RESIDENTIAL BUILDING TRANSPORTATION PERFORMANCE MONITORING STUDY
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EXECUTIVE SUMMARY

The Residential Transportation Performance Monitoring Study is an aggregate analysis of 16 individual transportation performance monitoring studies conducted at high-density residential buildings in Arlington to comply with legal conditions adopted during their development process.

Building-level studies provided information about travel and parking behaviors in residential buildings where transportation demand management (TDM) services are provided by Arlington County Commuter Services (ACCS). These studies aim to provide data and feedback to staff and decision-makers in order to evaluate Arlington’s parking and TDM policies and programs.

The aggregate study combined data from the 16 buildings into a larger data set that provided a greater level of confidence in the findings and protected the privacy of residents. These generalized findings can be used for public dissemination and discourse about the performance of residential buildings relative to County transportation objectives.

Commuter travel

Weekly commute mode split, commute distance, and other commute characteristics were assessed based on surveys completed by building residents. Key findings include:

- Study residents use transit more than Arlington residents overall (34 percent study vs. 27 percent) and significantly more than the regional average of 21 percent.
- Study residents’ commute travel is similar to the travel patterns of commuters who live in the immediate neighborhood of the study buildings, but they ride transit slightly more.
- Access to transit service at home and walkability of a residential area are both related to low drive-alone rates for commuting.
- Parking is a powerful factor in commute decision-making, but parking availability/price at work is likely more important than parking at home.
- Work location is a strong component of commute mode.

Non-work travel

Mode share and other characteristics of non-work trips were assessed based on surveys by building residents. Key findings include:

- Transit, walking, and biking account for 39 percent of the non-work trips made by study residents.
- The non-work transit share is higher for study buildings than for their immediate neighborhoods.
- Access to transit seems a less significant factor in non-work mode choice than for commuting.

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1 The overall response rate for building resident surveys across the 16 buildings was 20%.
• The share of non-work walk trips is clearly related to the extent of services within walking distance.
• The role of residential parking on non-work mode use is difficult to define – most likely it influences vehicle ownership, which in turn influences mode choice.

**Vehicle trip generation**

Vehicle trip generation was based on tube (or hose) counts for vehicles entering or exiting the parking facilities of the building. Counts were conducted for 24 hours/day for 7 consecutive days. Parking occupancy was calculated for the 7-day survey period based on a one-time manual count during the week. Key findings of the trip generation analysis include:

• Peak hour and daily trips for buildings within Metrorail corridors for all days of the week were much lower than predicted trips based on appropriate Institute of Transportation Engineers (ITE) rates. Some trip generation rates for buildings outside the Metrorail corridors were also much lower than ITE rates.
• The location – within or outside the Metrorail corridors - was the most significant factor affecting trip generation. Density of destinations (Walk Score), higher neighborhood intensity, and provision of a shuttle or free transit seemed to be associated with lower trip generation outside the corridors.
• There was no noticeable difference in the trip generation of apartments and condominiums, or by average age of residents in the building.

**Vehicle ownership and use**

The analysis for this section is based on resident surveys, vehicle trip counts, and parking occupancy calculations. Key findings include:

• Vehicle ownership increased with average household income.
• Condominium owners owned more vehicles per adult than apartment residents.
• There was a definite inverse relationship between vehicle ownership and transit access.
• Ownership rates were lower in more walkable areas than in “car dependent” areas, but were about the same if the area was “somewhat,” “very,” or “extremely” walkable.
• Vehicle ownership is strongly related to the cost of residential parking – particularly at a cost of $95 or more per month.
• Few parking garages approached full occupancy. The average maximum parking occupancy for all study buildings was 80%. The average minimum parking occupancy was 38% within the Metrorail corridors and 20% outside the Metrorail corridors.
• Parking occupancy and vehicle use seemed unrelated to the spaces per resident provided.
• Overall parking occupancy within Metrorail corridors was similar for all weekdays. Weekend occupancy was higher. Sunday evening occupancy was similar to the occupancy on weekday evenings.
Influence of TDM Services

The awareness and use of TDM services, and how that influenced travel behavior was assessed based on resident surveys. Key findings include:

- Respondents who knew of Arlington services used non-drive-alone transportation options, such as transit, bicycling and walking, at higher rates for commute and non-work trips than did respondents who were not aware of Arlington services. Respondents who had used the services had even higher use rates.
- There was a strong relationship between the awareness/use of TDM services in the workplace and the use of non-drive-alone transportation options for commuting. There was a modest relationship of commute mode with home-based TDM.
- 75 percent of respondents had TDM services at work.
- 85 percent of respondents mentioned having at least one home-based TDM service, and 56 percent had used a service.
- Home-based transit and bike/walk services seemed to influence the use of these modes for non-work trips.
- Awareness of Arlington TDM services was the same as for the County overall, and 34 percent had used an Arlington service.

Uses of this report

Policies and programs that may be informed by the findings of this study include:

- Mode split and trip generation data can provide a baseline for future evaluations as new ACCS (or other transportation) programs and services are provided at buildings or in urban villages in order to reduce the need to drive and encourage use of other modes of transportation.
- A better understanding of vehicle ownership rates and parking occupancy as well as the correlated factors can help shape policies that better support reduced auto ownership and the “right-sizing” of residential parking facilities.
- Observed trip generation rates and the comparison to ITE standard rates can help improve the accuracy of traffic impact analyses conducted during the development approval stage of residential buildings.
- This study may be useful to transportation planners and agencies outside Arlington to evaluate their trip generation rates, mode shares, and transportation policies.
- Data collected during this study can be used to update the ITE trip generation and parking generation rates.
I. STUDY PURPOSE AND METHODOLOGY

In Arlington County, VA, transportation demand management (TDM), also known as mobility management, is provided by Arlington County Commuter Services (ACCS), a bureau of the Transportation Division, Department of Environmental Services. The ACCS mission is to “provide the most accurate, timely and useful information and services to residents, workers and visitors in Arlington to increase the use of transportation options such as transit, biking and walking”. ACCS programs and services support the Arlington County transportation vision of mixed-use high-density urban villages served by multiple modes of transportation surrounded by primarily residential lower density neighborhoods.

Arlington County works with developers and property managers on the design and implementation of transportation infrastructure and services as buildings go through the development approval process. However, the transportation choices made by the tenants once the building is built and occupied contribute to the building’s impact on the transportation system. Transportation performance monitoring/evaluation studies play an important role in understanding the transportation trends in the county.

One of the TDM strategies used at buildings applying for special exceptions, either through the site plan process or in keeping with the Columbia Pike Form Based Code, is the requirement to conduct a transportation study at set intervals to evaluate the transportation patterns of residents, tenants, and visitors. Arlington first adopted a TDM policy for site plan development in 1990. Some important policy objectives were to:

- Maintain peak hour level of service at major intersections at or preferably above Level of Service D.
- Limit single occupancy vehicle trips generated by development.
- Reduce vehicle-generated air pollution.
- Maximize transportation alternatives while minimizing single occupancy travel.
- Encourage efficient, cost effective modes of transportation that focus on moving people, not vehicles.
- Improve transit information and dissemination so people will be able to make the most efficient and friendly use of the system.
- Encourage group riding and shared parking arrangements through parking management plans.

TDM-related development conditions have evolved over the years to include new and improved TDM strategies, and to better align with updated County goals and policies, all of which help to achieve the enduring vision of providing a sustainable multimodal transportation system in the County.

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2 More information on the Arlington County site plan process can be found at http://building.arlingtonva.us/project/site-plan-projects/
3 More information on the Columbia Pike Form Based Code can be found at http://www.columbiapikeva.us/revitalization-story/columbia-pike-initiative/columbia-pike-form-based-code/
After the 1990 policy was put into effect, a number of sites were legally obligated to conduct a transportation performance monitoring study. But in 2010, the vast majority of sites had not fulfilled this obligation. To facilitate compliance, the County developed a standard study scope and methodology, and then worked with developers/owners/property managers to fulfill the overdue requirement. This aggregate study is an analysis of 16 of these individual transportation performance monitoring studies conducted at residential buildings in Arlington.

I.A. Study objectives

At the building level, transportation performance monitoring studies were conducted to learn about the travel and parking behavior of Arlington residents in high-density residential buildings. These studies explored several building and neighborhood characteristics, as well as awareness and attitudes of residents that could potentially cause or correlate to the identified travel behavior.

The data from these individual building studies was aggregated to increase the applicability of the findings as well as to protect the privacy of residents in the studied buildings. Findings from the aggregate study may be used for public dissemination and discourse about the transportation performance of Arlington’s residential buildings, and the factors that have a significant influence or correlation with travel behavior.

The aggregate study compiled information from the individual building studies to address the following topics:

- **Mode split and vehicle trip generation** - How well are these buildings supporting countywide transportation goals and objectives? Are we moving more people without more traffic?
- **Parking provision and availability** - How well are these buildings supplying the “right” amount of parking? Are minimum parking needs met?
- **Auto ownership** - What is the relationship between auto ownership, travel behavior, and other local conditions?
- **Awareness/attitudes** - Is there a correlation between the awareness and attitudes of residents with their observed travel behavior? Do travel assistance/services influence mode choice and trip generation?
- **Local trip generation data** - How do Arlington sites compare to the Institute of Transportation Engineers (ITE) standards for trip generation? How accurate are the traffic impact analyses (TIA) that use ITE standards to estimate impacts of new developments?

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**Arlington County Master Transportation Plan TDM-related Objectives**

- Minimize vehicular trips and maximize the use of other travel options
- Maximize local travel choices
- Reduce auto dependence
- Reduce auto ownership
- Use TDM measures as tools to reduce local congestion problems
- Ensure that minimum parking needs are met and excessive parking is not built
I.B. Study description

Transportation performance monitoring studies were conducted at 16 residential sites between 2010 and 2012. Figure 1 indicates the general locations of these sites. Eleven sites were located within the two Metrorail corridors, i.e. Jefferson-Davis or yellow/blue line and Rosslyn-Ballston or orange line. Of the five remaining sites, one site was located near the East Falls Church Metrorail but was aggregated with sites outside the Metrorail corridors since many neighborhood and travel variables were similar to these sites. One site was located in Shirlington and another along Columbia Pike, two planning areas with rich bus service but no Metrorail service. Two sites were located on either side of I-395 close to the Glebe Road exit.

Neighborhood data for each site included the census blocks within Arlington whose centroid was less than a quarter mile from the study site.

Figure 1: Locations of Study Sites
The 16 buildings included seven apartment buildings, one extended-stay hotel, and eight condominium buildings. The buildings varied in population density, and some had retail on the ground floor. This sample represented about:

- 3,700 occupied dwelling units at an average occupancy of 96 percent
- 4,840 total parking spaces, all types
- 1.04 – 1.55 residential parking spaces per unit (not including visitor/retail spaces)
- Over 38,000 vehicle trips
- 1,450 resident survey responses (25 percent response rate)

Table 1 compares the demographic characteristics of the building residents in the study to those of all Arlington County residents.

