Richmond Regional Transportation Planning Organization
SUPPORTED BY PlanRVA

Richmond Regional Park and Ride Investment Strategy

Technical Memo III – Draft
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Introduction

The Richmond Regional Transportation Planning Organization (RRTPO) identified the opportunity in the FY19 Unified Planning Work Program (UPWP) to assess park and ride needs and develop an investment strategy to advance park and ride projects at a regional level. The development of a regional park and ride investment strategy was specifically called for in the UPWP under the focal area of "expanding access to transit through multimodal connectivity and park and ride projects" and is intended to inform plan2045, the RRTPO's next Long Range Transportation Plan.

The purpose of the resulting *Richmond Regional Park and Ride Investment Strategy* study is to form the foundation for leveraging park and ride lots in the Richmond region as part of a larger travel demand management strategy. This study will assess existing conditions and existing needs, identify potential future needs, develop project recommendations, and identify implementation strategies to advance and promote park and ride projects in the Richmond region.

Previous statewide efforts have been conducted to identify and evaluate park and ride needs and this study will add a regional perspective and build upon these statewide studies. Relevant previous statewide studies include:

- The *VDOT Statewide Park and Ride Study (2013)* - conducted a statewide inventory of existing park and ride lots; identified recommendations for new, expanded, or closed park and ride lots; conducted a statewide survey to understand characteristics of park and ride users; and assisted VDOT with public outreach and awareness of park and ride facilities.
- The *VDOT Park and Ride Investment Strategy (2016 and 2018 update)* - compiled park and ride project recommendations from each of the VDOT districts, developed a project prioritization process, and scored and ranked projects to develop an investment strategy for each district.

The types, sizes, and features of a park and ride lot vary depending on many factors including demographics, land use, and travel patterns. Since these factors differ throughout Virginia, regional park and ride priorities can be fine-tuned within the statewide framework. Previous statewide studies evaluated park and ride lots using a single methodology statewide. This statewide methodology prioritized projects based on population density, traffic volumes, traffic congestion, and proximity to existing park and ride facilities. The *Richmond Regional Park and Ride Investment Strategy* will build upon these previous studies by identifying and validating park and ride projects to align with regional needs. The study will consider factors such as proximity to transit, demographics, land use, and travel patterns, in addition to factors considered in the statewide study. The desired outcome of the study is to develop a regional strategy for park and ride in the Richmond area and provide jurisdictions with the foundation and support to advance park and ride projects locally by prioritizing and better positioning projects for funding.

A Study Advisory Group (SAG) was formed for this study to help inform the development of the regional strategy for park and ride in the Richmond area. SAG members provided regional perspectives, participated in project meetings, reviewed technical memos, and provided feedback to help identify park and ride needs and develop project recommendations. SAG members included representatives from the following jurisdictions and agencies:

- Town of Ashland
- Charles City County
- Chesterfield County
- Goochland County
- Hanover County
- Henrico County
- New Kent County
- Powhatan County
- City of Richmond
- Greater Richmond Transit Company (GRTC)
- RideFinders, Inc.
- Virginia Department of Rail and Public Transportation (DRPT)
- Virginia Department of Transportation (VDOT)

This technical memo summarizes the recommendations for park and ride in the Richmond region. This is the third of five technical memorandums to be completed as part of the *Richmond Regional Park and Ride Investment Strategy* study:

- Technical Memo I – Existing Conditions and Existing Needs
- Technical Memo II – Future Needs
- **Technical Memo III – Project Recommendations**
- Technical Memo IV – Implementation Strategy
- Technical Memo V – Funding Needs and Potential Funding Sources

Park and Ride Recommendation Development

Overview of Recommendation Development Process

Park and ride project recommendations were developed in collaboration with the SAG members for the park and ride needs areas identified in Phase I and II of the needs evaluation process (and described in Technical Memo II). **Figure 1** provides an overview of the needs evaluation and recommendations development process and **Figure 2** shows the regional park and ride needs areas identified during both phases of the needs evaluation.

