or Out** *of Building*	**Raw Count** *tally of vehicles (for typical, privately-owned passenger cars; left side) or tally of vehicle occupants (right side)*								
			Vehicles with 1 occupant *# of vehicles*	Vehicles with 2 occupants *# of vehicles*	Vehicles with 3 occupants *# of vehicles*	Vehicles with 4 occupants *# of vehicles*	Vehicles with 5 occupants *# of vehicles*	Carshare Vehicle* *# of people including driver*	Delivery *# of people inc. driver*	Service *# of people inc. driver*	Bicycles *# of people*
:00 to **:15**	Residential	Inbound									
		Outbound									
	Retail	Inbound									
		Outbound									
:15 to **:30**	Residential	Inbound									
		Outbound									
	Retail	Inbound									
		Outbound									

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form revised April 23, 2015

MULTI MODAL TRIP GENERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: *(circle one)*

Address: _____ Tue Wed Thu 7am-8am 8am-9am 9am-10am 4pm-5pm 5pm-6pm 6pm-7pm

Door(s): _____ **Counter**: _____

Time *after hour*	**Land Use**	**In or Out** *of Building*	**Raw Count** *tally of vehicles (for typical, privately-owned passenger cars; left side) or tally of vehicle occupants (right side)*								
			Vehicles with 1 occupant *# of vehicles*	Vehicles with 2 occupants *# of vehicles*	Vehicles with 3 occupants *# of vehicles*	Vehicles with 4 occupants *# of vehicles*	Vehicles with 5 occupants *# of vehicles*	Carshare Vehicle* *# of people including driver*	Delivery *# of people inc. driver*	Service *# of people inc. driver*	Bicycles *# of people*
:30 to **:45**	Residential	Inbound									
		Outbound									
	Retail	Inbound									
		Outbound									
:45 to **:00**	Residential	Inbound									
		Outbound									
	Retail	Inbound									
		Outbound									

** Carshare vehicles are rental cars leased on an hourly basis. Carshare vehicles are available from Zipcar, Car2Go, Enterprise to Go, etc and will have the company name on or near the front doors.*

In case of emergency, call 911.
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form revised April 23, 2015

MULTI MODAL TRIP GENERATION STUDY

Building ID: _____ **Date**: ____ / ____ / 2015 **Hour**: *(circle one)* 7am-8am 4pm-5pm

Address: _____ Tue Wed Thu 8am-9am 5pm-6pm

Door(s): _____ **Counter**: _____ 9am-10am 6pm-7pm

Time *after hour*	**In or Out** *of Building*	**Raw Count** *tally of vehicles (for typical, privately-owned passenger cars; left side) or tally of vehicle occupants (right side)*										
		Valet					**Hired Cars**					**Hotel Shuttle** *# of passengers*
		Vehicles with 1 occupant *# of vehicles*	Vehicles with 2 occupants *# of vehicles*	Vehicles with 3 occupants *# of vehicles*	Vehicles with 4 occupants *# of vehicles*	Vehicles with 5 occupants *# of vehicles*	Vehicles with 1 passenger *# of vehicles*	Vehicles with 2 passengers *# of vehicles*	Vehicles with 3 passengers *# of vehicles*	Vehicles with 4 passengers *# of vehicles*	Vehicles with 5 passengers *# of vehicles*	
:00 to **:15**	Inbound											
	Outbound											
:15 to **:30**	Inbound											
	Outbound											
:30 to **:45**	Inbound											
	Outbound											
:45 to **:00**	Inbound											
	Outbound											

In case of emergency, call 911.

In the event of issues during data collection, please call team coordinator _____ at (_____) _____-_____.

form revised April 23, 2015

Appendix B. Site Information

Table B.1 | List of Sites

Database #	Neighborhood	Census Block Group	TAZ	AM Peak Hour Start	PM Peak Hour Start	Primary Use	Secondary Use	Retail Type	TripGen Type	Residential Units	Hotel Rooms	Occupancy Rate	Estimated Occupied Units	Office SF	Retail SF	Parking Spaces	Parking Type	Parking Study Site
1	Brightwood	110010025022	161	8:00:00 AM	4:00:00 PM	Residential	Retail	Neighborhood	Low	161	0	-	161	0	17,000	145		No
2	Petworth	110010025022	161	7:15:00 AM	6:00:00 PM	Residential	-	-		75	0	-	75	0	0	0		No
3	Brightwood	110010024001	162	7:45:00 AM	5:30:00 PM	Residential	-	-		49	0	94%	49	0	0	19	Residential Parking Only	Yes
4	Petworth	110010025021	161	7:45:00 AM	5:45:00 PM	Residential	-	-		130	0	-	130	0	0	120		No
5	Columbia Heights	110010028011	156	8:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	297	0	-	297	0	6,104	247		No
6	Columbia Heights	110010030001	173	8:15:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	228	0	-	228	0	21,000	161		No
7	Columbia Heights	110010028021	155	7:45:00 AM	5:45:00 PM	Residential	Retail	Neighborhood	Low	229	0	94%	229	0	19,194	300	Separate Retail and Residential	Yes
8	Monumental Core	110010072002	372	8:00:00 AM	6:00:00 PM	Residential	-	-		266	0	-	266	0	0	210		No
9	Near Southeast	110010072001	372	8:00:00 AM	5:00:00 PM	Residential	Retail	Neighborhood	Low	200	0	-	200	0	2,000	150		No
10	Near Southeast	110010072001	372	8:00:00 AM	6:00:00 PM	Residential	-	-		448	0	-	448	0	0	372		No
11	Near Southeast	110010072001	372	7:30:00 AM	5:00:00 PM	Residential	-	-		246	0	-	246	0	0	0		No
12	Edgewood	110010106002	206	8:15:00 AM	6:00:00 PM	Residential	Retail	Destination	Low	440	0	87%	384	0	52,000	399	Residential Parking Only	Yes
13	Brightwood	110010025021	161	8:45:00 AM	5:15:00 PM	Residential	Retail	Neighborhood	Low	72	0	-	72	0	11,515	57		No
14	North Capitol Street	110010072001	372	7:15:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	237	0	97%	237	0	6,000	220	Residential Parking Only	Yes
15	Near Northeast	110010106002	205	7:45:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	212	0	-	212	0	3,600	173		No
16	Near Northeast	110010106002	282	8:00:00 AM	6:00:00 PM	Residential	-	-	-	432	0	94%	432	0	0	428	Shared Retail and Residential	Yes
17	Golden Triangle	110010071002	300	7:30:00 AM	6:00:00 PM	Residential	Retail	Destination	High	247	0	-	247	0	53,392	438		No
18	West End	110010055002	54	8:45:00 AM	5:30:00 PM	Residential	Retail	Destination	High	225	0	-	225	0	26,857	175		No
19	Tenleytown	110010010012	100	8:45:00 AM	5:00:00 PM	Residential	Retail	Destination	Low	208	0	99%	208	0	88,000	330	Separate Retail and Residential	Yes
20	Logan Circle/Shaw	110010052014	186	7:00:00 AM	5:30:00 PM	Residential	Retail	Neighborhood	High	90	0	-	90	0	35,715	175		No
21	Cardozo/Shaw	110010044001	189	8:00:00 AM	5:00:00 PM	Residential	Retail	Neighborhood	Low	190	0	95%	190	0	17,000	172	Residential Parking Only	Yes
22	Dupont Circle	110010055004	49	8:00:00 AM	5:45:00 PM	Residential	Retail	Neighborhood	High	225	0	98%	225	0	20,000	-		No
23	Cardozo/Shaw	110010048011	191	8:30:00 AM	5:30:00 PM	Residential	Office	Neighborhood	High	205	0	96%	205	24,000	-	185	Shared Retail and Residential	Yes
24	Queens Chapel	110010095081	243	7:45:00 AM	4:00:00 PM	Residential	Retail	Neighborhood	Low	308	0	92%	308	0	3,333	308		No
25	Kalorama Heights	110010059001	199	8:15:00 AM	5:30:00 PM	Residential	Retail	Neighborhood	Low	371	0	91%	371	0	3,200	312		No
26	Columbia Heights	110010030001	173	9:00:00 AM	4:00:00 PM	Residential	Retail	Neighborhood	High	117	0	94%	117	0	18,000	110		No
27	Woodridge	110010047012	196	8:00:00 AM	6:00:00 PM	Residential	Retail	Destination	High	536	0	100%	536	0	110,405	783		No
28	Penn Quarter	110010058001	19	7:45:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	225	0	-	225	0	20,000	-	Shared Retail and Residential	Yes

Database #	Neighborhood	Census Block Group	TAZ	AM Peak Hour Start	PM Peak Hour Start	Primary Use	Secondary Use	Retail Type	TripGen Type	Residential Units	Hotel Rooms	Occupancy Rate	Estimated Occupied Units	Office SF	Retail SF	Parking Spaces	Parking Type	Parking Study Site
29	Petworth	110010025022	161	8:15:00 AM	6:00:00 PM	Residential	Retail	Destination	Low	218	0	79%	172	0	63,125	215	Shared Retail and Residential	No
30	Near Northeast	110010106002	282	8:00:00 AM	6:00:00 PM	Residential	Retail	Destination	Low	215	0	96%	215	0	45,455	270	Shared Retail and Residential	No
31	Cardozo/Shaw	110010043002	184	8:45:00 AM	6:00:00 PM	Residential	Retail	Destination	High	268	0	79%	213	0	23,100	152	Separate Retail and Residential	No
32	Golden Triangle	110010044001	189	8:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	231	0	94%	231	0	56,834	170	Residential Parking Only	No
33	North Capitol Street	110010047021	201	8:30:00 AM	5:15:00 PM	Residential	Retail	Destination	High	303	0	92%	303	0	80,976	377	Shared Retail and Residential	No
34	Navy Yard	110010072002	366	8:00:00 AM	5:15:00 PM	Residential	Retail	Destination	High	225	0	93%	225	0	53,500	-	Separate Retail and Residential	No
35	Chinatown	110010058002	199	8:15:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	203	0	92%	203	0	8,573	142	Residential Parking Only	Yes
36	Navy Yard	110010072002	367	7:45:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	225	0	96%	225	0	10,240	204	Residential Parking Only	No
37	Mount Vernon Square	110010049022	194	8:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	130	0	100%	130	0	8,500	70	Residential Parking Only	No
38	Chinatown	110010059001	198	8:00:00 AM	5:45:00 PM	Residential	Retail	Neighborhood	High	440	0	95%	440	0	1,500	313	Residential Parking Only	Yes
39	Golden Triangle	110010107001	55	8:45:00 AM	5:00:00 PM	Residential	Retail	Neighborhood	High	140	0	98%	140	0	6,240	-	Residential Parking Only	No
40	West End	110010055003	55	8:15:00 AM	5:00:00 PM	Residential	Retail	Neighborhood	Low	92	0	-	92	0	5,900	175	Residential Parking Only	No
41	Columbia Heights	110010031001	166	7:00:00 AM	5:30:00 PM	Residential	Retail	Neighborhood	Low	83	0	98%	83	0	2,315	29	Residential Parking Only	No
42	Penn Quarter	110010058001	24	8:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	160	0	98%	160	0	6,500	90	Residential Parking Only	No
43	Columbia Heights	110010036001	176	8:30:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	255	0	97%	255	0	6,671	150	Residential Parking Only	No
44	Cardozo/Shaw	110010044002	184	8:00:00 AM	5:45:00 PM	Residential	Retail	Neighborhood	Low	144	0	92%	144	0	1,100	34	Residential Parking Only	No
45	Logan Circle/Shaw	110010049012	188	7:45:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	281	0	-	281	0	8,055	214	Residential Parking Only	Yes
46	Near Northeast	110010055002	54	8:45:00 AM	4:15:00 PM	Residential	Retail	Neighborhood	High	335	0	97%	335	0	8,400	370	Public Parking	Yes
47	Dupont Park	110010055002	54	8:00:00 AM	4:15:00 PM	Residential	Office	Neighborhood	Low	40	0	85%	34	14,582	-	106	Public Parking	No
48	Dupont Circle	110010055001	49	8:15:00 AM	5:30:00 PM	Residential	Retail	Neighborhood	Low	88	0	99%	88	0	2,000	-	Residential Parking Only	No
49	Downtown	110010101001	25	7:45:00 AM	5:30:00 PM	Residential	Retail	Neighborhood	High	163	0	99%	163	0	10,366	165	Residential Parking Only	No
50	Golden Triangle	110010044001	189	9:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	80	0	-	80	0	7,025	44	Residential Parking Only	No
51	Columbia Heights	110010037003	177	8:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	High	225	0	92%	225	0	15,963	198	Separate Retail and Residential	No
52	Cardozo/Shaw	110010043002	184	8:00:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	125	0	90%	125	0	18,800	90	Residential Parking Only	No
53	Logan Circle/Shaw	110010052014	186	8:30:00 AM	5:30:00 PM	Residential	Retail	Neighborhood	Low	84	0	-	84	0	9,143	78	Residential Parking Only	No
54	Golden Triangle	110010106002	205	8:45:00 AM	6:00:00 PM	Residential	Retail	Neighborhood	Low	126	0	-	126	0	4,725	108	Residential Parking Only	No
55	Near Northeast	110010106002	204	8:00:00 AM	4:00:00 PM	Residential	Retail	Neighborhood	High	469	0	93%	469	0	1,400	420	Residential Parking Only	Yes
56	Golden Triangle	110010107001	38	8:30:00 AM	5:15:00 PM	Office	Retail	Neighborhood	High	0	0	-	0	259,633	5,629	279	Public Parking	No
57	Downtown	110010101001	25	8:30:00 AM	6:00:00 PM	Office	Retail	Neighborhood	High	0	0	-	0	136,572	6,000	93	Public Parking	No
58	Downtown East	110010102002	11	8:45:00 AM	6:00:00 PM	Office	Retail	Neighborhood	Low	0	0	-	-	-	-	500	Office Parking Only	No
59	Southwest Employment Area	110010041001	48	7:45:00 AM	5:45:00 PM	Hotel	-	-		0	397	-	0	0	0	100	Public Parking	No
60	Kalorama Heights	110010041001	48	7:45:00 AM	5:45:00 PM	Hotel	-	-		0	147	-	0	0	0	-	Public Parking	No
61	Dupont Circle	110010042021	47	8:15:00 AM	6:00:00 PM	Hotel	Retail	Neighborhood	High	0	327	-	0	0	-	-	Hotel Parking Only	No

