Introduction

Background
More than 30 years ago, Arlington County leaders envisioned a development approach characterized by coordinated urban planning and transportation design. Since then, the County has invested in mixed-use “urban village" land development combined with an interconnected, multi-modal transportation system.

Arlington planners have concentrated high-density commercial and residential development around Metrorail stations in the Rosslyn-Ballston and Jefferson Davis Metrorail corridors, while maintaining lower density residential neighborhoods in the rest of the County. The County has also supported a high level of public transit, non-motorized facilities, and transportation amenities to maximize travel options that are more sustainable than driving alone.

The result is a network of walkable, mixed-use neighborhoods well-served by public transportation and pedestrian facilities. This visionary approach created an environment that fosters mobility and accessibility, but visionary development alone does not ensure success, when placed in the middle of a vehicle-dependent region. Travelers must learn of the variety of travel options available, understand how they work, and consider how to incorporate them into their personal trip decision-making process.
Arlington County Commuter Services

Arlington County Commuter Services (ACCS), a bureau of the Transportation Division of the Department of Environmental Services, provides transportation demand management (TDM) support, sales, and outreach. The bureau’s mission is to make it easy for residents, employees, and visitors to use all available transportation options to meet their travel needs. ACCS programs and services support the Arlington County land use vision of mixed-use high-density urban villages served by multiple modes of transportation and surrounded by lower-density, primarily residential neighborhoods.

One way in which Arlington County Commuter Services makes information about travel options to the public is through its CommuterStores. Pictured here is the CommuterStore in the Crystal City neighborhood of Arlington County.
Research Purposes and Priorities

This study brings together site plan performance monitoring data collected between 2013 and 2015 through the enforcement of Arlington County’s transportation demand management (TDM) site plan requirements. This analysis builds upon lessons from the last decade about the relationship between the built environment, awareness and use of TDM services, and transportation behavior in Arlington and the DC metro region, and gives Arlington a current look at the transportation performance of office buildings on the Rosslyn-Ballston Corridor in particular. The main purposes defined for this study include:

1. Learn about travel and parking behaviors of office employees who work in one of the densest, most urban sections of Arlington.

2. Provide useful local data about which factors are most likely to influence travel and parking behaviors.

3. Support better understanding about what influences transportation choices and outcomes so as to help the County reach its long-term objectives and to influence national planning standards.

Through the scoping process conducted for the study, five research priorities were identified:

1. Contribute to building and neighborhood travel profiles

2. Describe influences of TDM on mode split

3. Describe influences of TDM on parking behavior

4. Describe the adequacy of parking supply

5. Explore influence of ACCS on economic competitiveness

The final study design and results were reasonably able to speak to the first four of these priority areas.
Methods
This study used existing literature and especially previous Arlington County studies to shape the selection of key study variables for analysis. The data-collection methods used include vehicle-trip counts, parking-occupancy counts, and a series of surveys with property managers, employers, and employees at 16 office buildings in Arlington County’s Rosslyn-Ballston Corridor. Similar to other studies made by transportation researchers in recent decades, this study used a “cross-sectional” method. Although the building data was collected between 2013 and 2015, each building’s data collection occurred at one time over only a few weeks; therefore, the researchers treated the 16-building data “set” as a point-in-time snapshot of travel at these buildings.

Summary Statistics
Off the 16 sites studied, 12 were primarily office buildings, all but one of which had at least some retail space. Four sites also had residential units, and one had a hotel on site. The 16 buildings represented about 3.7 million square feet of office space, with individual buildings ranging between approximately 41,400 and 625,000 square feet. Based on property manager interviews, office-space occupancy exceeded 90 percent in 12 buildings, with the additional four buildings ranging between 60 percent and 76 percent occupied, for a sample-wide office occupancy rate of 86 percent.

All building sites had similar, excellent transit access; all were within 0.4 miles of a Metrorail station, and all were within 0.2 miles of ART bus and/or Metrobus service. Additionally, all sites were within 0.3 miles of a Capital Bikeshare station.