Figure 1: Needs Evaluation and Recommendation Development Process

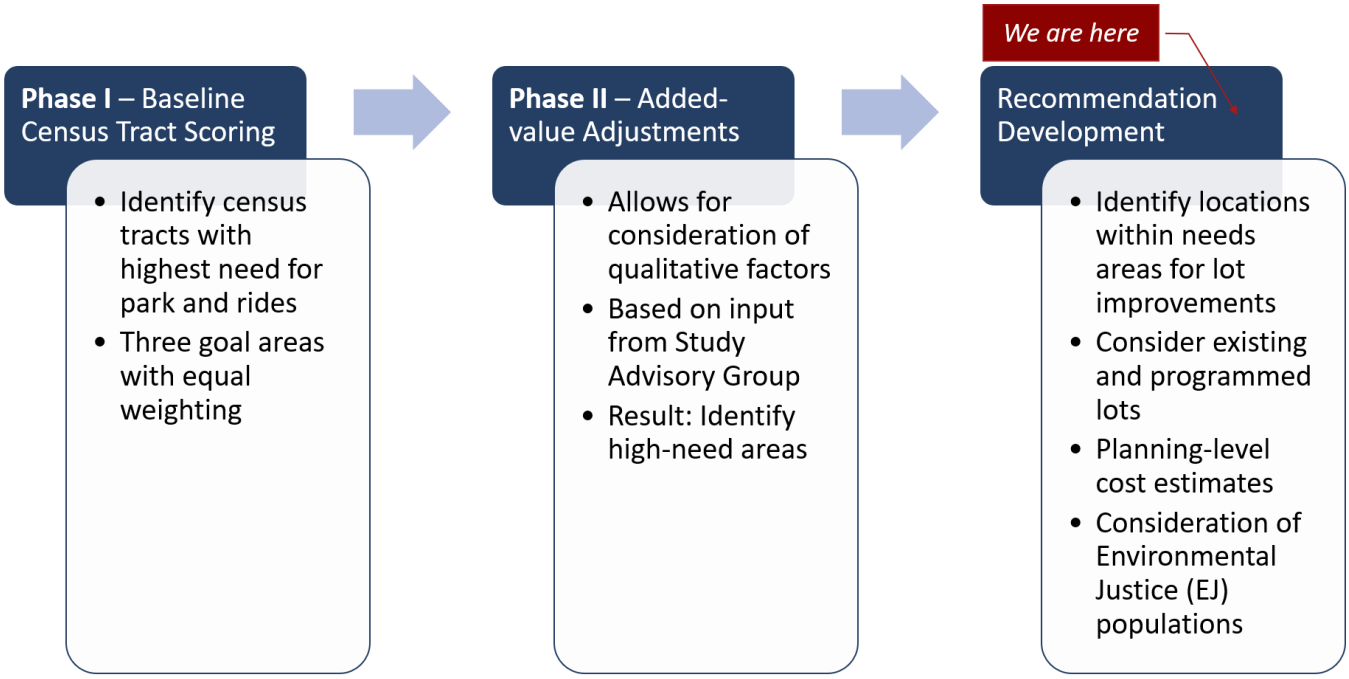
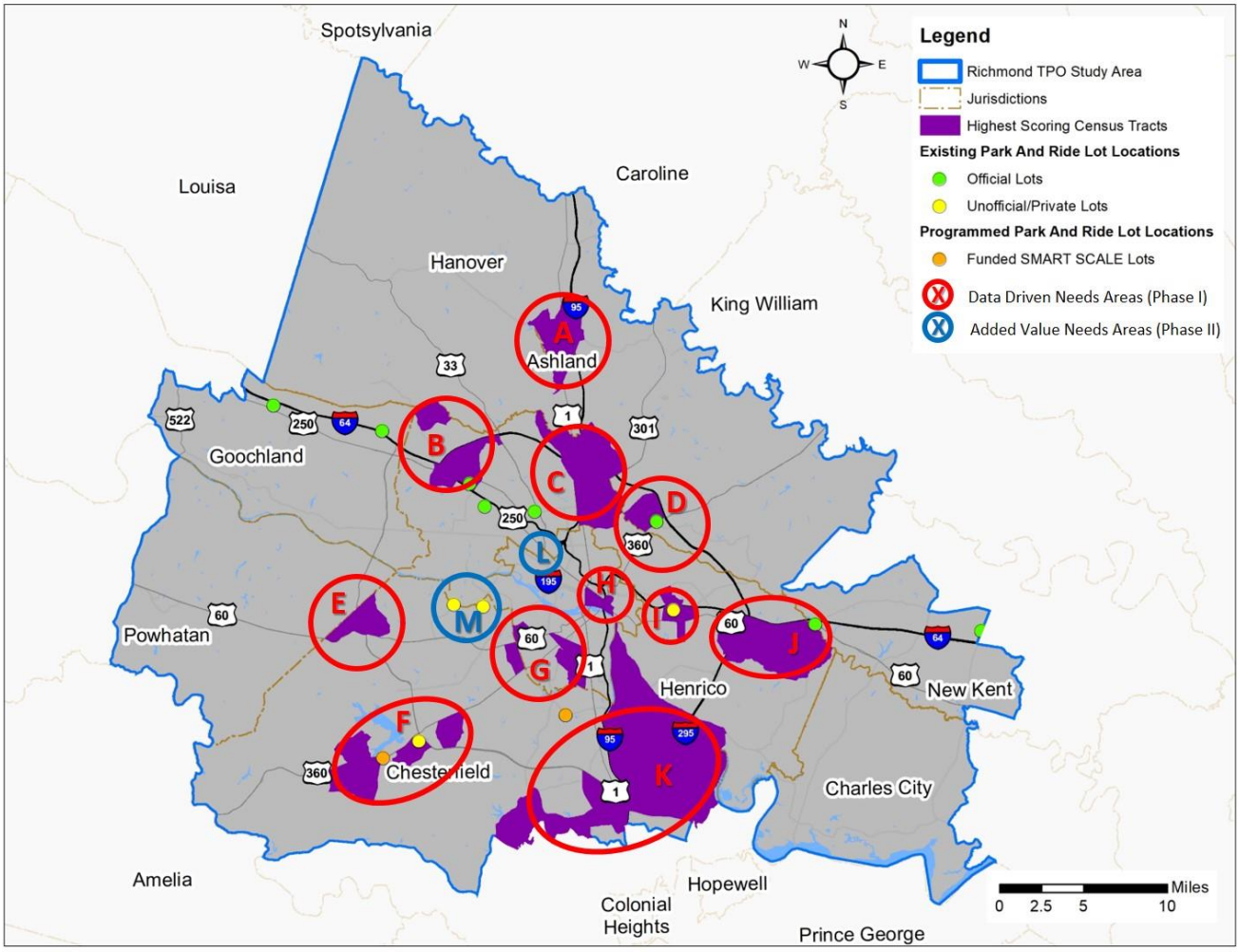


Figure 2: Regional Park and Ride Needs Areas



As a first step in the recommendations development process, the locations of existing and programmed park and ride lots and the existing occupancy at those lots was considered to determine if the identified need was already met. **Table 1** summarizes whether needs in the identified needs areas were met, only met in the short term, or not met.