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>County (1)</th>
<th>In relation to the Arlington population at large, the sample is…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure &lt;5 years</td>
<td>69%</td>
<td>35%</td>
<td>Newer</td>
</tr>
<tr>
<td>Households with 2 persons or fewer</td>
<td>88%</td>
<td>60%</td>
<td>Smaller</td>
</tr>
<tr>
<td>Sex</td>
<td>49% male</td>
<td>49% male</td>
<td>Same</td>
</tr>
<tr>
<td>Age &lt;35 years</td>
<td>47% (71% under 45)</td>
<td>32%</td>
<td>Younger</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>76% White, 11% Asian, 6% Hispanic, 4% Black</td>
<td>83% White, 6% Asian, 4% Hispanic, 4% Black</td>
<td>Fewer Asian, more Hispanic</td>
</tr>
<tr>
<td>Household Income $80K+</td>
<td>77% (65% $100K+)</td>
<td>60%</td>
<td>Wealthier</td>
</tr>
<tr>
<td>Employment</td>
<td>88%</td>
<td>67%</td>
<td>More employed</td>
</tr>
<tr>
<td>Work Location</td>
<td>45% DC/Alexandria 27% Arlington</td>
<td>41% DC/Alexandria 33% Arlington</td>
<td>More work in DC/Alexandria, fewer in Arlington</td>
</tr>
</tbody>
</table>

(1) County comparison from 2008 Household Travel Survey (Metropolitan Washington Council of Governments)

A complete list of study variables is attached as Appendix A. The variables were grouped into three categories:

i) Building and neighborhood data
These data were collected through an interview with the property manager as well as
through secondary research of Arlington County data (including Planning, Research and Analysis Team data, Capital Bikeshare, and Department of Real Estate Assessments) and public websites (including Walkscore, and Google Maps). The key variables included:

- Building/site factors
- Neighborhood characteristics
- Access to transportation infrastructure
- Access to transportation information/assistance
- Demographics of residents
- Work location of residents

ii) Parking and trip generation

Vehicle trips were counted by tube (or hose) counts for 24 hours/day for seven consecutive days for each entrance/exit of parking facilities, i.e. garages or surface lots. Tube counts are a widely used method for automatic trip data collection. Counts are conducted by placing a rubber tube or hose across the travel lanes, and recording the pressure changes caused by wheels of vehicles crossing the tubes as axle movements. Trips were aggregated into 15-minute intervals. Parking occupancy was calculated for the seven-day survey period based on a one-time manual count during the week. The counts were used to identify key variables:

- Peak hour time of day (AM and PM)
- Peak hour trips generated
- Daily total trips generated
- Parking occupancy by time of day

The counts were compared with ITE codes 221 (low-rise apt); 222 (high-rise apt); 232 (high rise condo/townhouse); 310 (hotel).

iii) Resident survey

Resident participation in the survey was voluntary and surveys were conducted both online and on survey forms disseminated by the survey team at on-site events or through the property manager. The property manager was also asked to send notifications and reminders over e-mail for a period of two to four weeks or until a response rate of at least 20 percent was reached. The surveys were used to assess the following key variables:

- Weekly commute mode split, commute distance, and other commute characteristics
- Mode share of non-work trips
- Vehicle ownership
II. FINDINGS

II.A. Mode split

The mode split analysis is based on voluntary surveys taken by residents between 2010 and 2012. Employed residents were asked to report how they travel to work in a “typical week.” All respondents were asked about travel for non-work purposes. These two types of travel can have quite different characteristics and were analyzed separately.

II.A.1. Commute travel

Comparisons were made between the study residents’ typical commute mode split and mode splits for:

- all regional commuters in the Washington metropolitan region based on the 2010 State of Commute Survey by the Metropolitan Washington Council of Governments (2010 SOC);
- Arlington resident commuters based on the 2010 SOC; and
- employed residents who lived in the 12 transportation analysis zones (TAZs) in which the 16 residential study buildings were located based on the 2008 Household Travel Survey by the Metropolitan Washington Council of Governments (2008 HH Survey).

Comparisons were also made for sub-groups of study residents based on:

- access to transit service (i.e. rail and bus) at home;
- walkability of the residential area; and
- access to parking at home and the cost for parking at home and work.

Access to major highways, biking/walking paths, or Capital Bikeshare stations were analyzed but did not show any significant influence. Carshare availability was very limited and was excluded from the analysis.

All commute mode share comparisons exclude telework and compressed schedule days off unless specified otherwise.
Study residents vs. region and all Arlington residents

Figure 2 presents commute mode shares as a percentage of weekly commute trips. The figure includes four modes for travel to job locations outside the home: drive-alone, transit (bus, Metrorail/subway, and commuter rail), drive or ride with others (i.e., carpool/vanpool), and bike/walk. The figure also includes the mode share for telework and compressed work schedule. These are not actual travel modes, but rather show work trips avoided through use of these options.

Study respondents drove alone to work slightly less than all Arlington residents (51 percent versus 54 percent) and considerably less than the regional average of 64 percent. Study residents used transit more than Arlington residents overall (34 percent study vs. 27 percent all Arlington residents). The transit difference was even more striking when compared with the regional average. Study residents walked/biked at about the same rate as all Arlington residents, but both groups used these modes much more than commuters region-wide. Study residents drove/rode with others at about half the regional rate. The telework/compressed schedule percentages were essentially the same across the three groups.

Figure 2: Weekly Commute Trips by Mode

Study Residents, All Arlington Residents, All Washington Region Commuters
(Includes Telework / Compressed Schedule Days Off)

(Study residents n = 1,283, All Arlington residents n = 551, Regional commuters n = 6,050)
Study residents vs. neighboring area residents

The commute mode split of study residents was compared to residents in the vicinity of the buildings in the 2008 HH Survey to assess the influence of the availability of transportation services in their immediate home area. As illustrated in Figure 3, study residents biked/walked at about the same rate as do their neighbors, but they rode transit slightly more; 36 percent of their weekly commute trips (excluding telework and compressed schedules) were transit trips, compared with 32 percent of weekly trips made by neighboring area residents. The results also suggest that study residents made slightly more drive-alone trips than their neighbors and only one-third as many by driving/riding with others.

Figure 3: Weekly Commute Trips by Mode – Study Residents vs. Neighboring Area Residents

(Study residents n = 1,283, Household Travel Survey TAZs n = 462)
Within vs. outside the Metrorail corridors

Study respondents who lived in the Metrorail corridors drove alone much less (52 percent of weekly commute trips) than did study residents who lived outside the corridors, i.e. non-Metrorail (66 percent of weekly commute trips) (Figure 4). They also made considerably more commute trips by transit (37 percent Metrorail corridor vs 27 percent Non-Metrorail) and more trips by bike/walk (8 percent Metrorail corridor vs 3 percent Non-Metrorail).

**Figure 4: Weekly Commute Trips by Mode – Study Residents in Metrorail Corridors vs. Non-Metrorail**

(Study residents: Metrorail corridors n = 1,068, Non-Metrorail = 215)
Outside Metrorail corridors: study residents vs. neighboring area residents

Figure 5 presents the mode split of study residents who lived outside the Metrorail corridors compared to the mode split for their neighbors (as estimated from the 2008 HH Survey for the non-Metrorail TAZs). Both groups had similar commute mode profiles except that study residents drove/rode with others less often.

Figure 5: Weekly Commute Trips by Mode – Outside Metrorail Corridors: Study Residents vs. Neighboring Area Residents
(Outside Metrorail Corridors: Study residents n = 215, Household Travel Survey TAZs n = 311)

Metrorail corridor: study residents vs. neighboring area residents

A similar “neighborhood” comparison was made for study respondents who lived in Metrorail Corridors (Figure 6). Study residents used transit and biked/walked at about the same rate as their neighbors.

Figure 6: Weekly Commute Trips by Mode – Metrorail Corridor: Study Residents vs. Neighboring Area Residents
(Metrorail corridors: Study residents n = 1,068, Household Travel Survey TAZs n = 151)
Distance to Metrorail

Commute mode split clearly correlated with distance from home to Metrorail (Figure 7). As the distance increased, the share of trips made by driving alone went up and transit use dropped. Study residents who lived within two blocks of a Metrorail station drove alone for only 48 percent of their weekly commute trips and made 37 percent by transit. By contrast, residents who lived one mile or more from Metrorail made 61 percent of their commute trips by driving alone and 29 percent by transit. Even more striking was the difference in bike/walk rates; residents who lived within two blocks of Metrorail made 8 percent of commute trips by bike/walk, compared with just 2 percent for residents who lived one mile or more from Metrorail. The bike/walk mode shares for residents who lived within two blocks of Metrorail and those who lived three to five blocks were essentially the same.

Figure 7: Weekly Commute Trips by Mode – Study Residents by Distance from Home to Metrorail
(0-2 blocks n = 373, 3-5 blocks n = 573, 6-10 blocks n = 0, 1 mile or more n = 337)
Transit Score™

Transit Score™ assigns a rating of 0 to 100 to addresses, indicating how well they are served by public transportation. The highest ratings of 90 to 100 (“Rider's Paradise”) are given for locations with multiple transit options available within a quarter of a mile. Lower ratings indicate progressively more limited service, with lower operating frequency and greater walking distance. Transit Score™ was used as a proxy for the quality and availability of transit service to the building. Mode split was compared for groups of residents by their home Transit Score™ (Figure 8).

Figure 8: Weekly Commute Trips by Mode – Study Residents by Transit Score™
(Transit Score: 0-24 n = 0, 25-51 n = 253, 52-69 n = 661, 70-89 n = 369, 90-100 n = 0)

The commute drive-alone mode share decreased steadily as the “Transit Score” of the resident’s building went up from “some transit” to “excellent transit.” Interestingly, there was little difference in transit use between the “some transit” and “good transit” conditions, but the share of weekly trips by transit jumped substantially when transit was “Excellent,” suggesting there is a feasibility or desirability threshold for transit use. Bike/walk use rose noticeably even when transit was only at the “good” level, but this could be related to a general walkability and mixed-use components of land uses in the “good” and “excellent” transit areas, rather than solely or primarily to the quality of transit.

7 For more on the Transit Score methodology, see: http://www.walkscore.com/transit-score-methodology.shtml
Walk Score™

A similar mode split pattern was evident for residents who lived in areas with higher “walk scores.” Walk Score™ is another index, with ratings from 0 to 100, which indicates the relative number of public and personal amenities, such as businesses, parks, theaters, schools and other common destinations, within 1 mile of an address. The score is not a true measure of walkability since it does not take into account factors such as safety, topography or street design.\(^8\)

As shown in Figure 9, as Walk Score™ rose, the share of commute trips made by driving alone fell and the shares of transit and bike/walk increased. The changes in driving alone and bike/walk were particularly notable but only until Walk Score reached the “very walkable” category; there were no further significant change with “walker’s paradise.”