The sixteen buildings were home to 135 office tenants. Of those, 63 agreed to participate in employer interviews. Of approximately 13,400 employees based in these buildings, the employee surveys obtained 2,644 responses, for an overall response rate of 20 percent.
The results of this study come from data collected at sixteen office buildings along the Rosslyn-Ballston Corridor in Arlington County, Virginia. Map Source: Mobility Lab. Data Sources: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.
PARKING IS UNDERUTILIZED

1,763 EMPTY PARKING SPACES IN 16 BUILDINGS = OFFICE SPACE FOR 2,116 EMPLOYEES
Trip Generation Lower than Predicted
The 13 buildings included in the trip-generation part of the analysis\(^1\) generated weekday daily vehicle trips at a much lower rate than predicted by the Institute for Transportation Engineers (ITE) Trip-Generation Manual; specifically, vehicle-trip-generation rates at the 13 buildings ranged between 39 percent and 79 percent of the ITE-predicted values. It is common practice in trip-generation studies to compare the data observed at the study site to those in the Trip-Generation Manual because planners and traffic engineers commonly refer to it for guidance when forecasting or estimating vehicle traffic.

The study buildings also generated many fewer trips in comparison with ITE-published rates for weekday AM peak hour trips, at highest only achieving 66 percent of the ITE predicted rate. These data show how much better Arlington’s R-B corridor performs with respect to trip generation than the typical office building in the US. These findings are consistent with those of other researchers who are testing the suitability of ITE factors for mixed-use urban areas.

Parking Occupancy Lower than Supply
This study’s results also reinforced existing research when it came to parking-garage occupancy. Average weekday (Monday through Thursday\(^2\)) parking occupancy at all 16 buildings was no higher than 85 percent across all the build-

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\(^1\) Three of the study buildings were broadly mixed-use, with grocery retail, gym, housing, and/or hotel uses. Because these buildings represented quite different travel patterns and the commute travel could not always be segmented from the non-work travel, these buildings were excluded from some of the trip-generation analysis.

\(^2\) Parking and trip behavior on Fridays frequently varies from that seen on other week days since Fridays are frequently taken as holidays and because individuals will vary travel behavior as part of their weekend plans.
ings studied and was as low as 50 percent in one case. Though parking garages are not intended to operate at 100 percent occupancy, the parking occupancies seen here indicate that many Arlington office buildings provide more parking than necessary, even when controlling for the varying rates of office-space occupancy in these buildings. As expected, weekend parking occupancy in office building garages was lower than on week days, with the exception of three buildings where garages served a more diverse mix of uses (offices coupled with large scale retail, hotels, and residences). In these buildings, overall demand for parking in the building was relatively stable across all seven days of the week, just as proponents of shared parking would predict. Unfortunately, the true benefits of this shared parking opportunity are not realized because in these buildings the parking is separated by land use type, not shared across land use types.

**Few Workers Park On-Street**

When asked, workers at these 16 buildings reported that they are most likely to park in the garages at the office building where they work or at other parking garages nearby; only three percent said that they park on the street. This finding is important because (as in other communities) community members concerned about high-density development in Arlington frequently cite concerns about “spillover” parking, a situation in which individuals who drive to work take up on-street parking spaces in nearby residential neighborhoods.
Rosslyn-Ballston Corridor Commuters Drive Alone Less, Use Other Options More

Study respondents drove alone to work less frequently than all Arlington workers (47 percent of commute trips versus 54 percent of commute trips) and considerably less than the regional average (66 percent of commute trips). Study respondents used transit more than all Arlington workers (32 percent and 26 percent of commute trips, respectively), and much less than the regional average (18 percent of commute trips). Study residents walked/biked at twice the rate for all Arlington workers and four times the rates of commuters region-wide. However, workers in the District of Columbia (and especially in the District’s downtown employment core) are still less likely to commute by driving alone (41 percent of commute trips), more likely to take transit (38 percent of commute trips), and more likely to carpool or vanpool (11 percent of commute trips).

When the researchers look at Arlington residents who work in

Share of Commute Trips Made by Mode of Travel. Study Respondents Compared with Workers who Commute Elsewhere

TW/CWS = “Telework/Compressed Work Schedule.” Here “telework” represents trips commuters do not take to an office on days when they work from home or elsewhere. “Compressed work schedule” refers to a day when commuters do not work at their usual office or elsewhere because they work longer hours on other days of the week. Since telework and compressed work schedules are techniques used to reduce travel demand, they are included here.
the 16 office buildings, only 37 percent of commute trips to these office buildings are made by driving alone, while fully 28 percent of trips are made by walking, 26 percent by public transportation, and 6 percent by biking. District of Columbia residents who reverse commute to these Arlington locations are still less likely to drive to work (only 30 percent of trips), probably due, in part, to DC’s much lower household-vehicle-ownership rates and the relative greater difficulty in driving across the Potomac River, compared to driving through the neighborhoods of Arlington. Indeed, in this study sample, individuals living in households with zero vehicles available make only 3 percent of their commute trips by driving alone. For individuals from one-car households the share is 40 percent; for individuals in households with two or more vehicles, the share is over 60 percent.
TDM-Related Key Findings: Influence of Pricing on Mode Choice