Table 1: Summary of Existing Need Status

Needs Area	Reason Need Met/Not Met
Need Met	
D: I-295 at US 360	Met by existing Mechanicsville official lot
F: US 360 at Route 288	To be met by funded SMART SCALE park and ride project at US 360 at Chesterfield Career and Technical Center
Need Met in Short Term	
B: I-64 at I-295	Met in the short term by adjacent official lots at Gaskins Road and Hickory Haven
I: I-64/US 60 at S. Laburnum Avenue	Met in the short term by unofficial lot at White Oak Commons
M: Huguenot Road at Forest Hill Avenue	Met in the short term by unofficial lots at Bon Air Baptist Church and Huguenot United Methodist Church
Need Not Met	
A: Ashland	No existing official or unofficial lots in needs area
C: I-95 at I-295	No existing official or unofficial lots in needs area
E: US 60 at Route 288	No existing official or unofficial lots in needs area
G: Chippenham Parkway	No existing official or unofficial lots in needs area
H: East of Downtown	No existing official or unofficial lots in needs area
J: I-295 at US 60	Official lot at Bottom's Bridge at capacity
K: Route 10/Route 288 at I-95/I-295	No existing official or unofficial lots in needs area
L: US 250 at Willow Lawn/Staples Mill	No existing official or unofficial lots in needs area

For needs areas where the needs were not fully met, SAG feedback was used to identify more targeted "project recommendation areas" within the needs area. These project recommendation areas were focused on locations near interchanges and where intermodal travel could be facilitated by the presence of a park and ride lot. SAG members provided local knowledge of the areas to help identify recommended locations to meet the identified need, as well as provide input on potentially available publicly-owned land in the area. Continuing coordination with the localities will be important throughout the implementation of the regional park and ride investment strategy as specific parcels are identified.

The more targeted project recommendation areas are shown in **Figure 3** and described in **Table 2**. In some needs areas, more than one potential project location was recommended for further evaluation. It is intended that only one project per needs area would ultimately be implemented to meet the demand for a particular area. Monitoring and evaluation following implementation of the initial project will determine if there is demand for any additional lots within this needs area. If additional lots are needed, the other project recommended locations would be positioned for further feasibility.