Figure 9: Weekly Commute Trips by Mode – Study Residents by Walk Score™
(Walk Score: 0-49 n = 110, 50-69 n = 147, 70-89 n = 639, 90-100 n = 387)

\(^8\) For more on the Walk Score methodology, see: [http://www.walkscore.com/methodology.shtml](http://www.walkscore.com/methodology.shtml)
Parking availability at home

Commute mode was compared for study residents of buildings with limited parking vs. those with more parking availability. Parking availability was defined as the number of residential parking spaces per adult resident. The number of residential spaces and the estimated number of adult residents in the building was provided by the property manager. The parking availability in the study buildings ranged from a low of 0.63 spaces per resident to a high of 1.22 spaces per resident. About seven in ten survey respondents live in buildings with fewer than one space per resident; 33 percent live in buildings with 0.66 to 0.75 spaces per resident and 37 percent third live in buildings with between 0.76 and 0.95 spaces per resident. The remaining 30 percent live in buildings with 0.96 spaces or more per resident, essentially at least one space for each resident who wants to garage a vehicle.

Many parking studies have concluded that parking is a powerful factor in commute decision-making, particularly when commuters have access to non-driving travel options. Figure 10 shows the commute mode split for respondents who live in Metrorail corridors by the number of parking spaces available per adult resident in their residential building. As shown, the drive-alone rate was lower and the transit rate was higher for residents in study buildings with limited parking than for residents of buildings with enough parking for all residents. The difference in drive alone rate was statistically significant, but the transit differences were not significant).

Figure 10: Weekly Commute Trips by Mode – Study Residents by Parking Availability at Home – Metrorail Corridor Only

(Parking spaces per adult resident: 0.66 to 0.75 n = 190; 0.76 to 0.95 n = 477, 0.96 or more n = 228)
Parking cost at home

Commute mode split showed a greater relationship to the cost of residential parking than the number of parking spaces. About half of the residents in the survey - residents in condominiums - paid no fee to park at home. Among the apartment dwellers, about a quarter paid less than $50 per month, 57 percent paid between $50 and $99, and 17 percent paid $100 or more per month.

The 55 percent drive-alone mode split for the condominium residents who paid no parking charge was not statistically different from the rate for apartment residents who paid a modest fee of less than $50 per month. But the commute drive-alone rate fell noticeably when the resident parking charge was between $50 and $99 per month and fell further when parking cost was $100 or more per month (Figure 11).

Figure 11: Weekly Commute Trips by Mode – Study Residents by Parking Cost at Home
(Parking cost per month: $0 n = 632; $1 - $49 n = 169, $50 - $99 n = 371, $100 or more n = 111)
Parking cost at work

Workplace parking cost was based on survey responses about the amount a resident paid or would pay if they drove to work. This cost appeared to have a more significant impact on commute mode, primarily when parking reached $100 per month (Figure 12). About 56 percent of employed study residents said they had free parking at work; the remaining 44 percent would need to pay to park on days they drove. The analysis showed that 69 percent of residents with access to free parking drove alone to work, compared with about half of residents who paid between $1 and $150 per month to park, and only 25 percent who paid $151 or more. But residents who had free parking disproportionately worked outside the core area of the region, where transit is not as available, so their high drive-alone rate could be partly due to lack of travel options as well as the impact of free parking. Transit rates increased slightly when any parking fee was charged, but the most noticeable increase was at a monthly fee of $151 or more; at this level, the share of weekly commute trips made by transit doubled.

Figure 12: Weekly Commute Trips by Mode – Study Residents by Parking Cost at Work
(Parking cost per month: $0 n = 695, $1 - $100 n = 103, $101 - $150 n = 73, $151 or more n = 348)

As shown above, the influence of the cost of parking at work on the choice of commute mode may be interrelated with workplace transit access if the places with the lowest parking cost have the lowest transit access, and vice versa. Likewise, where we see a strong relationship between mode choice and work location we may also be seeing the influence of parking pricing at work. For reference, 39 percent of respondents who said they work in DC or Alexandria said they had access to free parking, whereas 49 percent respondents who work in Arlington had access to free parking at work. Fully 91 percent of respondents who said they work elsewhere in the DC region reported having access to free parking at work.
Study residents by work location

The survey data indicate that where residents worked strongly influenced how they got to work (Figure 13). The drive-alone commute mode share for residents who worked in Arlington and the District of Columbia was well below the average rate for all study residents (51 percent); 42 percent of residents who worked in Arlington and 37 percent who worked in the District drove alone to work, compared to 80 percent of residents who worked in another part of the Washington metropolitan region.

Among commuters to the District, the primary mode used was transit (53 percent of study residents). Study residents who worked in Arlington used transit (28 percent) or biked/walked (21 percent) at similar rates. The high bike/walk mode share is not surprising considering that most of the study buildings are located in walkable areas with significant commercial space.

Figure 13: Weekly Commute Trips by Mode – Study Residents by Work Location
(Work location: Arlington County n = 332; District of Columbia n = 505, Other area n = 398)
II.A.2. Non-commute travel

Non-commute travel analysis was based on questions on the resident survey about the number and mode of non-work trips made from home “yesterday.” Since “yesterday” would have been relative to the day the respondent took the survey, the trips reported can be expected to include both weekday and weekend trips, thus can be considered a “typical” day.

Daily non-work trips estimated number

Seventy percent of all respondents said they made at least one non-work trip from home yesterday. On average, study respondents made 2.3 non-work trips per day (Figure 14). This is less than the 2.7-trips reported in the 2008 HH Survey for the study TAZs. But it is likely that the study survey undercounts non-work trips slightly. In the 2008 HH Survey, respondents recorded their trips as they made them using a written travel “diary” that they later used as a memory aid to report their trips to the survey researchers. By contrast, the study survey asked respondents to retrospectively recall their trips. Even though they only needed to think back one day, it is likely that some minor trips were missed, or a round-trip was counted as one trip rather than two one-way trips as required by the survey question.

Figure 14: Daily Non-work Trips – Study and 2008 HH Survey TAZs Inside and Outside the Metrorail Corridors

(Study: All n = 1,416, Metrorail corridors n = 1,044, Non-Metrorail n = 372; HH Survey TAZs: All n = 630, Metrorail corridors n = 186, Non-Metrorail n = 444)

Among study residents, there was little difference in the number of trips made by those who lived in a Metrorail corridor (2.3 trips per day) and those who lived outside the Metrorail corridors (2.4 trips). By contrast, the 2008 HH Survey found a higher trip count (2.9 trips) for non-Metrorail areas than for Metrorail corridors (2.5 trips). This is likely related to the higher share of single-family residences and large household sizes in the 2008 HH Survey outside the Metrorail corridors. The difference was less noticeable in the study survey, because it included only multi-family dwellings.
Mode distribution - study residents vs. Arlington residents

Respondents who said they made non-work trips were asked how many non-work one-way trips they made by each of the modes. Overall, study residents made a quarter (24 percent) of their non-work trips by walking and 14 percent by transit. They used a personal vehicle for about six in ten trips; 40 percent were by driving alone and 21 percent were trips driving or riding with others (Table 2).

Table 2: Daily Non-work Trip – Mode Distribution for Study Residents vs. All Arlington Residents

<table>
<thead>
<tr>
<th>Mode</th>
<th>Study Residents (n = 1,416)</th>
<th>2009 Arlington Resident Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive-alone</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Drive/ride with others</td>
<td>21%</td>
<td>36%</td>
</tr>
<tr>
<td>Walk/Bike</td>
<td>25%</td>
<td>16%</td>
</tr>
<tr>
<td>Transit</td>
<td>14%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Study residents made about the same share of trips by driving alone (40 percent) as did all Arlington residents, as estimated in the 2009 Arlington Resident Survey\(^9\) conducted by ACCS. But study residents made more trips by transit (14 percent study residents vs. 8 percent all Arlington residents) and walking (24 percent study residents vs. 16 percent all Arlington residents). And they made fewer trips by driving/riding with others (21 percent study residents vs. 36 percent all Arlington residents). The lower rate of driving/riding with others for study buildings likely reflects the lower presence of households with children compared with all Arlington.

Mode distribution: study residents vs neighboring area residents

As shown in Figure 15, the non-work mode distribution for study respondents was also different than for all residents of their immediate home area. Study residents used transit and drove alone for more of their non-work trips than their neighbors. They drove/rode with others less.

![Figure 15: Daily Non-work Trips – Study and 2008 HH Survey TAZ](image1)

(Study: All n = 1,416, Metrorail corridors n = 1,044, Non-Metrorail n = 372; HH Survey TAZs: All n = 630, Metrorail corridors n = 186, Non-Metrorail n = 444)

**Study Metrorail vs non-Metrorail**

As shown in Figure 16, residents who lived in a Metrorail corridor used transit for a much higher share of their non-work trips from home (28 percent) compared with for residents who lived outside the Metrorail corridors (12 percent). Residents within the Metrorail corridors also drove/rode with others slightly less than non-Metrorail residents, but they drove alone much less (37 percent Metrorail vs. 49 percent non-Metrorail).

![Figure 16: Daily Non-work Trips – Study Residents Inside and Outside the Metrorail Corridors](image2)

(Study: Metrorail corridors n = 1,044, Non-Metrorail n = 372)
Distance to Metrorail

As shown in Figure 17, the mode share pattern for non-work trips was essentially the same for residents who lived within two blocks and between three and five blocks from Metrorail. But residents who lived more than one mile from Metrorail drove alone for 50 percent of their non-work trips, while residents who lived within five blocks of Metrorail made only about 37 percent of their non-work trips by driving alone. Thus, proximity to transit appears to support transit use for non-work trips, although it is likely a less significant factor in non-work mode choice than for commute mode decisions.

Figure 17: Non-work Trips by Mode – Study Residents by Distance from Home to Metrorail Station

(0-2 blocks n = 446, 3-5 blocks n = 632, 6-10 blocks n = 0, 1 miles or more n = 372)

Walk Score™

Residents who lived in areas with Walk Scores of 70 or more, representing areas that are “very walkable” or “walker’s paradise” walked for more than a quarter of their non-work trips (Figure 18). In comparison, residents made only about one in ten walk trips in less pedestrian-friendly areas. The share of non-work walk trips was clearly related to the extent of services within walking distance. This relationship was stronger for non-work trips than was observed for commute trips. This is a logical result assuming a significant portion of the non-work walking trips are made to local business establishments.
Using the Transit Score™ for each of the study addresses as a proxy for the quality and availability of transit service at the building, the analysis observed whether residents’ non-work mode split differed according to “transit score” (Figure 19). Higher bike/walk mode share was noted for residents who lived in buildings with transit scores of 70 or more. There were no statistical differences in the use of transit by residents with different transit scores. As transit was used for a relatively small share of all non-work trips, this could mean that the non-work trips made by transit were longer-distance trips, such as to the District of Columbia, and the transit access distance was not a deterrent. Also, the highest transit score was just 80 for the sample of buildings, and the range of scores (45-80) may have been too small for any differences to be measurable.
Parking availability and cost at home

Availability of resident parking seemed to have a modest impact on the drive-alone rate for non-work trips, but transit use fell as parking availability increased. There is higher availability of transit in the Metrorail corridors where parking is more limited. Most likely, reduced availability of parking at home affects mode use indirectly by influencing lower vehicle ownership.