Table B.2 | Site-Level Trip Generation and Environmental Variables

Database #	AM Peak Person Counts	AM Estimated Drive Count	AM Estimated Drive Pax Counts	AM Estimated Walk Counts	AM Estimated Bike Counts	AM Estimated Transit Counts	PM Peak Person Counts	PM Estimated Drive Counts	PM Estimated Drive Pax Counts	PM Estimated Walk Counts	PM Estimated Bike Counts	PM Estimated Transit Counts	MMA auto HBW	MMA auto HBO	MMA transit HBW	MMA transit HBO	MMA walk HBW	MMA walk HBO	MMA walk HBO - new	MMA walk HBW - new	adj MMA walk HBO	adj MMA walk HBW	1/4-mile population	SLD %0-Car Households	SLD % 1-car Households	SLD % <2 car HH	ITE Expected Trip Gen Forecast - AM Peak	ITE Expected Trip Gen Forecast - PM Peak
1	142	30	3	39	4	66	229	43	24	70	5	87	1,437,700	19,189	1,272,335	21,094	13,721	227	-	-	322	322	7,484	27%	43%	70%	71	127
2	42	-	-	8	4	30	38	4	3	11	-	20	1,437,700	19,189	1,272,335	21,094	11,730	159	716	739	866	889	7,438	27%	43%	70%	26	30
3	30	8	2	8	-	14	17	1	-	2	1	12	1,428,154	19,139	1,302,950	21,651	12,148	155	-	-	98	98	6,668	52%	25%	77%	17	20
4	95	56	13	6	-	19	78	33	20	4	-	21	1,437,700	19,189	1,272,335	21,094	11,582	158	712	739	972	999	5,735	61%	28%	89%	44	52
5	258	46	5	93	14	99	242	38	6	136	8	54	1,483,288	19,580	1,299,316	21,117	15,636	202	1,056	1,059	1,650	1,653	13,988	38%	56%	95%	101	119
6	331	82	4	109	4	132	841	101	61	458	31	190	1,537,567	20,146	1,322,465	21,573	25,320	268	-	220	456	676	13,173	32%	56%	88%	335	321
7	358	70	10	123	2	152	591	80	9	248	13	241	1,606,612	21,022	1,312,268	21,366	33,009	289	575	576	1,033	1,034	15,234	62%	36%	99%	104	202
8	201	96	8	48	4	44	172	63	11	65	5	29	1,611,748	19,735	1,308,174	20,371	27,702	81	-	-	532	532	3,192	75%	18%	93%	90	106
9	116	42	9	41	2	23	133	41	9	65	5	13	1,611,748	19,735	1,308,174	20,371	31,577	109	39	339	439	739	3,192	30%	62%	91%	79	98
10	258	81	39	67	5	68	242	89	20	99	4	30	1,611,748	19,735	1,308,174	20,371	34,014	111	973	976	1,869	1,872	3,269	30%	62%	91%	152	179
11	177	71	18	54	3	31	118	39	11	46	1	21	1,611,748	19,735	1,308,174	20,371	34,014	111	973	976	1,465	1,468	3,540	30%	62%	91%	84	98
12	1,000	281	35	322	28	334	1,272	196	49	877	34	116	1,657,098	21,127	1,458,935	24,385	40,382	177	-	-	768	768	2,746	37%	43%	80%	484	572
13	132	55	19	53	2	3	310	113	26	117	14	40	1,635,539	20,622	1,347,311	21,751	43,940	229	160	161	304	305	4,646	61%	28%	89%	106	125
14	144	44	8	62	1	29	229	68	5	123	-	33	1,437,700	19,189	1,272,335	21,094	11,086	175	299	339	773	813	5,962	30%	62%	91%	81	95
15	68	11	2	43	1	11	135	37	7	59	2	30	1,611,748	19,735	1,308,174	20,371	31,881	111	67	67	491	491	3,539	37%	43%	80%	92	117
16	404	96	11	174	17	107	422	88	22	233	2	77	1,606,945	20,111	1,203,694	19,027	45,537	223	-	-	864	864	3,933	0	0	80%	147	173
17	457	142	5	213	3	94	821	353	76	232	11	149	1,486,597	18,129	1,222,690	18,686	17,276	174	503	505	997	999	4,378	46%	39%	85%	619	698
18	332	101	8	202	14	8	704	142	16	480	35	31	1,759,652	23,086	1,391,936	21,897	115,314	1,159	397	398	847	848	7,245	40%	42%	83%	805	735
19	152	75	6	40	2	29	721	321	52	195	2	150	1,270,794	17,523	1,131,228	18,593	12,876	185	-	-	416	416	2,415	26%	49%	74%	505	499
20	295	60	5	196	16	18	342	52	4	242	26	18	1,731,994	22,964	1,294,110	20,743	110,178	796	807	811	987	991	12,635	40%	48%	88%	99	225
21	190	39	9	87	7	48	247	64	26	101	6	50	1,689,843	22,080	1,339,759	21,706	61,375	410	384	385	764	765	8,397	20%	64%	84%	109	163
22	253	40	4	168	11	29	336	27	7	267	12	22	1,750,662	23,082	1,395,763	22,919	108,687	1,023	-	-	450	450	6,597	61%	35%	97%	248	219
23	329	37	9	157	11	116	200	23	7	106	11	52	1,712,610	22,519	1,457,459	24,088	60,113	309	-	53	410	463	7,974	45%	40%	85%	636	390
24	620	177	81	108	-	254	583	154	51	137	-	241	1,230,679	16,928	1,156,076	19,247	4,448	25	-	-	616	616	2,045	60%	33%	92%	227	221
25	212	60	-	104	6	42	405	83	27	235	6	54	1,721,366	22,447	1,473,941	24,349	92,949	351	616	618	1,358	1,360	7,385	52%	42%	95%	129	160
26	223	52	8	129	8	25	399	99	9	190	13	87	1,537,567	20,146	1,322,465	21,573	19,538	210	587	765	821	999	12,833	32%	56%	88%	295	259
27	730	240	16	378	16	80	1,340	291	33	891	52	73	1,722,865	22,621	1,482,125	24,464	93,504	410	-	-	1,072	1,072	9,275	63%	27%	90%	932	1139
28	413	64	14	229	1	104	872	169	111	438	6	149	1,736,475	22,561	1,504,731	25,029	115,690	443	-	-	450	450	2,419	46%	49%	95%	203	320
29	409	256	33	98	-	22	645	182	43	288	46	86	1,437,700	19,189	1,272,335	21,094	11,730	159	716	739	1,061	1,083	7,724	27%	43%	70%	505	597
30	346	157	7	137	9	36	737	221	30	357	47	82	1,635,539	20,622	1,347,311	21,751	42,789	235	-	-	430	430	5,513	37%	43%	80%	380	474
31	445	146	23	201	13	63	1,068	166	45	673	34	149	1,714,675	22,624	1,266,849	20,304	68,672	451	364	535	790	961	9,380	35%	55%	90%	277	309
32	352	125	15	137	30	45	558	129	58	328	24	19	1,689,843	22,080	1,339,759	21,706	55,030	371	450	451	912	913	10,961	20%	64%	84%	276	404
33	830	464	48	233	10	75	1,315	472	123	422	115	183	1,690,239	21,788	1,325,732	21,346	74,708	287	-	-	606	606	3,474	51%	39%	91%	495	559
34	599	298	30	190	4	76	843	298	42	337	20	145	1,510,572	18,264	1,362,831	21,596	21,863	90	-	-	450	450	2,218	75%	18%	93%	477	573
35	293	90	10	74	-	119	137	17	5	89	21	4	1,721,366	22,447	1,473,941	24,349	104,453	447	-	-	406	406	5,095	41%	55%	96%	113	155
36	78	34	6	25	3	10	195	39	16	123	3	14	1,443,709	17,246	1,243,472	19,113	18,678	37	-	-	450	450	1,706	75%	18%	93%	112	159
37	291	72	8	184	8	19	268	17	1	219	8	22	1,730,915	22,840	1,461,163	23,949	102,520	507	553	582	813	842	11,194	20%	67%	88%	350	209
38	412	83	10	158	14	147	382	65	7	189	9	112	1,730,257	22,743	1,472,700	24,205	100,455	441	1,278	1,281	2,158	2,161	6,367	52%	42%	95%	202	197
39	120	51	5	58	2	5	289	57	20	207	-	5	1,757,134	23,146	1,438,977	23,135	141,671	1,376	254	255	534	535	6,559	67%	31%	97%	91	116
40	80	35	2	43	-	-	184	55	16	108	2	3	1,757,134	23,146	1,438,977	23,135	133,586	1,334	406	430	590	614	6,541	50%	46%	96%	64	90
41	56	13	1	26	5	10	65	15	1	36	6	8	1,527,678	20,122	1,312,328	21,681	17,698	313	321	322	487	488	8,475	38%	49%	87%	36	47
42	247	88	10	102	2	45	212	34	7	125	6	40	1,746,127	22,958	1,556,240	26,348	128,229	568	297	298	617	618	1,760	46%	49%	95%	279	264
43	121	66	4	37	2	12	207	40	10	138	13	5	1,691,831	22,191	1,177,125	18,575	55,002	371	450	451	960	961	11,843	43%	47%	89%	165	311
44	67	17	1	30	4	14	90	11	6	50	4	18	1,714,675	22,624	1,266,849	20,304	70,635	430	172	173	460	461	7,745	24%	44%	68%	50	62
45	279	55	8	170	12	34	423	44	2	359	3	15	1,726,229	22,773	1,322,910	21,198	73,716	329	-	-	562	562	8,109	31%	47%	78%	113	151
46	627	160	11	387	11	58	487	88	11	341	9	39	1,759,652	23,086	1,391,936	21,897	109,921	1,113	-	-	670	670	7,025	40%	42%	83%	544	306
47	109	49	2	51	-	7	164	39	4	104	-	17	1,759,652	23,086	1,391,936	21,897	117,659	1,174	-	-	68	68	7,168	40%	42%	83%	57	86
48	53	6	-	33	8	6	50	-	-	50	-	-	1,750,662	23,082	1,395,763	22,919	109,186	1,040	735	1,062	911	1,238	6,957	49%	42%	91%	30	35
49	101	46	29	24	2	-	121	25	10	61	3	23	1,747,407	23,123	1,474,806	24,283	135,168	794	-	-	326	326	8,808	49%	47%	96%	107	147
50	102	40	6	46	2	8	241	64	15	111	9	42	1,689,843	22,080	1,339,759	21,706	61,375	410	384	385	544	545	9,703	20%	64%	84%	121	162
51	285	95	20	136	9	25	524	109	1	367	33	13	1,687,133	22,094	1,191,975	19,044	53,467	370	572	574	1,022	1,024	14,008	37%	52%	89%	254	244
52	141	35	5	77	7	17	307	81	4	192	4	27	1,714,675	22,624	1,266,849	20,304	77,542	532	-	-	250	250	8,984	35%	55%	90%	77	184
53	75	23	-	46	1	5	124	23	1	93	3	4	1,731,994	22,964	1,294,110	20,743	103,545	710	253	463	421	631	12,262	40%	48%	88%	54	55
54	70	21	2	41	-	6	42	12	1	27	-	3	1,606,945	20,111	1,203,694	19,027	41,848	219	-	-	252	252	4,013	37%	43%	80%	77	98
55	641	204	27	248	12	151	322	99	5	147	15	56	1,658,264	21,160	1,460,120	24,373	52,398	214	-	-	938	938	3,024	37%	43%	80%	249	224
56	499	240	18	194	18	28	367	44	25	76	14	208															101	58
57	148	72	5	37	-	35	206	39	7	124	13	24															36	50
58	545	253	7	228	6	51	485	305	40	89	5	46																
59	309	64	124	116	2	3	559	97	109	273	-	81																
60	159	18	30	106	-	4	110	19	15	61	-	15																
61	444	72	147	202	-	23	594	80	90	350	11	64																

Table B.3 | Retail Summary

Database	Retail ID	LUC	Assumed Retail SF	Retail SF Alt 1	Retail SF Alt 2	Retail SF Alt 3	Retail Type	High/Low TripGen Site	AM Peak Person Counts	AM Peak Hour Surveys	AM Estimated Drive Count	AM Estimated Drive Pax Count	AM Estimated Walk Count	AM Estimated Bike Count	AM Estimated Transit Count	AM Peak Person TripGen Rate	AM Peak Vehicle Trip Gen Rate	PM Peak Person Counts	PM Estimated Drive Count	PM Estimated Drive Pax Count	PM Estimated Walk Count	PM Estimated Bike Count	PM Estimated Transit Count	PM Peak Vehicle TripGen Rate	PM Peak Person TripGen Rate
1	1.01	820	17,000	17000	0	0	Neighborhood	low	37	25	3.0	0.0	10.4	0.0	23.7	2.2	0.2	122	10.4	11.5	28.8	2.3	69.1	0.6	7.2
6	6.01	820	9,000	0	9000	0	Neighborhood	low	21	0	-	-	-	-	-	2.3		250	-	-	-	-	0.0		27.8
6	6.02	911	3,000	0	3000	0	Neighborhood	high	4	4	0.0	0.0	1.0	0.0	3.0	1.3	0.0	-	-	-	-	-	-		
6	6.03	931	3,000	0	3000	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		80	18.2	18.2	7.3	3.6	32.7	6.1	26.7
6	6.04	932	3,000	0	3000	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		269	12.5	18.8	200.2	6.3	31.3	4.2	89.7
6	6.05	936	3,000	0	3000	0	Neighborhood	high	208	58	50.2	7.2	129.1	3.6	17.9	69.3	16.7	111	28.3	7.9	62.2	0.8	11.8	0.0	37.0
7	7.01	820	3,733	0	3733	0	Neighborhood	low	53	53	2.0	2.0	24.0	0.0	25.0	14.2	0.5	126	10.5	0.0	36.8	10.5	68.3	2.8	33.8
7	7.02	820	2,489	0	2489	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		132	7.2	1.8	56.1	0.0	66.9	2.9	53.0
7	7.03	820	3,733	0	3733	0	Neighborhood	low	85	59	7.2	2.9	37.5	0.0	37.5	22.8	1.9	63	0.0	0.0	39.0	2.0	22.0	0.0	16.9
7	7.04	876	3,750	0	3750	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		46	1.2	0.0	17.4	3.7	23.6	0.3	12.3
7	7.05	911	2,489	0	3000	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		-	-	-	-	-	-		
7	7.06	931	3,000	0	3000	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		24	4.0	2.7	6.7	0.0	10.7	1.3	8.0
9	9.01	931	2,000	2000	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		43	8.4	1.0	29.4	4.2	0.0	4.2	21.5
12	12.01	850	50,000	50000	0	0	Destination	low	433	55	70.9	0.0	118.1	70.9	173.2	8.7	1.4	692	16.9	2.3	641.4	31.5	0.0	0.3	13.8
12	12.02	0	2,000	2000	0	0	Neighborhood	high	37	37	0.0	0.0	33.0	0.0	4.0	18.5	0.0	61	10.9	10.9	38.1	1.1	0.0	5.4	30.5
13	13.01	850	11,515	11515	0	0	Neighborhood	low	87	79	36.3	7.7	41.8	1.1	0.0	7.6	3.2	226	97.0	19.8	81.6	11.0	16.5	8.4	19.6
14	14.01	0	6,000	6000	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		82	26.6	0.0	53.2	0.0	2.1	4.4	13.7
15	15.01	931	3,600	3600	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		37	12.3	0.0	22.2	2.5	0.0	3.4	10.3
17	17.01	850	47,000	47000	0	0	Destination	low	229	229	29.0	2.0	154.0	2.0	42.0	4.9	0.6	256	44.0	12.0	80.0	6.0	114.0	0.9	5.4
17	17.02	911	3,196	0	3196	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		7	2.0	2.0	1.0	0.0	2.0	0.6	2.2
17	17.03	933	3,196	0	3196	0	Neighborhood	low	14	14	4.0	0.0	8.0	0.0	2.0	4.4	1.3	26	10.0	2.0	13.0	0.0	1.0	3.1	8.1
18	18.01	492	5,019	0	5019	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		-	-	-	-	-	-		
18	18.02	850	11,800	11800	0	0	Destination	low	160	152	4.2	0.0	144.2	8.4	3.2	13.6	0.4	345	0.0	3.1	313.9	18.6	9.3	0.0	29.2
18	18.03	933	10,038	0	10038	0	Neighborhood	low	17	15	5.7	0.0	5.7	4.5	1.1	1.7	0.6	89	13.6	0.0	51.3	12.6	11.5	1.4	8.9
19	19.01	826	12,000	12000	0	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		43	43.0	0.0	0.0	0.0	0.0	3.6	3.6
19	19.02	826	26,500	26500	0	0	Neighborhood	low	6	5	1.2	1.2	2.4	0.0	1.2	0.2	0.0	62	16.9	1.9	39.5	0.0	3.8	0.6	2.3
19	19.03	863	49,500	49500	0	0	Destination	low	32	30	10.7	3.2	10.7	2.1	5.3	0.6	0.2	112	8.4	5.6	37.8	1.4	58.8	0.2	2.3
20	20.01	492	25,000	0	25000	0	Neighborhood	low	212	177	26.4	2.4	153.3	16.8	13.2	8.5	1.1	175	23.9	0.0	118.2	20.5	12.5	1.0	7.0
20	20.02	715	2,143	0	2143	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		4	1.0	0.0	1.0	0.0	2.0	0.5	1.9
20	20.03	876	4,286	0	4286	0	Neighborhood	low	4	3	0.0	0.0	2.7	0.0	1.3	0.9	0.0	64	11.7	0.0	48.0	3.2	1.1	2.7	14.9
20	20.04	911	2,143	0	2143	0	Neighborhood	high	2	2	0.0	0.0	2.0	0.0	0.0	0.9	0.0	49	3.3	3.3	41.4	0.0	1.1	1.5	22.9
20	20.05	932	2,143	0	2143	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		2	0.0	0.0	2.0	0.0	0.0	0.0	0.9
21	21.01	820	6,800	0	6800	0	Neighborhood	low	9	9	1.0	2.0	6.0	0.0	0.0	1.3	0.1	10	0.0	0.0	10.0	0.0	0.0	0.0	1.5
21	21.02	932	3,400	0	3400	0	Neighborhood	high	43	41	10.5	0.0	21.0	1.0	10.5	12.6	3.1	10	3.0	2.0	2.0	0.0	3.0	0.9	2.9
21	21.03	931	3,400	0	3400	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		18	3.2	3.2	8.5	0.0	3.2	0.9	5.3
21	21.04	931	3,400	0	3400	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		83	26.0	18.0	24.0	0.0	15.0	7.6	24.4
22	22.01	492	2,350	0	2350	0	Neighborhood	low	4	4	0.0	0.0	4.0	0.0	0.0	1.7	0.0	5	0.0	0.0	5.0	0.0	0.0	0.0	2.1
22	22.02	492	4,701	0	4701	0	Neighborhood	low	21	20	1.1	0.0	17.9	2.1	0.0	4.5	0.2	37	1.3	0.0	29.1	1.3	5.3	0.3	7.9
22	22.03	820	4,701	0	4701	0	Neighborhood	low	15	15	7.0	0.0	8.0	0.0	0.0	3.2	1.5	18	0.0	0.0	18.0	0.0	0.0	0.0	3.8
22	22.04	820	1,197	1197	0	0	Neighborhood	low	5	4	0.0	0.0	0.0	0.0	5.0	4.2	0.0	13	4.3	0.0	7.6	0.0	1.1	3.6	10.9
22	22.05	820	4,701	0	4701	0	Neighborhood	low	35	29	3.6	0.0	30.2	0.0	1.2	7.4	0.8	81	0.0	0.0	73.7	2.1	5.2	0.0	17.2
22	22.06	936	2,350	0	2350	0	Neighborhood	high	61	61	4.0	0.0	47.0	2.0	8.0	26.0	1.7	63	1.2	0.0	54.5	3.6	3.6	0.5	26.8
23	23.01	820	8,000	0	8000	0	Neighborhood	low	25	25	3.0	0.0	17.0	1.0	4.0	3.1	0.4	22	3.0	1.0	13.0	2.0	3.0	0.4	2.8
23	23.02	931	8,000	0	8000	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		32	3.1	2.1	16.5	2.1	8.3	0.4	4.0
23	23.03	936	4,000	0	4000	0	Neighborhood	high	101	89	4.5	4.5	60.1	2.3	29.5	25.3	1.1	37	1.0	0.0	22.0	0.0	14.0	0.3	9.3
23	23.04	936	4,000	0	4000	0	Neighborhood	high	85	84	5.1	4.0	36.4	3.0	36.4	21.3	1.3	19	1.1	1.1	11.6	3.2	2.1	0.3	4.8
24	24.01	851	1,667	0	1667	0	Neighborhood	high	303	275	22.0	13.2	50.7	0.0	217.1	181.8	13.2	298	9.5	11.6	67.4	0.0	209.5	5.7	178.8
24	24.02	630	1,667	0	1667	0	Neighborhood	low	2	2	1.0	0.0	0.0	0.0	1.0	1.2	0.6	3	2.0	0.0	0.0	0.0	1.0	1.2	1.8
25	25.01	820	3,200	0	3200	0	Neighborhood	low	12	8	1.5	0.0	4.5	1.5	4.5	3.8	0.5	20	0.0	0.0	18.6	0.0	1.4	0.0	6.3
26	26.01	939	2,250	0	2250	0	Neighborhood	high	27	27	4.0	0.0	15.0	4.0	4.0	12.0	1.8	54	14.5	0.0	19.7	4.2	15.6	6.5	24.0
26	26.02	820	3,375	0	3375	0	Neighborhood	low	19	14	2.7	2.7	13.6	0.0	0.0	5.6	0.8	64	9.1	2.6	41.8	1.3	9.1	2.7	19.0
26	26.03	820	4,500	0	4500	0	Neighborhood	low	16	16	5.0	2.0	6.0	0.0	3.0	3.6	1.1	28	9.0	0.0	13.0	5.0	1.0	2.0	6.2