Figure 3: Park and Ride Project Recommendation Areas

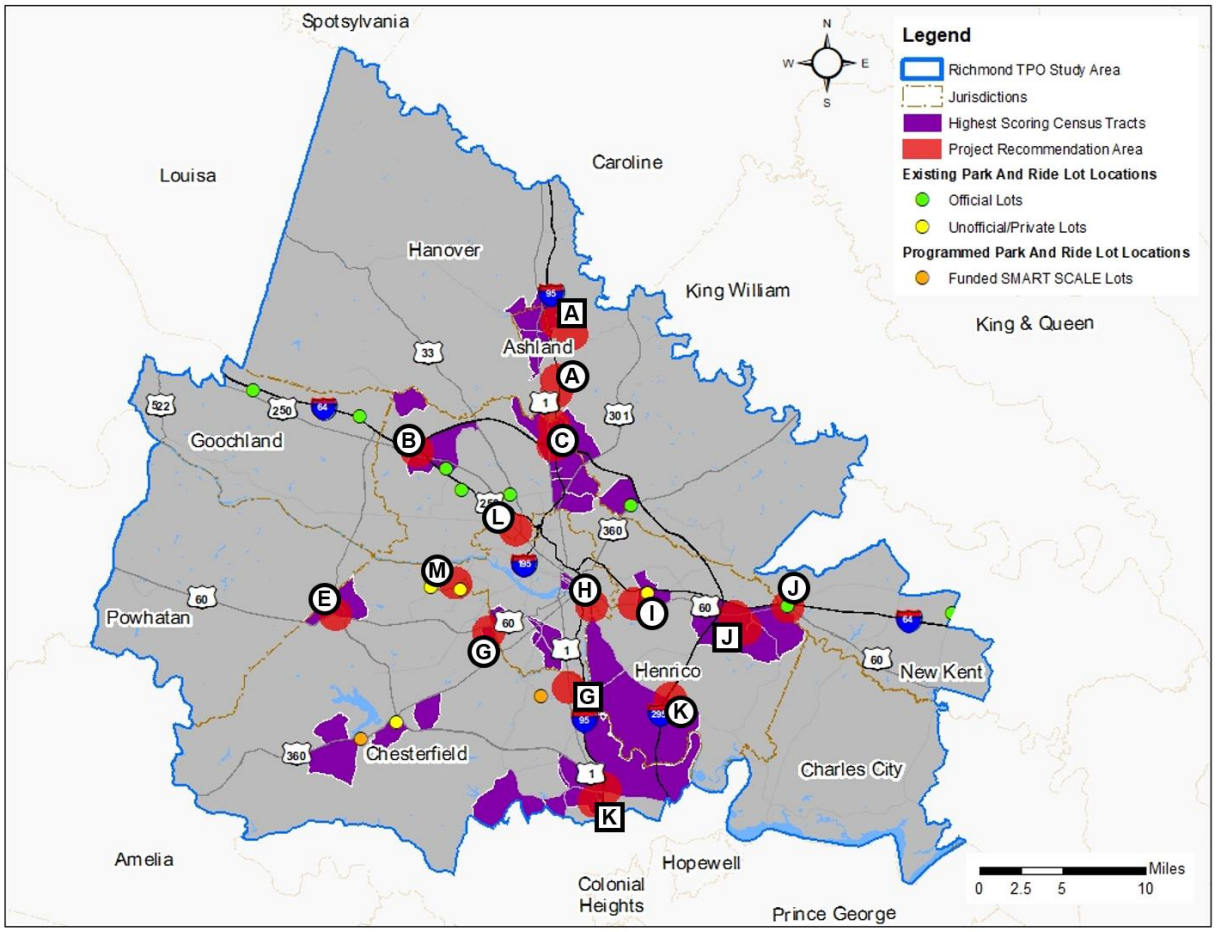


Table 2: Park and Ride Project Recommendation Area Descriptions

Needs Area	Project Recommendation Area Description	Map ID
A	I-95 at Lewistown Road near Lakeridge Parkway	Ⓐ
	I-95 at Route 54 east of interchange	🅰
B	I-64 at I-295 in Short Pump	Ⓑ
C	I-95 at I-295 near Virginia Center Commons	Ⓒ
E	US 60 at Route 288 near Westchester Commons	Ⓔ
G	Chippenham Parkway at Midlothian Turnpike	Ⓖ
	Chippenham Parkway at US 1/US 301	🅶
H	Eastern Pulse Terminus	Ⓗ
I	I-64 at S. Laburnum Avenue near US 60	Ⓘ
J	Bottoms Bridge	Ⓙ
	I-295 at US 60 near Technology Boulevard/Elko Road	🅹
K	I-95 at Route 10	🅺
	I-295 at Route 5	Ⓚ
L	Western Pulse Terminus	Ⓛ
M	Huguenot Road/Forest Hill Avenue/Chippenham Parkway	Ⓜ

The following sections provide additional details on the park and ride recommendations in each of the project areas, including recommended actions in each needs area, estimated demand, planning-level cost estimates, and recommended features and amenities.

Park and Ride Needs Area Recommendations

Park and ride recommendations for each needs area are summarized in **Table 3**. Establishing an official park and ride lot is recommended for each identified needs area where the need is not already met. Planning and design of these lots should begin as early as possible. Since the implementation timeframes for constructing these lots will vary by location depending on the availability of land and funding, additional recommendations help address or partially address park and ride needs in the interim. Some interim recommendations include: (1) establishing formal agreements or leases with private lot owners, (2) advertising nearby existing lots that are underutilized, and (3) continuing to monitor usage of existing lots.

Table 3: Summary of Needs Area Recommendations

Needs Area	Recommendations

A: Ashland	▪ Explore formal agreement or leasing opportunities at private lots in the vicinity of Route 54 and US 1
	▪ Identify site and construct new official park and ride lot near I-95 Exit 89 (Lewistown Road) or I-95 Exit 92 (Route 54). Potential locations include:
	  ▪ Publicly-owned parcels west of I-95 on Lakeridge Parkway (Exit 89)
	  ▪ Publicly-owned parcels east of I-95 on Route 54 (Exit 92)

B: I-64 at I-295	▪ Need met in the short-term from existing adjacent official lots (Gaskins Road and Hickory Haven) ▪ Identify site and construct new official park and ride lot near I-64 at I-295. Potential locations include: ▪ Old I-64/I-295 loop ramp in Short Pump
C: I-95 at I-295	▪ Explore formal agreement or leasing opportunities at private lots in the vicinity of Virginia Center Commons ▪ Identify site and construct new official park and ride lot near I-95 at I-295. Potential locations include: ▪ Near Virginia Center Commons
D: I-295 at US 360	▪ Need met by existing official lot (Mechanicsville) ▪ Continue to monitor occupancy of existing lot and need for additional parking capacity in this area
E: US 60 at Route 288	▪ Explore formal agreement or leasing opportunities at private lots in the vicinity of Westchester Commons ▪ Identify site and construct new official park and ride lot near US 60 at Route 288. Potential locations include: ▪ Near Westchester Commons
F: US 360 at Route 288	▪ Need expected to be met by funded SMART SCALE lot at Chesterfield Career and Technical Center ▪ Monitor use of new lot and any additional needs in the vicinity of the US 360/Route 288 interchange

G: Chippenham Parkway	▪ Once constructed, monitor use of funded SMART SCALE lot at Chippenham and Hopkins to determine additional needs in this area
	▪ Identify site and construct new official park and ride lot near Chippenham Parkway at US 1/US 301. Potential locations include:
	  ▪ Near Food Lion on US 1/301 north of Chippenham Parkway
	▪ Identify site and construct new official park and ride lot near Chippenham Parkway and Midlothian Turnpike. Potential locations include:
	  ▪ Country-owned parcel at Stonebridge

Needs Area	Recommendations
H: East of Downtown	▪ Identify site and construct new official park and ride lot within 1/4-mile of Pulse eastern terminus at Rocketts Landing
I: I-64/US 60 at S. Laburnum Avenue	▪ Need met in the short-term from unofficial lot at White Oak Commons. Explore formal agreement or leasing opportunities to establish greater permanence at this site. ▪ Identify site and construct new official park and ride lot near I-95 at S. Laburnum Avenue