The non-work mode split showed a greater relationship to the cost of residential parking (Figure 20). Residents who paid a $50 or more per month for parking were less likely to drive-alone for non-work trips than those who had free parking or paid less than $50 per month. But this could be related to lower car ownership generally rather than a choice not to use a car they own.

Figure 20: Non-work Trips by Mode – by Parking Cost at Home
(Parking cost per month: $0 n = 676; $1 - $49 n = 204, $50 - $99 n = 413, $100 or more n = 123)
II.B. Vehicle trip generation

In this section, “trips” refer to the total vehicle trips entering or leaving the site. The majority of trips analyzed in this study related to residential land uses. However, a small percentage of trips may have been generated by other uses, usually retail or restaurant employee parking, where the configuration of the parking facility did not allow for exclusion of such spaces.

Daily trips are defined as the total vehicle trips observed in a 24-hour period. A peak hour trip refers to the highest number of vehicle trips observed during one hour. Trip data were aggregated into 15-minute intervals, and the peak hour was calculated to the closest 15 minutes. A morning (AM) and an evening (PM) peak hour were calculated for weekdays, defined as Monday through Friday. In order to determine if travel patterns on Fridays were distinct from patterns on other weekdays, trip generation was studied in four intervals: Monday through Thursday, Friday, Saturday, and Sunday. Trip generation rates per occupied unit and per adult resident were compared for buildings or groups of buildings by different characteristics. The general trend for the four intervals and the two types of rates were often similar, and a select number of charts/graphs are depicted in this report.

II.B.1. Observed trip generation rates

Location within/outside the Metrorail corridor

The location in relation to the Metrorail corridor was the most significant factor affecting vehicle trip generation. Buildings within the Metrorail corridors generated almost half the daily vehicle trips per occupied unit than those outside the corridors (Figure 21). This may be explained by the fact that transportation options and land use patterns are distinctly different in the “urban villages” within the Metrorail corridors.

Figure 21: Daily Vehicle Trips per Occupied Unit by Inside/Outside the Metrorail Corridor
A scatter plot of the 16 buildings (Figure 22) showed that daily vehicle trip generation from Monday to Thursday for most of the buildings within one mile of a Metrorail station was similar – about 1.5 to 2.5 vehicle trips per occupied unit per day. The exceptions were buildings that differed in location or land use. The building in the East Falls Church area is shown in yellow, and the extended-stay hotel is shown in red. Three of the four remaining sites offered either a free shuttle to the Metrorail station or ongoing transit subsidy. This factor may have been the key influence for lower vehicle trip generation observed at buildings outside the Metrorail corridors.

Figure 22: Daily Vehicle Trips per Occupied Unit by Distance from Metrorail (Mon – Thu)
Neighborhood intensity

Another key influencing factor for vehicle trip generation was neighborhood intensity. Neighborhood intensity was defined as the total number of residents and employees per acre within a quarter mile radius of the building. Neighborhood data was based on Arlington census blocks that were largely within the quarter mile radius.

As shown in Figure 23, daily vehicle trips per occupied unit decreased as neighborhood intensity increased for all days of the week.

Figure 23: Daily Vehicle Trips per Occupied Unit By Neighborhood Intensity
Walk Score™ - Walk Score was another neighborhood characteristic that correlated to vehicle trip generation. For all days of the week, daily vehicle trips per adult resident generally decreased as the Walk Score increased (Figure 24).

Figure 24: Daily Vehicle Trips per Adult Resident by Walk Score™

All the buildings within the Metrorail corridors had high Walk Scores of 80 or more, indicating higher densities of destinations within one mile of the building. Figure 25 shows that vehicle trip generation for buildings within the Metrorail corridors (shown in green) did not correlate to the Walk Scores. However, vehicle trip generation for buildings outside the two Metrorail corridors did decrease as Walk Score increased.

Figure 25: Daily Vehicle Trips per Occupied Unit by Walk Score™
Although the buildings within the Metrorail corridors varied in character – apartments or condominiums, average age of the residents, vehicle ownership rates, average household income – the vehicle trip generation rates did not correlate strongly to any of these individual factors. All these buildings generated between 1.7 and 2.4 trips per occupied unit. The exception was the extended-stay hotel with 3.4 trips per occupied unit.

II.B.2. Comparison with ITE rates

ITE’s Trip Generation Manual 9th Edition provides trip generation rates per dwelling unit for a number of residential categories (listed in Table 3).

<table>
<thead>
<tr>
<th>Code</th>
<th>Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td>Single-Family Detached Housing</td>
</tr>
<tr>
<td>220</td>
<td>Apartment</td>
</tr>
<tr>
<td>221</td>
<td>Low-Rise Apartment</td>
</tr>
<tr>
<td>222</td>
<td>High-Rise Apartment</td>
</tr>
<tr>
<td>223</td>
<td>Mid-Rise Apartment</td>
</tr>
<tr>
<td>224</td>
<td>Rental Townhouse</td>
</tr>
<tr>
<td>230</td>
<td>Residential Condominium/Townhouse</td>
</tr>
<tr>
<td>231</td>
<td>Low-Rise Residential Condominium/Townhouse</td>
</tr>
<tr>
<td>232</td>
<td>High-Rise Residential Condominium/Townhouse</td>
</tr>
<tr>
<td>233</td>
<td>Luxury Condominium/Townhouse</td>
</tr>
<tr>
<td>270</td>
<td>Residential Planned Unit Development</td>
</tr>
</tbody>
</table>

Observed trips at each building were compared to predicted trips based on published rates for the most appropriate ITE residential land use code. Vehicle trips during morning and evening peak hours on weekdays, daily peak hour on weekends, and total daily vehicle trips on all days of the week were much lower than predicted trips based on appropriate ITE rates for buildings within the Metrorail corridors (Figures 26 and 27). Trip generation rates for buildings outside the Metrorail corridors were also lower than applicable ITE rates.
Figure 26: Peak Hour Trip Generation by Distance to Metrorail Compared to ITE Standards

Figure 27: Daily Trip Generation by Distance to Metrorail Compared to ITE Standards
Apartments vs. condominiums - The majority of buildings in this study were compared to ITE land use categories 222 (high-rise apartment) or 232 (high-rise condominium). There was no noticeable difference in the trip generation of apartments and condominiums. For both ITE codes, peak hour trips for buildings within the Metrorail corridors were 35-55 percent less than the predicted trips for all days of the week; daily trips were 40-60 percent less (Figure 28).

![Figure 28: Apartment and Condominium Trips compared to ITE standards](image)
II.C. Vehicle ownership and use

II.C.1. Parking occupancy

Parking occupancy of a residential building’s parking facilities was analyzed to determine the appropriateness of the number of parking spaces provided to the spaces being used. Parking occupancy varied considerably between buildings (Figure 29). Maximum parking occupancy ranged from 66 percent to 96 percent. Few parking facilities approached full occupancy, indicating that there was excess parking compared to the demand at that building.

Since the vast majority of parking spaces in the study buildings were used by residents, and maximum parking occupancy occurred at night when the vehicles were parked for the night, maximum parking occupancy was also an indicator of the number of vehicles owned by the building’s residents.

Minimum parking occupancy usually occurred in the middle of the workday, ostensibly after the residents who drove to work had left their homes. Observing minimum parking occupancy rates helped to understand the rate of vehicle use for commuting. Minimum parking occupancy for the study buildings ranged from 5 percent to 47 percent. Vehicles that were not used for commuting may have been used for shorter trips at different times of the day. However, since the majority of parking facilities had a minimum occupancy of over 20 percent, we can conclude that many vehicles were rarely used.

Figure 29: Parking Occupancy Compared to the Number of Resident Parking Spaces per Unit for each Residential Building (n=13)

Note: Consistent parking occupancy and space counts were not available for all study buildings.
Maximum and minimum parking occupancy rates were averaged across buildings in different locations, i.e. within two blocks of the Metrorail station, more than two blocks from the Metrorail station but within the corridors, and outside the Metrorail corridors. Average maximum parking occupancy was similar for all locations but average minimum parking occupancy was lower within the Metrorail corridors (Figure 30). It must be noted that buildings located more than two blocks from the Metrorail station but within the Metrorail corridor had fewer parking spaces available (between 1.0 and 1.2 parking spaces per residential unit) compared to other locations which ranged from 1.19 to 1.55 parking spaces per residential unit.

**Figure 30: Parking Occupancy by Distance to the Metrorail Station**

Overall parking occupancy within the Metrorail corridors was similar for all weekdays (Figure 31). Friday evening parking occupancy was similar to Saturday evening. Weekend parking occupancy was higher but Sunday evening was similar to weekday evenings.

**Figure 31: Average Parking Occupancy within the Metrorail Corridors (Percent of Total Spaces)**
II.C.2. Vehicle ownership

The correlation of vehicle ownership to trip generation and mode choice was examined to determine if the strong relationship found in travel research in other locations was true among the buildings studied in Arlington. Vehicle ownership rates and the factors associated with vehicle ownership were derived from responses to the resident survey in this study. Vehicles per adult resident were calculated based on two questions: how many adult residents (18 years and older) live in the household; and how many motor vehicles are “owned or leased” by members of your household. No distinction is made between the number of vehicles “available” to members of the household and vehicle ownership rate.

In this study, vehicle ownership increased with average household income, both within and outside the Metrorail corridors (Figure 32); condominium residents had higher vehicle ownership rates than apartment residents in similar locations. This may be due to the higher average household incomes of condominium owners than apartment renters.

Figure 32: Vehicle Ownership by Income and Location
However, vehicle usage did not correlate with vehicle ownership. Figure 33 shows the daily trips per occupied unit for apartments and condominiums within and outside the Metrorail corridors. As described above, trip generation was similar for both types of buildings within the Metrorail corridors although vehicle ownership rates were distinctly different.

![Figure 33: Daily Trips per Occupied Unit by Distance from the Metrorail Corridor](image)

As shown in Figure 34, 7 percent of study residents reported that they had no household vehicles. About three in ten (28 percent) residents were “car lite,” i.e. they had less than one vehicle per adult in the household. Across all study respondents, the average number of vehicles was 0.84 per adult resident. The rate of vehicle ownership was higher for residents who were employed (0.85 vehicle per adult) than for residents who were not employed (0.77 vehicle per adult). Condominium residents had a higher vehicle ownership rate (0.88 vehicles per adult) than apartment residents (0.79 vehicles per adult).