Unlike many other studies of travel behavior in transit-oriented developments, this research focuses attention on the relationship between pricing for parking and transit, as well as other TDM measures that office building owners and employers might offer, including secure bike parking and subsidies for carpooling and vanpooling. Though TDM influences travel behavior in concert with density, land-use mix, and transportation infrastructure, the 16 buildings studied had very similar surrounding densities and very similar access to transit infrastructure. Therefore, when the researchers analyzed the impact of pricing and other forms of TDM, they made the simplifying assumption that these impacts are independent of variation in density, land-use mix, and transportation infrastructure.

Parking Subsidies Encourage Driving; Transit Subsidies Encourage Transit

In general, transportation pricing appears to be a powerful factor influencing travel behavior, which is consistent with findings from other studies. Employees with access to generous parking subsidies that brought their out-of-pocket cost down to $0 were much more likely to drive to work than those who paid market prices for parking. When employees had access to transit subsidies, they were about twice as likely to take transit for their commutes. Though direct subsidies for carpooling and direct or tax-advantaged subsidies or set-asides for vanpooling may also have a strong relationship to actual rates of carpooling and vanpooling respectively,
FREE PARKING LEADS TO MORE DRIVING

R-B corridor employers and property owners offer more than $25 million in parking subsidies each year. About a quarter of all survey respondents said that they pay or would pay nothing to park.
these benefits were perceived available so infrequently that the researchers could not analyze their correlation with behavior.

**Magnitude of Parking Subsidies in the Rosslyn-Ballston Corridor**

Based on the share of employees who said that they pay or would pay nothing to park at the sixteen buildings studied (24%), and the listed price for unreserved monthly parking permits at these buildings (a range between $90 and $170 with a $110 average), the researchers estimate that employers in the studied buildings offer about $3.5 million worth of free parking to their employees each year. If one extrapolates the figures from the 16 buildings and their estimated 13,400 employees to the 89,900 employees across the Rosslyn-Ballston Corridor, free-parking subsidies in the corridor may be as much as $25 million each year.

This estimate is believed to be a conservative one for three reasons:

4. The regional State of the Commute surveys indicate that free parking is more prevalent in the Metrorail Corridors than it was in this sample.

5. These calculations do not include people who get a partial subsidy for parking costs. Due to the way this survey question was worded, it was difficult to quantify the value of the partial parking subsidies, so they were omitted from the estimates.

6. The estimate is based on the cost of an unreserved space monthly parking permit. Reserved space parking permits are more expensive, and it is possible that many employers subsidize reserved parking permits in addition to, or instead of, unreserved permits.

**Interaction between Parking and Transit Subsidies**

The degree to which parking pricing and transit subsidies can either work together or at cross purposes to influence travel behavior was another important finding. It may be obvious that employees are more likely to drive when employers subsidize
parking but not transit. However, these data are also consistent with other research that has found that when parking and transit subsidies are available together, the potential behavior impacts of the transit subsidy offer are diminished. When employers simultaneously make available free parking and subsidized transit, employees are half as likely to commute by transit as when they have access to transit subsidies but no parking subsidies.

**Influence of Carpooling and Vanpooling Incentives**

Services and subsidies for carpooling and vanpooling (such as ride-matching, preferential carpool/vanpool parking, and financial incentives) were made available at frequencies much lower than services or subsidies that support transit and bicycling commutes. From a TDM perspective, transit may be preferable to ridesharing in that transporting an individual on transit is more space efficient than transporting him or her in a carpool or vanpool; however, carpooling and vanpooling are still more efficient than driving alone, and may be the only reasonable option, other than driving alone, for those who do not live near fixed-route transit.

When employees do report carpool and vanpool benefits as available, they report using them at rates similar to use of other available benefits. For example, 17 percent of employees who report access to carpool financial incentives take advantage of them, which is close to the 19 percent of employees who report using secure bicycle parking when they know it is available. These data suggest that employers and building owners may shift more individuals from driving alone to shared rides if ridesharing services and
Transit Subsidies and Parking Prices Promote Transit Ridership

The share of commute trips taken on transit jumps dramatically when transit subsidies are combined with unsubsidized, market-rate parking.
subsidies were more readily available and promoted.

To close out this brief summary of key findings, it’s worth reminding the reader that this analysis has not explored this dataset exhaustively, and there are perhaps more detailed insights to be gleaned. In just one example, these data indicate there was a set of respondents (393) who primarily drove alone to their workplace (on the Rosslyn-Ballston Corridor), and yet they lived less than half a mile (or a ten-minute walk) from Metrorail at the home end of their trip. This suggests a group whose barriers to mode shift may be low, and who may benefit from targeted incentives, education, and promotion of travel options. There may be similar detailed findings within the dataset which could inform specific promotional campaigns, or specific development review processes for the Ballston, Clarendon, and Rosslyn neighborhoods featured in this study.

Availability and Use of Worksite TDM Services as Reported by Employees

<table>
<thead>
<tr>
<th>Car/Vanpool Services</th>
<th>Share of Respondents</th>
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</thead>
<tbody>
<tr>
<td>Help finding carpool / vanpool partner</td>
<td>39% 6%</td>
</tr>
<tr>
<td>Reserved/preferential carpool/vanpool parking</td>
<td>21% 2%</td>
</tr>
<tr>
<td>Cash / financial benefits for carpools</td>
<td>10% 2%</td>
</tr>
<tr>
<td>Cash / financial benefits for vanpools</td>
<td>9% 1%</td>
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</tbody>
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<tr>
<th>Transit Services</th>
<th>Share of Respondents</th>
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<tbody>
<tr>
<td>SmarBenefits / financial benefits for transit</td>
<td>26% 39%</td>
</tr>
<tr>
<td>Transit schedule / route information</td>
<td>27% 37%</td>
</tr>
<tr>
<td>Shuttle to Metrorail</td>
<td>16% 9%</td>
</tr>
</tbody>
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<tr>
<th>Bicycling Services</th>
<th>Share of Respondents</th>
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<tbody>
<tr>
<td>Secure parking for bicycles in the building</td>
<td>50% 12%</td>
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<tr>
<td>Personal lockers/showers for bicyclists</td>
<td>45% 13%</td>
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<tr>
<td>Bicycle / walking information</td>
<td>39% 16%</td>
</tr>
<tr>
<td>Free/discounted Capital Bikeshare membership</td>
<td>18% 2%</td>
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<tr>
<td>Other cash/financial benefit for bicycling</td>
<td>7% 1%</td>
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</tbody>
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<table>
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<tr>
<th>Other Services</th>
<th>Share of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation info display/kiosk in building lobby</td>
<td>18% 11%</td>
</tr>
<tr>
<td>Free/discounted carshare membership</td>
<td>22% 3%</td>
</tr>
<tr>
<td>Guaranteed Ride Home</td>
<td>17% 2%</td>
</tr>
<tr>
<td>Transportation info on company intranet</td>
<td>11% 7%</td>
</tr>
<tr>
<td>Company vehicles for personal trips during workday</td>
<td>3%</td>
</tr>
</tbody>
</table>
These findings point to several policy and programmatic recommendations, of which just a few are highlighted here:

- Planners and developers should rely on locally collected trip-rate data instead of the values contained in the *Trip-Generation Handbook* produced by the Institute of Transportation Engineers, or they should utilize one of the growing number of “adjustment” methods created by other researchers to derive trip-generation rates that will forecast future trip-generation rates with more accuracy.

- Given the low parking occupancy rates, not only should jurisdictions use local data to tailor parking requirements better to need, but they can strive to ease the regulatory process for converting underutilized automobile parking to other uses.

- Jurisdictions should encourage more shared parking, especially through the creation of vertically mixed-use buildings that directly share garage spaces across land use types.

- Investments and strategies that help households downsize their car ownership may help them make more sustainable transportation choices for commute trips.

- The high walking, biking, and transit mode splits described here should help frame debates on how to spend money on transportation and how to allocate space for different modes of transportation.

- Jurisdictions should pursue strategies to discourage parking subsidies, which dampen the effectiveness of transit subsidies and other TDM programs.

If you enjoyed this highlights report and would like more detailed study methodology, results, and recommendations, you can find the full report on the Mobility Lab website, at http://www.mobilitylab.org/mobility-lab-research-catalog/.