J: I-295 at US 60	▪ Advertise the New Kent Public Works park and ride lot and monitor usage
	▪ Identify site and construct new or expand existing park and ride lot near I-64/US60/I-295. Potential locations include:
	  ▪ Expanding the existing Bottoms Bridge lot or building a second lot on the western side of the parcel
	  ▪ Commonwealth-owned parcel at VDOT residency

K: Route 10/Route 288 at I-95/I-295	▪ Explore formal agreement for park and ride use of Capital Trail parking area at the Four Mile Creek Trailhead near I-295 on Route 5
	▪ Identify site and construct new official park and ride lot near the I-95/Route 10 interchange. Potential locations include:
	  ▪ Northeast quadrant of I-95 at Route 10 interchange
	  ▪ West of I-95 on US 1/US 301
	  ▪ East of I-95 near John Tyler Community College

L: US 250 at Willow Lawn/ Staples Mill	▪ Promote use of City of Richmond Arthur Ashe shuttle ▪ Identify site and construct new official park and ride lot within 1/4-mile of Pulse western terminus in the Willow Lawn/Staples Mill area
M: Huguenot Road at Forest Hill Avenue	▪ Need met in the short term from unofficial lots at Bon Air Baptist Church and Huguenot Methodist Church. Explore formal agreements or leasing opportunities to establish greater permanence at these sites. ▪ Explore formal agreement or leasing opportunities at other private lots in this area if existing unofficial lots can no longer be used for park and ride ▪ Identify site and construct new official park and ride lot near Huguenot Road/ Forest Hill Avenue/Chippenham Parkway

Recommended Park and Ride Lot Size and Cost Estimates

For each project recommendation area, the parking demand was estimated to determine the recommended number of parking spaces for the construction of an official park and ride lot in the area. A sketch planning model derived from Florida Department of Transportation (FDOT) methodology for determining park and ride demand was used to estimate the number of parking spaces needed in each project recommendation area. The model used traffic volumes on the major roadways expected to feed into a park and ride lot in each project recommendation area to estimate the commuter demand. For validation, this methodology was tested on existing official park and ride lots in the Richmond region and found to be representative of the existing occupancy observed at those lots.

Planning level cost estimates were developed for each project recommendation area using the estimated number of parking spaces needed and per space unit costs. Unit cost ranges were developed based on a review of proposed park and ride project cost estimates from FY20 SMART SCALE applications. Right-of-way costs were not included in the costs ranges as these will be contingent on available land, leasing and purchasing opportunities, and coordination with public and private entities. The low and high unit cost ranges are summarized in **Table 4**.

Table 4: Unit Cost Ranges for Park and Ride Projects

Low Unit Cost	High Unit Costs
Typical Features/Amenities at Park and Ride Lot	
▪ Lower-density lot ▪ Minimal earthwork required ▪ Minimal amenities ▪ No transit service	▪ Higher-density lot ▪ More significant earthwork required ▪ Greater number of amenities ▪ Transit service
Per Space Unit Cost	
$9,500	$21,000
Per space unit costs include PE, construction, lighting/landscaping, and earthwork	
Per Lot Unit Cost	
$180,000	$330,000
Per lot unit costs are in addition to per space costs and include stormwater management and electric charging	

Note: Costs reported in 2019 dollars.

Cost estimates at the high-end of the unit cost range reflect park and ride lot designs that incorporate a greater number of amenities and design elements, such as access roads, bus loading areas, bicycle parking, and sidewalks, as well as sites where more significant earthwork is required. Estimates at the low-end of the unit cost range are more representative of a park and ride lot design with minimal amenities, design elements, and earthwork. **Table 5** provides a summary of the recommended number of spaces and cost estimate ranges for park and ride lots in each of the project recommendation areas. The size and cost estimates presented should be used for site identification and planning purposes

only. When specific sites are identified in these areas for park and ride lots, a conceptual layout should be developed to determine a more accurate site-specific cost estimate.

Table 5: Park and Ride Project Recommended Lot Sizes and Cost Estimates

Project Recommendation Area		Recommended Spaces	Cost Estimate	
			Low	High
Ⓐ	I-95 at Lewistown Road near Lakeridge Parkway	200	$ 2,060,000	$ 4,530,000
🅐	I-95 at Route 54 east of interchange	200	$ 2,060,000	$ 4,530,000
Ⓑ	I-64 at I-295 in Short Pump	320	$ 3,190,000	$ 7,050,000
Ⓒ	I-95 at I-295 near Virginia Center Commons	380	$ 3,760,000	$ 8,310,000
Ⓔ	US 60 at Route 288 near Westchester Commons	70	$ 840,000	$ 1,800,000
Ⓖ	Chippenham Parkway at Midlothian Turnpike	330	$ 3,290,000	$ 7,260,000
🅖	Chippenham Parkway at US 1/US 301	270	$ 2,720,000	$ 6,000,000
Ⓗ	Eastern Pulse Terminus	130	$ 1,400,000	$ 3,060,000
Ⓘ	I-64 at S. Laburnum Avenue near US 60	120	$ 1,310,000	$ 2,850,000
Ⓙ	Bottoms Bridge	90*	$ 1,030,000	$ 2,220,000
🅙	I-295 at US 60 near Technology Boulevard/Elko Road	120*	$ 1,310,000	$ 2,850,000
🅚	I-95 at Route 10	250	$ 2,540,000	$ 5,580,000
Ⓚ	I-295 at Route 5	50	$ 650,000	$ 1,380,000
Ⓛ	Western Pulse Terminus	290	$ 2,910,000	$ 6,420,000
Ⓜ	Huguenot Road/Forest Hill Avenue/ Chippenham Parkway	130	$ 1,400,000	$ 3,060,000

*Note: Park and ride demand at Need Area J is partially served by 40 spaces at the existing Bottoms Bridge lot. The recommended spaces for the project recommendation areas in Needs Area J are in addition to these existing spaces.