![Figure 34: Number of Vehicles Owned or Leased per Adult Resident of the Household](image)

- 0 cars per adult, 7%
- 0.1 - 0.99 vehicles per adult, 28%
- 1 vehicle per adult, 60%
- More than 1 vehicle per adult, 5%

Average Number of Vehicles per Adult Resident
- Overall – 0.84
- Not employed – 0.77
- Employed – 0.85
- Apartments – 0.79
- Condominiums – 0.88
Within/Outside the Metrorail Corridors

While vehicle ownership is a factor in mode choice, vehicle ownership itself is a choice. The share of urban residents forgoing auto ownership is likely dependent on sufficient travel options. The survey data indicated a definite inverse relationship between vehicle ownership and transit access. Vehicle ownership was lower among residents who lived in the Metrorail corridors; one in ten (9 percent) did not have a car in the household, compared with only 3 percent of residents outside the Metrorail corridors. The car-lite percentage was also slightly higher for Metrorail-corridor residents (28 percent) than for residents who lived outside the Metrorail areas (25 percent). And residents who live in the Metrorail corridors owned, on average, 0.81 vehicles per adult resident in the household, while residents who lived outside the Metrorail areas owned an average of 0.92 vehicles per adult resident.

Transit Score™

Vehicle ownership dropped steeply and progressively as the overall availability and quality of home-area transit – as measured by Transit Score – increased (Figure 35). In areas with “excellent transit,” the ownership rate was 0.76 vehicles per adult, compared with 0.95 vehicles in areas rated as “some transit.”

Figure 35: Number of Vehicles Owned or Leased per Adult Resident by Transit Score™
(Transit Score: 0-24 n = 0, 25-49 n = 261, 50-69 n = 657, 70-89 n = 397, 90-100 n = 0)
Walk Score™ – As illustrated in Figure 36, vehicle ownership rates were lower in walkable areas than in “car dependent” areas, but were about the same whether the area was “somewhat walkable,” “very walkable,” or a “walkers' paradise.”

Figure 36: Number of Vehicles Owned or Leased per Adult Resident by Walk Score™
(Walk Score: 0-49 n = 112, 50-69 n = 143, 70-89 n = 641, 90-100 n = 419)

Vehicle ownership by parking availability at home

Vehicle ownership increased slightly as parking availability increased, and was highest when the building had parking for all adult residents (Figure 37). Vehicle ownership was about the same (0.80 – 0.81) when the building offered parking for 95 percent or fewer of the adult residents. When parking was available for all adult residents, the ownership rates rose to 0.87 vehicles per adult resident. The ownership rate was nearly 100 percent when parking was more than adequate for all residents to park a vehicle. However, this could be related to the locations of buildings with this degree of parking availability and the availability of non-driving travel options in those locations.
Vehicle ownership by parking cost at home

Vehicle ownership also appeared to be strongly related to the cost of residential parking, with the number of vehicles per adult falling as the cost rises (Figure 38). The ownership rate was 0.89 vehicles per adult when there was no monthly parking fee. At a monthly fee of $1 to $94, the ownership rate was 0.83. When the cost rose to $95 per month or more, the ownership rate was just 0.71 per adult, a substantial drop.

Figure 38: Number of Vehicles per Adult Resident by Monthly Charge for First Parking Space
(Parking cost per month: $0 n = 676; $1 - $49 n = 204, $50 - $99 n = 413, $100 or more n = 123)
II.D. Awareness, influence, and preferences

The resident survey explored residents’ awareness of TDM information and assistance services offered at home or at work in order to determine the role TDM services play in influencing commute and non-work travel behavior. For worksite TDM services, employed residents were presented with a list and asked to check all services that were “available and have used”, “available but not used”, or “not available”. For home-based services, on-site interviews were conducted with property managers to identify the services provided to residential tenants. But residents are not always aware of all the services available to them, so the resident survey asked all residents what services they believe are available. These results were used to assess the perceived home-based TDM service level from the viewpoint of residents.

II.D.1. Work-based TDM services

Availability and Use of Work-based TDM Services

Three-quarters (75 percent) of employed respondents said their employers offered at least one of the listed TDM services. The most commonly-named services were transit route/schedule information, transit pass discount or other financial incentive, and secure bicycle parking, noted by almost half the employed residents (Figure 39). About four in ten residents said their employers offered an opportunity to telework. Two other services were noted by about a third of employed residents: bicycle/walking information (34 percent) and personal showers or lockers for bicyclists (34 percent).

Figure 39: Work-based TDM Services – Services Available and Services Used
(n = 1,316, multiple responses permitted)
Figure 39 also shows the percentage of residents who said they had used the services. About 54 percent of residents who said a workplace service was available had used a service. Transit information (24 percent), transit subsidies/financial incentives (27 percent), telework (24 percent), and bicycle/walking information (14 percent) were the most widely-used TDM services.

Work-based TDM services were classified into three levels by the type and number of services offered:

- **Low TDM** – No financial incentive, but some non-financial support services (e.g., Guaranteed Ride Home, preferential parking, transit information, etc.)
- **Moderate TDM** – Some financial incentive, plus zero to two support services
- **High TDM** – Some financial incentive, plus three or more support services

Nearly half of study residents mentioned a package of services that constituted a moderate to high TDM program; 28 percent reported a high TDM level and 18 percent reported a moderate TDM level. Three in ten (31 percent) reported services that would meet the low TDM level. The remaining 22 percent said they didn’t know of any services or left this question blank (Figure 40).

**Figure 40: Level of TDM Assistance Offered at Work**

\( n = 1,316 \)
Commute mode by work-based TDM service level

Only about four in ten employees who had access to moderate to high work-based TDM drove alone to work, compared with 64 percent who reported a low TDM level and 71 percent who reported no work-based TDM services (Figure 41). The difference in the drive-alone rate was overwhelmingly made up through a higher use of transit, although the bike/walk rate also increased as residents had access to more substantial TDM services.

*Figure 41: Weekly Commute Mode by Level of TDM Assistance Offered at Work*  
(No services reported n = 279, Low TDM n = 401, Moderate TDM n = 226, High TDM n = 353)
II.D.2. Home-based TDM services

Availability and use of home-based TDM services

All residents, whether employed and not, were shown a list of seven travel assistance services and asked to mark the services that were available at the building or complex where they lived as well as the services they had used. Most (85 percent) study residents said they had access to TDM services at home. Two services, secure bicycle parking and transit schedule information, were named by about two-thirds of residents (Figure 42). Nearly six in ten (58 percent) noted availability of bicycle/walking information. About a quarter (25 percent) said they had access to a shuttle to a bus stop or train station. Only three of the buildings operate such a service, but many of the sites were well-served by bus routes and residents may have been indicating these services. Nearly two in ten (16 percent) said discounted transit passes were available through their building or complex.

About 56 percent of residents who said a travel assistance service was offered at home had used one of the services. The most often-used services included transit schedule/route information, and bicycle/walking information. Both services had been used by more than half of the residents who believed the service was available. About a third of the residents who said secure bicycle parking was available had used it.

![Figure 42: Home-Based TDM Services – Services Available and Services Used](chart.png)
Commute mode by access to home-based TDM services

Access to home-based TDM services did not seem to have an influence on residents' commute mode choice. Residents who had access to the highest level of TDM services at home (3 or more services, including a subsidy or shuttle bus) made about 58 percent of their weekly work trips by driving alone. By comparison, residents who reported low TDM access (0 to 2 services) drove alone for just 46 percent of their weekly commute trips (Figure 43).

![Figure 43: Weekly Commute Mode by Availability of Home-based TDM Services](image)

Non-work trip modes by access to home-based TDM services

Residents who reported access to home-based TDM services made about 26 percent of their non-work trips by walking, compared with 22 percent for residents who said no TDM services were offered at home (Figure 44). But note that the sample of respondents who said no services are available is small and the differences shown in mode use are not statistically significant.

![Figure 44: Non-Work Trip Modes by Availability of Home-based TDM Services](image)
While no definitive connection between general availability of home-based TDM services and non-drive-alone mode use was observed, Figure 45 indicates that mode-specific services may influence the use of those specific modes. Residents who reported having access to bike/walk information showed greater use of bike/walk for non-work trips (28 percent) than did residents who said the service was not available (22 percent). A similar result was found for availability of secure bicycle parking.

**Figure 45: Non-work Bike/Walk Mode split by Availability of Bike/Walk Services**

(Bike/walk information: No service n = 172, Service available n = 847; Bike parking: No service n = 440, Service available n = 976)

Availability of a discounted transit pass also appeared to influence non-work transit use; residents who said this service was available made 19 percent of their non-work trips by transit, compared with 12 percent of trips by residents who did not have this service (Figure 46). However, there is little difference in transit mode use when either transit information or shuttle is offered, but this result might be skewed by misreporting of regular route transit as shuttle availability.

**Figure 46: Non-work Transit Mode split by Availability of Transit Services**

(Transit information: No service n = 456, Service available n = 960; Transit pass: No service n = 1,179, Service available n = 237; Shuttle to bus/train: No service n = 973, Service available n = 443)
Residents’ interest in additional home-based TDM services

Residents who said they did not have access to one or more of the home-based TDM services described above were asked how likely they would be to make more of their trips by transit, bicycling, walking, or driving/riding with others if these services were available. For example, a respondent who said that transit information and bike parking were not available was asked this follow-up question for each of these services. The rating scale ranged from “1–not at all likely” to “5–very likely.”

Figure 47 shows the services that were presented to residents and the percentages of residents who gave ratings of: 4 or 5 (very likely). The chart also shows the percentage of residents who said the service was available. Since services like bicycle/walk information, transit information, and bicycle parking were available to a large number of residents, they were rated by only a few residents.

Residents expressed the greatest interest in discounted transit passes; about six in ten residents said this service would encourage them to make more trips by non-drive-alone modes. A quarter reported an interest in a shuttle to transit, transit schedule information, and bicycle/walking information. These services all are generally available, so greater promotion of the services to tenants might be all that is needed for these services.
II.D.3. Local and regional TDM services

Availability and use of work-based TDM services

Residents were asked if they were aware of and if they had contacted or used travel services from any of eight Arlington County or two regional organizations. The most widely known organization of the ten shown was the Washington Metropolitan Area Transit Authority (WMATA) or “Metro”; 91 percent of residents knew of this regional organization and 83 percent had used it (Figure 48). The other regional program, Commuter Connections, was known to 48 percent of the residents.