Database	Retail ID	LUC	Assumed Retail SF	Retail SF Alt 1	Retail SF Alt 2	Retail SF Alt 3	Retail Type	High/Low TripGen Site	AM Peak Person Counts	AM Peak Hour Surveys	AM Estimated Drive Count	AM Estimated Drive Pax Count	AM Estimated Walk Count	AM Estimated Bike Count	AM Estimated Transit Count	AM Peak Person TripGen Rate	AM Peak Vehicle Trip Gen Rate	PM Peak Person Counts	PM Estimated Drive Count	PM Estimated Drive Pax Count	PM Estimated Walk Count	PM Estimated Bike Count	PM Estimated Transit Count	PM Peak Vehicle TripGen Rate	PM Peak Person TripGen Rate
26	26.04	911	2,250	0	2250	0	Neighborhood	high	112	87	15.4	0.0	88.8	2.6	5.1	49.8	6.9	99	23.9	1.1	43.2	2.3	28.4	10.6	44.0
26	26.05	932	1,125	0	1125	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		46	10.7	0.0	18.2	0.0	17.1	9.5	40.9
26	26.06	933	1,125	0	1125	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		48	9.4	4.2	28.2	0.0	6.3	8.3	42.7
26	26.07	820	3,375	0	3375	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		19	2.7	0.0	10.9	0.0	5.4	0.8	5.6
27	27.01	850	58,916	58916	0	0	Destination	low	201	197	44.9	1.0	130.6	4.1	20.4	3.4	0.8	356	24.0	1.0	307.0	13.0	11.0	0.4	6.0
27	27.02	911	2,460	2460	0	0	Neighborhood	high	2	2	2.0	0.0	0.0	0.0	0.0	0.8	0.8	-	-	-	-	-	-		
27	27.03	816	9,105	9105	0	0	Neighborhood	low	23	16	1.4	0.0	21.6	0.0	0.0	2.5	0.2	47	5.4	2.7	24.2	9.4	5.4	0.6	5.2
27	27.04	939	1,399	1399	0	0	Neighborhood	high	5	0	-	-	-	-	-	3.6		42	6.0	0.0	30.0	4.0	2.0	4.3	30.0
27	27.05	492	25,672	0	25672	0	Neighborhood	low	63	58	14.1	2.2	43.4	3.3	0.0	2.5	0.6	132	14.7	0.0	101.5	7.9	7.9	0.6	5.1
27	27.06	932	7,565	7565	0	0	Neighborhood	high	24	20	7.2	0.0	15.6	0.0	1.2	3.2	1.0	113	32.0	4.6	62.8	0.0	13.7	4.2	14.9
27	27.07	932	1,481	1481	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		31	3.0	1.0	26.0	0.0	1.0	2.0	20.9
27	27.08	931	2,344	2344	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		61	4.9	0.0	54.4	0.0	1.6	2.1	26.0
27	27.09	932	1,463	1463	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		111	45.0	0.0	48.0	1.0	17.0	30.8	75.9
28	28.01	826	3,333	0	2857	3333	Neighborhood	low	1	1	1.0	0.0	0.0	0.0	0.0	0.3	0.3	3	1.0	0.0	0.0	0.0	2.0	0.3	0.9
28	28.02	880	3,333	0	2857	3333	Neighborhood	high	261	233	16.8	5.6	151.2	0.0	87.4	78.3	5.0	132	3.2	0.0	97.7	1.1	30.0	1.0	39.6
28	28.03	931	3,333	0	2857	3333	Neighborhood	high	0	0	-	-	-	-	-	0.0		146	31.0	23.2	88.5	0.0	3.3	9.3	43.8
28	28.04	931	3,333	0	2857	3333	Neighborhood	high	0	0	-	-	-	-	-	0.0		68	10.0	3.0	49.0	0.0	6.0	3.0	20.4
28	28.05	820	23,333	0	5714	23333	Neighborhood	low	0	0	-	-	-	-	-	0.0		215	67.7	61.8	42.8	0.0	42.8	2.9	9.2
28	28.06	931	3,333	0	2857	3333	Neighborhood	high	0	0	-	-	-	-	-	0.0		130	31.0	22.3	39.6	0.0	37.1	9.3	39.0
29	29.01	850	63,125	63125	0	0	Destination	low	299	33	90.6	0.0	172.2	0.0	36.2	4.7	1.4	486	78.1	34.7	264.7	39.1	69.4	1.2	7.7
30	30.01	850	43,390	43390	0	0	Destination	low	155	22	7.0	7.0	112.7	14.1	14.1	3.6	0.2	480	45.5	10.1	293.1	45.5	85.9	1.0	11.1
30	30.02	911	2,065	2065	0	0	Neighborhood	high	3	1	0.0	0.0	3.0	0.0	0.0	1.5	0.0	-	-	-	-	-	-		
31	31.01	850	15,000	15000	0	0	Destination	low	193	79	22.0	0.0	127.0	7.3	36.6	12.9	1.5	721	30.2	3.0	552.1	33.2	102.6	2.0	48.1
31	31.02	936	1,100	1100	0	0	Neighborhood	high	104	12	0.0	8.7	69.3	8.7	17.3	94.5	0.0	43	10.8	0.0	32.3	0.0	0.0	9.8	39.1
31	31.03	931	5,000	5000	0	0	Neighborhood	high	-	-	-	-	-	-	-			54	13.0	6.0	30.0	0.0	5.0	2.6	10.8
31	31.04	911	2,000	2000	0	0	Neighborhood	high	40	26	4.6	0.0	26.2	0.0	9.2	20.0	2.3	69	6.9	0.0	36.8	2.3	23.0	3.5	34.5
32	32.01	931	7,000	7000	0	0	Neighborhood	high	-	-	-	-	-	-	-			67	7.1	9.4	50.5	0.0	0.0	1.0	9.6
32	32.02	932	2,030	2030	0	0	Neighborhood	high	-	-	-	-	-	-	-			24	0.0	3.2	16.0	4.8	0.0	0.0	11.8
32	32.03	492	45,000	45000	0	0	Neighborhood	low	151	66	29.7	0.0	84.7	29.7	6.9	3.4	0.7	216	52.6	30.5	102.5	16.6	13.8	1.2	4.8
32	32.04	918	831	831	0	0	Neighborhood	low	-	-	-	-	-	-	-			9	3.0	0.0	3.0	3.0	0.0	3.3	9.8
32	32.05	960	1,039	1039	0	0	Neighborhood	low	13	13	3.0	0.0	8.0	0.0	2.0	12.5	2.9	18	5.4	0.0	12.6	0.0	0.0	5.2	17.3
32	32.06	939	934	934	0	0	Neighborhood	high	-	-	-	-	-	-	-			10	0.0	0.0	10.0	0.0	0.0	0.0	10.6
33	33.01	960	1,002	1002	0	0	Neighborhood	low	22	8	5.5	0.0	11.0	0.0	5.5	22.0	5.5	16	4.0	0.0	4.0	4.0	4.0	4.0	16.0
33	33.02	936	1,634	1634	0	0	Neighborhood	high	171	49	45.4	0.0	97.7	3.5	24.4	104.7	27.8	34	8.5	0.0	17.0	0.0	8.5	5.2	20.8
33	33.03	932	2,340	2340	0	0	Neighborhood	high	-	-	-	-	-	-	-			43	9.9	0.0	33.1	0.0	0.0	4.2	18.4
33	33.04	857	76,000	76000	0	0	Destination	low	355	63	50.7	16.9	191.6	11.3	84.5	4.7	0.7	760	153.7	53.8	252.9	130.6	169.0	2.0	10.0
34	34.01	932	1,700	1700	0	0	Neighborhood	high	-	-	-	-	-	-	-			25	3.6	7.1	10.7	0.0	3.6	2.1	14.7
34	34.02	932	1,800	1800	0	0	Neighborhood	high	54	28	11.6	3.9	32.8	3.9	1.9	30.0	6.4	149	28.8	4.8	67.3	8.0	40.0	16.0	82.8
34	34.03	850	50,000	50000	0	0	Destination	low	335	63	47.9	0.0	180.8	0.0	106.3	6.7	1.0	359	54.1	0.0	210.8	8.5	85.5	1.1	7.2
35	35.01	820	5,715	0	5715	0	Neighborhood	low	174	52	30.1	3.3	33.5	0.0	107.1	30.4	5.3	15	0.0	0.0	12.0	0.0	3.0	0.0	2.6
35	35.02	932	2,858	0	2858	0	Neighborhood	high	-	-	-	-	-	-	-			8	4.0	0.0	2.0	0.0	2.0	1.4	2.8
36	36.01	820	8,140	8140	0	0	Neighborhood	low	-	-	-	-	-	-	-			23	6.9	2.3	12.7	0.0	1.2	0.8	2.8
36	36.02	932	2,100	2100	0	0	Neighborhood	high	-	-	-	-	-	-	-			19	8.1	2.7	5.4	0.0	2.7	3.9	9.0
36	36.03	#N/A	-	-	-	-	Neighborhood	#N/A	-	-	-	-	-	-	-			3	0.0	0.0	3.0	0.0	0.0		
37	37.01	936	4,250	0	4250	0	Neighborhood	high	73	12	6.1	6.1	48.7	12.2	0.0	17.2	1.4	-	-	-	-	-	-		
37	37.02	880	4,250	0	4250	0	Neighborhood	high	124	84	17.7	0.0	91.5	3.0	11.8	29.2	4.2	220	8.4	0.0	182.8	5.6	21.1	2.0	51.8
38	38.01	960	750	0	750	0	Neighborhood	low	19	12	3.2	0.0	15.8	0.0	0.0	19.8	3.3	19	0.0	0.0	19.0	0.0	0.0	0.0	19.8
38	38.02	939	750	0	750	0	Neighborhood	high	94	59	8.0	3.2	55.8	0.0	27.1	100.1	8.5	32	5.3	0.0	20.0	0.0	6.7	5.7	34.1
39	39.01	932	1,178	1178	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		119	19.8	13.2	85.9	0.0	0.0	16.8	101.0
39	39.02	932	1,813	1813	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		13	2.9	0.0	10.1	0.0	0.0	1.6	7.2
39	39.03	918	691	691	0	0	Neighborhood	low	-	-	-	-	-	-	-			16	0.0	0.0	16.0	0.0	0.0	0.0	17.4
39	39.04	960	734	734	0	0	Neighborhood	low	11	9	0.0	0.0	11.0	0.0	0.0	11.5	0.0	4	0.0	0.0	4.0	0.0	0.0	0.0	4.2

Database	Retail ID	LUC	Assumed Retail SF	Retail SF Alt 1	Retail SF Alt 2	Retail SF Alt 3	Retail Type	High/Low TripGen Site	AM Peak Person Counts	AM Peak Hour Surveys	AM Estimated Drive Count	AM Estimated Drive Pax Count	AM Estimated Walk Count	AM Estimated Bike Count	AM Estimated Transit Count	AM Peak Person TripGen Rate	AM Peak Vehicle Trip Gen Rate	PM Peak Person Counts	PM Estimated Drive Count	PM Estimated Drive Pax Count	PM Estimated Walk Count	PM Estimated Bike Count	PM Estimated Transit Count	PM Peak Vehicle TripGen Rate	PM Peak Person TripGen Rate
39	39.05	918	1,824	1824	0	0	Neighborhood	low	5	4	0.0	0.0	3.8	1.3	0.0	2.7	0.0	3	0.0	0.0	2.4	0.6	0.0	0.0	1.6
40	40.01	931	5,900	5900	0	0	Neighborhood	high	-	-	-	-	-	-	-			102	25.5	5.1	67.6	1.3	2.6	4.3	17.3
41	41.01	493	2,315	2315	0	0	Neighborhood	low	25	24	7.3	0.0	13.5	4.2	0.0	10.8	3.1	22	4.0	0.0	10.0	5.0	3.0	1.7	9.5
42	42.01	931	3,250	0	3250	0	Neighborhood	high	-	-	-	-	-	-	-			43	0.0	0.0	43.0	0.0	0.0	0.0	13.2
42	42.02	933	3,250	0	3250	0	Neighborhood	low	156	73	49.2	8.5	68.4	0.0	29.9	48.0	15.1	94	22.1	5.5	44.2	0.0	22.1	6.8	28.9
43	43.01	493	4,426	4426	0	0	Neighborhood	low	3	3	0.0	0.0	2.0	0.0	1.0	0.7	0.0	114	11.2	5.1	91.6	5.1	1.0	2.5	25.8
43	43.02	492	45,000	2245	0	45000	Neighborhood	low	15	8	1.9	0.0	13.1	0.0	0.0	0.3	0.0	3	3.0	0.0	0.0	0.0	0.0	0.1	0.1
44	44.01	820	1,100	1100	0	0	Neighborhood	low	0	0	-	-	-	-	-	0.0		28	1.4	2.8	15.6	2.8	5.4	1.3	25.5
45	45.01	931	3,100	3100	0	0	Neighborhood	high	16	15	0.0	0.0	9.6	0.0	6.4	5.2	0.0	92	13.0	0.0	79.0	0.0	0.0	4.2	29.7
45	45.02	866	4,955	4955	0	0	Neighborhood	high	90	16	5.6	0.0	84.4	0.0	0.0	18.2	1.1	211	4.3	0.0	205.3	0.0	1.4	0.9	42.6
46	46.01	960	2,100	0	2100	0	Neighborhood	low	9	7	1.3	0.0	7.7	0.0	0.0	4.3	0.6	30	3.3	0.0	26.7	0.0	0.0	1.6	14.3
46	46.02	939	2,100	0	2100	0	Neighborhood	high	158	115	23.4	1.4	120.9	0.0	12.4	75.2	11.1	90	3.3	0.0	60.0	0.0	26.7	1.6	42.9
46	46.03	936	2,100	0	2100	0	Neighborhood	high	291	121	50.5	9.6	190.0	12.0	28.9	138.6	24.0	107	12.2	2.4	90.0	0.0	2.4	5.8	51.0
46	46.04	939	2,100	0	2100	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		22	2.0	0.0	16.0	0.0	4.0	1.0	10.5
47	47.01	931	3,645	0	3645	0	Neighborhood	high	41	17	2.4	0.0	31.4	0.0	7.2	11.2	0.7	19	0.0	0.0	19.0	0.0	0.0	0.0	5.2
47	47.02	918	3,645	0	3645	0	Neighborhood	low	-	-	-	-	-	-	-			26	0.0	0.0	22.8	0.0	3.3	0.0	7.1
47	47.03	960	3,645	0	3645	0	Neighborhood	low	14	1	0.0	0.0	14.0	0.0	0.0	3.8	0.0	11	0.0	0.0	11.0	0.0	0.0	0.0	3.0
47	47.04	931	3,645	0	3645	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		16	2.3	0.0	13.7	0.0	0.0	0.6	4.4
48	48.01	960	2,000	0	2000	0	Neighborhood	low	17	7	0.0	0.0	14.6	0.0	2.4	8.5	0.0	19	0.0	0.0	19.0	0.0	0.0	0.0	9.5
49	49.01	820	4,014	4014	0	0	Neighborhood	low	37	15	9.9	17.3	9.9	0.0	0.0	9.2	2.5	32	6.4	19.2	0.0	0.0	6.4	1.6	8.0
49	49.02	918	3,072	3072	0	0	Neighborhood	low	-	-	-	-	-	-	-			6	6.0	0.0	0.0	0.0	0.0	2.0	2.0
49	49.03	932	3,280	3280	0	0	Neighborhood	high	8	2	0.0	0.0	8.0	0.0	0.0	2.4	0.0	24	5.0	0.0	17.0	1.0	1.0	1.5	7.3
50	50.01	932	7,025	7025	0	0	Neighborhood	high	71	23	21.6	3.1	34.0	0.0	12.3	10.1	3.1	171	37.5	16.7	70.9	12.5	33.4	5.3	24.3
51	51.01	960	1,008	1008	0	0	Neighborhood	low	8	4	0.0	0.0	8.0	0.0	0.0	7.9	0.0	28	2.3	0.0	25.7	0.0	0.0	2.3	27.8
51	51.02	850	9,000	9000	0	0	Neighborhood	low	79	61	18.1	6.5	50.5	0.0	3.9	8.8	2.0	213	22.3	0.0	173.4	17.3	0.0	2.5	23.7
51	51.03	936	1,338	1338	0	0	Neighborhood	high	17	8	2.1	2.1	10.6	0.0	2.1	12.7	1.6	27	1.7	0.0	25.3	0.0	0.0	1.3	20.2
51	51.04	492	2,840	2840	0	0	Neighborhood	low	37	9	8.2	0.0	24.7	4.1	0.0	13.0	2.9	58	15.5	0.0	42.5	0.0	0.0	5.4	20.4
51	51.05	932	1,777	1777	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		73	25.9	0.0	44.7	0.0	2.4	14.6	41.1
52	52.01	876	3,133	0	3133	0	Neighborhood	low	-	-	-	-	-	-	-			7	-	-	-	-	-		2.2
52	52.02	931	3,133	0	3133	0	Neighborhood	high	-	-	-	-	-	-	-			43	17.2	1.4	20.1	0.0	4.3	5.5	13.7
52	52.03	876	3,133	0	3133	0	Neighborhood	low	-	-	-	-	-	-	-			55	8.3	0.0	41.7	1.7	3.3	2.7	17.6
52	52.04	911	3,133	0	3133	0	Neighborhood	high	4	1	0.0	0.0	4.0	0.0	0.0	1.3	0.0	17	1.7	0.0	13.6	0.0	1.7	0.5	5.4
52	52.05	876	3,133	0	3133	0	Neighborhood	low	-	-	-	-	-	-	-			9	0.0	0.0	9.0	0.0	0.0	0.0	2.9
52	52.06	931	3,133	0	3133	0	Neighborhood	high	44	12	3.7	0.0	36.7	0.0	3.7	14.0	1.2	103	29.8	0.0	68.0	0.0	5.2	9.5	32.9
53	53.01	826	1,805	1805	0	0	Neighborhood	low	-	-	-	-	-	-	-			48	6.4	0.0	40.0	1.6	0.0	3.5	26.6
53	53.02	715	7,338	7338	0	0	Neighborhood	low	-	-	-	-	-	-	-			8	0.0	0.0	5.3	0.0	2.7	0.0	1.1
54	54.01	851	925	925	0	0	Neighborhood	high	30	6	0.0	0.0	30.0	0.0	0.0	32.4	0.0	-	-	-	-	-	-		
54	54.02	820	3,800	3800	0	0	Neighborhood	low	-	-	-	-	-	-	-			7	0.0	0.0	7.0	0.0	0.0	0.0	1.8
55	55.01	936	1,400	1400	0	0	Neighborhood	high	290	70	70.4	4.1	132.6	4.1	78.7	207.1	50.3	219	56.4	0.0	104.1	13.0	45.5	40.3	156.4
56	56.01	876	2,493	2493	0	0	Neighborhood	low	7	7	0.0	0.0	6.0	0.0	1.0	2.8	0.0	34	0.0	0.0	13.6	6.8	13.6	0.0	13.6
56	56.02	939	1,436	1436	0	0	Neighborhood	high	121	38	0.0	0.0	105.1	3.2	12.7	84.3	0.0	55	0.0	0.0	15.7	0.0	39.3	0.0	38.3
56	56.03	876	1,700	1700	0	0	Neighborhood	low	6	0	-	-	-	-	-	3.5		-	-	-	-	-	-		
57	57.01	932	2,540	2540	0	0	Neighborhood	high	27	10	2.7	0.0	24.3	0.0	0.0	10.6	1.1	65	5.9	0.0	56.1	3.0	0.0	2.3	25.6
57	58.01	841	3,460	3460	0	0	Neighborhood	high	0	0	-	-	-	-	-	0.0		71	10.9	1.8	41.9	5.5	10.9	3.2	20.5
58	58.02	931	-	-	-	0	Neighborhood	high	-	-	-	-	-	-	-			54	36.0	14.7	0.0	0.0	3.3	38.7	58.0
58	58.03	939	-	-	-	0	Neighborhood	high	148	149	1.0	1.0	144.0	2.0	0.0	157.6	1.1	-	-	-	-	-	-		
61	61.01	939	-	-	-	0	Neighborhood	high	111	70	3.2	0.0	99.9	0.0	7.9	118.2	3.4	69	0.0	0.0	54.9	0.0	4.1	0.0	73.5
61	61.02	925	-	-	-	0	Neighborhood	high	-	-	-	-	-	-	-			175	3.9	0.0	163.3	0.0	7.8	4.2	189.2

Appendix C. Database Metadata

Table C.1 | Metadata for Site Summary Table

Label	Field Type	Description	Allowable Values or Formula	Notes
Database#	Integer	Unique site identifier (integer) assigned chronologically by date of first count, starting with Phase 1 data		
Building Name	Text	Common name of the building		
Address	Text	Street address		
Site Notes	Text	Special notes regarding the site		
Data Source	Text	Study phase and team performing counts/surveys	Phase 1, Phase 2 Symmetra, Phase 2 Gorove/Slade	Add additional values in future phases
Building ID	Text	The site name used by the team collecting the data		
Date of AM count	Date	Data on which morning period count was conducted		
AM Peak-Hour Start	Time	Start time of morning peak hour	7:00-9:00 a.m.	
PM Peak-Hour Start	Time	Start time of evening peak hour	4:00-6:00 p.m.	
Primary Use	Text	The primary land use in the building (largest square footage)	Residential, Office, Hotel, Retail, School	Possibly other types, e.g., medical
Secondary Use	Text	The secondary land use in the building (retail if mixed-use)	Retail	Possibly other types e.g., residential/office or hotel/ office
Other Use	Text	A third use, e.g., in a residential/retail building with hotel	Office, Hotel	Possibly other types
Retail Type	Text	Whether retail is primarily neighborhood-serving or destination retail (attracting from a broader area)	Neighborhood, Destination	
Residential Units	Integer	Total number of residential units on site		
Occupancy Rate	Percent	Percent of residential units that are occupied (apartments) or sold (condos)	0-100%	
Estimated Occupied Units	Integer	Adjusted residential units for buildings not fully occupied	If Occupancy Rate >90%, Residential Units, Else	

Label	Field Type	Description	Allowable Values or Formula	Notes
			Residential Units * Occupancy Rate	
Residential Type	Text	Renter or owner-occupied	Apartment, Condominium	
Hotel Rooms	Integer	Total number of hotel rooms on site		
Office SF	Integer	Occupied square footage of office uses on site		Vacant square feet should be excluded if known
Retail SF	Integer	Occupied square footage of retail uses on site		Vacant square feet should be excluded if known. Can be included in Retail Summary Table
Parking Type	Text	Indicates whether parking is exclusive to one or more uses in the building, shared among uses, or open to the public	None, Residential, Office, Hotel, Shared, Separate, Public	Residential, Office, Hotel = all parking exclusive to that use Separate = exclusive parking for two or more uses in building
Parking Spaces: Primary Only	Integer	Number of parking spaces reserved exclusively for primary use in building		The sum of the "Parking Spaces" fields should equal the total number of on-site parking spaces
Parking Spaces: Secondary Only	Integer	Number of parking spaces reserved exclusively for secondary use in building		
Parking Spaces: Shared/Public	Integer	Number of parking spaces shared among building occupants and/or open to the public		
Parking Spaces: Unknown Use	Integer	Number of parking spaces for which exclusive or shared use designation is unknown		
Parking Study Site	Text	Whether the site was also included in the Park Right DC study	Yes, No	
Census Block Group	Text	Census block group in which the site is located		
Neighborhood	Text	District of Columbia neighborhood in which site is located		

Table C.2 | Metadata for Retail Summary Table

Label	Field Type	Description	Allowable Values or Formula	Notes
Database Number	Integer	Unique site identifier (integer) assigned chronologically by date of first count, starting with Phase 1 data		
Retail ID	#.00	Unique identifier for each retail use (or set of uses accessed by common doors) on the site		Retail ID is in the form of X.YY, where X = Database number and YY = number of retail use assigned sequentially 1… n by site. Each use, or set of uses, should have a unique Retail ID. Multiple uses accessed by the same doors will have the same ID.
Door ID	Text	The name of the door or garage entrance used by the team collecting the data		
Building Name	Text	Common name of the building		
Address	Text	Street address		
Retail Type 1 LUC	Integer	ITE land use code for retail use		For multiple uses with different codes, use 820 (shopping center).
Retail Type	Text	Whether retail is primarily neighborhood-serving or destination retail (attracting from a broader area)	Neighborhood, Destination	
Retail Tenant	Text	Retail tenants		
Retail Type 1 SF	Integer	Square footage of retail use known to be associated with the tenant		
Retail SF Assumption 1	Integer	Assume square footage of retail use associated with tenant (multiple tenants, division unknown)		
Retail SF Assumption 2	Integer	Alternative assumption for multiple tenants		

Table C.3 | Metadata for Raw Data Table

Label	Field Type	Description	Allowable Values or Formula	Notes
Database Number	Integer	Unique site identifier (integer) assigned chronologically by date of first count, starting with Phase 1 data		All sites added to this database should have a unique database number that is used to link the raw data, site summary, and retail summary tabs.
Building ID	Text	The site name used by the team collecting the data		Redundant with Site Summary Table when placed in relational database.
Building Name	Text	Common name of the building		Redundant with Site Summary Table when placed in relational database.
Address	Text	Street address		Redundant with Site Summary Table when placed in relational database. If this database is expanded outside of D.C., will need to add city/place and state fields.
Door ID	Text	The name of the door or garage entrance used by the team collecting the data		In some cases, a "door" may include two doors to the same use observed by the same counter
Retail ID	#.00	Unique identifier for each retail use on the site		Retail ID is in the form of X.YY, where X = Database number and YY = number of retail use assigned sequentially 1…n by site. Each use, or set of uses, should have a unique Retail ID. Multiple uses accessed by the same doors will have the same ID.
Tenant	Text	List of retail tenants accessed by the door		Redundant with Retail Summary Table when placed in relational database.

Label	Field Type	Description	Allowable Values or Formula	Notes
Use	Text	Type of use	Residential, Retail, Commercial, Hotel, Mixed	"Mixed" is assigned to doors serving multiple use types, including garage entrances to unassigned parking. "Commercial" includes nonretail commercial (e.g., office).
Count/Survey	Text	Whether a count or survey was conducted	Count, Survey, Both	Only present in G/S Phase 2 counts. Can be inferred from data columns.
Date	Date	Date that door was counted (month/day/year)		
Counter	Text	Person counting the door		Only present in G/S Phase 2 counts.
Door/Garage	Text	Whether "door" is a doorway, garage, or valet station	Door, Door + Garage, Garage, Valet	
Hour Start	Text	Hour during which the recorded observations were made	A – 7:00 am-8:00 am, B – 8:00 am-9:00 am, C – 9:00 am-10:00 am, D – 4:00 pm-5:00 pm, E – 5:00 pm-6:00 pm, F – 6:00 pm-7:00 pm	
Sub Hour	Text	15-minute period during which the recorded observations were made	A – :00-:15, B – :15-:30, C – :30-:45, D – :45-:00	
I/O	Text	Whether the count/survey is of inbound or outbound traffic	In, Out	
Notes	Text	Notes provided by data collection crew		
DoorA_RawCount	Integer	Total number of persons observed using doorway in time period		Only for doors, not garage entrances
DoorB_RawCount	Integer	Total number of persons observed using doorway in time period, for second door observed by same counter		Only for doors, not garage entrances

Label	Field Type	Description	Allowable Values or Formula	Notes
Auto_DriveAlone/SOV	Integer	Number of people surveyed who arrived or departed by drive alone/SOV		
Auto_DriveCarpool	Integer	Number of people surveyed who arrived or departed as driver of vehicle with 2+ occupants		
Auto_PaxCarpool	Integer	Number of people surveyed who arrived or departed as passenger of vehicle with 2+ occupants		
Auto_Hired	Integer	Number of people surveyed who arrived or departed by hired vehicle (taxi, limo, Uber, Lyft, etc.)		
Auto_Rental	Integer	Number of people surveyed who arrived or departed by carshare vehicle		
Transit_Bus	Integer	Number of people surveyed who arrived or departed by bus		
Transit_Metrorail	Integer	Number of people surveyed who arrived or departed by Metrorail		
Transit_Train	Integer	Number of people surveyed who arrived or departed by other train (VRE, MARC, Amtrak)		
WalkOnly	Integer	Number of people surveyed who arrived or departed by walk. Also includes people observed walking into garages.		
BikeOnly	Integer	Number of people surveyed who arrived or departed by bicycle. Also includes people observed biking into garages.		
RecTrip	Integer	Number of people surveyed who were making "recreational" trip (to/from same destination)		
Delivery	Integer	Number of people surveyed who arrived or departed by delivery vehicle		

Label	Field Type	Description	Allowable Values or Formula	Notes
Declined_to_Answer	Integer	Number of people surveyed who declined to answer		
Park_Lot	Integer	Number of people surveyed who parked in lot or garage, if arrived by auto		
Park_Street	Integer	Number of people surveyed who parked on street, if arrived by auto		
Park_Other	Integer	Number of people surveyed who parked in other location, if arrived by auto		
Ph1_Garage_SOV	Integer	Number of vehicles observed using garage entrance, containing 1 person		Only populated for Phase 1 sites. Data collection forms changed in Phase 2
Ph1_Garage_ DriveCarpool	Integer	Number of vehicles observed using garage entrance, containing 2+ persons		Only populated for Phase 1 sites. Data collection forms changed in Phase 2
Ph1_Garage_ PaxCarpool	Integer	Number of nondrivers in vehicles observed using garage entrance containing 2+ persons		Only populated for Phase 1 sites. Data collection forms changed in Phase 2
Ph1_Garage_ Carshare	Integer	Number of vehicles observed using garage entrance that are carshare vehicles		Only populated for Phase 1 sites. Data collection forms changed in Phase 2
Garage_SOV	Integer	Number of vehicles observed using garage entrance, containing 1 person		Only populated for Phase 2 sites
Garage_HOV2	Integer	Number of vehicles observed using garage entrance, containing 2 persons		Only populated for Phase 2 sites
Garage_HOV3	Integer	Number of vehicles observed using garage entrance, containing 3 persons		Only populated for Phase 2 sites
Garage_HOV4	Integer	Number of vehicles observed using garage entrance, containing 4 persons		Only populated for Phase 2 sites
Garage_HOV5plus	Integer	Number of vehicles observed using garage entrance, containing 5 or more persons		Only populated for Phase 2 sites

Label	Field Type	Description	Allowable Values or Formula	Notes
Garage_CarshareOcc	Integer	Number of people observed in carshare vehicles		Only populated for Phase 2 sites
Garage_DeliveryOcc	Integer	Number of people observed in delivery vehicles		Only populated for Phase 2 sites
Garage_ServiceOcc	Integer	Number of people observed in service vehicles		Only populated for Phase 2 sites
Garage_Bicycle	Integer	Number of bicyclists using garage entrance		Only populated for Phase 2 sites
Valet w/1	Integer	Number of vehicles arriving or departing with 1 occupant and serviced by valet		Only recorded at hotels. Assuming valet service does not count as a vehicle-trip or person-trip (e.g., they are moving the vehicle to an on-site garage).
Valet w/2	Integer	Number of vehicles arriving or departing with 2 occupants and serviced by valet		
Valet w/3	Integer	Number of vehicles arriving or departing with 3 occupants and serviced by valet		
Valet w/4	Integer	Number of vehicles arriving or departing with 4 occupants and serviced by valet		
Valet w/5	Integer	Number of vehicles arriving or departing with 5+ occupants and serviced by valet		
Hired w/1	Integer	Number of hired vehicles (taxi, etc.) arriving or departing with 1 occupant in addition to driver		Only recorded at hotels.
Hired w/2	Integer	Number of hired vehicles (taxi, etc.) arriving or departing with 2 occupants in addition to driver		
Hired w/3	Integer	Number of hired vehicles (taxi, etc.) arriving or departing with 3 occupants in addition to driver		

Label	Field Type	Description	Allowable Values or Formula	Notes
Hired w/4	Integer	Number of hired vehicles (taxi, etc.) arriving or departing with 4 occupants in addition to driver		
Hired with 5	Integer	Number of hired vehicles (taxi, etc.) arriving or departing with 5+ occupants in addition to driver		
Hotel Shuttle	Integer	Number of hotel shuttles arriving or departing		
DOORSURVEY_Drive	Formula	Number of people surveyed arriving or departing by SOV, HOV driver, carshare, or delivery vehicle	= Auto_DriveAlone/SOV + Auto_DriveCarpool + Auto_Rental + Delivery	
DOORSURVEY_ HOVpax	Formula	Number of people surveyed arriving or departing as nondriver vehicle occupant	= Auto_PaxCarpool + Auto_Hired	
DOORSURVEY_Walk	Formula	Number of people surveyed who arrived or departed by walk	= WalkOnly + RecTrip	Assuming rec trips are mostly walk. Some might be bike but this was not captured in survey.
DOORSURVEY_Bike	Formula	Number of people surveyed who arrived or departed by bicycle	= BikeOnly	
DOORSURVEY_ Transit	Formula	Number of people surveyed who arrived or departed by bus	= Transit_Bus + Transit_Metrorail + Transit_Train	
GARAGEVALET_Drive	Formula	Number of people driving vehicles (or number of vehicles) using garage or serviced by valet	= Ph1_Garage_SOV + Ph1_Garage_DriveCarpool + Ph1_Garage_Carshare + Garage_SOV + Garage_HOV2 + Garage_HOV3 + Garage_HOV4 + Garage_HOV5plus + Valet w/1 + Valet w/2 + Valet w/3 + Valet w/4 + Valet w/5 + Garage_CarshareOcc + Garage_DeliveryOcc + Garage_ServiceOcc	We do not know the actual number of carshare, delivery, or service vehicles – only occupancy. Need to assume an average occupancy (here = 1). Change survey protocol in future efforts to capture both vehicles and occupancy.

Label	Field Type	Description	Allowable Values or Formula	Notes
GARAGEVALET_ HOVpax	Formula	Number of passengers in vehicles using garage or serviced by valet with 2+ occupants, or using hired vehicle	= Ph1_Garage_PaxCarpool + Garage_HOV2 + 2*Garage_HOV3 + 3*Garage_HOV4 + 4*Garage_HOV5plus + Valet w/2 + 2*Valet w/3 + 3*Valet w/4 + 4*Valet w/5 + Hired w/1 + 2*Hired w/2 + 3*Hired w/3 + 4*Hired w/4 + 5*Hired w/5 + 2*Hotel Shuttle	We are assuming that the driver of a hired vehicle does not count towards person-trips, but that all occupants are HOV passengers. We are also making an arbitrary assumption about hotel shuttle occupancy (2 persons per vehicle). May want to record number of persons in future efforts.
GARAGEVALET_Bike	Formula	Number of people observed using garage by bicycle	= Garage_Bicycle	For garage sites
TOTAL_Door_Survey	Formula	Total Persons Surveyed (Doors)	= sum of DOORSURVEY fields	This is only the total number of people surveyed – it does not include person-trips by hired vehicle driver
TOTAL_Door_Count	Formula	Total Persons Counted (Doors)	= DoorA_RawCount + DoorB_RawCount	
TOTAL_Garage_ Vehicles	Formula	Total Vehicle-Trips Counted (Garages + Valet + Hired)	= GARAGEVALET_Drive + 2*(Hired w/1 + Hired w/2 + Hired w/3 + Hired w/4 + Hired w/5) + Hotel Shuttle	This assumes that a hired vehicle generates 2 trips (1 inbound, 1 outbound). For the hotel shuttle that is not clear and perhaps should be explicitly recorded in data collection.
TOTAL_Garage_ Persons	Formula	Total Person-trips in Vehicles Counted (Garages + Valet + Hired)	= GARAGEVALET_Drive + GARAGEVALET_HOVpax + GARAGEVALET_Bike	For analysis purposes it is probably more relevant to classify bikes with the DOORSURVEY bikes. They are included here so we get a complete summation of the garage counts.

Appendix D. Maps of Environmental Variables

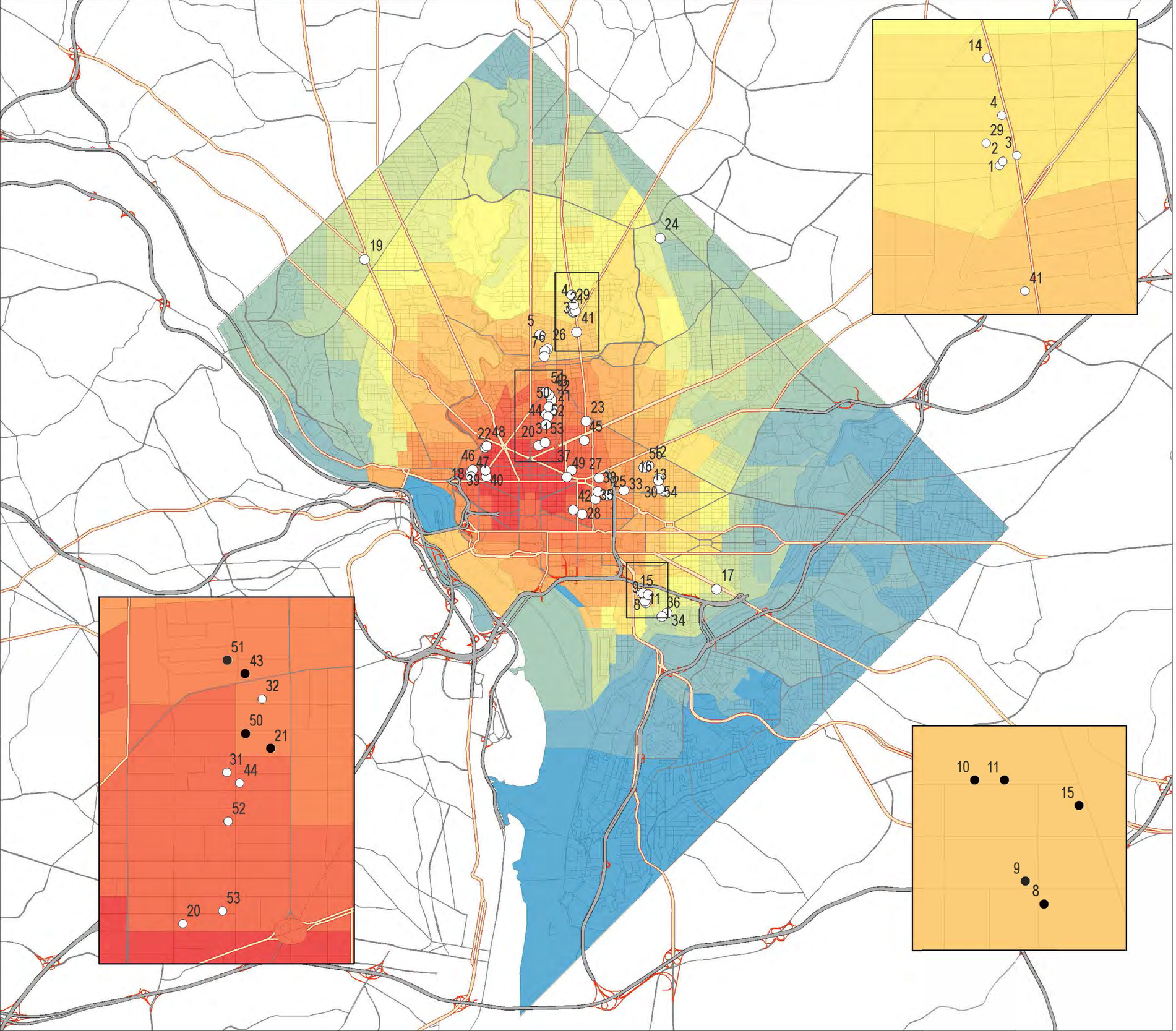
MMA Score Map

Access Score

Auto - Home-Based Work

- 0.00 - 953,000
- 954,000 - 1,000,000
- 1,010,000 - 1,180,000
- 1,190,000 - 1,260,000
- 1,270,000 - 1,300,000
- 1,310,000 - 1,350,000
- 1,360,000 - 1,400,000
- 1,410,000 - 1,460,000
- 1,470,000 - 1,530,000
- 1,540,000 - 1,610,000
- 1,620,000 - 1,670,000
- 1,680,000 - 1,710,000
- 1,720,000 - 1,730,000
- 1,740,000 - 1,750,000
- 1,760,000 - 1,770,000

0 0.5 1 2 3 4 Miles



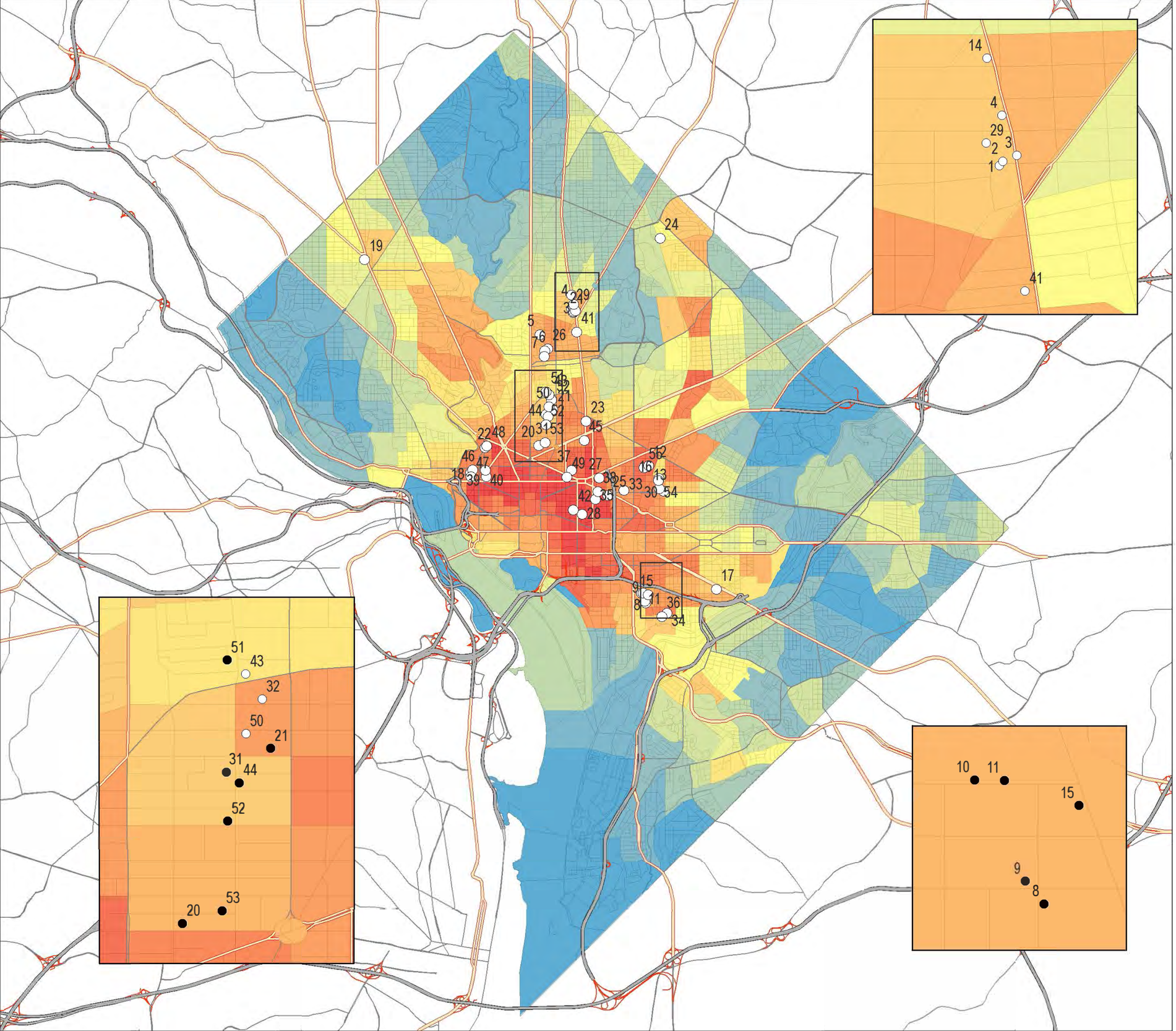
MMA Score Map

Access Score

Auto - Home-Based Other

- 0.00 - 12,100
- 12,200 - 12,700
- 12,800 - 15,800
- 15,900 - 16,700
- 16,800 - 17,400
- 17,500 - 18,000
- 18,100 - 18,400
- 18,500 - 18,800
- 18,900 - 19,400
- 19,500 - 20,200
- 20,300 - 21,300
- 21,400 - 21,900
- 22,000 - 22,600
- 22,700 - 23,000
- 23,100 - 23,700

0 0.5 1 2 3 4 Miles



MMA Score Map

Access Score

Transit - Home-Based Work

- 0.00 - 695,000
- 696,000 - 796,000
- 797,000 - 850,000
- 851,000 - 910,000
- 911,000 - 960,000
- 961,000 - 1,030,000
- 1,040,000 - 1,100,000
- 1,110,000 - 1,170,000
- 1,180,000 - 1,220,000
- 1,230,000 - 1,270,000
- 1,280,000 - 1,320,000
- 1,330,000 - 1,350,000
- 1,360,000 - 1,400,000
- 1,410,000 - 1,470,000
- 1,480,000 - 1,570,000

0 0.5 1 2 3 4 Miles

MMA Score Map

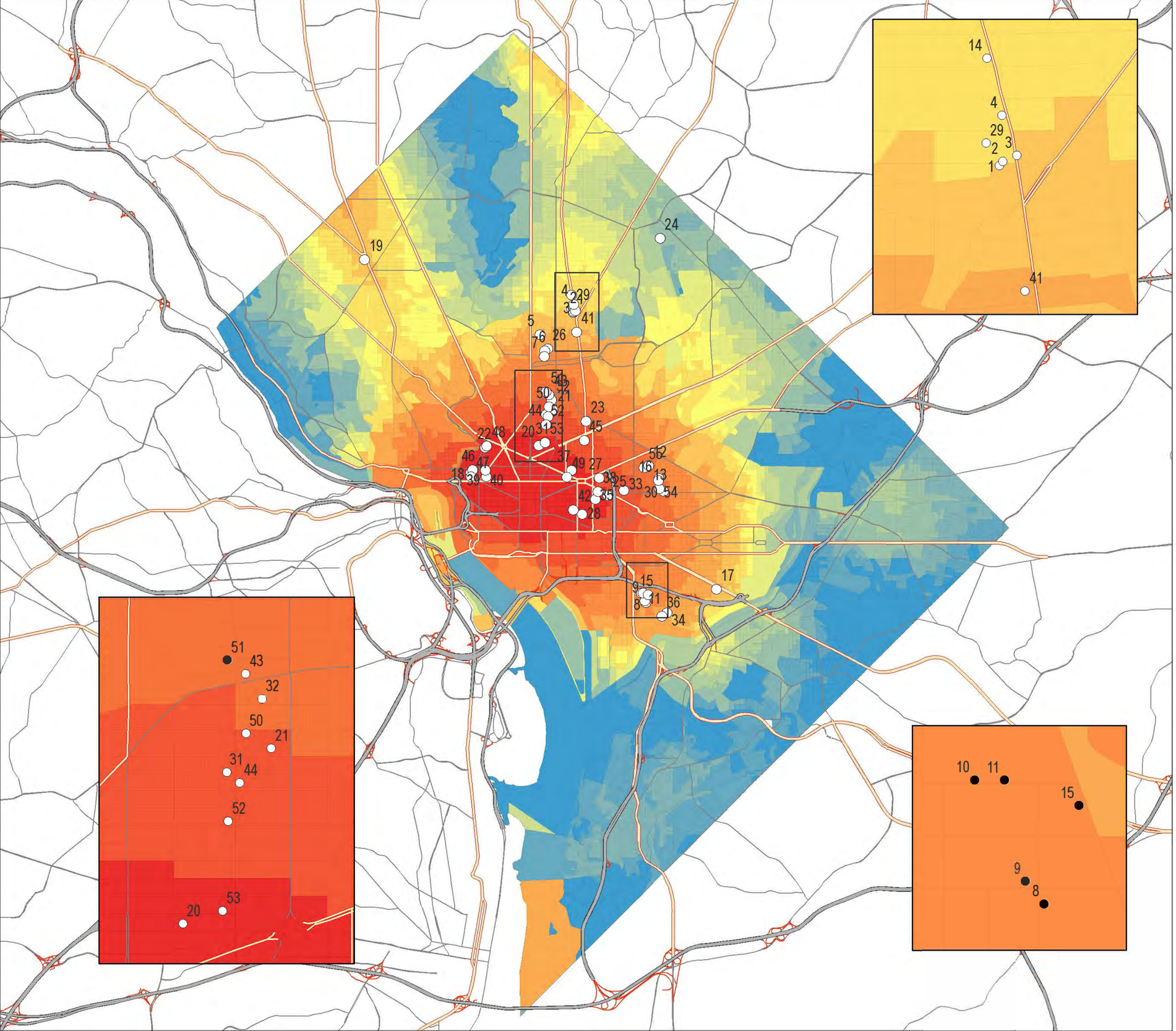
Access Score

Transit - Home-Based Other

- 0.00 - 10,500
- 10,600 - 12,200
- 12,300 - 13,300
- 13,400 - 14,400
- 14,500 - 15,100
- 15,200 - 16,300
- 16,400 - 17,500
- 17,600 - 18,600
- 18,700 - 19,200
- 19,300 - 20,100
- 20,200 - 21,200
- 21,300 - 21,700
- 21,800 - 22,900
- 23,000 - 24,300
- 24,400 - 26,600

Miles

0 0.5 1 2 3 4



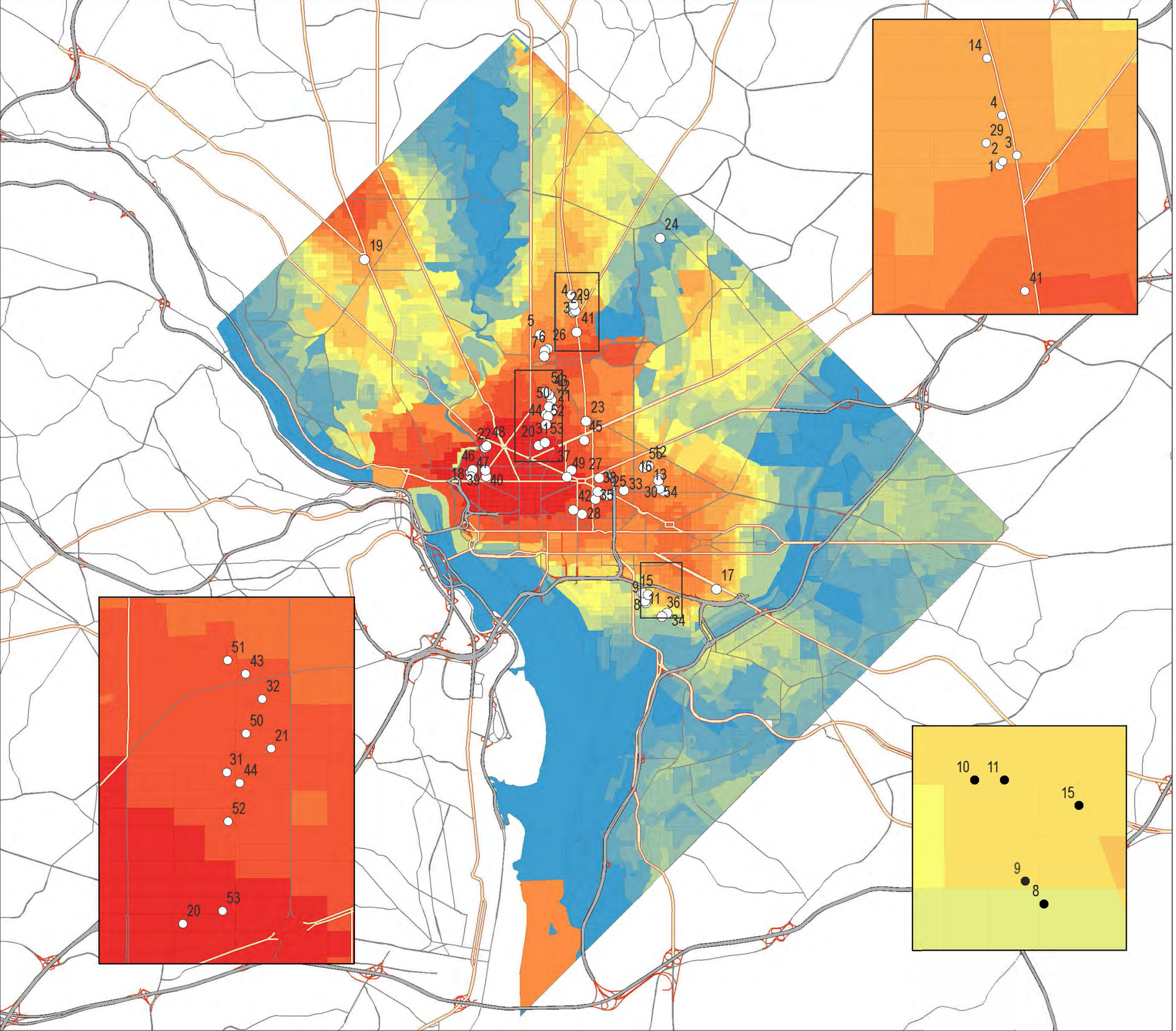
MMA Score Map

Access Score

Walk - Home-Based Work

- 36.8 - 2,250
- 2,260 - 2,800
- 2,810 - 3,480
- 3,490 - 4,610
- 4,620 - 5,810
- 5,820 - 7,010
- 7,020 - 8,420
- 8,430 - 9,880
- 9,890 - 12,100
- 12,200 - 16,400
- 16,500 - 26,200
- 26,300 - 39,900
- 40,000 - 61,200
- 61,300 - 94,100
- 94,200 - 166,000

0 0.5 1 2 3 4 Miles

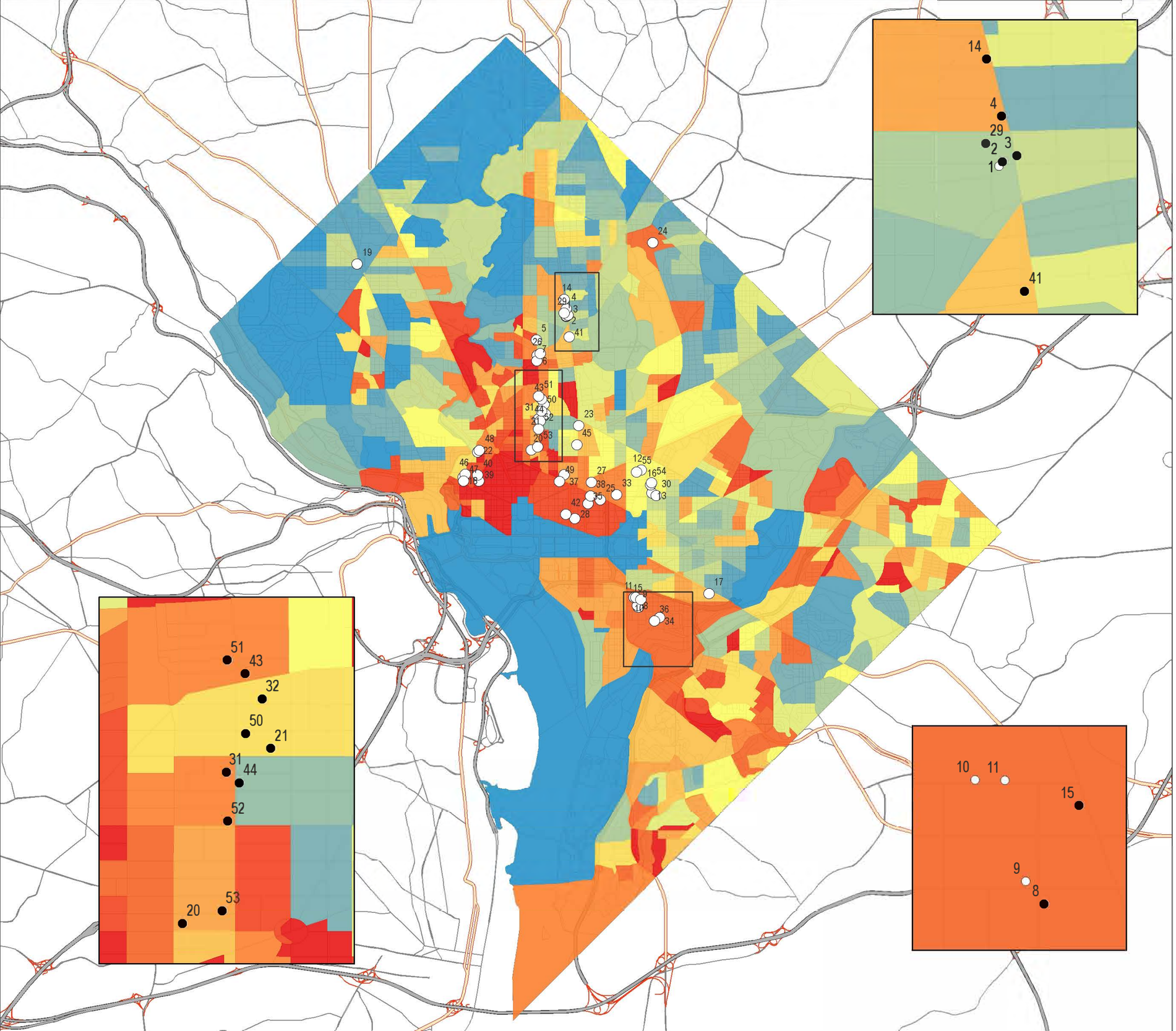


MMA Score Map

Walk - Home-Based Other

0 - 10	87 - 102
11 - 25	103 - 121
26 - 37	122 - 146
38 - 48	147 - 188
49 - 59	189 - 249
60 - 72	250 - 328
73 - 86	329 - 605
	606 - 1,470

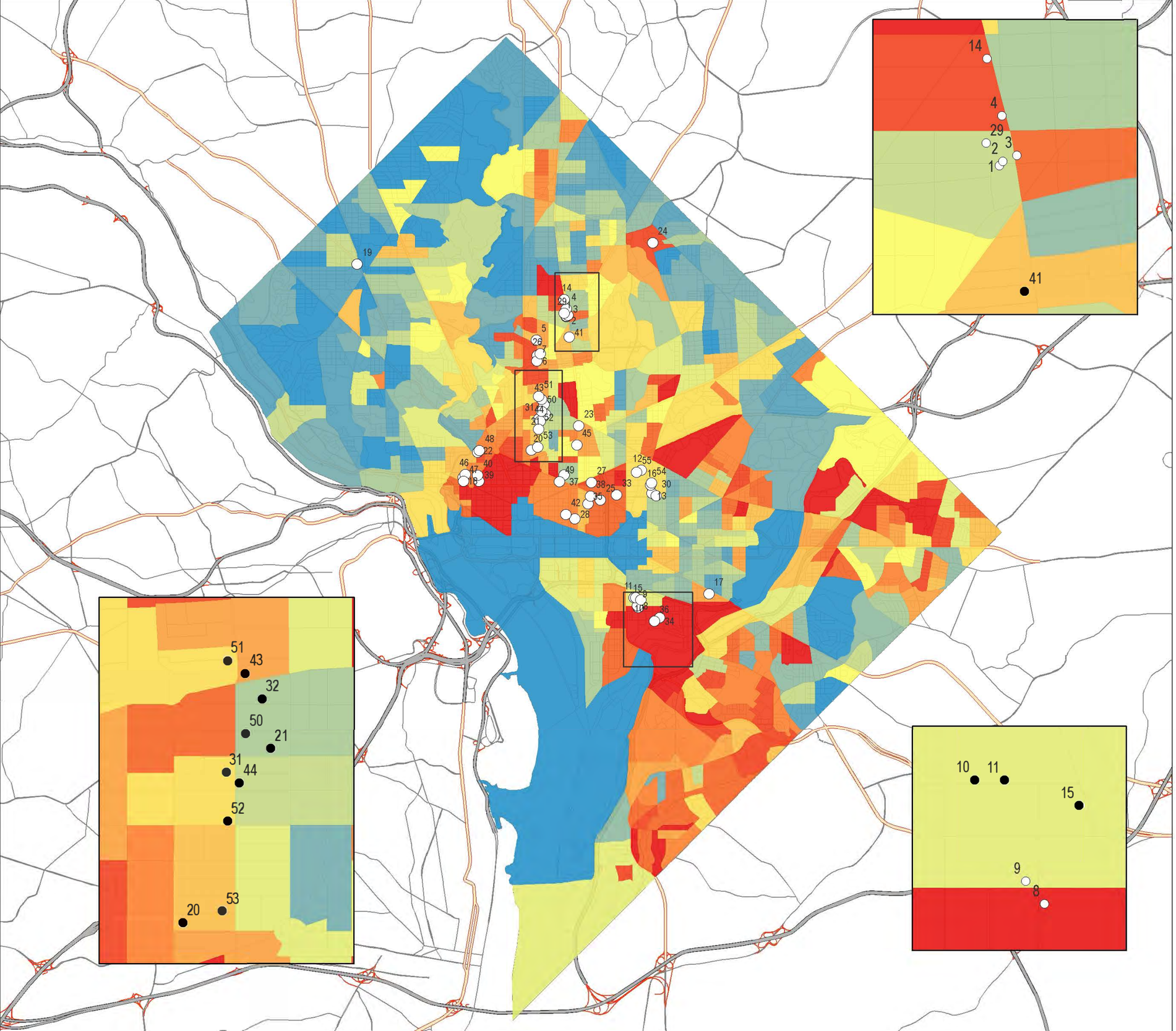
0 0.5 1 2 3 4 Miles



Percent Zero & One-Car Households

- 0% - 43%
- 44% - 56%
- 57% - 63%
- 64% - 68%
- 69% - 74%
- 75% - 77%
- 78% - 80%
- 81% - 82%
- 83% - 84%
- 85% - 88%
- 89%
- 90% - 91%
- 92% - 94%
- 95% - 96%
- 97% - 100%

0 0.5 1 2 3 4 Miles



Percent Zero-Car Households

- 0% - 5%
- 6% - 10%
- 11% - 16%
- 17% - 19%
- 20% - 24%
- 25% - 27%
- 28% - 31%
- 32% - 34%
- 35% - 38%
- 39% - 41%
- 42% - 46%
- 47% - 51%
- 52% - 58%
- 59% - 64%
- 65% - 100%

0 0.5 1 2 3 4 Miles

MMA Score Map

2015 Station Area Population

- 1,706 - 2,045
- 2,046 - 2,419
- 2,420 - 3,192
- 3,193 - 3,539
- 3,540 - 4,013
- 4,014 - 5,095
- 5,096 - 5,962
- 5,963 - 6,559
- 6,560 - 6,957
- 6,958 - 7,245
- 7,246 - 7,484
- 7,485 - 7,974
- 7,975 - 8,475
- 8,476 - 9,275
- 9,276 - 9,703
- 9,704 - 11,194
- 11,195 - 12,262
- 12,263 - 12,833
- 12,834 - 13,988
- 13,989 - 15,234

Miles
0 0.5 1 2 3 4

Appendix E. Regression Output

Mode-Specific Counts

AM Peak Persons

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.925
R Square	0.856
Adjusted R Square	0.830
Standard Error	142.480
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	5323276.270	2661638.135	131.111	0.000
Residual	44.000	893225.730	20300.585		
Total	46.000	6216502.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	1.087	0.121	8.959	0.000	0.842	1.332	0.842	1.332
Retail SF	3.081	0.876	3.518	0.001	1.316	4.846	1.316	4.846

PM Peak Persons

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.942
R Square	0.886
Adjusted R Square	0.861
Standard Error	193.407
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	12847663.870	6423831.935	171.732	0.000
Residual	44.000	1645870.130	37406.139		
Total	46.000	14493534.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	1.124	0.165	6.824	0.000	0.792	1.456	0.792	1.456
Retail SF	9.150	1.189	7.696	0.000	6.754	11.546	6.754	11.546

Mode-Specific Counts

AM Peak Drive Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.887
R Square	0.786
Adjusted R Square	0.758
Standard Error	62.255
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	626425.559	313212.779	80.815	0.000
Residual	44.000	170529.586	3875.672		
Total	46.000	796955.144			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.252	0.053	4.749	0.000	0.145	0.359	0.145	0.359
Retail SF	1.995	0.383	5.213	0.000	1.224	2.766	1.224	2.766

PM Peak Drive Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.927
R Square	0.860
Adjusted R Square	0.834
Standard Error	55.949
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	846821.412	423410.706	135.265	0.000
Residual	44.000	137730.607	3130.241		
Total	46.000	984552.019			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.155	0.048	3.257	0.002	0.059	0.251	0.059	0.251
Retail SF	3.222	0.344	9.368	0.000	2.529	3.915	2.529	3.915

Mode-Specific Counts

AM Peak Passenger Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.707
R Square	0.499
Adjusted R S	0.465
Standard Erro	13.897
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	8480.104	4240.052	21.956	0.000
Residual	44.000	8497.094	193.116		
Total	46.000	16977.198			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Oc	0.046	0.012	3.852	0.000	0.022	0.069	0.022	0.069
Retail SF	0.104	0.085	1.219	0.229	-0.068	0.276	-0.068	0.276

PM Peak Passenger Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.788
R Square	0.621
Adjusted R S	0.590
Standard Erro	22.856
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	37740.572	18870.286	36.122	0.000
Residual	44.000	22985.933	522.408		
Total	46.000	60726.505			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Oc	0.039	0.019	2.011	0.050	0.000	0.078	0.000	0.078
Retail KSF	0.641	0.140	4.561	0.000	0.358	0.924	0.358	0.924

Mode-Specific Counts

AM Peak Walk Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.908
R Square	0.825
Adjusted R	0.798
Standard E	65.534
Observatio	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	891221.134	445610.567	103.757	0.000
Residual	44.000	188968.567	4294.740		
Total	46.000	1080189.701			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated (	0.467	0.056	8.376	0.000	0.355	0.580	0.355	0.580
Retail SF	1.066	0.403	2.647	0.011	0.254	1.878	0.254	1.878

PM Peak Walk Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.899
R Square	0.808
Adjusted R	0.781
Standard E	138.355
Observatio	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	3545282.198	1772641.099	92.604	0.000
Residual	44.000	842256.723	19142.198		
Total	46.000	4387538.920			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated (	0.709	0.118	6.016	0.000	0.471	0.946	0.471	0.946
Retail SF	3.940	0.850	4.633	0.000	2.226	5.654	2.226	5.654

Mode-Specific Counts

AM Peak Bike Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.790
R Square	0.624
Adjusted R S	0.593
Standard Erro	6.042
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	2668.994	1334.497	36.550	0.000
Residual	44.000	1606.491	36.511		
Total	46.000	4275.485			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Oc	0.025	0.005	4.863	0.000	0.015	0.035	0.015	0.035
Retail SF	0.063	0.037	1.701	0.096	-0.012	0.138	-0.012	0.138

PM Peak Bike Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.808
R Square	0.652
Adjusted R S	0.622
Standard Erro	15.387
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	19543.648	9771.824	41.273	0.000
Residual	44.000	10417.577	236.763		
Total	46.000	29961.226			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Oc	0.022	0.013	1.665	0.103	-0.005	0.048	-0.005	0.048
Retail SF	0.500	0.095	5.287	0.000	0.309	0.691	0.309	0.691

Mode-Specific Counts

AM Peak Transit Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.779
R Square	0.606
Adjusted R S	0.575
Standard Erro	56.076
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	213196.197	106598.098	33.899	0.000
Residual	44.000	138360.174	3144.549		
Total	46.000	351556.370			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Oc	0.297	0.048	6.225	0.000	0.201	0.393	0.201	0.393
Retail SF	-0.147	0.345	-0.427	0.672	-0.842	0.548	-0.842	0.548

PM Peak Transit Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.771
R Square	0.595
Adjusted R S	0.563
Standard Erro	59.281
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	227157.545	113578.773	32.319	0.000
Residual	44.000	154628.244	3514.278		
Total	46.000	381785.789			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Oc	0.199	0.050	3.940	0.000	0.097	0.301	0.097	0.301
Retail SF	0.847	0.364	2.323	0.025	0.112	1.581	0.112	1.581

Neighborhood / Destination Sites

Neighborhood Sites - AM Peak Persons Counts

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.921086724
R Square	0.848400752
Adjusted R Square	0.814530186
Standard Error	111.9081964
Observations	36

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	2382904.89	1191452.445	95.13775957	1.99343E-14
Residual	34	425797.1105	12523.44443		
Total	36	2808702			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	1.007968327	0.104894027	9.609396788	3.20376E-11	0.794798016	1.221138638	0.794798016	1.221138638
Retail SF	0.003086263	0.001509155	2.045027348	0.048654428	1.92913E-05	0.006153235	1.92913E-05	0.006153235

Neighborhood Sites - PM Peak Persons Count

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.914340456
R Square	0.83601847
Adjusted R Square	0.801783719
Standard Error	152.9547268
Observations	36

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	4055324.953	2027662.477	86.67021208	7.32552E-14
Residual	34	795435.0468	23395.14844		
Total	36	4850760			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.968508792	0.143367848	6.755411396	9.15465E-08	0.677150271	1.259867313	0.677150271	1.259867313
Retail SF	0.010090948	0.002062694	4.892120121	2.36927E-05	0.005899049	0.014282847	0.005899049	0.014282847

Neighborhood / Destination Sites

Destination Sites - AM Peak Persons Count

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.952893592
R Square	0.908006198
Adjusted R Square	0.771506972
Standard Error	197.9572175
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	3094303.52	1547151.76	39.48118999	0.000154086
Residual	8	313496.4798	39187.05998		
Total	10	3407800			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	2.303712968	0.639361696	3.60314511	0.006950484	0.829342254	3.778083682	0.829342254	3.778083682
Retail SF	-0.001931374	0.002874371	-0.671929129	0.520557405	-0.008559686	0.004696938	-0.008559686	0.004696938

Destination Sites - PM Peak Persons Count

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.977268433
R Square	0.955053589
Adjusted R Square	0.824435288
Standard Error	232.757406
Observations	10

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	9209365.92	4604682.96	84.99487054	1.23034E-05
Residual	8	433408.0803	54176.01004		
Total	10	9642774			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	3.13508849	0.751759252	4.170335757	0.003120665	1.401528546	4.868648434	1.401528546	4.868648434
Retail SF	0.000715414	0.003379676	0.21168137	0.837648914	-0.007078132	0.00850896	-0.007078132	0.00850896

High/Low Trip Generation Sites

Low Trip Gen Sites AM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.869
R Square	0.755
Adjusted R Square	0.699
Standard Error	156.271
Observations	24.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	1659545.979	829772.989	33.978	0.000
Residual	22.000	537257.021	24420.774		
Total	24.000	2196803.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Unit	0.994	0.190	5.234	0.000	0.600	1.387	0.600	1.387
Retail SF	2.691	1.457	1.847	0.078	-0.330	5.712	-0.330	5.712

Low Trip Gen Sites - PM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.948
R Square	0.899
Adjusted R Square	0.849
Standard Error	147.739
Observations	24.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	4266424.073	2133212.037	97.734	0.000
Residual	22.000	480187.927	21826.724		
Total	24.000	4746612.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Unit	1.151	0.179	6.411	0.000	0.778	1.523	0.778	1.523
Retail SF	8.158	1.377	5.923	0.000	5.302	11.014	5.302	11.014

High/Low Trip Generation Sites

High Trip Gen Sites - AM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.959
R Square	0.919
Adjusted R Square	0.865
Standard Error	127.651
Observations	22.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	3693803.664	1846901.832	113.343	0.000
Residual	20.000	325895.336	16294.767		
Total	22.000	4019699.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Unit	1.167	0.153	7.641	0.000	0.848	1.485	0.848	1.485
Retail SF	3.134	1.061	2.954	0.008	0.921	5.348	0.921	5.348

High Trip Gen Sites - PM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.940
R Square	0.883
Adjusted R Square	0.827
Standard Error	239.028
Observations	22.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2.000	8604231.932	4302115.966	75.298	0.000
Residual	20.000	1142690.068	57134.503		
Total	22.000	9746922.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Unit	1.087	0.286	3.800	0.001	0.490	1.683	0.490	1.683
Retail SF	9.831	1.987	4.947	0.000	5.685	13.976	5.685	13.976

MMA Scores

AM Peak Persons Count

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.933
R Square	0.870
Adjusted R Square	0.810
Standard Error	149.875
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10.000	5407855.675	540785.568	24.075	0.000
Residual	36.000	808646.325	22462.398		
Total	46.000	6216502.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	1.223	0.253	4.832	0.000	0.709	1.736	0.709	1.736
Retail KSF	3.237	0.956	3.386	0.002	1.298	5.175	1.298	5.175
MMA auto HBW	0.001	0.001	1.157	0.255	-0.001	0.003	-0.001	0.003
MMA auto HBO	-0.084	0.067	-1.253	0.218	-0.220	0.052	-0.220	0.052
MMA transit HBW	-0.002	0.002	-1.303	0.201	-0.006	0.001	-0.006	0.001
MMA transit HBO	0.130	0.091	1.428	0.162	-0.055	0.315	-0.055	0.315
MMA walk HBW	-0.001	0.001	-0.496	0.623	-0.003	0.002	-0.003	0.002
MMA walk HBO	0.134	0.157	0.855	0.398	-0.184	0.452	-0.184	0.452
MMA population - walk HBO	-0.045	0.302	-0.150	0.882	-0.657	0.567	-0.657	0.567
MMA population - walk HBW	0.012	0.287	0.043	0.966	-0.570	0.595	-0.570	0.595

PM Peak Persons Count

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.945
R Square	0.893
Adjusted R Square	0.838
Standard Error	207.808
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10.000	12938898.106	#########	29.962	0.000
Residual	36.000	1554635.894	43184.330		
Total	46.000	14493534.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	1.109	0.351	3.161	0.003	0.397	1.820	0.397	1.820
Retail KSF	9.190	1.325	6.935	0.000	6.503	11.878	6.503	11.878
MMA auto HBW	0.001	0.001	0.368	0.715	-0.002	0.004	-0.002	0.004
MMA auto HBO	-0.026	0.093	-0.277	0.784	-0.214	0.163	-0.214	0.163
MMA transit HBW	-0.001	0.002	-0.430	0.670	-0.006	0.004	-0.006	0.004
MMA transit HBO	0.050	0.126	0.398	0.693	-0.206	0.307	-0.206	0.307
MMA walk HBW	0.000	0.002	-0.131	0.896	-0.004	0.003	-0.004	0.003
MMA walk HBO	0.037	0.217	0.171	0.865	-0.404	0.478	-0.404	0.478
MMA population - walk HBO	-0.504	0.419	-1.204	0.237	-1.353	0.345	-1.353	0.345
MMA population - walk HBW	0.433	0.398	1.087	0.284	-0.375	1.240	-0.375	1.240

MMA and Parking

AM Peak ADMS & Parking Spaces

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.945
R Square	0.894
Adjusted R Square	0.836
Standard Error	0.125
Observations	41.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9.000	4.205	0.467	29.905	0.000
Residual	32.000	0.500	0.016		
Total	41.000	4.705			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Parking Spaces	0.000053	0.000155	0.338416	0.737260	-0.000264	0.000369	-0.000264	0.000369
MMA auto HBW	0.000000	0.000001	-0.136356	0.892394	-0.000002	0.000002	-0.000002	0.000002
MMA auto HBO	0.000021	0.000061	0.336034	0.739039	-0.000104	0.000145	-0.000104	0.000145
MMA transit HBW	0.000000	0.000002	0.266313	0.791707	-0.000003	0.000004	-0.000003	0.000004
MMA transit HBO	-0.000021	0.000087	-0.244173	0.808656	-0.000197	0.000155	-0.000197	0.000155
MMA walk HBW	0.000000	0.000001	-0.424825	0.673807	-0.000003	0.000002	-0.000003	0.000002
MMA walk HBO	-0.000009	0.000161	-0.054264	0.957062	-0.000336	0.000319	-0.000336	0.000319
MMA population - walk HBO	0.000023	0.000290	0.079112	0.937436	-0.000568	0.000613	-0.000568	0.000613
MMA population - walk HBW	-0.000088	0.000287	-0.306057	0.761543	-0.000673	0.000497	-0.000673	0.000497

PM Peak ADMS & Parking Spaces

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.952
R Square	0.906
Adjusted R Square	0.851
Standard Error	0.084
Observations	41.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9.000	2.176	0.242	34.176	0.000
Residual	32.000	0.226	0.007		
Total	41.000	2.402			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Parking Spaces	0.000111	0.000104	1.064255	0.295178	-0.000102	0.000324	-0.000102	0.000324
MMA auto HBW	0.000000	0.000001	0.153207	0.879197	-0.000001	0.000001	-0.000001	0.000001
MMA auto HBO	-0.000007	0.000041	-0.167436	0.868080	-0.000091	0.000077	-0.000091	0.000077
MMA transit HBW	0.000001	0.000001	0.733797	0.468415	-0.000001	0.000003	-0.000001	0.000003
MMA transit HBO	-0.000039	0.000058	-0.673190	0.505660	-0.000158	0.000079	-0.000158	0.000079
MMA walk HBW	-0.000002	0.000001	-1.966568	0.057957	-0.000003	0.000000	-0.000003	0.000000
MMA walk HBO	0.000077	0.000108	0.714699	0.479977	-0.000143	0.000298	-0.000143	0.000298
MMA population - walk HBO	0.000086	0.000195	0.441375	0.661910	-0.000311	0.000483	-0.000311	0.000483
MMA population - walk HBW	-0.000125	0.000193	-0.646546	0.522537	-0.000519	0.000269	-0.000519	0.000269

MMA and Parking

AM Peak ADMS & Parking Rate

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.948
R Square	0.898
Adjusted R Square	0.842
Standard Error	0.122
Observations	41.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9.000	4.227	0.470	31.473	0.000
Residual	32.000	0.478	0.015		
Total	41.000	4.705			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
MMA auto HBW	0.000000	0.000001	-0.060667	0.952001	-0.000002	0.000002	-0.000002	0.000002
MMA auto HBO	0.000020	0.000059	0.330693	0.743032	-0.000101	0.000140	-0.000101	0.000140
MMA transit HBW	0.000000	0.000002	0.013567	0.989260	-0.000003	0.000003	-0.000003	0.000003
MMA transit HBO	-0.000003	0.000085	-0.029536	0.976621	-0.000175	0.000170	-0.000175	0.000170
MMA walk HBW	0.000000	0.000001	-0.165087	0.869914	-0.000003	0.000002	-0.000003	0.000002
MMA walk HBO	-0.000065	0.000159	-0.406164	0.687326	-0.000388	0.000259	-0.000388	0.000259
MMA population - walk HBO	-0.000007	0.000279	-0.026641	0.978911	-0.000577	0.000562	-0.000577	0.000562
MMA population - walk HBW	-0.000061	0.000275	-0.220508	0.826877	-0.000622	0.000500	-0.000622	0.000500
Parking Rate	0.093515	0.073487	1.272542	0.212349	-0.056173	0.243203	-0.056173	0.243203

PM Peak ADMS & Parking Rate

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.959
R Square	0.920
Adjusted R Square	0.869
Standard Error	0.077
Observations	41.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9.000	2.210	0.246	41.016	0.000
Residual	32.000	0.192	0.006		
Total	41.000	2.402			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
MMA auto HBW	0.000000	0.000001	0.249939	0.804232	-0.000001	0.000001	-0.000001	0.000001
MMA auto HBO	-0.000006	0.000038	-0.156900	0.876309	-0.000082	0.000071	-0.000082	0.000071
MMA transit HBW	0.000000	0.000001	0.364856	0.717619	-0.000002	0.000003	-0.000002	0.000003
MMA transit HBO	-0.000019	0.000054	-0.361784	0.719891	-0.000129	0.000090	-0.000129	0.000090
MMA walk HBW	-0.000001	0.000001	-1.507712	0.141438	-0.000003	0.000000	-0.000003	0.000000
MMA walk HBO	-0.000004	0.000101	-0.044309	0.964933	-0.000209	0.000200	-0.000209	0.000200
MMA population - walk HBO	0.000063	0.000177	0.353271	0.726202	-0.000298	0.000423	-0.000298	0.000423
MMA population - walk HBW	-0.000107	0.000174	-0.615219	0.542761	-0.000463	0.000248	-0.000463	0.000248
Parking Rate	0.124374	0.046550	2.671846	0.011765	0.029555	0.219194	0.029555	0.219194

MMA and Parking

AM Vehicles & Parking Spaces

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.903062811
R Square	0.815522441
Adjusted R Square	0.720696588
Standard Error	65.58792684
Observations	41

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	11	570507.5993	51864.32721	12.05649142	4.6177E-08
Residual	30	129053.2844	4301.776147		
Total	41	699560.8837			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.440504157	0.2543	1.7321	0.0935	-0.0789	0.9599	-0.0789	0.9599
Retail KSF	2.167188156	0.6650	3.2591	0.0028	0.8091	3.5252	0.8091	3.5252
Parking Spaces	-0.125718751	0.2338	-0.5377	0.5947	-0.6032	0.3518	-0.6032	0.3518
MMA auto HBW	0.000737336	0.0005	1.4445	0.1590	-0.0003	0.0018	-0.0003	0.0018
MMA auto HBO	-0.046100612	0.0327	-1.4083	0.1693	-0.1130	0.0208	-0.1130	0.0208
MMA transit HBW	-0.001340298	0.0009	-1.5116	0.1411	-0.0032	0.0005	-0.0032	0.0005
MMA transit HBO	0.071046718	0.0455	1.5618	0.1288	-0.0219	0.1639	-0.0219	0.1639
MMA walk HBW	-0.00033615	0.0006	-0.5424	0.5915	-0.0016	0.0009	-0.0016	0.0009
MMA walk HBO	0.079912006	0.0904	0.8841	0.3837	-0.1047	0.2645	-0.1047	0.2645
MMA population - walk HBO	-0.050417905	0.1522	-0.3312	0.7428	-0.3613	0.2605	-0.3613	0.2605
MMA population - walk HBW	0.031559075	0.1509	0.2092	0.8357	-0.2765	0.3397	-0.2765	0.3397

PM Vehicles & Parking Spaces

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.936799569
R Square	0.877593433
Adjusted R Square	0.80345791
Standard Error	59.34096808
Observations	41

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	11	757389.281	68853.571	19.55317176	1.57323E-10
Residual	30	105640.5148	3521.350493		
Total	41	863029.7957			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.024947557	0.2301	0.1084	0.9144	-0.4450	0.4949	-0.4450	0.4949
Retail KSF	2.76718569	0.6016	4.5994	0.0001	1.5385	3.9959	1.5385	3.9959
Parking Spaces	0.130074102	0.2115	0.6149	0.5432	-0.3019	0.5621	-0.3019	0.5621
MMA auto HBW	-5.35152E-05	0.0005	-0.1159	0.9085	-0.0010	0.0009	-0.0010	0.0009
MMA auto HBO	0.003291942	0.0296	0.1111	0.9122	-0.0572	0.0638	-0.0572	0.0638
MMA transit HBW	0.000474679	0.0008	0.5917	0.5585	-0.0012	0.0021	-0.0012	0.0021
MMA transit HBO	-0.027079211	0.0412	-0.6580	0.5156	-0.1111	0.0570	-0.1111	0.0570
MMA walk HBW	-0.000212172	0.0006	-0.3784	0.7078	-0.0014	0.0009	-0.0014	0.0009
MMA walk HBO	-0.012681043	0.0818	-0.1551	0.8778	-0.1797	0.1543	-0.1797	0.1543
MMA population - walk HBO	-0.013904539	0.1377	-0.1010	0.9203	-0.2952	0.2674	-0.2952	0.2674
MMA population - walk HBW	0.004651291	0.1365	0.0341	0.9730	-0.2741	0.2834	-0.2741	0.2834

Population within 1/4-mile of sites

Person Counts - AM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.928
R Square	0.861
Adjusted R Square	0.831
Standard Error	141.851
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	5351263.183	1783754.394	88.648	0.000
Residual	43.000	865238.817	20121.833		
Total	46.000	6216502.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/4-mile population	-0.005	0.004	-1.179	0.245	-0.013	0.003	-0.013	0.003
Estimated Occupied Unit	1.207	0.158	7.644	0.000	0.889	1.525	0.889	1.525
Retail SF	3.123	0.873	3.579	0.001	1.363	4.883	1.363	4.883

Person Counts - PM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.942
R Square	0.887
Adjusted R Square	0.858
Standard Error	195.296
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	12853489.400	4284496.467	112.334	0.000
Residual	43.000	1640044.600	38140.572		
Total	46.000	14493534.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/4-mile population	0.002	0.006	0.391	0.698	-0.009	0.013	-0.009	0.013
Estimated Occupied Unit	1.069	0.217	4.918	0.000	0.631	1.507	0.631	1.507
Retail SF	9.130	1.201	7.600	0.000	6.708	11.553	6.708	11.553

Population within 1/4-mile of sites

Walk Counts - AM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.909
R Square	0.826
Adjusted R Square	0.794
Standard Error	66.203
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	891725.725	297241.908	67.819	0.000
Residual	43.000	188463.976	4382.883		
Total	46.000	1080189.701			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/4-mile population	0.001	0.002	0.339	0.736	-0.003	0.004	-0.003	0.004
Estimated Occupied Unit	0.451	0.074	6.125	0.000	0.303	0.600	0.303	0.600
Retail SF	1.061	0.407	2.604	0.013	0.239	1.882	0.239	1.882

Walk Counts - PM Peak

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.902
R Square	0.813
Adjusted R Square	0.781
Standard Error	137.983
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	3568845.542	1189615.181	62.482	0.000
Residual	43.000	818693.378	19039.381		
Total	46.000	4387538.920			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1/4-mile population	0.004	0.004	1.112	0.272	-0.004	0.012	-0.004	0.012
Estimated Occupied Unit	0.599	0.154	3.899	0.000	0.289	0.908	0.289	0.908
Retail SF	3.902	0.849	4.597	0.000	2.190	5.614	2.190	5.614

Zero and One-Car Households

AM Peak Person Trips - 0 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.926
R Square	0.857
Adjusted R Square	0.827
Standard Error	143.877
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	5326375.122	1775458.374	85.768	0.000
Residual	43.000	890126.878	20700.625		
Total	46.000	6216502.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SLD %0-Car Households	-40.243	104.011	-0.387	0.701	-250.000	169.515	-250.000	169.515
Estimated Occupied Units	1.150	0.204	5.628	0.000	0.738	1.562	0.738	1.562
Retail SF	3.101	0.886	3.501	0.001	1.315	4.888	1.315	4.888

PM Peak Person Trips - 0 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.942
R Square	0.888
Adjusted R Square	0.860
Standard Error	194.314
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	12869935.362	4289978.454	113.617	0.000
Residual	43.000	1623598.638	37758.108		
Total	46.000	14493534.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SLD %0-Car Households	107.885	140.473	0.768	0.447	-175.405	391.175	-175.405	391.175
Estimated Occupied Units	0.954	0.276	3.456	0.001	0.397	1.511	0.397	1.511
Retail SF	9.096	1.196	7.602	0.000	6.683	11.508	6.683	11.508

Zero and One-Car Households

AM Peak Person Trips - 0 & 1 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.927
R Square	0.858
Adjusted R Square	0.829
Standard Error	143.064
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	5336405.030	1778801.677	86.909	0.000
Residual	43.000	880096.970	20467.371		
Total	46.000	6216502.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SLD % <2 car HH	-44.338	55.360	-0.801	0.428	-155.981	67.305	-155.981	67.305
Estimated Occupied Units	1.230	0.216	5.687	0.000	0.794	1.666	0.794	1.666
Retail SF	3.110	0.880	3.534	0.001	1.336	4.885	1.336	4.885

PM Peak Person Trips - 0 & 1 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.942
R Square	0.887
Adjusted R Square	0.859
Standard Error	194.763
Observations	46.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	12862425.522	4287475.174	113.028	0.000
Residual	43.000	1631108.478	37932.755		
Total	46.000	14493534.000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SLD % <2 car HH	47.014	75.365	0.624	0.536	-104.973	199.002	-104.973	199.002
Estimated Occupied Units	0.972	0.294	3.301	0.002	0.378	1.566	0.378	1.566
Retail SF	9.119	1.198	7.610	0.000	6.702	11.535	6.702	11.535

Zero and One-Car Households

AM Peak Vehicle Trips - 0 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.888
R Square	0.788
Adjusted R Square	0.756
Standard Error	62.253
Observations	47.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	635595.516	211865.172	54.668	0.000
Residual	44.000	170520.702	3875.471		
Total	47.000	806116.218			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.235	0.082	2.858	0.006	0.069	0.401	0.069	0.401
Retail SF	0.002	0.000	5.362	0.000	0.001	0.003	0.001	0.003
SLD %0-Car Households	8.909	44.023	0.202	0.841	-79.813	97.630	-79.813	97.630

PM Peak Vehicle Trips - 0 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.930
R Square	0.864
Adjusted R Square	0.835
Standard Error	55.314
Observations	47.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	857627.608	285875.869	93.435	0.000
Residual	44.000	134623.170	3059.617		
Total	47.000	992250.778			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.099	0.073	1.353	0.183	-0.048	0.246	-0.048	0.246
Retail SF	0.003	0.000	9.497	0.000	0.002	0.004	0.002	0.004
SLD %0-Car Households	41.750	39.115	1.067	0.292	-37.082	120.582	-37.082	120.582

Zero and One-Car Households

AM Peak Vehicle Trips - 0 & 1 Car Households

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.889
R Square	0.790
Adjusted R Square	0.757
Standard Error	62.101
Observations	47.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	636428.800	212142.933	55.009	0.000
Residual	44.000	169687.418	3856.532		
Total	47.000	806116.218			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.285	0.087	3.256	0.002	0.108	0.461	0.108	0.461
Retail SF	0.002	0.000	5.454	0.000	0.001	0.003	0.001	0.003
SLD % <2 car HH	-11.911	23.486	-0.507	0.615	-59.245	35.422	-59.245	35.422

PM Peak Vehicle Trips - 0 & 1 Car Households

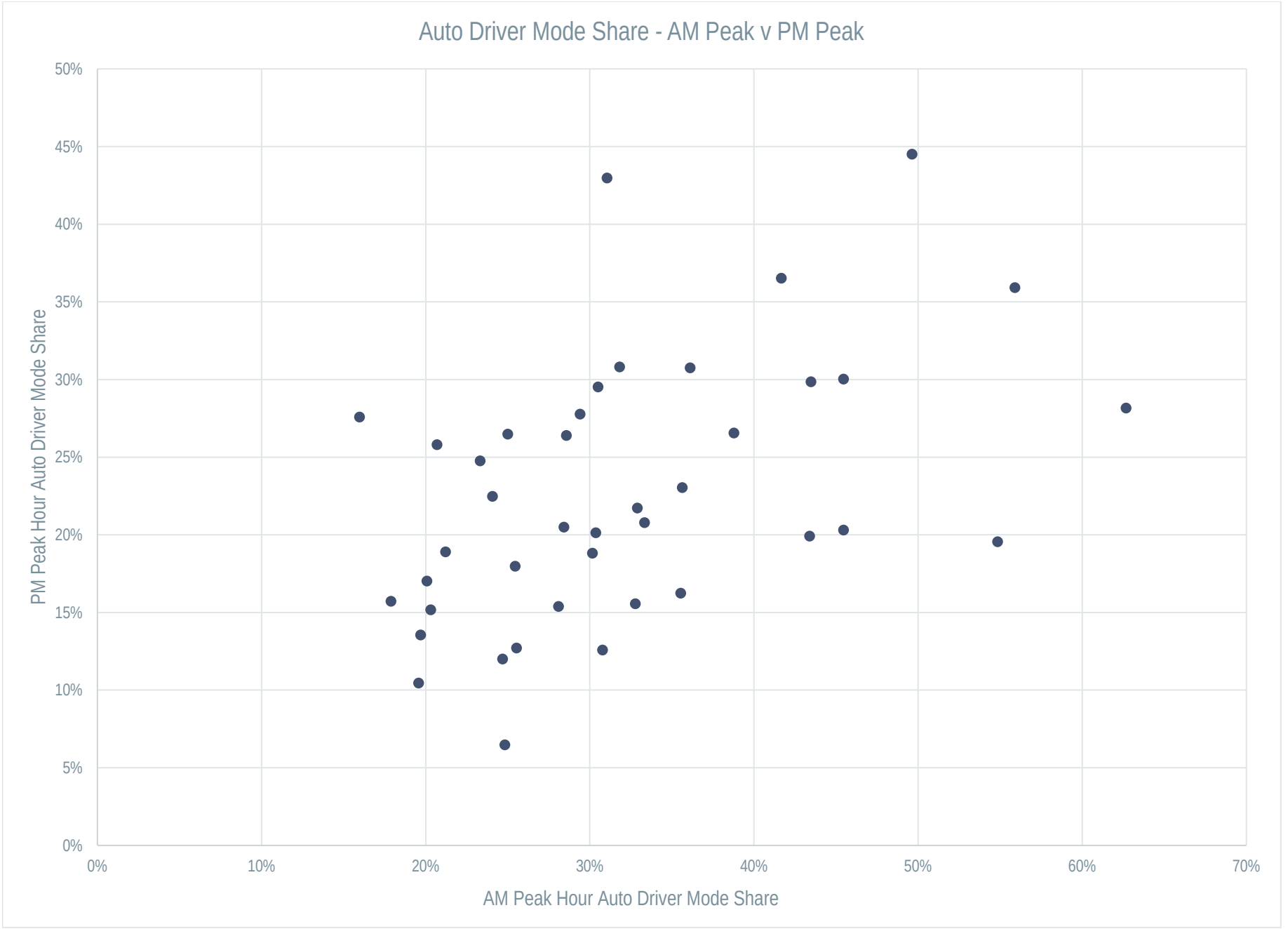
SUMMARY OUTPUT

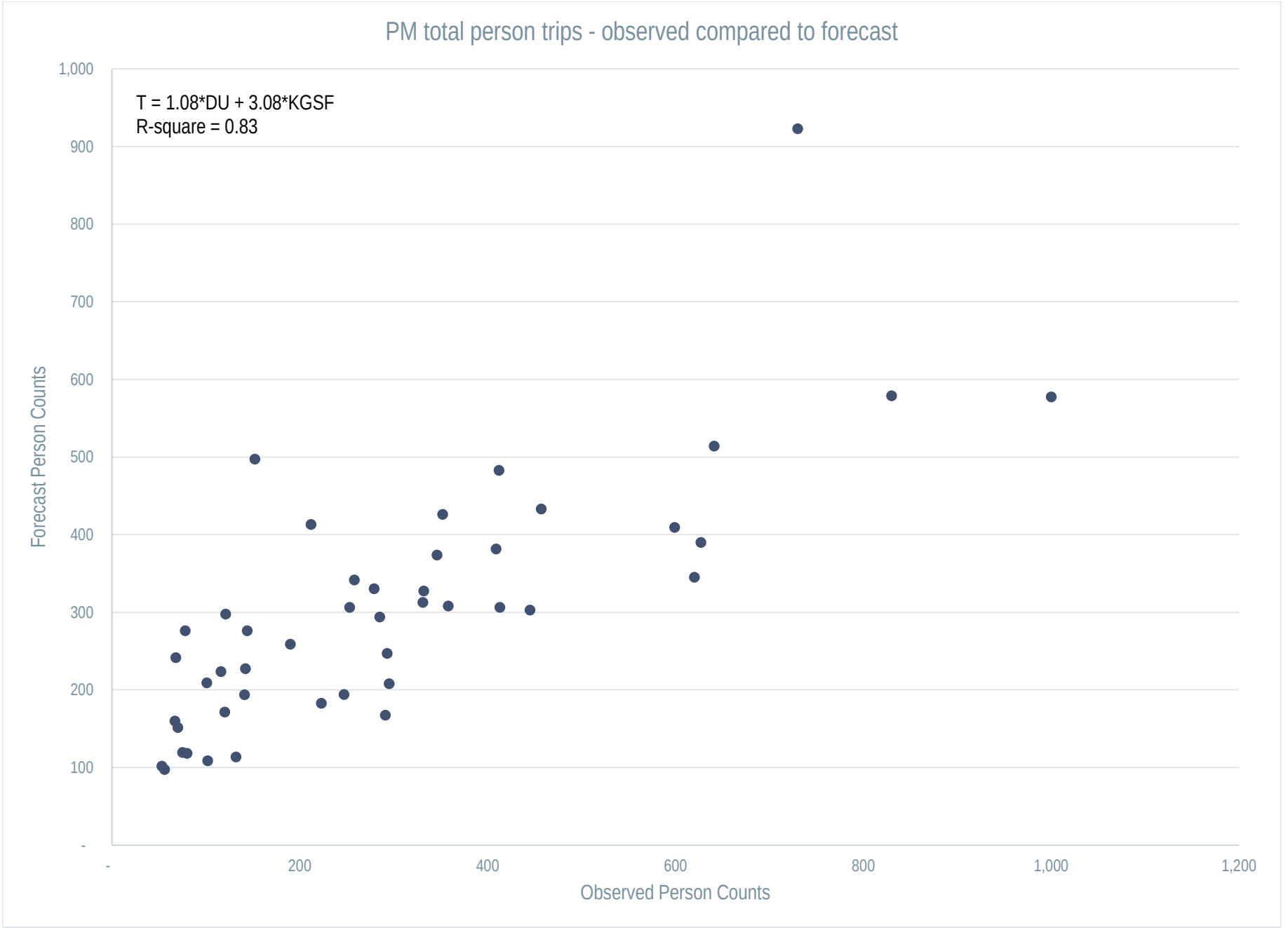
Regression Statistics	
Multiple R	0.928
R Square	0.861
Adjusted R Square	0.832
Standard Error	55.903
Observations	47.000