Recommended Park and Ride Lot Features and Amenities

In 2018, VDOT developed the *Park & Ride Design Guidelines* to provide localities with a resource on features and amenities to consider when designing park and ride lots. The guidelines incorporate perspectives from several Virginia agencies, including VDOT, DRPT, Department of Conservation and Recreation, and Department of Environmental Quality and include guidance on the following park and ride lot features and amenities:

- Parking layout
- Drop-off/pick-up areas
- Bus loading/unloading areas
- Access/egress points
- Vehicle circulation
- Carpooling/vanpooling
- Bike parking
- Bus stops and shelters
- Trash receptacles
- Safety features
- Lighting
- Signage
- Vegetation
- Stormwater management
- Solar energy generation
- Green technologies
- Integrated corridor management
- Electric vehicle charging

The recommended implementation of these features and amenities is dependent on the surrounding environment of the park and ride lot. The *Park and Ride Design Guidelines* defines three types of lot environments (high density, medium density, and low density) and provides guidance on elements that are required, preferred, and suggested for each type of location. High-density locations are typically located in urban or suburban areas and are generally accessible by foot, bicycle, or high-capacity transit. Medium-density locations are typically suburban lots found near highway interchanges and often are served by buses and carpooling/vanpooling. Low-density locations are typically found in rural locations near interstate highways or arterials and often have limited transit service.

Due to the differences in features and amenities at the three types of lots, construction costs will vary. The required and recommended park and ride lot elements at high-density locations address a comprehensive set of design concerns and, as a result, sites designed to meet the design guidelines for high-density lots are expected to have unit costs at the higher end of the cost estimate ranges. Conversely, the design guidelines require far fewer elements to be implemented at low-density locations, so it may be possible to implement lots in these areas with unit costs in the lower end of the cost estimate ranges.

Using the *Park and Ride Design Guidelines* as a reference, each of the park and ride project recommendation areas was categorized as high, medium, or low density and these categories were used to inform the recommended features and amenities at the lot. **Table 6** summarizes the lot density types for each project recommendation area.

Table 6: Project Recommendation Area Lot Design Type

Project Recommendation Area		Lot Density Type
Ⓐ	I-95 at Lewistown Road near Lakeridge Parkway	Low
🅐	I-95 at Route 54 east of interchange	Low
Ⓑ	I-64 at I-295 in Short Pump	Medium
Ⓒ	I-95 at I-295 near Virginia Center Commons	Medium
Ⓔ	US 60 at Route 288 near Westchester Commons	Low
Ⓖ	Chippenham Parkway at Midlothian Turnpike	Medium
🅖	Chippenham Parkway at US 1/US 301	Medium
Ⓗ	Eastern Pulse Terminus	High
Ⓘ	I-64 at S. Laburnum Avenue near US 60	Medium
Ⓙ	Bottoms Bridge	Low
🅙	I-295 at US 60 near Technology Boulevard/Elko Road	Low
🅚	I-95 at Route 10	Medium
Ⓚ	I-295 at Route 5	Low
Ⓛ	Western Pulse Terminus	High
Ⓜ	Huguenot Road/Forest Hill Avenue/Chippenham Parkway	Medium

Park and ride lots can play an important role in multimodal connectivity and lot design should consider opportunities for these connections. Existing and future transit routes, bicycle facilities, vanpools, and pedestrian facilities were reviewed to identify potential multimodal connections to inform lot design. A summary of the travel modes served in each of the park and ride project recommendation areas is provided in **Table 7.** The following sources were used to identify the potential multimodal connections:

- **Transit Service:** Existing transit service included existing GRTC routes and future transit service included routes in the *Richmond Transit Vision Plan*. For locations where there is existing or future transit service that travels on a nearby highway but does not stop in the area, the table designates the transit service as "Potential" to reflect the opportunity for route modifications to connect the park and ride lot to transit.
- **Bicycle Facilities:** Existing bicycle facilities included lanes, cycletracks, shared use paths, and designated biking routes identified through Bike Walk RVA's Bikeways Map and Open Street Map's Cycle Map. Bicycle facilities designated as "Potential" were identified as proposed bicycle touring routes in the *Richmond Regional Bicycle and Pedestrian Plan*.
- **Vanpools:** Existing vanpool locations included those identified by RideFinders in the vicinity of a project recommendation area. Due to the changing nature of vanpool locations and the attractiveness of park and ride lots to serve as vanpool origins, all other park and ride project recommendation areas were listed as "Potential". Lot design that includes supportive features for vanpool and carpool, such as drop-off/pick-up areas, should be considered for all recommended lot areas.
- **Pedestrian Facilities:** Existing pedestrian facilities included the presence of sidewalks and paths determined through aerial imagery and included areas where either an adequate sidewalk network or trail system, such as the Virginia Capital Trail, is present. Pedestrian facilities designated as "Potential" were identified as proposed pedestrian corridors in the *Richmond Regional Bicycle and Pedestrian Plan*. While pedestrian facilities would be beneficial for internal circulation at all recommended lot areas, construction of external sidewalk facilities may not be necessary where an existing network to link to is not available.

Table 7: Travel Modes Served at Park and Ride Project Recommendation Areas

Project Recommendation Area		Transit Service		Bicycle Facilities	Vanpool	Pedestrian Facilities
		Existing	Future			
Ⓐ	I-95 at Lewistown Road near Lakeridge Parkway	Potential	Potential		Yes	Yes
🅐	I-95 at Route 54 east of interchange	Potential	Potential		Yes	Potential
Ⓑ	I-64 at I-295 in Short Pump	Yes	Yes	Potential	Potential	Yes
Ⓒ	I-95 at I-295 near Virginia Center Commons	Potential	Yes		Yes	Yes
Ⓔ	US 60 at Route 288 near Westchester Commons		Yes		Potential	Yes
Ⓖ	Chippenham Parkway at Midlothian Turnpike	Yes	Yes		Yes	Yes
🅖	Chippenham Parkway at US 1/US 301	Yes	Yes		Potential	Potential
Ⓗ	Eastern Pulse Terminus	Yes	Yes	Yes	Potential	Yes
Ⓘ	I-64 at S. Laburnum Avenue near US 60	Yes	Yes		Yes	Potential
Ⓙ	Bottoms Bridge		Yes	Potential	Yes	Potential
🅙	I-295 at US 60 near Technology Boulevard/Elko Road		Potential	Potential	Potential	
🅚	I-95 at Route 10	Potential	Yes		Yes	Yes
Ⓚ	I-295 at Route 5		Potential	Yes	Potential	Yes
Ⓛ	Western Pulse Terminus	Yes	Yes	Yes	Potential	Yes
Ⓜ	Huguenot Road/Forest Hill Avenue/Chippenham Parkway	Yes	Yes	Yes	Potential	Potential

The *Park and Ride Design Guidelines* identify features and amenities that are required, preferred, and suggested for each lot density type based on federal and state regulations and guidelines, as well as characteristics of the surrounding area. These features and amenities are summarized in **Table 8**.

After specific sites are identified in the project recommendation areas, the inclusion of features and amenities in the lot design should be further evaluated for the specific location. Lot design should consider and be flexible to accommodate potential future multimodal connections. Additional amenities, features, and design standards may be recommended or required by the locality. Some features may also require coordination with other parties, including localities, VDOT, and private land owners or may be constrained by property ownership and formal usage or leasing agreements.

Table 8: Park and Ride Design Guidelines Features and Amenities

Feature/Amenity	Low Density	Medium Density	High Density
Parking layout	Angled spaces required, where possible	Perpendicular spaces required	Perpendicular spaces required
Drop-off/ pick-up areas	Kiss & Ride area suggested	Kiss & Ride area preferred	Kiss & Ride area required
Bus loading/ unloading areas	Boarding lanes and adequate queuing space required if served by transit	Boarding lanes and adequate queuing space required if served by transit	Boarding lanes and adequate queuing space required if served by transit
Access/egress points	None specified	Two entrances preferred	Two entrances preferred
Vehicle circulation	One-way traffic required, where possible	Two-way traffic required	Two-way traffic required
Non-vehicle circulation	Internal walkways preferred	Internal walkways required; External connections preferred	Internal walkways required; External connections preferred
Bike parking	2-3 bike racks preferred, bike lockers suggested	1 space for every 10 to 20 vehicle spaces required; covered bike parking preferred	1 space for every 10 to 20 vehicle spaces required; covered bike parking preferred
Bus stops and shelters	Shelters preferred if served by transit	Shelters required if served by transit	Shelters required if served by transit
Trash receptacles	Preferred	Required at all boarding areas	Required at all boarding areas
Security	Emergency assistance phones preferred	Emergency assistance phones preferred	Emergency assistance phones preferred
Lighting	LED lighting with shielding fixtures preferred	LED lighting with shielding fixtures required	LED lighting with shielding fixtures required
Signage	Traffic control preferred; bus route signage suggested if served by transit	Traffic control and bus route signage (if served by transit) required; Integrated corridor management technologies, like real-time information, preferred	Traffic control and bus route signage (if served by transit) required; Integrated corridor management technologies, like real-time information, preferred
Vegetation	Native, context sensitive plants required; 10-20% of lot area suggested	Native, context sensitive plants required; 10-20% of lot area suggested	Native, context sensitive plants required; 10-20% of lot area suggested
Stormwater management	Green retention infrastructure required	Green retention infrastructure required; porous asphalt mix preferred for lot surfacing	Green retention infrastructure required; porous asphalt mix preferred for lot surfacing
Solar energy generation	Panels in high-sun areas preferred	Panels in high-sun areas preferred; solar canopies over parking spaces suggested	Panels in high-sun areas preferred; solar canopies over parking spaces suggested
EV Charging	Stations for 2% of all spaces suggested	Stations for 2% of all spaces preferred	Stations for 2% of all spaces preferred

Environmental Justice Evaluation

Concentrations of environmental justice (EJ) populations (as described in Technical Memorandum I) were evaluated in the project recommendation areas to ensure an equitable distribution of improvements. The purpose of analyzing EJ concentrations is to provide fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to laws, regulations, and policies[1]. During the design of park and ride lots, accessibility for EJ populations should be considered, including connections to other travel modes and appropriate lot features/amenities. **Figure 4** shows existing and programmed park and ride lots, as well as park and ride project recommendation areas, overlaid on a base map of the concentration of EJ populations and **Table 9** summarizes the EJ analysis for the study area. The EJ population concentration is based on an index considering individuals with disabilities, low-income households, elderly populations, limited English proficiency, non-white or Hispanic populations, and low vehicle ownership households. Areas designed as “highest” had the greatest concentration of EJ populations when compared to other census tracts in the study area. Since specific recommendation locations have not yet been identified and the project recommendation areas extend across multiple census tracts, the EJ population concentration for the recommendations was taken as the weighted average of the EJ population concentrations in all the census tracts within the project recommendation area. Park and ride project recommendation areas were found to be distributed among the EJ densities with the majority of the recommendation areas in locations with “high” and “average” EJ concentrations.

1 https://www.epa.gov/environmentaljustice

Figure 4: Recommended Lot Areas with Concentration of Environmental Justice (EJ) Population

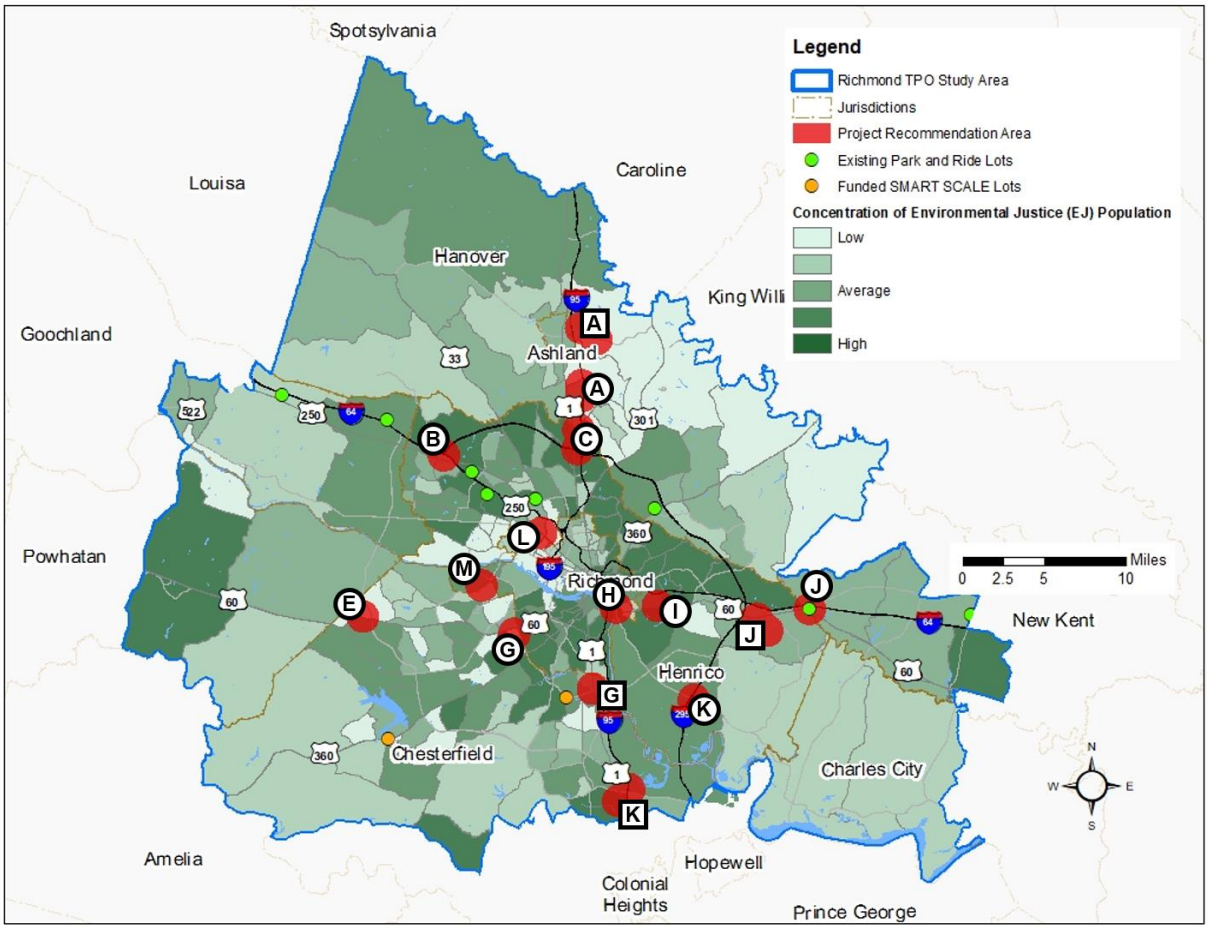


Table 9: Comparison of Park and Ride Lots to Concentration of EJ Populations

	EJ Population Concentration				
	Highest EJ Population	High EJ Population	Average EJ Population	Low EJ Population	Lowest EJ Population
Existing* and Programmed Lots	3 (33%)	4 (44%)	1 (11%)	1 (11%)	0
Project Recommendation Areas	1 (7%)	5 (33%)	5 (33%)	2 (13%)	2 (13%)
Total	**4 (17%)**	**9 (38%)**	**6 (25%)**	**3 (13%)**	**2 (8%)**

* Does not included “unofficial” lots in analysis

Next Steps

In the next phase of this project, implementation strategies will be developed for the park and ride recommendations discussed in this technical memorandum. Implementation strategies will include details on the steps needed to progress the recommendations such as planning and design, environmental considerations, identification of potential funding sources, and requirements for formal lot usage and leasing agreements, as well as ongoing considerations after a lot is in use. The strategy will also identify the roles and responsibilities of local, regional, and state entities throughout the implementation process. Implementation strategies and funding sources will be summarized in Technical Memo IV and V.