Eighty-five percent of all residents surveyed reported being aware of at least one of the Arlington County travel assistance organization; 78 percent knew Arlington Transit bus, 51 percent were aware of The Commuter Store™, 48 percent had heard of BikeArlington, and 35 percent had heard of WalkArlington. More than one-quarter knew of CommuterPage.com (27 percent) and two in ten were aware of Arlington County Commuter Services (22 percent), Arlington Transportation Partners (19 percent), and CommuterDirect.com (17 percent). Awareness of all of the Arlington County organizations was essentially the same as the awareness observed in among all Arlington residents in the 2009 Arlington Resident Travel Survey.

A third (34 percent) of all study respondents had used an Arlington service. The ART bus was the most commonly-used service, with 32 percent of all residents having used this service, but about 21 percent of residents had used the Commuter Store and 14 percent had used BikeArlington.

Figure 48: Awareness and Use of Arlington County and Regional Travel Information and Assistance Services

(n = 1,283)

<table>
<thead>
<tr>
<th>Travel Information / Assistance Services</th>
<th>Aware / not used</th>
<th>Aware and have used</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMATA / Metro</td>
<td>8%</td>
<td>83%</td>
</tr>
<tr>
<td>ART bus</td>
<td>46%</td>
<td>32%</td>
</tr>
<tr>
<td>Commuter Store</td>
<td>30%</td>
<td>21%</td>
</tr>
<tr>
<td>BikeArlington</td>
<td>34%</td>
<td>14%</td>
</tr>
<tr>
<td>Commuter Connections</td>
<td>32%</td>
<td>6%</td>
</tr>
<tr>
<td>WalkArlington</td>
<td>26%</td>
<td>9%</td>
</tr>
<tr>
<td>CommuterPage.com</td>
<td>19%</td>
<td>8%</td>
</tr>
<tr>
<td>Arlington County Commuter Services</td>
<td>19%</td>
<td>3%</td>
</tr>
<tr>
<td>Arlington Transportation Partners</td>
<td>17%</td>
<td>2%</td>
</tr>
<tr>
<td>Commuter Direct</td>
<td>15%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Percentage of respondents reporting awareness and use
Commute and non-work mode split by awareness and use of Arlington TDM services

Commute modes appeared to be related to residents’ awareness and use of Arlington services. As illustrated in Figure 49, 52 percent of residents who said they were aware of Arlington services drove alone to work, compared with 57 percent of residents who did not know of the services. Residents who were aware of Arlington services used transit for commuting more than those who were not aware.

There was an even greater impact on commute mode when residents had used Arlington services. Residents who had used an Arlington service drove alone to work for only 45 percent of their weekly trips and made 39 percent by transit.

Figure 49: Weekly Commute Mode Split by Awareness and Use of Arlington County Travel Information and Assistance Services

(Not aware of services n = 179, Aware of services n = 1,104, Used services n = 629; Note that respondents who “used services” also are included in the base for respondents who are “aware of services”)
The pattern for non-work trip mode split by awareness and use of Arlington TDM services was similar (Figure 50). Residents who were aware of the services made 39 percent of their non-work trips by driving alone, compared with 53 percent of trips made by those who were not aware. Residents aware of the services made more trips by both transit and bike/walk than those who were not aware. Again, use of the services was correlated to a higher rate of transit and bike/walk use.

While it is logical to expect that the information does have a positive role on mode use, it is important to note that this is not necessarily a causal relationship. It is possible that residents who use or are interested in using non-drive-alone modes seek out travel information services at a higher rate than do other residents, so the observed relationship is not definitive.
III. USES OF THIS STUDY

The residential performance monitoring aggregate study and the individual building studies provide valuable feedback for improving Arlington’s transportation policy and programs. It can help improve new/existing education and outreach campaigns, contribute to parking discussions on appropriate residential parking ratios for development approval, and inform parking and TDM policy updates and implementation. Ways that the findings of this study address the policies highlighted earlier in this report include:

- Mode split and trip generation data can provide a baseline for future evaluations as new ACCS and other transportation programs and services are provided at buildings or in urban villages in order to reduce the need to drive and encourage use of other modes of transportation.

- A better understanding of vehicle ownership rates and parking occupancy as well as the correlated factors can help shape policies that better support reduced auto ownership and the “right-sizing” of residential parking facilities.

- Observed trip generation rates and the comparison to ITE standard rates can help improve the accuracy of TIAs conducted during the development approval stage of residential buildings. The finding that trip generation rates did not vary significantly between apartments and condominiums within the Metrorail corridors can alleviate the concern of the future use of the building, since residential building owners have been known to switch their properties between these two uses post-construction based on market demand or other factors. This study can also support a better assessment of mode share based on building-specific influencing factors.

This study may also be useful to transportation planners and agencies outside Arlington to evaluate their trip generation rates, mode shares, and transportation policies. Data collected during this study can be used to update the ITE trip generation and parking generation rates.

Caveats

- Survey results are likely to be biased due to various reasons. Survey participation by residents was on a voluntary basis. Incentives and encouragement were offered at different levels at each building. Surveys were conducted over approximately two years.

- This study was not designed to investigate causality of mode choice. Correlation of a limited number of variables was studied.

- Small sample sizes for some variables and the limited range of variables in this study make it difficult to test for interactions among variables and relative influences of variables.

- Vehicle trip generation and parking occupancy was determined for the whole garage. The small number of non-residential spaces that could not be excluded for practical reasons are not anticipated to have had a significant impact on the findings.
Future research needs

Questions that were not addressed during this study but may be investigated in future residential building studies include:

- What is the pedestrian and bicycle trip generation of these sites?
- How do residential buildings built through the special exceptions (site plan or use permit) development approval process compare with other residential buildings?
- What routes do people take on their commute?
- Do “edge sites” behave differently than sites either within or outside the Metrorail corridors?
- What is the relationship between TDM services and mode split, controlling for parking availability, pricing, access to transit, and the walkability of the neighborhood around the building?
- Do committed affordable housing (CAF) units generate a different number of vehicle trips, demand for parking spaces, or travel patterns than market rate units?

Future research strategies may also increase and diversify the sample of buildings to include broader geography, more building types, and varied neighborhood characteristics.
## Appendix A: List of Variables

Variables are grouped into six broad categories:

- Building Variables
- Neighborhood/Area Transportation Variables
- TDM Service Variables
- Resident Commute Variables
- Resident Non-Commute Travel Variables
- Traffic Generation Variables

<table>
<thead>
<tr>
<th>Building Variables (Site)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Urban village / neighborhood / County area</td>
</tr>
<tr>
<td>Total Units</td>
<td>Number of units</td>
</tr>
<tr>
<td>Occupied Units</td>
<td>Number of occupied units</td>
</tr>
<tr>
<td>Occupancy Rate</td>
<td>Percentage occupied units</td>
</tr>
<tr>
<td>Density of Units</td>
<td>Dwelling per acre (residential units)</td>
</tr>
<tr>
<td>Stories</td>
<td>Number of stories</td>
</tr>
<tr>
<td>Housing Type</td>
<td>Condo (C - 1)/Apartment (A- 2)</td>
</tr>
<tr>
<td>Ground floor retail</td>
<td>Does building have ground floor retail space (1 yes, 2 no)</td>
</tr>
<tr>
<td>Price Level - owned</td>
<td>Average sale price of 1 bedroom unit</td>
</tr>
<tr>
<td>Price level - rented</td>
<td>Average rent for 1 bedroom unit</td>
</tr>
<tr>
<td>Prop Mgr Awareness</td>
<td>Property manager knows of 4+ Arlington programs (1-yes, 2-no)</td>
</tr>
<tr>
<td>Prop Mgr Tenure</td>
<td>Property manager years at site</td>
</tr>
<tr>
<td>Prop Mgr Residence</td>
<td>Property manager lives in Arlington (1-yes, 2-no)</td>
</tr>
<tr>
<td>Transportation Importance</td>
<td>Property manager considers transportation assistance important to</td>
</tr>
<tr>
<td></td>
<td>attract/retain residents (1-yes, 2-no)</td>
</tr>
<tr>
<td>ATP Events/Outreach</td>
<td>Property manager has had contact with Arlington Transportation</td>
</tr>
<tr>
<td></td>
<td>Partners within last year</td>
</tr>
</tbody>
</table>
### Building Variables (Parking)

<table>
<thead>
<tr>
<th>Building Variables (Parking)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Parking Ratio per Unit</td>
<td>Average number of spaces per dwelling unit</td>
</tr>
<tr>
<td>Residential Parking Ratio per Unit</td>
<td>Average number of residential spaces per unit</td>
</tr>
<tr>
<td>Residential parking ratio - grouped</td>
<td>Ave spaces per residential unit - grouped (&lt;0.5, .51-.75, .76-1.0, 1.01-1.25, 1.26-1.50, 1.51-1.75, 1.76+)</td>
</tr>
<tr>
<td>Residential Parking Ratio per Resident</td>
<td>Average number of residential spaces per adult resident</td>
</tr>
<tr>
<td>Owned/Leased Parking</td>
<td>Is parking owned or leased (1-own, 2-lease, 3-comb)</td>
</tr>
<tr>
<td>Unbundled Parking</td>
<td>Is parking deed/lease unbundled from unit (1-yes, 2-no)</td>
</tr>
<tr>
<td>Parking charge</td>
<td>Monthly parking cost for first regular space</td>
</tr>
<tr>
<td>Incremental Parking charge</td>
<td>Y/N if monthly parking cost increases for 2+ spaces (1-yes, 2-no)</td>
</tr>
<tr>
<td>Paid Public Parking</td>
<td>Are public/visitor/retail spaces free/paid? (1-free, 2-paid)</td>
</tr>
<tr>
<td>Bike Parking per Adult Resident</td>
<td>Bike parking offered: Ratio of class 1 and 2 bike parking spaces to adult residents</td>
</tr>
<tr>
<td>Bike parking C1</td>
<td>Number of C1 parking spaces</td>
</tr>
<tr>
<td>Bike parking C2</td>
<td>Number of C2 parking spaces</td>
</tr>
<tr>
<td>Bike parking C3</td>
<td>Number of C3 parking spaces</td>
</tr>
<tr>
<td>Daytime Street Parking (8am-5pm)</td>
<td>Parking on adjacent blocks: 1-short term meters, 2-12hr meters, 3-zoned, 4-free</td>
</tr>
<tr>
<td>Nighttime Street Parking (after 6pm)</td>
<td>Parking on adjacent blocks: 1-short term meters, 2-12hr meters, 3-zoned, 4-free</td>
</tr>
</tbody>
</table>