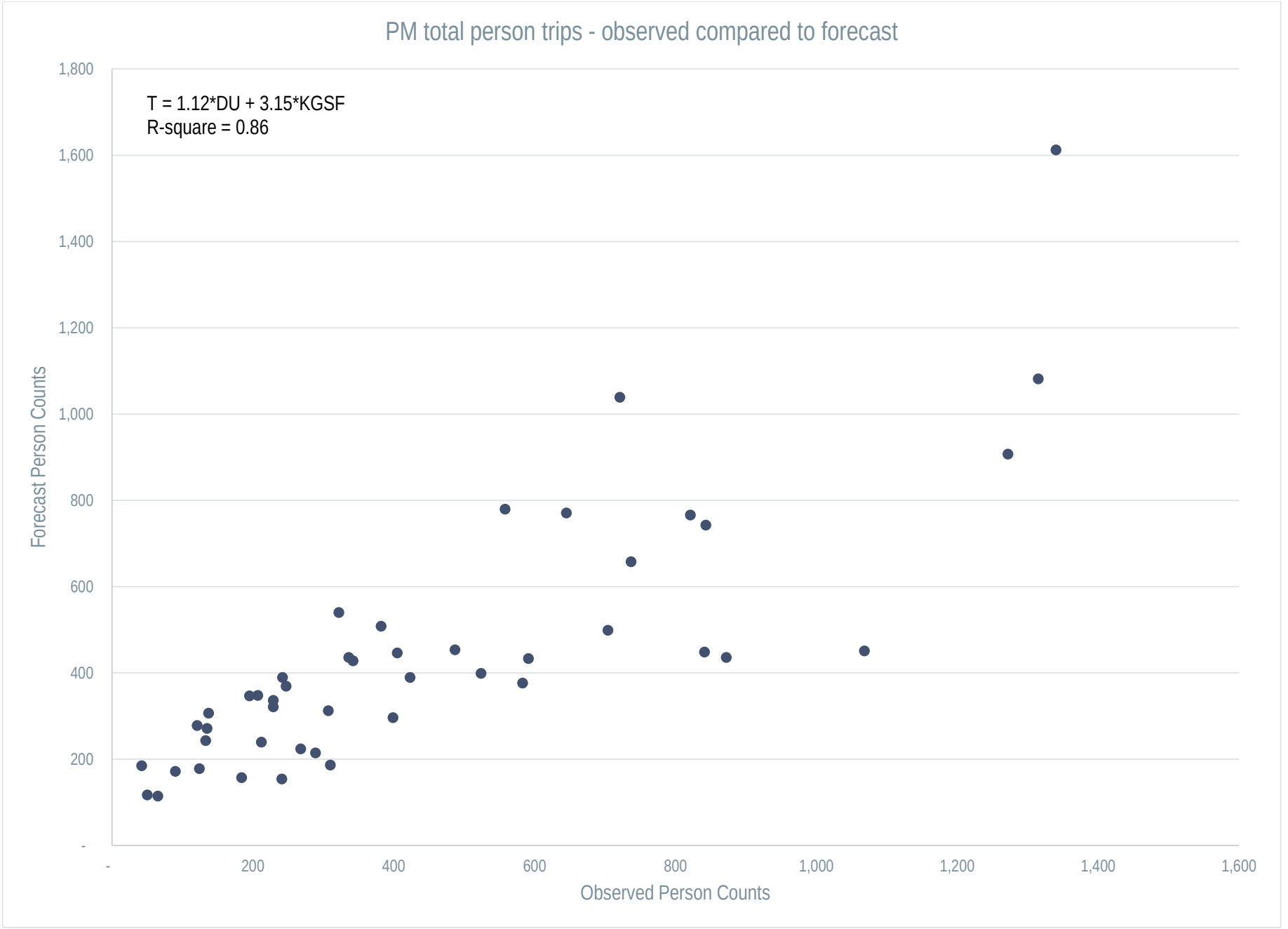
ANOVA

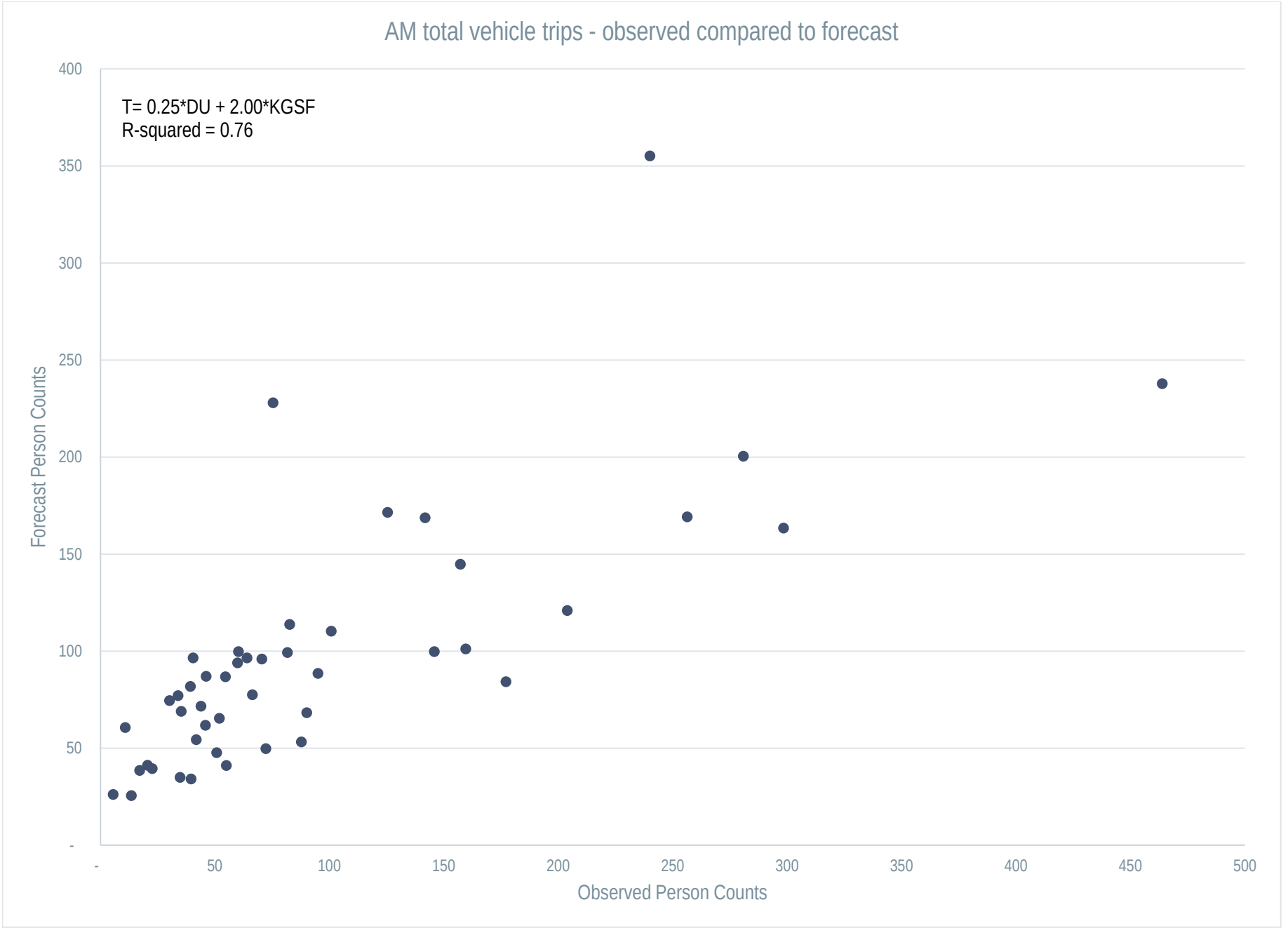
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.000	854746.512	284915.504	91.170	0.000
Residual	44.000	137504.265	3125.097		
Total	47.000	992250.778			

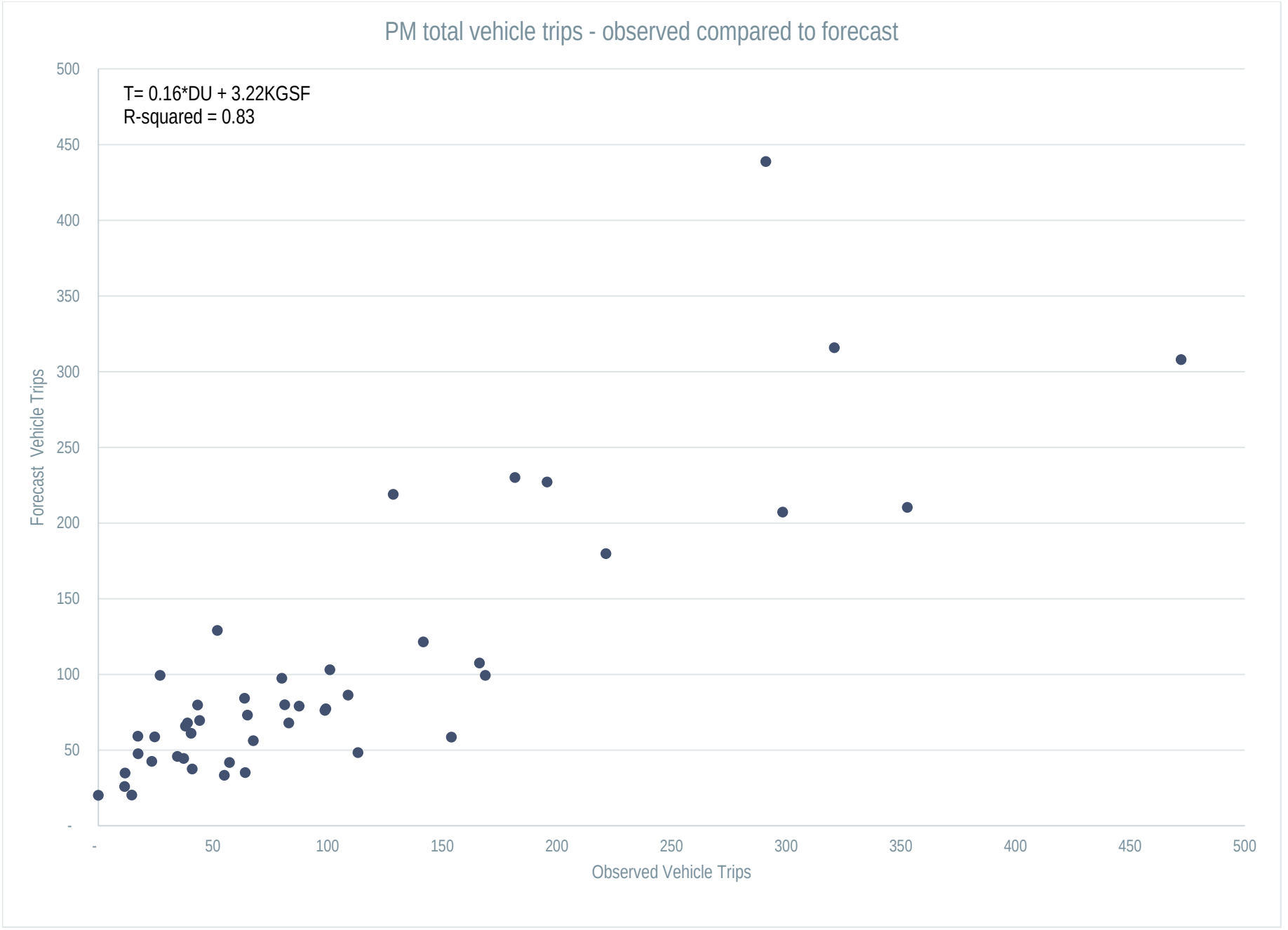
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Estimated Occupied Units	0.132	0.079	1.682	0.100	-0.026	0.291	-0.026	0.291
Retail SF	0.003	0.000	9.488	0.000	0.003	0.004	0.003	0.004
SLD % <2 car HH	9.298	21.142	0.440	0.662	-33.310	51.907	-33.310	51.907


Auto Driver Mode Share - AM Peak v PM Peak
PM Peak Hour Auto Driver Mode Share
AM Peak Hour Auto Driver Mode Share
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0%
10%
20%
30%
40%
50%
60%
70%


PM total person trips - observed compared to forecast
T = 1.08*DU + 3.08*KGSF
R-square = 0.83
Forecast Person Counts
Observed Person Counts
1,000
900
800
700
600
500
400
300
200
100
-
-
200
400
600
800
1,000
1,200


PM total person trips - observed compared to forecast
T = 1.12*DU + 3.15*KGSF
R-square = 0.86
Forecast Person Counts
Observed Person Counts
1,800
1,600
1,400
1,200
1,000
800
600
400
200
-
-
200
400
600
800
1,000
1,200
1,400
1,600


AM total vehicle trips - observed compared to forecast
T= 0.25*DU + 2.00*KGSF
R-squared = 0.76
Forecast Person Counts
Observed Person Counts
400
350
300
250
200
150
100
50
-
-
50
100
150
200
250
300
350
400
450
500


PM total vehicle trips - observed compared to forecast
T= 0.16*DU + 3.22KGSF
R-squared = 0.83
Forecast Vehicle Trips
Observed Vehicle Trips
500
450
400
350
300
250
200
150
100
50
-
-
50
100
150
200
250
300
350
400
450
500

Appendix F. List of Assumptions

1. Site GSF/DU information

    a. Residential vacancies:

        i. Where occupancy is > 90% or not known, estimated occupancy is listed as equal to the site's total DUs. Typical vacancy rate is 96% due to normal levels of housing turnover; the goal of a trip generation rate is to forecast trips for built DUs with a normal vacancy rate (as opposed to "occupied DUs")

        ii. Where occupancy is < 90%, use occupied DUs rather than built DUs

    b. Vacant stores not included in GSF

    c. Where a site's total retail GSF is known but individual retail bay sizes are unknown, assume all retail bay sizes are of identical size (i.e., each bay has GSF = total site retail GSF divided by number of establishments)

2. Treatment of person-trip to vehicle-trip conversions

    a. Deliveries and carshare trips are assumed to be SOV

    b. Recreational trips are assumed to be walk trips

    c. Taxis are assumed to be SOV for surveyed users and include both a vehicle trip (but not a separate person trip) representing that the vehicle has to arrive to/from the site but that the taxi driver is not associated with the site. A different assumption may also be warranted for office/hotel sites.

    d. For doorways where no surveys are available corresponding to person-trip counts (changes are made in the original data worksheet from the field review):

        i. If the zero-survey condition exists for only one time period, the mode share is assumed to be equal to the same doorway's mode share for the remainder of the peak hour within the peak period (a.m. or p.m.)

        ii. If the zero-survey condition exists for the full peak hour within the peak period (Phase 1, Site 1 loading dock doorway) the mode share for all time periods with in the peak period (a.m. or p.m.) is assumed to be equal to the mode share for the sum of all doorways during the three-hour count

e. Rounding error for survey/count correlation:

   i. Use person-trip counts as the dispositive variable

   ii. In expanding from surveyed totals to match the observed count totals, allow SOV and HOV drivers to be proportionally increased to non-integer numbers in each time period

   iii. No work yet done to formally identify/track all other users by mode

3. Segregation of mixed-access doorways

   a. Garages – in first assessment, no segregation to residential or retail attempted

      i. Garage segregation information only available for 14 sites in the RSP study

      ii. Garages often noted as not readily separable (D2, D6 noted)

   b. Mixed retail doorways – doorways noted as being associated with multiple retail sites assumed as being LUC 820 (shopping center)

   c. Multiple doorways per retail tenant – where one retail tenant has multiple doorways the counts are combined to facilitate rate calculations

   d. Retail/residential doorways – in first assessment, doorways noted as being associated with both residential and retail (generally a back loading door) treated similar to garages in terms of associated with neither residential nor retail (site/doorways D5/P6 only such case noted)

4. ITE land use code considerations – the judgment calls identified below may not ultimately be too important; they are primarily useful for sorting/comparing among uses that are clearly/definitely within a common LUC rather than examining outliers that may not fit the standard definitions

   a. There are several dry cleaners – using LUC 960 from Parking Generation for comparison; no published trip generation rates

   b. 820 and 826 may be worth spot-checking to see if any of the tenants should obviously reassigned to a different code; 820 (shopping center) is our adopted "miscellaneous" code and includes a couple museum/educational sites; 826 (specialty retail) would logically apply to a couple sites although the ITE manual only has 4 sites from which the trip generation rates are derived

   c. Tesla "dealership" at 1050 K coded as 841 (auto sales)

5. Additional site data QA/QC notes:

    a. We have dropped Site 23 in our master database # from the analysis because the primary non-residential space is either 50KGSF or 110KGSF for the United Negro College Fund offices

    b. We have dropped Site 47 because the primary non-residential space is office instead of retail

    c. Certain other smaller spaces may arguably be office rather than retail but are small enough to be part of the 715 or 820/826 LUC without being primarily a "residential/office" mixed use

6. Regression analysis

    a. Use Excel data analysis with linear regression and fixed Y-intercept at 0 to establish an initial relationship for "DU + KGSF"

7. Site-specific building and parking assumptions

    a. Generally, site specific information on DU and SF obtained from sources as noted in the following DDOT Trip Generation Site Screening file (version saved and archived on 8/28 at 12:43 PM):

    https://docs.google.com/spreadsheets/d/1SNt15RZGEUXEKpe3h4XK6qVSi42X_6K-lt5bttV_jtg/edit?pli=1#gid=0

    b. Resolution of conflicting information includes site-specific adjustments in database, with source as noted:

        i. Site 4: 28,000 in ModeledModeSplitData ITE calcs cell F8 not associated with a specific use in columns K-Q/S-Y; no retail doorways counted, so set to zero (and site dropped from the combination residential/retail database)

        ii. Site 5: Retail not identified in retail doorway tab as it shares doorway/counts with residential; site dropped from the combination residential/retail database

        iii. Site 6: Surveys not performed at the combined retail sites for doorway 6.01. The person trip rates include both counts and KGSF. The mode-specific trip rates are technically in error as they include the 9,000 GSF but have no mode specific trips

        iv. Site 7:

            1. Total Retail GSF = 19194 from Phase 1 ModeledModeSplitData spreadsheet cell F11

            2. Lou's 3750 and Acre 3000 from J. Rogers 8/27 e-mail

3. Other five sites divided equally at 2488.8 each

v. Site 12: Data from ModeledModeSplitData columns N-O and V-W used to total 52,000 GSF per S. Dock 8/24 e-mail

vi. Site 17: 6,392 of retail GSF not Harris Teeter divided equally among convenience retail and service use (Site Screening database of 5,000 and 1,392 appears to be citation of web resource which uses rounding convention for 5,000)

vii. Site 19: 88,000 from SiteScreeningDatabase assigned 12,000 to Framing Shop and 49,500 to Best Buy based on media articles; remainder assigned to Container Store

viii. Site 22: 20,000 total less 1197 assigned to Linea Pitti in Site Screening Database assigned equally to other sites

ix. Site 23: 24,200 total retail GSF divided equally among three tenants. United Negro College Fund considered office; not counted or identified as retail. **Site dropped from residential+retail category**

x. Site 24: Door counts indicate a 7-11 site; 5,000 GSF divided into 7-11, clinic, and vacant site equally

xi. Site 25: Unidentified tenant determined to be shared by Carving Room/cleaners based on door counts

xii. Site 27: Ray's Hellburger and Alta Strada dropped from list based on lack of door counts. Name of hardware store and bank changed based on door count labels. Vida Fitness adjusted from 25,672 to 25,000 based on interpretation of J. Rogers 8/27 e-mail re: Site 20 and Vida Fitness website statement of over 25,000 SF – in retrospect, not a needed adjustment, but a small one)

xiii. Site 28: Assumed 1986 article cited in screening database applies only to retail tenants; space divided equally among them. 20,000 GSF rough estimate applied to theatre based on rough dimensions /citations such as 66'x34' stage size, seating capacity for 451, 2,000 GSF lobby space: http://www.shakespearetheatre.org/_pdf/rentals/lansburgh_tech_rider.pdf. Theatre shares doorway with tenant, so separate LUC and consideration of seats as independent variable not applicable to doorway count – LUC of 820 assumed

xiv. Site 43: YMCA size adjusted from 2,245 SF to match Site 32 data point of 45,000 SF based on Y-website indication of amenities including 6-lane pool, rooftop exercise terrace, culinary studio, 3 group studio spaces, conferencing facilities, etc.: http://www.ymcadc.org/tour.cfm?bid=01

xv. Site 47: 62,514 commercial GSF determined to be office as primary use (compared to 40 DU); not counted or identified as retail. (18,227 retail divided among four tenants equally; entered twice on site screening database). **Site dropped from residential+retail category**

8. Definition of "binned" retail categories:

   a. Destination/Neighborhood – provided by DDOT in site screening database:

      i. YMCA site removed (not different from second YMCA site or Vida Fitness sites)

      ii. Shakespeare theatre site and bookstores not used as destination sites (both identified in screening database as potential destination uses in neighborhood sites)

   b. "Low"/"high" trip generation sites; "high trip generation" sites defined as places with at least one tenant determined to be in one of the following ITE land use codes (for purposes of expediency, only one sub-code category for each land use type was used without adjustments for size, hours of operation, presence/absence of drive-thru, etc.):

      i. 851: Convenience Market

      ii. 880: Pharmacy/Drugstore

      iii. 932: High Turnover Sit-Down Restaurant

      iv. 933: Fast Food Restaurant

      v. 936: Coffee/Donut Shop

      vi. 939: Bread/Donut/Bagel Shop