### Building Variables (Resident Demographics)

<table>
<thead>
<tr>
<th>Building Variables (Resident Demographics)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Residents</td>
<td>Estimated/actual number of adult residents</td>
</tr>
<tr>
<td>Tenure &lt; 2 years</td>
<td>Percentage residents who have lived in Arlington &lt; 2 years</td>
</tr>
<tr>
<td>Tenure &lt; 5 years</td>
<td>Percentage residents who have lived in Arlington &lt; 5 years</td>
</tr>
<tr>
<td>Household Size</td>
<td>Average number of residents per household</td>
</tr>
<tr>
<td>Adults in Household</td>
<td>Average number of adult residents per household</td>
</tr>
<tr>
<td>Vehicles per Household</td>
<td>Average number of vehicles per household</td>
</tr>
<tr>
<td>Vehicles per Adult resident</td>
<td>Average number of vehicles per adult resident</td>
</tr>
<tr>
<td>Average Age</td>
<td>Average age of residents</td>
</tr>
<tr>
<td>Average Income</td>
<td>Average household income</td>
</tr>
<tr>
<td>Male/Female Split</td>
<td>Average percent of males per household</td>
</tr>
<tr>
<td>Employment Rate</td>
<td>Percentage residents who are employed</td>
</tr>
<tr>
<td><strong>Neighborhood / Area Transportation Variables</strong></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Area Population</strong></td>
<td>Neighborhood population (PRAT)</td>
</tr>
<tr>
<td><strong>Area Employment</strong></td>
<td>Neighborhood employment (PRAT)</td>
</tr>
<tr>
<td><strong>Population / Employment ratio</strong></td>
<td>Ratio of residential population to employment in the neighborhood</td>
</tr>
<tr>
<td><strong>Metrorail Distance</strong></td>
<td>Actual distance from site to Metrorail stop</td>
</tr>
<tr>
<td><strong>Metrorail Distance Grouped</strong></td>
<td>0-2 blocks, 3-5 blocks, 6-10 blocks, 11 blocks or more</td>
</tr>
<tr>
<td><strong>Bus Distance</strong></td>
<td>Distance from home to nearest bus stop (mi)</td>
</tr>
<tr>
<td><strong>Bus Frequency</strong></td>
<td>Bus service frequency during peak period (future)</td>
</tr>
<tr>
<td><strong>Highway Access</strong></td>
<td>Actual distance from site to interstate / major arterial</td>
</tr>
<tr>
<td><strong>Bike Path Access</strong></td>
<td>Actual distance from site to bike/walk trail</td>
</tr>
<tr>
<td><strong>Bikeshare Availability</strong></td>
<td>Actual distance from site to bikeshare trail</td>
</tr>
<tr>
<td><strong>Carshare Availability</strong></td>
<td>Actual distance from site to carshare location</td>
</tr>
<tr>
<td><strong>Walk Score</strong></td>
<td>Walk Score number</td>
</tr>
<tr>
<td><strong>Transit Score</strong></td>
<td>Transit Score number</td>
</tr>
<tr>
<td><strong>Bike Score</strong></td>
<td>Bike Score number (future)</td>
</tr>
<tr>
<td><strong>Density of Neighborhood within 0.5 miles radius</strong></td>
<td>Residential = DU per acre; Office = GSF per acre</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TDM Service Variables</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transportation Options Information</strong></td>
<td>Level 1 - Kiosk/New tenant welcome packets/ACCS link on website/Redefine or other campaign material; Level 2 – ALSO ATP fair/Trip Planning Assistance/Onsite sale of SmarTrip cards; Level 3 – ALSO Transit Store in building (future)</td>
</tr>
<tr>
<td><strong>Carshare in garage</strong></td>
<td>Carsharing service using reserved spaces in the garage, Y/N</td>
</tr>
<tr>
<td><strong>Shuttle</strong></td>
<td>Shuttle to Metrorail offered, Y/N</td>
</tr>
<tr>
<td><strong>Transit Fare Subsidy</strong></td>
<td>None (0) / One time at initial occupancy (1) / one SmarTrip card to each new resident (2) / Ongoing, incl. transit system contributions that create free or reduced rides for residents (3)</td>
</tr>
<tr>
<td><strong>Carshare Membership Subsidy</strong></td>
<td>Building offers carshare membership subsidy (future)</td>
</tr>
<tr>
<td><strong>Bikeshare membership subsidy</strong></td>
<td>Building offers bikeshare membership subsidy (future)</td>
</tr>
<tr>
<td><strong>Additional Building TDM</strong></td>
<td>Building offers services that are not a site plan requirement</td>
</tr>
<tr>
<td><strong>Perceived Building TDM Level - weighted average</strong></td>
<td>Weighted building TDM level - perceived by resident (survey variable) - Score from 1 (low) to 3 (high)</td>
</tr>
<tr>
<td><strong>Residents perceiving high level of TDM in building</strong></td>
<td>Percentage of residents who perceive a high level of building TDM - defined by offering 3+ services, including financial or shuttle</td>
</tr>
<tr>
<td>Resident Commute Travel Variables</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Teleworkers</td>
<td>% of employed residents who telework at least occasionally</td>
</tr>
<tr>
<td>Commute drive alone</td>
<td>% of weekly commute trips residents make by driving alone</td>
</tr>
<tr>
<td>Commute Bus</td>
<td>% of weekly commute trips residents make by bus</td>
</tr>
<tr>
<td>Commute Metrorail</td>
<td>% of weekly commute trips residents make by Metrorail</td>
</tr>
<tr>
<td>Commute CP/VP</td>
<td>% of weekly commute trips residents make by carpool or vanpool</td>
</tr>
<tr>
<td>Commute Walk/Bike</td>
<td>% of weekly commute trips residents make by walk or bicycle</td>
</tr>
<tr>
<td>Commute Telework/CWS</td>
<td>% of weekly commute trips residents eliminate by telework or CWS</td>
</tr>
<tr>
<td>Commute distance (mi)</td>
<td>Average one-way travel distance from home to work</td>
</tr>
<tr>
<td>Commute time (min)</td>
<td>Average one-way travel time from home to work</td>
</tr>
<tr>
<td>Paid commute parking</td>
<td>% of employed residents who pay to park at work</td>
</tr>
<tr>
<td>Monthly work parking fee</td>
<td>Average monthly parking fee at work (residents who pay)</td>
</tr>
<tr>
<td>Work TDM level – Low / Moderate</td>
<td>% of employed residents with low or unknown TDM level at work: - Low - 0-3 services/no financial, Moderate - 4+ no financial</td>
</tr>
<tr>
<td>Work TDM level – High / Very high</td>
<td>% of employed residents with high TDM level at work</td>
</tr>
<tr>
<td>Work transit subsidy</td>
<td>% of employed respondents with transit subsidy offered at work</td>
</tr>
<tr>
<td>Resident Non-Work Travel Variables</td>
<td></td>
</tr>
<tr>
<td>Non-work trips</td>
<td>% of residents who make non-work trip on a typical day</td>
</tr>
<tr>
<td>Non-work Drive alone</td>
<td>% of daily non-work trips residents make by driving alone</td>
</tr>
<tr>
<td>Non-work Carpool</td>
<td>% of daily non-work trips residents make by driving/riding with others</td>
</tr>
<tr>
<td>Non-work Transit</td>
<td>% of daily non-work trips residents make by train/bus</td>
</tr>
<tr>
<td>Non-work Walk</td>
<td>% of daily non-work trips residents make by walking</td>
</tr>
<tr>
<td>Non-work Bike</td>
<td>% of daily non-work trips residents make by bicycle</td>
</tr>
<tr>
<td>Aware of Metro service</td>
<td>% residents who know of Metro / WMATA transit service</td>
</tr>
<tr>
<td>Used Metro service</td>
<td>% residents who have used Metro / WMATA transit</td>
</tr>
<tr>
<td>Aware of ART bus</td>
<td>% residents who know of ART bus</td>
</tr>
<tr>
<td>Used ART bus</td>
<td>% residents who have used ART bus</td>
</tr>
<tr>
<td>Aware of Arlington info</td>
<td>% of residents who know of Arlington info service</td>
</tr>
<tr>
<td>Used Arlington info</td>
<td>% of residents who have used Arlington info service</td>
</tr>
</tbody>
</table>
### Resident Trip Generation Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday AM Peak Trips</td>
<td>Weekday am observed trips / ITE %</td>
</tr>
<tr>
<td>Weekday PM Peak Trips</td>
<td>Weekday pm observed trips / ITE %</td>
</tr>
<tr>
<td>Saturday Peak Trips</td>
<td>Saturday observed trips / ITE %</td>
</tr>
<tr>
<td>Sunday Peak Trips</td>
<td>Sunday observed trips / ITE %</td>
</tr>
<tr>
<td>Weekday Daily Trips</td>
<td>Weekday observed trips / ITE %</td>
</tr>
<tr>
<td>Saturday Peak Trips</td>
<td>Saturday observed trips / ITE %</td>
</tr>
<tr>
<td>Sunday Peak Trips</td>
<td>Sunday observed trips / ITE %</td>
</tr>
<tr>
<td>Monday-Thursday trips</td>
<td>Average Monday-Thursday trips</td>
</tr>
<tr>
<td>Friday trips</td>
<td>Friday trips</td>
</tr>
<tr>
<td>Saturday trips</td>
<td>Saturday trips</td>
</tr>
<tr>
<td>Sunday trips</td>
<td>Sunday trips</td>
</tr>
<tr>
<td>Mon-Thurs Trips per unit</td>
<td>ave trips / unit (Mon-Thurs)</td>
</tr>
<tr>
<td>Friday Trips per unit</td>
<td>ave trips / unit (Fri)</td>
</tr>
<tr>
<td>Saturday Trips per unit</td>
<td>ave trips / unit (Sat)</td>
</tr>
<tr>
<td>Sunday Trips per unit</td>
<td>ave trips / unit (Sun)</td>
</tr>
<tr>
<td>Mon-Thurs Trips per adult</td>
<td>ave trips / adult res (Mon-Thurs)</td>
</tr>
<tr>
<td>Friday Trips per adult</td>
<td>ave trips / adult res (Fri)</td>
</tr>
<tr>
<td>Saturday Trips per adult</td>
<td>ave trips / adult res (Sat)</td>
</tr>
<tr>
<td>Sunday Trips per adult</td>
<td>ave trips / adult res (Sun)</td>
</tr>
<tr>
<td>Max Parking Occupancy</td>
<td>Highest % parking occ (night)</td>
</tr>
<tr>
<td>Min Parking Occupancy</td>
<td>Lowest % parking occ (midday)</td>
</tr>
</tbody>
</table>
Appendix B: Resident Survey Questions
Arlington County is conducting this survey to assess how well transportation services meet the needs of residents. We thank you for participating. Your answers will be completely confidential. The survey will take about 10 minutes. Please return your completed survey to the leasing office.

This survey is to be completed by residents aged 18 and older.

I. Employment Status

1. Which of the following best describes your employment status?
   - Employed full-time (35 hours or more per week)
   - Employed part-time (less than 35 hours per week)
   - A full-time student
   - Retired
   - Otherwise not employed (keeping house, looking for work)
   - Don't know/prefer not to answer

   If you answered either of these, please proceed to the next question.
   If you answered any of these, please skip to question #14.

2. In a typical week, how many weekdays (Monday through Friday) are you assigned to work? If the number of days varies from one week to another, please check the number that is most typical.
   - 0 days (skip to Question #14)
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 4 days one week and 5 days the next week (9/80 compressed work schedule)
   - Don't know

3. In a typical week, how many weekdays do you work at a location outside your home, for all or part of the day? Please check the number of days you work outside your home in a week you DO NOT have your compressed schedule day off.
   - 0 days
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - Don't know

4. If you do not work a conventional job, which of the following best describes your work situation?
   - I telework every weekday that I work
   - I'm self employed, with my primary work location at home
   - I work only on weekends
   - Another situation (please describe)
   - Don't know/prefer not to answer

   If yes, skip to question #10
II. Travel to Work

If you work at more than one location, answer for the location where you work most often.

5. How many weekdays do you typically use each of the following types of transportation to get to work? If you use more than one type on a single day (e.g., walk to the bus stop, then ride the bus), count only the type you use for the longest distance part of your trip. Please report your travel for the same number of days you answered in question #3.

<table>
<thead>
<tr>
<th>Type of Transportation</th>
<th>Number of Weekdays Used (0-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive alone, motorcycle, taxi</td>
<td></td>
</tr>
<tr>
<td>Ride a bus (Metro, ART, other bus)</td>
<td></td>
</tr>
<tr>
<td>Ride Metrorail or subway train</td>
<td></td>
</tr>
<tr>
<td>Ride a commuter train (VRE, MARC, Amtrak)</td>
<td></td>
</tr>
<tr>
<td>Carpool or vanpool (ride or drive with others in a car, truck, van, or SUV, dropped off)</td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
</tr>
<tr>
<td>Walk</td>
<td></td>
</tr>
<tr>
<td>Other (describe)</td>
<td></td>
</tr>
<tr>
<td>Total weekdays</td>
<td></td>
</tr>
</tbody>
</table>

   Number of people in the vehicle, including yourself? ______

6. For your main mode of transportation answered above, how long have you been using this type of transportation?

   ________ Months/years (circle one)   ________ Less than 1 month   ________ Don't know

7. About how many miles is it from your home to your usual work location?

   ________ One way miles   ________ Don't know

8. How many minutes does your trip to work typically take you?

   ________ Number of minutes   ________ Don't know

9. On the weekdays that you DO NOT work at your usual work location, how many days do you do each of the following?

<table>
<thead>
<tr>
<th>Situation</th>
<th>Number of Weekdays (0-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have a compressed work schedule day off</td>
<td></td>
</tr>
<tr>
<td>Have a regular day off - not compressed work schedule</td>
<td></td>
</tr>
<tr>
<td>Work at home all day (telework, telecommute)</td>
<td></td>
</tr>
<tr>
<td>Work at a client's or customer's office in the Washington metro area</td>
<td></td>
</tr>
<tr>
<td>Travel outside the Washington metro area for business</td>
<td></td>
</tr>
<tr>
<td>Some other situation</td>
<td></td>
</tr>
</tbody>
</table>
10. Do you ever telework or telecommute: that is, do you ever work at home or at a telework center for an entire work day, instead of traveling to your usual work location?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
</table>

10a. How often do you usually telework/telecommute?

<table>
<thead>
<tr>
<th>Less than one time per month</th>
<th>5 or more days a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 times per month</td>
<td>Don't know</td>
</tr>
<tr>
<td>1-2 days per week</td>
<td>Other (Please describe)</td>
</tr>
<tr>
<td>3-4 days per week</td>
<td></td>
</tr>
</tbody>
</table>

11. Listed below are travel services or benefits that might be available at your work. For each service or benefit, check the appropriate column.

<table>
<thead>
<tr>
<th>Service or Benefit</th>
<th>Available &amp; have used</th>
<th>Available but have not used</th>
<th>Not Available</th>
<th>Not Sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help finding carpool/vanpool partners, &quot;carpool matchlist&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transit schedule or route information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle/walking information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guaranteed Ride Home in case of emergencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term use of shared vehicle during the workday (e.g., carsharing, ZipCar)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discounted transit pass or other financial benefit for employees who ride trains or busses to work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash or other financial benefit for employees who carpool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash or other financial benefit for employees who vanpool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved or preferential parking for carpools/vanpools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure parking for bicycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal lockers or showers for employees who bicycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Parking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecommuting information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III. Parking

12. On days that you drive to work, where do you park? If you don't usually drive to work, please check where you would park if you had to drive.

<table>
<thead>
<tr>
<th>In a lot or garage at this work location</th>
<th>On the street</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a company-owned/leased lot or garage off-site/nearby</td>
<td>Don't know</td>
</tr>
<tr>
<td>In a public or private lot or garage nearby</td>
<td>Other location (describe)</td>
</tr>
</tbody>
</table>
13. How much do you pay to park? If you usually don't drive, enter what you would have to pay if you drove.

$ ___________ per:  day / month (circle one)  ________ No charge, I park or would park for free

14. Do you currently have a monthly permit for parking?  ________ Yes  ________ No  ________ Don't know

IV. Non-work Trips Around the Home Location

For example, trips for errands, recreation, meals, personal appointments, or to pick someone up or drop someone off.

15. Think back to yesterday. At any time on that day, did you make any trips from your home for non-work purposes?

_______ Yes  ________ No  ________ Don't know

15a. If yes, how many non-work trips did you make by each of the following types of transportation? Please count both the trip leaving your home and the trip returning home as individual trips.

<table>
<thead>
<tr>
<th>Mode Type</th>
<th>Number of Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving alone or by taxi</td>
<td></td>
</tr>
<tr>
<td>Driving or riding with someone in a car or truck</td>
<td></td>
</tr>
<tr>
<td>Bus/train/Metrorail</td>
<td></td>
</tr>
<tr>
<td>Walk</td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
</tr>
</tbody>
</table>

V. Use of Travel Services

16. Listed below are services that might be available at the building or complex where you live. For each service, check the appropriate column.

<table>
<thead>
<tr>
<th>Service or Benefit</th>
<th>Available &amp; have used</th>
<th>Available but have not used</th>
<th>Not Available</th>
<th>Not Sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help finding a carpool or vanpool partner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transit schedule or route information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle or walking information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discounted passes for bus or train</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure parking for bicycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserved parking for carpools or vanpools</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shuttle Bus to bus stop or train station</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
17. If the following services were available at the building or complex or in the area where you live, how likely would you be to make more of your trips by carpooling, public transit, bicycling, or walking?

<table>
<thead>
<tr>
<th>Service or Benefit</th>
<th>Likely to try carpool, public transit, walking, or bicycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help finding a carpool or vanpool partner</td>
<td>1  2  3  4  Very likely  Not sure</td>
</tr>
<tr>
<td>Transit schedule or route information</td>
<td></td>
</tr>
<tr>
<td>Bicycle or walking information</td>
<td></td>
</tr>
<tr>
<td>Discounted passes for bus or train</td>
<td></td>
</tr>
<tr>
<td>Secure parking for bicycles</td>
<td></td>
</tr>
<tr>
<td>Reserved parking for carpool or vanpool</td>
<td></td>
</tr>
<tr>
<td>Shuttle Bus to bus stop or train station</td>
<td></td>
</tr>
<tr>
<td>Safe, well-lit sidewalks or bicycle paths</td>
<td></td>
</tr>
</tbody>
</table>

18. Shown below is a list of organizations and programs that provide transportation information and assistance for residents in Arlington. For each organization, check the appropriate column.

<table>
<thead>
<tr>
<th>Organization/Program</th>
<th>Have used services of the organization</th>
<th>Know of organization but have not used</th>
<th>Don't know of the organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlington County Commuter Services (ACCS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Commuter Store</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CommuterPage.com</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CommuterDirect.com</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WalkArlington</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BikeArlington</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arlington Transportation Partners (ATP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arlington Transit (ART)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro/Washington Metropolitan Area Transit Authority (WMATA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commuter Connections</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VI. Demographics

19. About how long have you lived in Arlington County?

- _____ Less than 2 years
- _____ 2 - 5 years
- _____ 6 - 10 years
- _____ More than 10 years
- _____ Don't know/prefer not to answer
20. In total, how many motor vehicles in working condition, including automobiles, trucks, vans, and highway motorcycles, are owned or leased by members of your household?

\[
\begin{array}{ccc}
\text{Number of vehicles} & \text{Don't know/prefer not to answer} \\
\end{array}
\]

21. Including yourself, how many persons live in your household?

\[
\begin{array}{ccc}
\text{Number of people} & \text{Don't know/prefer not to answer} \\
\end{array}
\]

22. How many of these household members are under the age of 16?

\[
\begin{array}{ccc}
\text{Number of people under 16 in the household} & \text{Don't know/prefer not to answer} \\
\end{array}
\]

23. In what county do you work? If you work in multiple locations or the location varies, please check the county in which you work most often.

\[
\begin{array}{ccc}
\text{Alexandria City, VA} & \text{Montgomery County, MD} \\
\text{Arlington County, VA} & \text{Prince George's County, MD} \\
\text{District of Columbia (Washington, DC)} & \text{Prince William County, VA} \\
\text{Fairfax County, VA} & \text{Other} \\
\text{(including City of Falls Church & City of Fairfax)} & \\
\text{Loudoun, County, VA} & \text{Don't know/prefer not to answer} \\
\end{array}
\]

24. In what year were you born?

\[
\begin{array}{ccc}
19 & \text{Don't know/prefer not to answer} \\
\end{array}
\]

25. Do you consider yourself to be Latino, Hispanic, or Spanish?

\[
\begin{array}{ccc}
\text{Yes} & \text{No} & \text{Prefer not to answer} \\
\end{array}
\]

26. Which one of the following best describes your racial background?

\[
\begin{array}{ccc}
\text{African-American or Black} & \text{Other} & \\
\text{Asian} & \text{Prefer not to answer} & \\
\text{White or non-Hispanic} & \\
\end{array}
\]

27. Which category best represents your household's total annual income?

\[
\begin{array}{ccc}
\text{Less than $20,000} & \text{$80,000 - $99,999} & \text{$140,000 - $159,999} \\
\text{$20,000 - $39,999} & \text{$100,000 - $119,999} & \text{$160,000 or more} \\
\text{$40,000 - $59,999} & \text{$120,000 - $139,999} & \text{Prefer not to answer} \\
\text{$60,000 - $79,999} & & \\
\end{array}
\]

28. Are you female or male?

\[
\begin{array}{ccc}
\text{Female} & \text{Male} & \text{Prefer not to answer} \\
\end{array}
\]

29. Comments on transportation in and around Arlington: