ANNE ARUNDEL COUNTY
MARYLAND

US 50/MD 665 Truman Park and Ride Ramp Feasibility Study

Final Study Report

July 11, 2022

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Executive Summary

Background

The Anne Arundel County Office of Transportation (OOT) is studying the feasibility of constructing additional access ramps both to ingress and egress the Harry S. Truman Park and Ride lot to and from US 50 via MD 665, along with the resulting impacts of this change in traffic patterns within the Study Area, specifically along Riva Road.

The Harry S. Truman Park and Ride lot is located within the Parole Town Center Growth Management Area in Anne Arundel County. Existing access to the Park and Ride lot is provided from both Harry S. Truman Parkway and Riva Road. Current access from US50/MD 665 to the Park and Ride lot is provided by an off-ramp from eastbound US 50 which becomes MD 665 and leads to Riva Road and an off-ramp from westbound US 50 to MD 665.

The County previously completed the Anne Arundel County Transportation Center Feasibility Study in 2020 to investigate the needs of various local and regional transit providers while maintaining a safe and cohesive environment for pedestrians, cyclists, and motorists. The Harry S. Truman Park and Ride lot was one of the two potential sites identified in the feasibility study for a transportation center.

Project Location

The US 50/MD 665 Truman Park and Ride Ramp Feasibility Study area is located in Parole, Maryland, in central Anne Arundel County, just west of Annapolis, approximately 30 miles south of Baltimore and 30 miles east of Washington, DC. US 50 is a six- to eight-lane expressway that carries up to 161,000 vehicles per day. The corridor serves a diverse traffic mix including local traffic in the Annapolis area, long-distance commuter traffic destined for downtown Washington, D.C. and regional traffic destined to the Eastern Shore. MD 665 is a 2.7-mile-long freeway that begins in Parole at a directional interchange with US 50/301 and terminates at Bywater Road.

The study area includes MD 665 from US 50/301 to Riva Road, Riva Road from the MD 665 interchange to Harry S. Truman Parkway, and a 0.5-mile long segment of Harry S. Truman Parkway west of Riva Road. The section of Riva Road in the study area is approximately half of a mile long with a posted speed limit of 40 mph and is functionally classified as a Minor Arterial under the County Functional Classification System (2015). Riva Road and Harry S. Truman Parkway are both closed roadway sections with curb and gutter and are lined with light/utility poles. The study area boundary is shown in **Figure ES-1**.

US 50/MD 665
Truman Park and Ride Ramp
Feasibility Study
Study Area

Project Study Area

Data Source:
Orthophoto-2020
AA County GIS Map Server

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Purpose and Need

The **purpose** of the US 50/MD 665 Truman Park and Ride Ramp Feasibility Study is to promote and accommodate expanded transit service at the Harry S. Truman Park and Ride lot and potentially enhance traffic operations and roadway safety along Riva Road and Harry S. Truman Parkway in the study area.

The **need** for the project is driven by current and projected usage of the Truman Park and Ride lot and traffic congestion and vehicle crash history that cause recurring and non-recurring delay from MD 665 along Riva Road and Harry S. Truman Parkway to the Truman Park and Ride lot.

Existing Conditions

The Study Team developed a baseline environmental inventory of natural, socioeconomic, and cultural resources in the study area to describe the location, type, and characteristics of resources that may be affected by potential roadway improvements and identify potential environmental constraints. Additionally, a geometric inventory, crash data analysis, existing traffic volumes, and existing traffic operational analysis were compiled.

Environmental Inventory

The results of the environmental inventory are illustrated in **Figure ES-2**. The study area is located within the South River watershed, includes various wetlands identified by the Maryland Department of Natural Resources (MDNR), and is drained by unnamed tributaries to Broad Creek.

Study Area Roadway Segments and Intersections

The following roadway segments and intersections are included in the study area:

Study Area Roadway Segments

- MD 665 from US 50 to MD 2
- Riva Road from MD 665 to Harry S. Truman Parkway
- Harry S. Truman Parkway from Riva Road to the Truman Park and Ride Entrance

Study Area Intersections

- Riva Road at MD 665 Ramps (Signalized)
- Riva Road at Admiral Cochrane Drive (Signalized)
- Riva Road at the Truman Park and Ride Entrance (Un-signalized)
- Riva Road at Harry S. Truman Parkway (Signalized)
- Harry S. Truman Parkway at the Truman Park and Ride Entrance (Signalized)

US 50/MD 665 Truman Park and Ride Ramp Feasibility Study Environmental Inventory

Study Area Boundary
NWI Wetlands
Forest Interior Dwelling Species
Streams
MDNR Wetlands
Sensitive Species Project Review Areas
Forest Conservation Easement

Data Source:
Data from AA County Open Data:
Streams- 2019, MDNR Wetlands-1995, Sensitive Species Project Review Area-2010, Forest Conservation Easements-2020, NWI Wetlands-1992,
Data from AA County GIS Map Server:
Orthophoto-2020

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Crash Data Analysis

Crash Data was obtained from the Maryland Department of Transportation State Highway Administration for the three-year period of 2017 to 2019 for the Study Area. Based on the available crash data, there are no significant crash issues in the Study Area.
On both Riva Road and Harry S. Truman Parkway, there were no fatal crashes. At the Park and Ride lot entrance on Riva Road, there was one crash that resulted in injury and three property damage crashes. At the Park and Ride lot entrance on Harry S. Truman Parkway, there was also one crash that resulted in injury and three property damage crashes.

Existing Traffic Analysis (Roadway Segments)

Existing Anne Arundel County VISSIM and Synchro traffic simulation models for the AM peak hour and the PM peak hour were refined for this study due to recent developments in the area, as well as updated traffic volumes, roadway geometrics, and parking demand.

A failing roadway segment operates at Level of Service (or LOS) F. There are several roadway segments in the Study Area that are failing in either (or both) the existing AM and PM peak hours. These include:

- Westbound MD 665 off ramp to southbound Riva Road in the AM peak hour
- Eastbound MD 665 to southbound Riva Road in the AM peak hour
- Eastbound MD 665 to northbound Riva Road in both the AM and PM peak hours
- Northbound Riva Road from Truman Parkway to Admiral Cochrane Drive in the AM peak hour
- Southbound Truman Parkway from the Park and Ride lot to Riva Road in both the AM and PM peak hours

Future Year (2045) No-Build Travel Demand Forecast

Traffic analysis was also conducted for the future 2045 No-Build scenario. The No-Build scenario reflects forecasted increases in vehicular traffic volumes, including those associated with transit improvements adopted in the Constrained Long-Range Transportation Plan. However, no network and traffic operational improvements, including signal timings, are included in the Study Area.

The following roadway segments in the Study Area are failing in both the future 2045 No-Build AM and PM peak hours:

- Westbound MD 665 off ramp to southbound Riva Road
- Eastbound MD 665 to southbound Riva Road
- Eastbound MD 665 to northbound Riva Road
- Northbound Riva Road from Truman Parkway to Admiral Cochrane Drive
- Eastbound Truman Parkway from the Park and Ride lot to Riva Road

Alternatives Development

No-Build (Alternative 1)

The No-Build Alternative (Alternative 1) serves as a basis of comparison of the benefits and impacts of the Build Alternative. The future No-Build condition reflects forecasted increases in vehicular traffic volumes, including those associated with transit improvements adopted in the Constrained Long-Range Transportation Plan. However, no network and traffic operational improvements, including signal timings, are included in the Study Area.

Build Alternative (Alternative 2)

The proposed Build Alternative (Alternative 2) was developed to improve safety in the study area by adding new dedicated ramps for the Truman Park and Ride lot, while minimizing impacts to property and area resources. The Build Alternative reflects forecasted increases in vehicular traffic volumes, including those associated with transit improvements adopted in the Constrained Long-Range Transportation Plan. Additionally, future transit routes serving longer-distance trips that do not currently access the Park and Ride lot were adjusted to serve the Park and Ride lot as a result of enhanced access.

Alternative 2 consists of Options 1 and 2, as shown in **Figure ES-3** and **Figure ES-4**. Both options include proposed new ramp alignments to and from US 50/MD 665 and the Truman Park and Ride lot that accommodate the anticipated future 2045 traffic and the safe passage of vehicles in the study area. Options 1 and 2 propose two slightly different access alignments for connecting the Park and Ride lot with US 50 and Maryland 665, which results in minimal difference from a traffic modeling perspective. It is assumed that the new ramps could be used by buses, Park and Ride lot users, and other vehicular traffic in the Study Area.

Future Year (2045) Build Traffic Analysis

Traffic analysis was conducted for the 2045 Build Alternative scenario, taking the proposed ramps into account, as well as the previously discussed forecasted increases in vehicular traffic volumes, and adjustments to additional future transit routes serving the Park and Ride lot based on the enhanced access.

The following roadway segments in the Study Area are failing in both the future 2045 Build Alternative AM and PM peak hours:

- Northbound Riva Road to eastbound MD 665 on ramp
- Eastbound MD 665 to southbound Riva Road
- Eastbound MD 665 to northbound Riva Road
- Northbound Riva Road from Truman Parkway to Admiral Cochrane Drive
- Eastbound Truman Parkway from the Park and Ride to Riva Road
- US 50 East Ramp to the Park and Ride lot
- US 50 West Ramp to the Park and Ride lot

ASSUMED VERTICAL CLEARANCE 16'-9"

POTENTIAL IMPACT TO OVERHEAD SIGN

POTENTIAL AREA FOR SWM FACILITY

PROP. UTILITY ACCESS

WORK REQUIRED ON EXISTING BRIDGE ABUTMENT SLOPE PAVING

POTENTIAL AREA FOR SWM FACILITY

YIELD CONDITION

POTENTIAL EXPANSION OF EXISTING SWM FACILITY

PROP. MSE WALL TIES INTO EXISTING WALL

IN FUTURE PHASES OF DESIGN, MODIFICATIONS TO SITE LAYOUT WILL BE REQUIRED FOR BUS CIRCULATION

50

MARYLAND 665

ARIS T ALLEN BLVD

HARRY S. TRUMAN PKY

RIVA RD

Legend

- Parcel Lines
- Streams
- MDNR Wetlands
- NWI Wetlands
- Proposed Bridge
- Proposed Asphalt
- Proposed Concrete
- Proposed Limit of Disturbance
- Proposed Concrete Barrier
- Proposed Retaining Wall

US 50/MD 665 TRUMAN PARK AND RIDE RAMP FEASIBILITY STUDY

FIGURE ES-3: BUILD ALTERNATIVE 2 - OPTION 1

September 2021

120' 0 120' 240'

SCALE: 1"=120'

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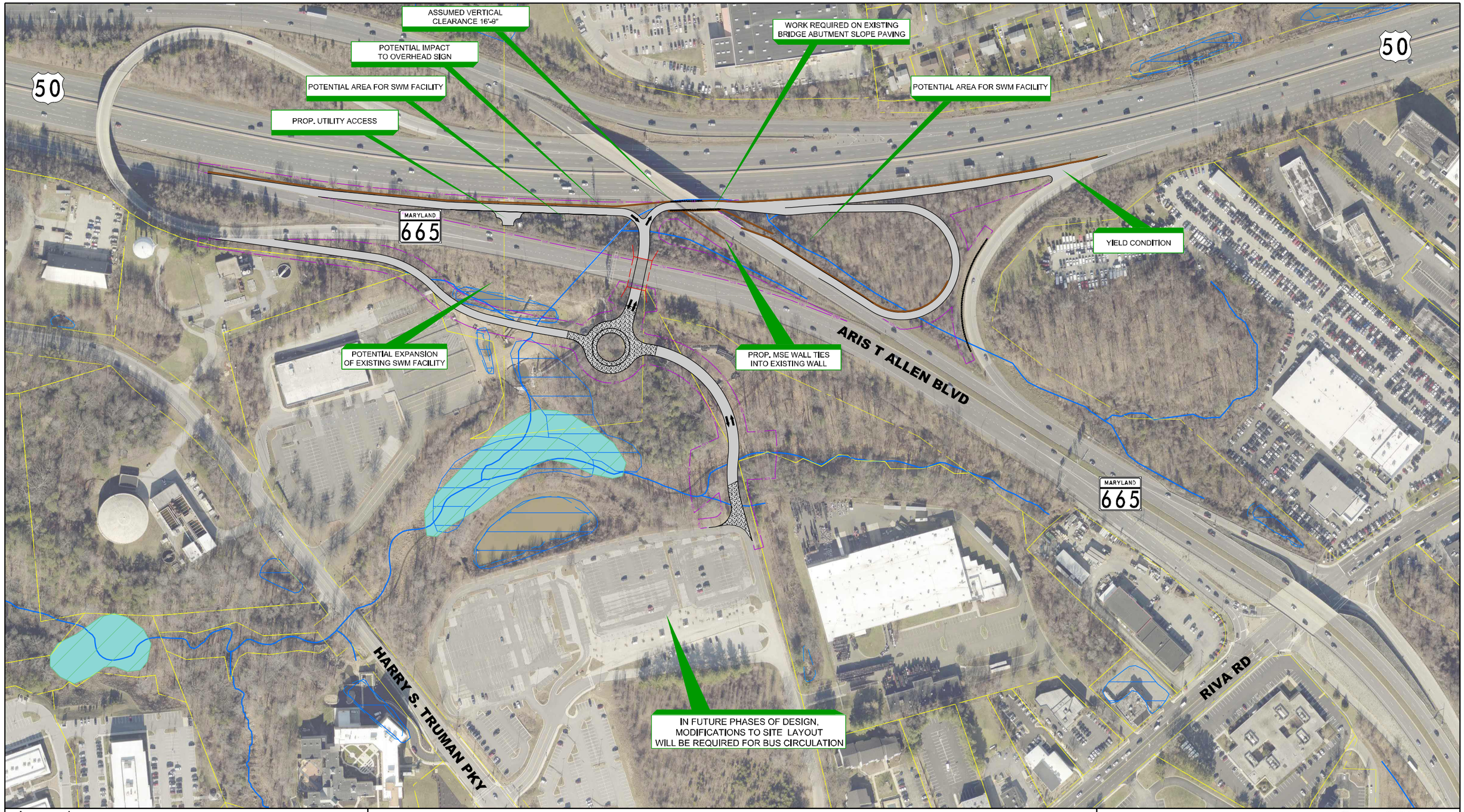

Legend

- Parcel Lines
- Streams
- MDNR Wetlands
- NWI Wetlands
- Proposed Bridge
- Proposed Asphalt
- Proposed Concrete
- Proposed Limit of Disturbance
- Proposed Concrete Barrier
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US 50/MD 665 TRUMAN PARK AND RIDE RAMP FEASIBILITY STUDY

FIGURE ES-4: BUILD ALTERNATIVE 2 - OPTION 2

September 2021

120' 0 120' 240'
SCALE: 1"=120'

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The following roadway segment in the Study Area is failing in the future 2045 Build Alternative AM peak hour only:

- Westbound MD 665 off ramp to northbound Riva Road

The following roadway segments in the Study Area are failing in the future 2045 Build Alternative PM peak hour only:

- Westbound MD 665 off ramp to southbound Riva Road
- Southbound Riva Road from Admiral Cochrane Drive to Truman Parkway

Generally, the Build condition worsens from the No-Build condition. This is at least partially due to the future Build condition including re-routed longer-distance transit trips through the Park and Ride as a result of enhanced access. The only roadway segment that shows a LOS improvement between the No-Build and the Build condition is the westbound MD 665 off ramp to southbound Riva Road in the AM peak hour.

Impacts and Costs of the Build Alternative

The Study Team identified the preliminary impacts of the two Build Alternative 2 Options and it should be noted that impacts will be refined in later stages of design. Option 1 affects three parcels, which are all owned by the Maryland Department of Transportation State Highway Administration or Anne Arundel County. Approximately 15 acres of forest and 2,300 linear feet of streams are impacted by this option. Option 2 affects four parcels, of which only one is a private commercial property. The small impact for the commercial property may be avoided in future design phases. Approximately seven acres of forest and 2,500 linear feet of streams are impacted by this option.

Preliminary cost estimates were developed for the Build Alternative 2 Options, which do not include Park and Ride lot site layout modifications. The planning-level cost estimates are $28.5 million for Option 1 and $29.3 million for Option 2.

Public Outreach

A public outreach presentation was prepared, and the information was posted on the County's US 50/MD 665 Truman Park and Ride Ramp Feasibility Study project website. The public comment period was open from May 13, 2022 to June 10, 2022 and input was accepted through email, phone, and the feedback form on the project website. Three comments were received and were not in support of the direct connection ramps to and from US 50/MD 665 to the Harry S. Truman Park and Ride.

Study Summary and Recommendation

In summary, the Anne Arundel County Office of Transportation studied the feasibility of constructing additional access ramps both to ingress and egress the Harry S. Truman Park and Ride lot to and from US 50 via MD 665. This study concludes that it is feasible to construct the access ramps. However, traffic growth cannot be addressed with only the addition of direct

access from the Park and Ride lot to and from US 50/MD 665. Improvements to the area roadway network will be necessary and were not within the scope of this study.

The proposed new ramps in the Build Alternative alter the travel patterns within the Study Area and facilitate easy access to US 50 and MD 665. The enhanced access to and from these roadways attracts travelers to use the Park and Ride lot as a pass-through to reach their destination. Traffic operations on the new ramps would be improved if through traffic was prohibited. However, other study area intersections and roadway segments would be adversely affected. Stated differently, any necessary improvements to reduce or prohibit through-traffic would enhance access for Park and Ride lot users, but other roadway and intersection upgrades would still be needed to improve traffic operations elsewhere.

Based on the findings of US 50/MD 665 Truman Park and Ride Ramp Feasibility Study, it is not recommended to move forward with this project at this time and to drop further study of direct connection ramps to and from US 50/MD 665 to the Harry S. Truman Park and Ride lot. While the direct connection ramps are feasible, the benefit of the proposed ramps are minor at a very high cost. Additionally, the improvements do not enhance traffic operations along Riva Road. At this time, the study will not move forward, but the improvements will remain an option for consideration in the future.

Future Next Steps

On April 19, 2021, the County Council approved an amendment to Plan 2040 (the General Development Plan for Anne Arundel County) which officially makes Parole Town Center a transit-oriented development (TOD). This designation fully supports the implementation of an improved Truman Park and Ride lot, along with the direct ingress and egress for the Park and Ride lot to and from US 50 via MD 665. The Parole Town Center TOD designation will continue to promote transit use through the future (2045) timeframe.

If, sometime in the future, funding is available and the project was selected to move forward, next steps would then include the development of roadway, transit, pedestrian, and bicycle improvement options that address future growth. In coordination with the Maryland Department of Transportation State Highway Administration, the Build Alternative would be refined and the processes for Interstate Access Point Approval and National Environmental Policy Act approval would be initiated with the Federal Highway Administration.

In future phases of design, detailed survey and utility identification will be necessary. Enhanced pedestrian and bicycle design elements in and around the Park and Ride lot site will be developed, in addition to site layout modifications to the Park and Ride lot for bus circulation, safe interactions between all modes, and to potentially to make the ramps less desirable for through traffic. Commuter parking impacts at the Park and Ride lot will be evaluated, including the traffic impacts of proposed ramps on parking lot operations.

Section 1: Introduction

Background

The Anne Arundel County Office of Transportation (OOT) is studying the feasibility of constructing additional access ramps both to ingress and egress the Harry S. Truman Park and Ride lot to and from US 50 via MD 665, along with the resulting impacts of this change in traffic patterns within the Study Area, specifically along Riva Road.

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US 50/MD 665
Truman Park and Ride Ramp
Feasibility Study
Study Area

Project Study Area

Data Source:
Orthophoto-2020
AA County GIS Map Server

N

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Document Path: C:\Users\scrivener\AECOM Directory\MdRt50TrumanParkandRideGIS - Documents\mapfiles\Truman_PnR_study_area_210301.mxd

Purpose and Need

The **purpose** of the US 50/MD 665 Truman Park and Ride Ramp Feasibility Study is to promote and accommodate expanded transit service at the Harry S. Truman Park and Ride lot and potentially enhance traffic operations and roadway safety along Riva Road and Harry S. Truman Parkway in the study area.

The **need** for the project is driven by current and projected usage of the Truman Park and Ride lot and traffic congestion and vehicle crash history that cause recurring and non-recurring delay from MD 665 along Riva Road and Harry S. Truman Parkway to the Truman Park and Ride lot.

Section 2: Base Map and Data

This section presents and outlines the geographic information system (GIS) data used for the project, the architecture of the GIS data (type of files, how the files are distributed, and how the data is being accessed), and the source of the information.

The spatial data was mostly acquired from Anne Arundel County Open Data and Maryland iMap data sources. The data is in .shp format and uses the Maryland State Plane NAD 83 US feet coordinate system. Verizon, BGE – Electric & Gas, and County-owned fiber optic utility data was received in electronic form as a PDF for the Study Area. Verizon data was digitized, as well as underground BGE facilities and County-owned fiber optic cable data. In general, the digitized features are approximate locations due to the nature of the data source (in this case, drawings on a PDF). This applies to the Verizon, BGE, and County-owned fiber optic data related to this project and the digitized features represent best estimates/schematics based on the source data provided. In particular, BGE information was received on multiple sheets with sometimes overlapping data and conflicting lines and symbols not always referenced in the legend.

Only the data acquired that is located within the project Study Area and is relevant to this study was mapped in order to show existing conditions and conduct conceptual planning/engineering work.

Table 2-1 below presents the data requested as part of this study, including descriptions, source, format, architecture, date, and link information. Comcast (Cable Television) utility information was not provided and will not be included in the mapping for this study.

Table 2-1: Summary of Requested Study Area Spatial Data

Data	Description	Source	Format	Architecture	Date of Data	Link from Source Site
Planning/Environmental Planning Data						
Land Use Land Cover	AA countywide polygon areas showing 21 different classes of land cover	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2017	https://GIS.aacounty.org/arcGIS/rest/services/OpenData/Environment_OpenData/MapServer/7/query?outFields=*&where=1%3D1
TAZ	AA countywide polygon areas showing 256 transportation analysis zones and including TAZ ID information	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2015	https://opendata.aacounty.org/datasets/transportation-zones-2015
Census ACS Low-Income Households	AA countywide polygons areas showing 312 US Census block Groups. Linked to this are 2 US Census ACS tables showing low income household and population values for each blockgroup.	AA Co. Open Data and Census.gov	ESRI GIS shapefile and .csv tables	shapefile download from web-based GIS hub service, .csv tables download from US Census.gov.	polygons 2010, table 2019	https://opendata.aacounty.org/datasets/census-block-groups-2010/data;
Property Boundaries/ROW and Property Owner Information	AA countywide polygons showing 196,000 property areas and owner information for those properties.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://data.imap.maryland.gov/datasets/property-boundaries-tod
Adopted County Zoning	AA countywide polygons areas showing 35 different zoning classes	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2016	https://opendata.aacounty.org/datasets/zoning-adopted-1
Wetlands of Special State Concern – Linear Maryland,	Maryland statewide line features showing linear wetlands containing rare, threatened and endangered species	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2017	https://data.imap.maryland.gov/datasets/maryland-wetlands-wetlands-linear-special-state-concern
Wetlands of Special State Concern – Polygon Maryland	Maryland statewide polygon areas showing wetlands containing rare, threatened and endangered species	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2017	https://data.imap.maryland.gov/datasets/maryland-wetlands-wetlands-polygon-special-state-concern
DNR Wetlands Polygon	Maryland statewide revisions to National Wetland Inventory wetland polygon areas by MDNR and includes wetland class and type.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	1995	https://data.imap.maryland.gov/datasets/cd293a192f844ac49d9716ee5a107d7a_1
DNR Wetlands Linear (also include NWI Linear)	Maryland statewide revisions to National Wetland Inventory wetland lines by MDNR and includes wetland class and type.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	1995	https://data.imap.maryland.gov/datasets/maryland-wetlands-wetlands-linear-department-of-natural-resources
NWI Wetlands Polygons	Maryland statewide wetland polygon areas and include wetland type and code.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	1992	https://data.imap.maryland.gov/datasets/maryland-wetlands-wetlands-national-wetlands-inventory
Target Ecological Areas	Maryland statewide polygon area lands and watersheds of high ecological value identified by MDNR.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2011	https://data.imap.maryland.gov/datasets/maryland-focal-areas-targeted-ecological-areas
Green Infrastructure Hubs Corridors	Maryland statewide MDNR land conservation polygon areas	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2005	https://data.imap.maryland.gov/datasets/maryland-green-infrastructure-green-infrastructure-hubs-and-corridors
Forest Interior Dwelling Species	Maryland statewide polygon areas of potential habitat for forest interior dwelling species.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2013	https://data.imap.maryland.gov/datasets/maryland-green-infrastructure-green-infrastructure-hubs-and-corridors
Sensitive Species Areas	Maryland statewide polygon buffered areas that contain habitat for rare, threatened, and endangered species.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2010	https://data.imap.maryland.gov/datasets/maryland-living-resources-sensitive-species-project-review-areas
Open Water	Maryland statewide polygon areas showing lakes, ponds, and reservoirs.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/open-water-1
Impervious Surfaces	AA countywide polygon areas showing surfaces impervious to water intrusion	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2014	https://opendata.aacounty.org/datasets/impervious-surfaces

Data	Description	Source	Format	Architecture	Date of Data	Link from Source Site
Forest Conservation	AA countywide polygon areas showing protected forested private lands with limitations on certain activities.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2014	https://opendata.aacounty.org/datasets/forest-conservation-easements
Parks	AA countywide polygon areas showing parks and include name, type and inventory	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/park-features-polygon
PFA	AA countywide polygon areas showing communities targeted for investment and future growth	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/priority-funding-areas-2
Critical Areas	AA countywide polygon areas showing shoreline and tidal wetland buffers where development is restricted	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2018	https://opendata.aacounty.org/datasets/critical-areas
Cultural/Historic	Maryland statewide polygon areas showing districts, buildings, structures, objects, and sites for their significance in American history, archeology, architecture, engineering, or culture, and identifies them as worthy of preservation.	MdiMap	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2018	https://data.imap.maryland.gov/datasets/maryland-national-reGISter-historic-places-national-reGISter-of-historic-places
Prime Farm Soils	Polygon areas in central AA county showing SSURGO data soils and their relative importance for farming.	US NRCS	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2016	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053631
NHD- National Hydro Data	Line features for the USA, the National Hydrography Dataset (NHD) shows the water drainage network of rivers, streams, canals, lakes, ponds, coastline, dams, and streamgages.	USGS	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://viewer.nationalmap.gov/basic/?basemap=b1&category=nhd&title=NHD%20View#/
Streams	AA countywide polylines showing the stream network and includes stream type and name.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2019	https://opendata.aacounty.org/datasets/streams-1
Planimetric Data						
High Resolution Aerial Photography	Color Orthophoto image of AA county	ESRI	Image file	image file accessed via ArcGIS Server	2020	https://GIS.aacounty.org/image/services/Ortho/Color_2020/ImageServer
Road Edges (polygons)	AA countywide polygons areas showing paved and unpaved parking areas, roads and driveways and includes feature type and surface type.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/road-edges
Bridge Polygons	AA countywide polygon areas showing bridges and includes bridge type.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/bridges
Sidewalk Polygons	AA countywide polygon areas showing sidewalks and includes type.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/sidewalks-1
Fences	AA countywide polylines showing fences	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/fences-1
Paths	AA countywide polygon areas showing pathways	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/paths-1
Elevation- 1 ft contours	AA countywide polygons showing bridges and includes bridge type.	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2017	https://opendata.aacounty.org/datasets/topo-2017?geometry=-78.881%2C38.601%2C-74.355%2C39.348
Building Footprints	AA countywide polygons showing building footprints	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2019	https://opendata.aacounty.org/datasets/buildings-1

Data	Description	Source	Format	Architecture	Date of Data	Link from Source Site
Survey Monuments	AA countywide point features showing location of survey monuments and includes locational data	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/survey-ngs-monuments/data
Water Hydrants	AA countywide point features showing location of water hydrants	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/water-hydrants
Sewer Manholes	AA countywide point features showing location of sewer manholes	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/sewer-manholes-1
Water Mains	AA countywide polyline features showing location of water mains	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/water-mains
Pumping Stations	AA countywide point features showing location of pumping stations	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/water-pump-stations
Storm Pipe	AA countywide polyline feature showing location of storm pipes	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/storm-pipe
Sewer Mains	AA countywide polyline features showing location of sewer main lines	AA Co. Open Data	ESRI GIS shapefile	shapefile download from web-based GIS hub service	2020	https://opendata.aacounty.org/datasets/sewer-mains-1
Verizon Utilities	Study area polylines showing approximate location of above and below ground Verizon utilities	Verizon utility map (.pdf)	ESRI GIS shapefile	shapefile created from on screen digitizing	2021	Data was digitized from Verizon .pdf map source
BGE - Electric & Gas Utilities	Study area showing approximate location of BGE utilities	BGE utility map (.pdf)	ESRI GIS shapefile	shapefile created from on screen digitizing	2021	Underground facility data digitized from BGE .pdf map source
County-Owned Fiber Optic	Study area showing approximate location of County-owned fiber optic cables	County utility map (.pdf)	ESRI GIS shapefile	shapefile created from on screen digitizing	2021	Underground fiber optic cable data digitized from County .pdf map source
Cable Television Utilities	Comcast data is not available and will not be included in the mapping for this study.					

Section 3: Existing Conditions

This section provides a baseline environmental inventory of natural, socioeconomic, and cultural resources in the study area to describe the location, type, and characteristics of resources that may be affected by potential roadway improvements and identify potential environmental constraints. This section also provides a geometric inventory, crash data analysis, existing traffic volumes, and existing traffic operational analysis.

The COVID-19 pandemic has had significant effects on travel and mode choice. While the long-term impacts on traffic remain to be seen, recent field observations showed that traffic volumes and park and ride usage were noticeably lower than collected traffic data from prior years. Although it is impossible to predict how traffic will rebound, it is unlikely that traffic will remain at early 2021 lows. Therefore, the team used a 2018 traffic model provided by Anne Arundel County to provide a baseline for the existing conditions analysis.

Site Description

The Harry S. Truman Park and Ride lot is commuter-based, with morning and evening peak commuter bus service that requires all day parking. The Park and Ride lot has approximately 800 parking spaces, four bus bays, and serves multiple bus routes.

Bus routes include Maryland Department of Transportation Maryland Transit Administration (MDOT MTA) Commuter Bus Route 210 from Kent Island and Downtown Baltimore, MDOT MTA Commuter Bus Route 220 from Annapolis to Washington, D.C., and MDOT MTA Commuter Bus Route 230 from Severna Park and Annapolis to Washington, D.C. Previously, Megabus and Greyhound both had stops at the Park and Ride lot; however, these stops are no longer listed on the company websites.

Pedestrian and bicycle access to and from Riva Road and Harry S. Truman Parkway exists, with sidewalks and crosswalks available at intersections. However, there are no dedicated bicycle facilities or shared-use paths that link the site to nearby destinations. The Park and Ride lot has an existing structure that is utilized as a bike rack. MDOT MTA is currently working with a developer to install bike racks as part of their development related incentive program.

Environmental Inventory

Introduction

A baseline environmental inventory of natural, socioeconomic, and cultural resources in the study area was completed to describe the location, type, and characteristics of resources that may be affected by potential roadway improvements and identify potential environmental constraints. The results of the environmental inventory are illustrated in **Figure 3-1** and resources are characterized with respect to their location, potential regulatory significance, and known status. All references for the environmental inventory are included at the end of this section.

US 50/MD 665 Truman Park and Ride Ramp Feasibility Study Environmental Inventory

Study Area Boundary
NWI Wetlands
Forest Interior Dwelling Species
Streams
MDNR Wetlands
Sensitive Species Project Review Areas
Forest Conservation Easement

Data Source:
Data from AA County Open Data:
Streams- 2019, MDNR Wetlands-1995, Sensitive Species Project Review Area-2010, Forest Conservation Easements-2020, NWI Wetlands-1992,
Data from AA County GIS Map Server:
Orthophoto-2020

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Development of the Project Base Mapping and Environmental Inventory

The previously documented GIS data were used to identify land use, natural resources (wetlands, streams, soils, forests, and floodplains), community features, socioeconomic information, and historic properties within the study area. A limited field reconnaissance was conducted on January 28, 2021 to verify published information. No detailed surveys, inventories, or delineations of waters of the U.S., including wetlands, were conducted.

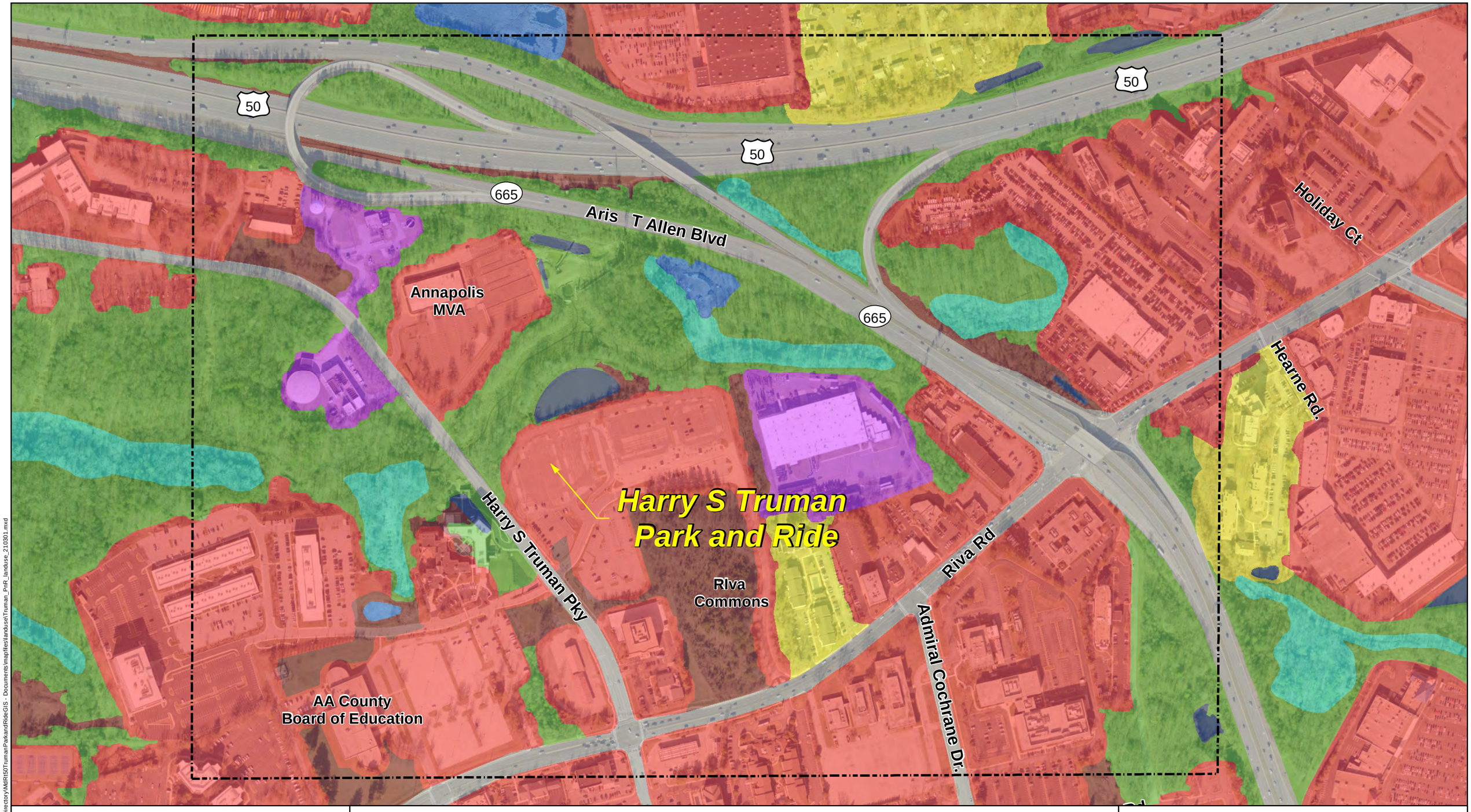
Resource information was obtained from online sources including Maryland iMAP and Maryland's Environmental Resources and Land Information Network (MERLIN). Resource information obtained included National Wetland Inventory (NWI) and Maryland Department of Natural Resources (MDNR) wetlands and waterways, forest interior dwelling species, priority funding areas, parks, targeted ecological areas, and historic properties. The US Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) online database was accessed to determine the potential for any federally listed threatened or endangered species to occur in the study area. Information on the presence of any known protected habitat for State-listed threatened or endangered species in the study area was obtained from MERLIN. Land use, 2019 American Community Survey 5-Year Estimate data, demographic, and income data were obtained from the Maryland Department of Planning (MDP) and the US Census online database.

Land Use

Land use in the study area consists of commercial, industrial, and residential areas located north of Riva Road to the southwest of MD 665 as shown in **Figure 3-2**. Forested areas are located to the east and west of Harry S. Truman Parkway with government and institutional facilities east of Harry S. Truman Parkway and north of Riva Road. These facilities include Annapolis Motor Vehicle Administration, Social Security Administration, Anne Arundel County Public Schools Board of Education, Maryland Department of Agriculture, and Broad Creek Water Treatment Facility. A commercial complex, the Annapolis Corporate Park office complex and Anne Arundel County Farmers Market, are located along Harry S. Truman Parkway, north of Riva Road. Commercial establishments include Coca-Cola Consolidated, Inc., Anne Arundel County Farmers Market, an outdoor market, and Bowen's Farm Supply.

The Maryland Department of Planning is responsible for the economic growth and development within the state. Priority Funding Areas (PFAs) are existing communities and places designated by local governments as needing state investment to support future growth. Areas eligible for county designation include existing communities and areas where industrial or other economic development is desired, and counties may designate areas planned for new residential communities which will be served by water and sewer systems and permitted residential density. The study area is located entirely within a state-eligible PFA.

Consistent with the land uses identified above, the County zoning classifications for the study area are shown in **Figure 3-3**. The predominant zoning classification is commercial, with some industrial uses and a small section of residential.



US 50/MD 665
Truman Park and Ride Ramp
Feasibility Study
Land Use/Land Cover

2017 Land Use Class

Commercial
Residential
Transportation
Woods
Industrial
Water
Open Wetland
Forested Wetland
Open Space

Study Area Boundary

Data Source:
Land Cover-AA County Open Data 2017
Orthophoto-AA County GIS Map Server 2020

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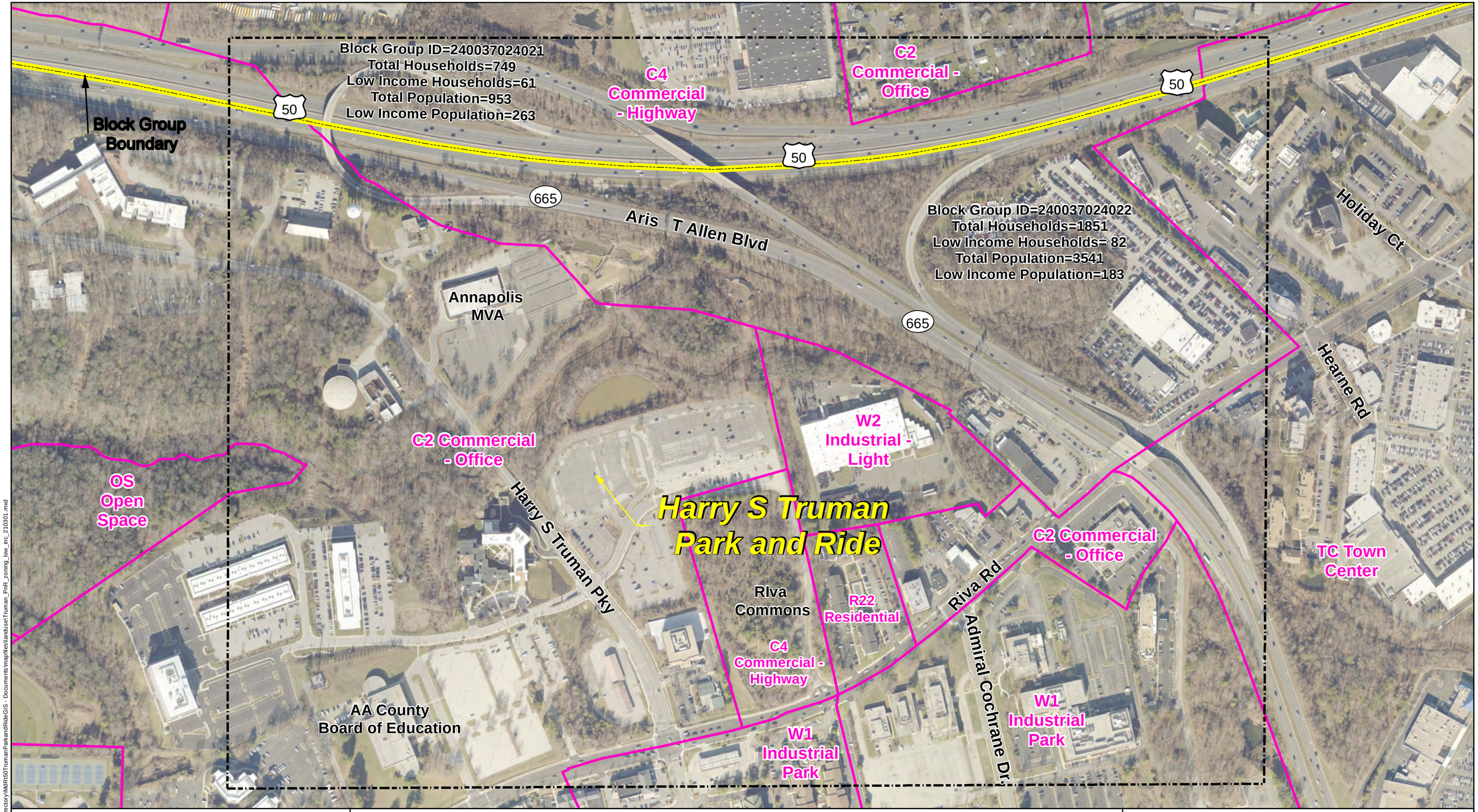

US 50/MD 665
Truman Park and Ride Ramp
Feasibility Study
County Zoning and
Low Income Households/Population

Zoning Area Boundary

Census Block Group Boundary

Study Area Boundary

Data Source:
Zoning-AA County Open Data March 2020
Low Income-US Census ACS 2019 5 Year Estimate
Orthophoto-AA County GIS Map Server 2020

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Cultural Resources

The team conducted a desktop survey using the Maryland Historical Trust's online database (Medusa) and no historic sites are present in the Study Area.

Natural Resources

An inventory of existing natural resources in the study area was completed using available published sources and limited field reconnaissance.

Waters of the US, Including Wetlands

The study area is located within the South River watershed and is drained by unnamed tributaries to Broad Creek. Broad Creek and its tributaries are designated as Use Class I – water contact recreation and protection of nontidal warmwater aquatic life. Instream work is prohibited in Broad Creek and its tributaries between March 1 and June 15.

The main tributary to Broad Creek within the study area is an intermittent stream with contiguous ephemeral channels that flows from east to west north of the intersection of MD 665 and Riva Road and continues north of the Harry S. Truman Park and Ride lot. The stream continues west under Harry S. Truman Parkway to its confluence with Broad Creek. As part of the field reconnaissance, the team observed the recent retrofit of the stormwater management (SWM) facility located adjacent to MD 665, east of the Annapolis Motor Vehicle Administration parking lot, as shown in **Figure 3-4** below. Another stormwater management facility is located south of the intermittent stream and north of the Harry S. Truman Park and Ride lot. The general locations of these waterways and the stormwater management facilities are shown in **Figure 3-1**.

Figure 3-4: MD 665 Stormwater Management Facility, Facing Northeast

MDNR identified 12 wetlands within the study area; seven of these are located east of Harry S. Truman Parkway and southwest of MD 665. A field delineation of waters of the US, including wetlands, would be required to verify the presence of jurisdictional resources within the study area. For impacts to waters of the US, including wetlands and their buffers, authorization under the Clean Water Act may be required from the US Army Corps of Engineers (USACE) and the Maryland Department of the Environment (MDE).

Forests

Forested areas exist between the developed areas between Harry S. Truman Parkway and US 50/MD 665 and along commercial properties along Riva Road, and along the western side of Harry S. Truman Parkway. Forested areas located east of Harry S. Truman Parkway were investigated to identify the successional stage, species composition, and general health. Forested areas are characterized as mid-successional and dominated by red maple (*Acer rubrum*) and American beech (*Fagus grandifolia*) in the overstory with American holly (*Ilex opaca*) and red maple in the understory. This forest is classified as a Maple-Beech-Birch eastern forest cover type.

The 2003 Annapolis Neck Small Area Plan identifies the importance of minimizing forest impacts relative to increasing forest retention and open space to the extent possible. The Plan recognizes that protecting natural resources is a high priority for the community and the retention of buffers along waterways is necessary to prevent further degradation of local streams such as the tributaries to Broad Creek within the study area.

In addition to the broader goals employed during planning, development of forested areas is regulated pursuant to §17-6-301 (Forest Conservation) of the County Code. Linear transportation projects are exempt from the Forest Conservation provisions if the project does not result in the cutting, clearing, or grading of more than 20,000 square feet of forest. Any non-exempt linear project is required to satisfy the Forest Conservation provisions of the County Code including preparation of a Forest Stand Delineation (FSD) and Forest Conservation Plan (FCP) detailing the location of proposed forest retention, afforestation, and reforestation. Five forest conservation easements are located within the study area.

Floodplains

Development in designated 100-year floodplains is regulated pursuant to Article 16 of the Anne Arundel County Code (Floodplain Management, Erosion and Sediment Control, and Stormwater Management). A review of FEMA floodplain mapping shows no floodplains are mapped within the study area.

Threatened and Endangered Species

The federal Endangered Species Act and the Maryland Nongame and Endangered Species Conservation Act provide the regulatory authority over activities affecting federal and State listed species in Maryland. Both the USFWS and the Maryland Department of Natural Resources (MDNR) maintain a database of listed rare, threatened, and endangered species and their habitats. MDNR's Sensitive Species Project Review Areas (SSPRA) mapping indicates that no threatened or endangered species or habitat occurs within the study area. Coordination with the

MDNR Environmental Review Program and Wildlife and Heritage Service (WHS) would be necessary to obtain current information on any known State listed or protected resources within the study area.

According to the USFWS IPaC system, except for occasional transient individuals, the only federally proposed or listed threatened or endangered species that may occur within the study area is the Northern Long-eared Bat (*Myotis septentrionalis*), listed as federally threatened (**Appendix A**).

Population and Demographics

The U.S. Census identifies Parole as a Census Designated Place (CDP). Population and demographic data were obtained from the US Census 2019 American Community 5-Year Estimate Profile data. The population for Parole was 14,894 in 2010 and 17,074 in 2019, an increase of 14.6 percent. Comparatively, the population for Anne Arundel County was 527,020 in 2010 and 571,275 in 2019, an increase of 8.4 percent. **Table 3-1** shows the demographic distribution for Parole and Anne Arundel County. Approximately 10.8 percent of the population in Parole is minority, compared to a 27.3 percent minority population countywide.

Table 3-1: Demographic Distribution for Parole and Anne Arundel County

	Parole		Anne Arundel County	
	Total	**Percentage**	**Total**	**Percentage**
Black or African American	1,045	6.1	95,710	16.8
American Indian and Alaska Native alone	29	0.2	1,175	0.2
Asian	310	1.8	21,605	3.8
Native Hawaiian and Other Pacific Islander alone	0	0	386	0.1
Some Other Race alone	77	0.5	13,578	2.4
Two or More Races	378	2.2	23,351	4.1
Hispanic or Latino*	593	3.5	44,621	7.8
Total Minority	1,839	10.8	155,805	27.3
White Alone	15,235	89.2	415,470	72.7
Total Population	17,074	100	571,275	100

* Hispanic or Latino is a component of all races listed above.
Source: US Census 2019 American Community 5-Year Estimate Profile

Median Household Income

The median household income for the Parole CDP was $104,006 for the 2015-2019 American Community Survey 5-Year Estimates. The median incomes for Anne Arundel County and for Maryland during the same time period were $100,798 and $86,738, respectively. Median incomes for Parole, Anne Arundel County, and Maryland are shown in **Table 3-2**. As shown in **Figure 3-3**, the study area is located between two census blocks. The examination of the two census blocks shows that 10 percent of the population is considered low income.

Table 3-2: Median Household Income, 2015-2019 (Parole CDP)

	Median Household Income
Parole CDP	$104,006
Anne Arundel County	$100,798
Maryland	$86,738

Source: US Census 2019 American Community 5-Year Estimate Profile

Existing Conditions Traffic Analysis

The study area includes three study segments:

- MD 665 from US 50 to MD 2
- Riva Road from MD 665 to Harry S. Truman Parkway
- Harry S. Truman Parkway from Riva Road to the Truman Park and Ride Lot Entrance

And five study intersections:

- Riva Road at MD 665 Ramps (Signalized)
- Riva Road at Admiral Cochrane Drive (Signalized)
- Riva Road at the Truman Park and Ride Lot Entrance (Un-signalized)
- Riva Road at Harry S. Truman Parkway (Signalized)
- Harry S. Truman Parkway at the Truman Park and Ride Lot Entrance (Signalized)

The site map was shown in **Figure 1-1**.

The following traffic analyses were conducted for this project:

- An inventory of existing geometric conditions, including traffic controls, lane use, and speed limits
- Crash data analysis of the study segments and study intersections
- Existing volumes were developed using previous traffic models and approved traffic studies
- Highway Capacity Manual (HCM) 6 Level of Service (LOS) and intersection delay analysis at all study intersections
- Travel time delay analysis of the study segments

Existing Geometric Conditions

Existing geometric lane configurations were verified on a January 28, 2021 field visit. Lane use and intersection control are shown in **Figure 3-5**.

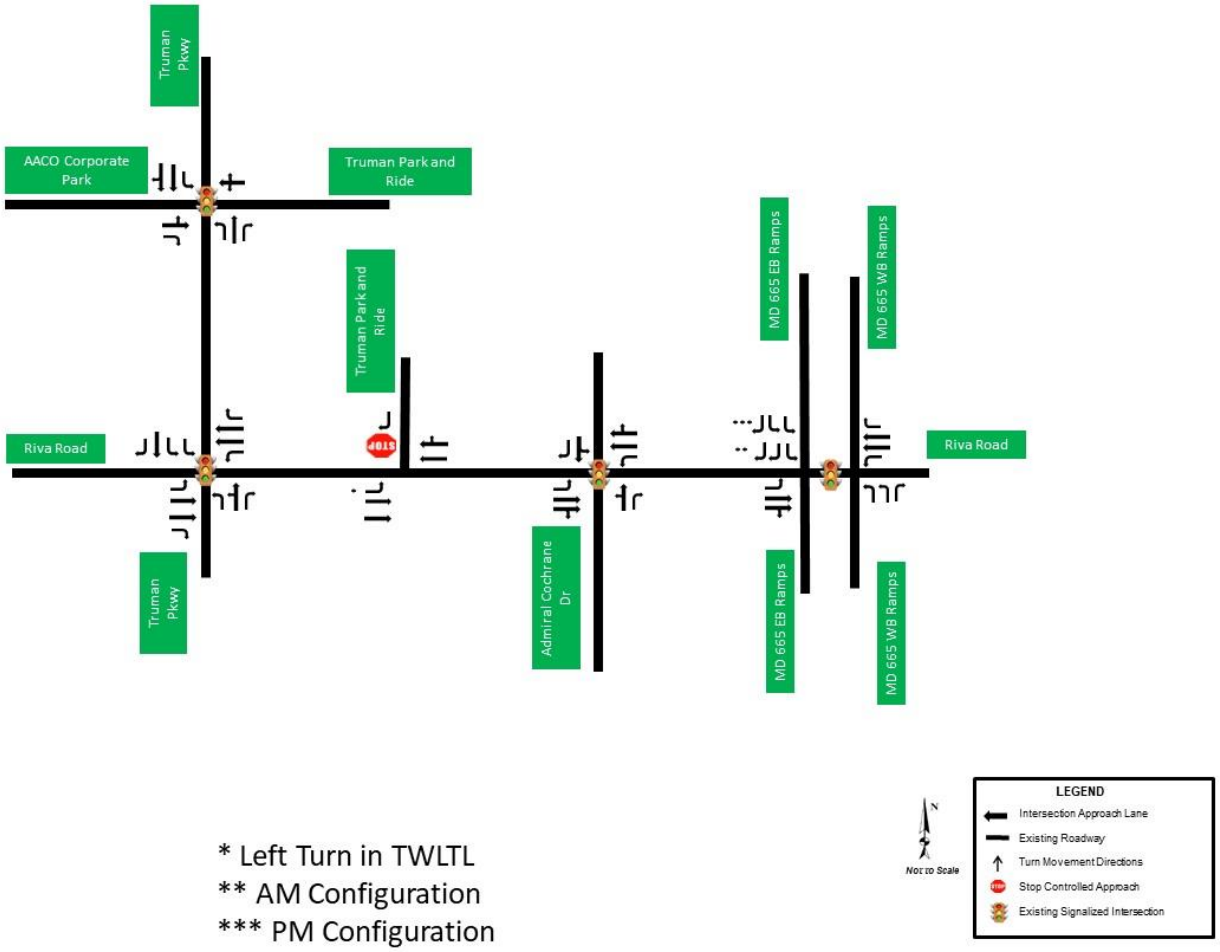

Figure 3-5: Existing Geometric Lane Configuration

Arterial descriptions for the study segments are provided below.

MD 665

In the study area, MD 665 is a 4-lane freeway with a speed limit of 55 MPH. There are three major interchanges in the study area (US 50, Riva Road, MD 2) along with two minor access points.

Riva Road

In the study area, Riva Road is a 4-lane local road with a speed limit of 40 MPH. There are three signalized intersections and one minor approach stop control intersection:

- Riva Road at MD 665 Ramps (Signalized)
- Riva Road at Admiral Cochrane Drive (Signalized)
- Riva Road at the Truman Park and Ride Lot Entrance (Un-signalized)

- Riva Road at Harry S. Truman Parkway (Signalized)

There are also many parking lots with access to Riva Road, and there is a two-way left turn lane (TWLTL) throughout most of the segment.

Harry S. Truman Parkway

In the study area, Harry S. Truman Parkway is a 3-lane local road with 2 southbound lanes and 1 northbound lane, with a speed limit of 35 MPH. There are two signalized intersections:

- Riva Road at Harry S. Truman Parkway (Signalized)
- Harry S. Truman Parkway at the Truman Park and Ride Lot Entrance (Signalized)

There is also access to two parking lots in the segment.

Crash Data Analysis

Crash Data was obtained from MDOT SHA for the three-year period of 2017-2019 for the following study segments:

- MD 665 from US 50 to MD 2
- Riva Road from MD 665 to Harry S. Truman Parkway
- Harry S. Truman Parkway from Riva Road to the Truman Park and Ride Lot Entrance

And five study intersections:

- Riva Road at MD 665 Ramps (Signalized)
- Riva Road at Admiral Cochrane Drive (Signalized)
- Riva Road at the Truman Park and Ride Lot Entrance (Un-signalized)
- Riva Road at Harry S. Truman Parkway (Signalized)
- Harry S. Truman Parkway at the Truman Park and Ride Lot Entrance (Signalized)

Historical crash data is included in **Appendix B**.

MD 665

Crash data results for MD 665 are shown in **Table 3-3** and **Table 3-4** below.

Table 3-3: Crash Severity for MD 665

Year	Severity			
	Fatal	Injury	Property Damage Only	Total
2017	0	6	14	20
2018	0	8	19	27
2019	0	7	22	29
Total	0	21	55	76

Table 3-4: Crash Type for MD 665

Year	Crash Type								
	Opposite Direction	Rear End	Sideswipe	Left Turn	Angle	Pedestrian	Fixed Object	Other	Total
2017	0	10	3	0	0	0	7	0	20
2018	0	9	3	0	0	0	10	5	27
2019	0	10	2	0	0	0	12	5	29
Total	0	29	8	0	0	0	29	10	76

There were no fatal crashes, 21 crashes that resulted in injury, and 55 property damage crashes. The most common crash types were rear-end crashes and fixed object crashes.

Riva Road

Crash data results for Riva Road are shown in **Table 3-5** and **Table 3-6** below.

Table 3-5: Crash Severity for Riva Road

Year	Severity			
	Fatal	Injury	Property Damage Only	Total
2017	0	9	17	26
2018	0	13	10	23
2019	0	6	16	22
Total	0	28	43	71

Table 3-6: Crash Type for Riva Road

Year	Crash Type								
	Opposite Direction	Rear End	Sideswipe	Left Turn	Angle	Pedestrian	Fixed Object	Other	Total
2017	0	7	4	5	5	0	4	1	26
2018	0	9	3	3	5	1	1	1	23
2019	1	8	1	3	4	0	3	2	22
Total	1	24	8	11	14	1	8	4	71

There were no fatal crashes, 28 crashes that resulted in injury, and 43 property damage crashes. The most common crash types were rear-end crashes, angle crashes, and left turn crashes.

The intersections with the most crashes were MD 655 at Riva Road and Truman Parkway at Riva Road with 38 and 21 crashes, respectively. Full crash data by intersection is shown in **Table 3-7**. **Table 3-7** only includes crash data at the intersections, so the totals vary from **Tables 3-5** and **3-6**.

Table 3-7: Crash Severity by Intersection (Riva Road)

Crash Severity	Study Intersection			
	Truman Pkwy	Park and Ride Entrance	Admiral Cochrane Dr	MD 655
Fatal	0	0	0	0
Injury	8	1	5	19
Property Damage Only	13	3	11	19
Total	21	4	16	38

Harry S. Truman Parkway

Crash data results for Harry S. Truman Parkway are shown in **Table 3-8** and **Table 3-9** below.

Table 3-8: Crash Severity for Harry S. Truman Parkway

Year	Severity			
	Fatal	Injury	Property Damage Only	Total
2017	0	1	1	2
2018	0	2	4	6
2019	0	1	5	6
Total	0	4	10	14

Table 3-9: Crash Type for Harry S. Truman Parkway

Year	Crash Type								
	Opposite Direction	Rear End	Sideswipe	Left Turn	Angle	Pedestrian	Fixed Object	Other	Total
2017	0	0	0	1	0	0	1	0	2
2018	0	1	1	0	3	0	1	0	6
2019	0	1	2	1	2	0	0	0	6
Total	0	2	3	2	5	0	2	0	14

There were no fatal crashes, 4 crashes that resulted in injury, and 10 property damage crashes. The most common crash types were angle crashes and sideswipe crashes.

There were only 4 crashes at Truman Parkway at the Park and Ride lot entrance, shown in **Table 3-10**Error! Reference source not found.. **Table 3-10** only includes crash data at the intersections, so the totals vary from **Tables 3-8** and **3-9**.

Table 3-10: Crash Data by Intersection (Truman Parkway)

Crash Severity	Study Intersection
	Park and Ride Entrance
Fatal	0
Injury	1
Property Damage Only	3
Total	4

Existing Traffic Volumes

Existing 2016 VISSIM models (AM peak hour and PM peak hour) were provided by Anne Arundel County as shown in **Figure 3-6**. However, the modeling study has focused on the network in the study area that includes Riva Road from West Street to Unity Lane, Harry S. Truman Parkway from the Annapolis Motor Vehicle Administration site to Admiral Cochrane Drive, MD 665 from John Hanson Highway to Vineyard Road, and MD 2 from John Hanson Highway to Tarragon Lane.

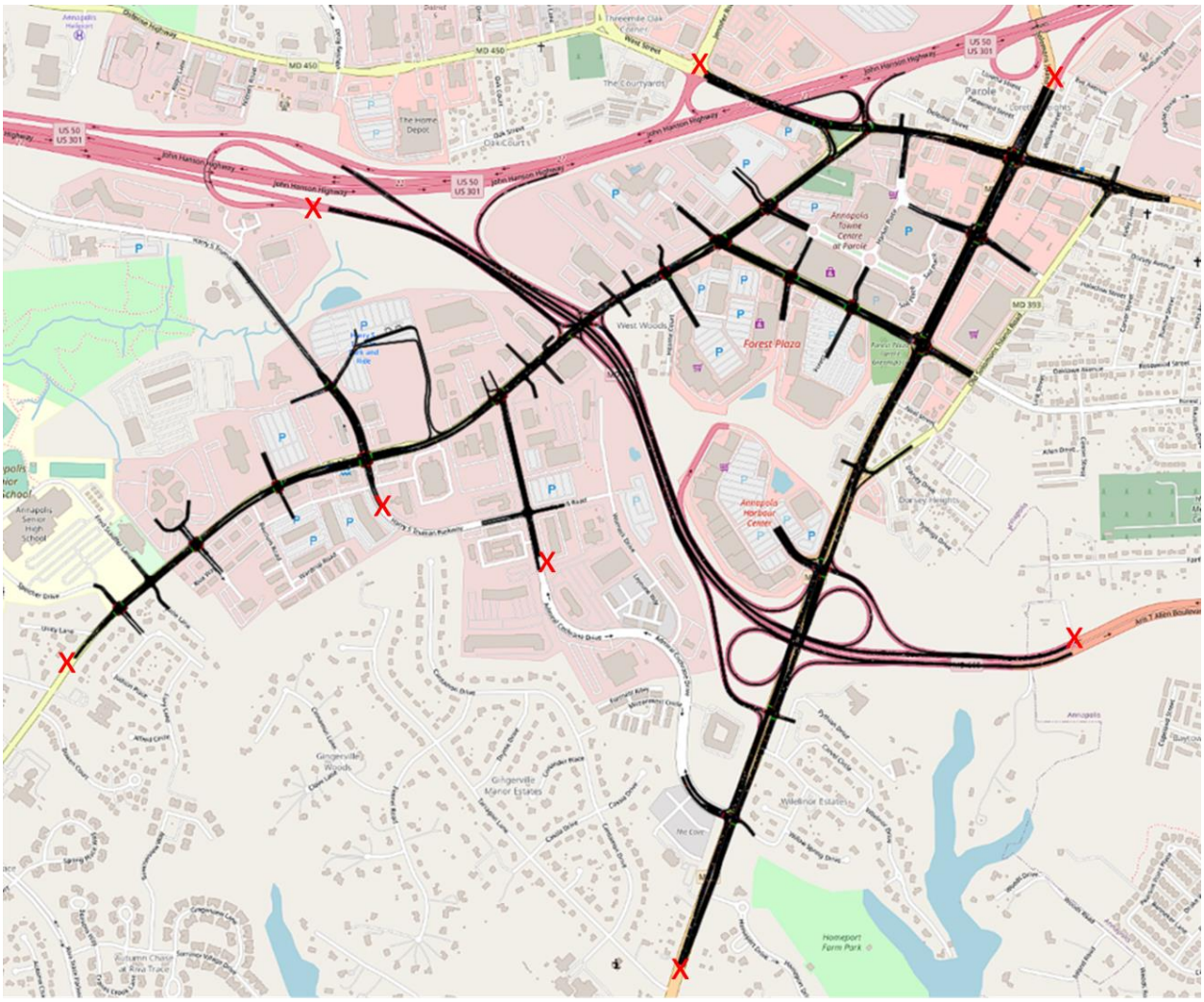

Figure 3-6: VISSIM Model Network

Network Refinements

The team reviewed the VISSIM models and found that the network needed additional details and refinements at the Truman Park and Ride lot location in order to use the model for this study. The necessary refinements were:

- The access road from Riva Road to the Truman Park and Ride lot was coded was one-way street in the model. It was changed to a two-way street.
- The entrance to the Truman Park and Ride lot from Harry S. Truman Parkway was coded as an un-signalized T-intersection. However, the existing entrance is at the Annapolis Corporate Park intersection. A new intersection has been coded with the signal timing obtained from Anne Arundel County.
- The number of lanes on southbound Harry S Truman Parkway at Riva Road was incorrectly coded in the model. The geometry of the intersection was corrected.
- The above network refinements were carried out for both AM and PM models.

Demand Adjustments

Because of recent developments in the study area, including the Anne Arundel Medical Center Psychiatric Day Hospital, many of the volumes and roadway geometries were outdated. Anne Arundel County provided 2018 counts at the following intersections to supplement the 2016 VISSIM model:

- Harry S. Truman Parkway at Truman Park and Ride lot
- Riva Road at Harry S. Truman Parkway
- Riva Road at Truman Park and Ride Lot
- Riva Road at Admiral Cochrane Drive
- Riva Road at MD 665 Ramps

The demand for the existing VISSIM model, at only the study area intersections listed above, was updated from 2016 to 2018 using the counts provided by the County.

Since the VISSIM model did not include information regarding the parking demand, the Baltimore Metropolitan Council (BMC) travel demand model was used to obtain an estimate of the parking demand in the study area. The section below describes the approach used for estimating the parking demand using the BMC model.

Existing year BMC model refinements, as shown in **Figure 3-7**, were carried out as listed below.

- Coordinates of the Truman Park and Ride lot were updated to represent current conditions
- Highway network refinements to include the Park and Ride loop (i.e., allowing access and egress from both Truman Parkway and Riva Road to the Truman Park and Ride)
- Turn prohibitions to make the intersection of Riva Road and the Truman Park and Ride lot a right-in, right-out (RIRO) intersection
- Transit network refinements to re-route the transit routes stopping at the corrected Truman Parkway transit stop location
- Refining the highway assignment scripts to output the turn volumes

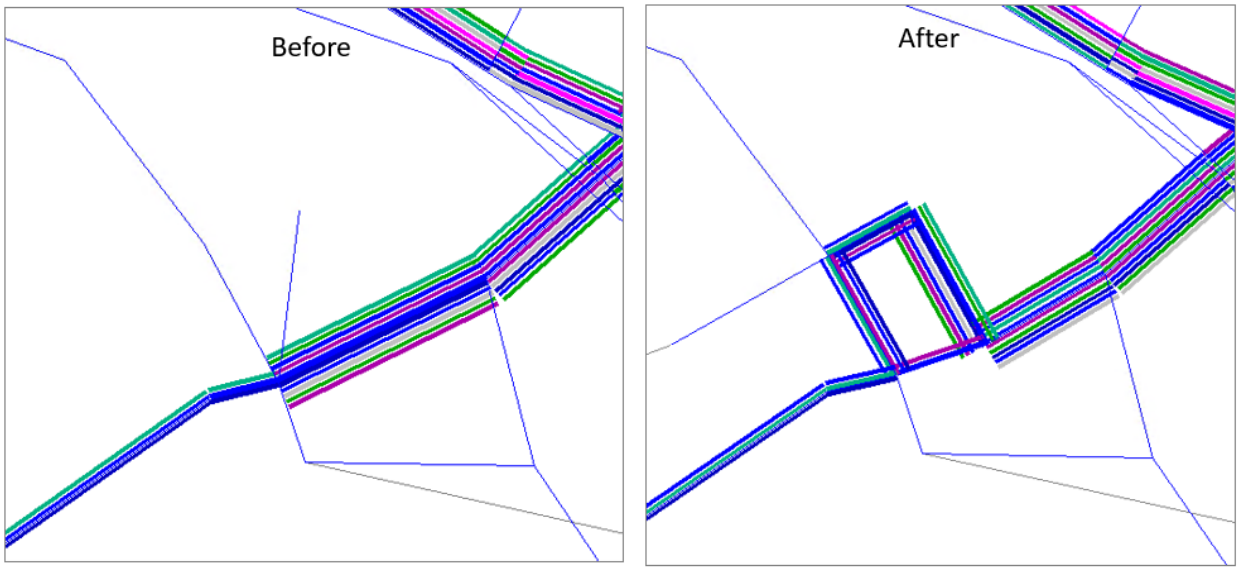

Figure 3-7: Existing Year BMC Model Network Refinements – Before and After

The existing year BMC model was run after making these refinements. **Table 3-11** shows the model estimated ridership for the Truman Park and Ride by mode of access for peak period, off-peak period and at daily level. **Figure 3-8** shows model estimated zone level drive access peak period trip productions for the Truman Park and Ride.

Table 3-11: Truman Park and Ride Lot Stop Ridership by Access Mode and Time Period

Access	Peak Period	Off Peak Period	Daily
Walk-Access	34	10	44
Drive-Access	380	347	727
Walk-Egress	52	2	54
Total	465	359	824

It should be noted that the BMC model does include drive access vehicles in its highway assignment step. The model implements a set of procedures (by purpose, time-period and direction production and attraction) to convert transit assignment production/attraction format outputs to origin-destination (O-D) format outputs. The resulting O-D format outputs (drive access AM and PM peak period vehicles) were further applied a peak period to hourly conversion factor to generate peak hour parking demand as shown in **Table 3-12**.

Table 3-12: Truman Parkway Parking Demand for AM Peak Hour and PM Peak hour

Access	AM Peak Hour ONs	PM Peak Hour OFFs
Drive-Access	137	167

The traffic balancing was performed using the 2018 supplemented counts along with the peak hour parking demand turn volumes from the BMC model. In addition to the parking demand turn volumes, the VISSIM model also needed the external entry points of the additional parking

demand from the BMC model. It was determined that a majority of the trips would use US 50 and MD 665 and a minor percentage of the trips would use Admiral Cochrane Drive and other approaches to access the park and ride lot.

The balanced volumes and additional external demand were then incorporated into the 2016 VISSIM model in the form of trip inputs and intersection level routing decisions; model runs were then performed for both AM and PM time periods.

The 2016 VISSIM model resulting volumes are shown in **Figure 3-9** and **Figure 3-10**.

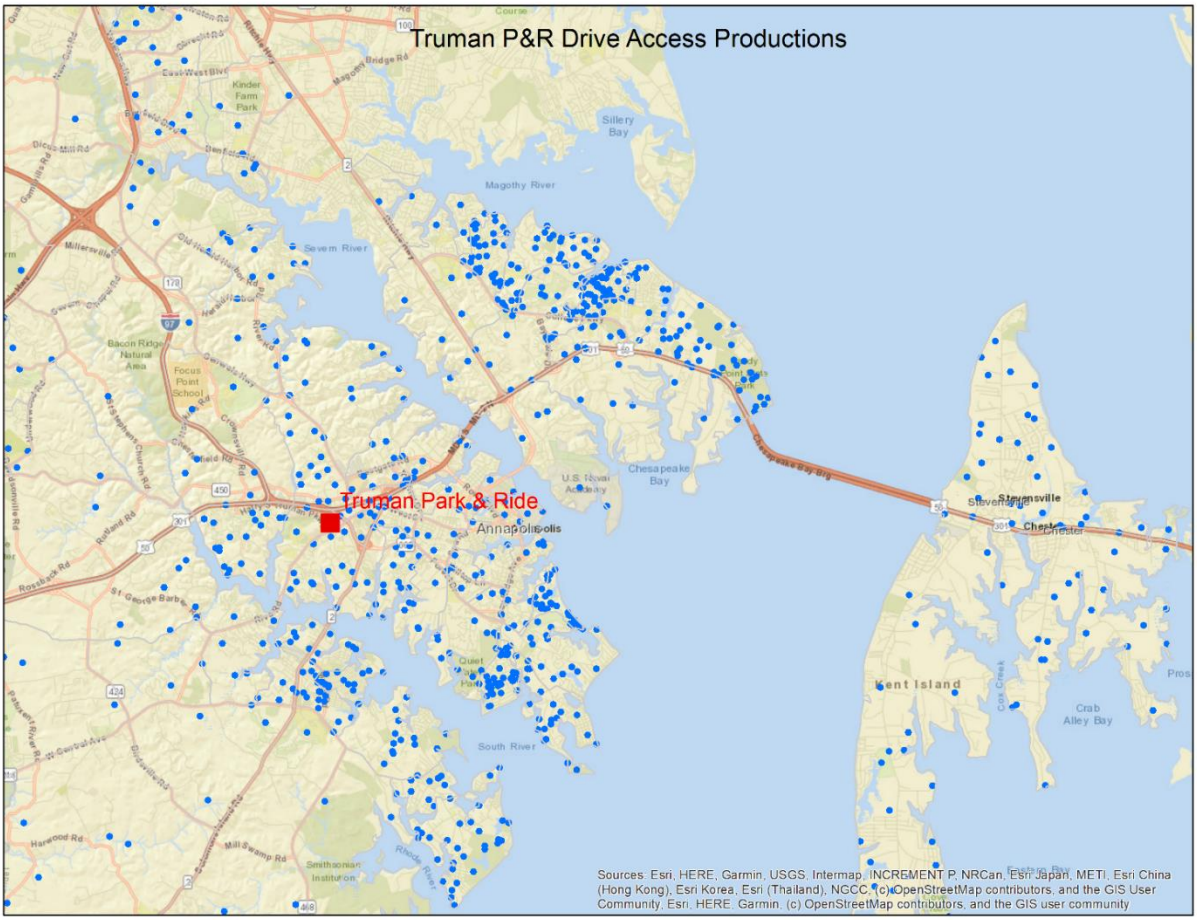

Figure 3-8: Truman Park and Ride Drive Access Productions – Peak Period

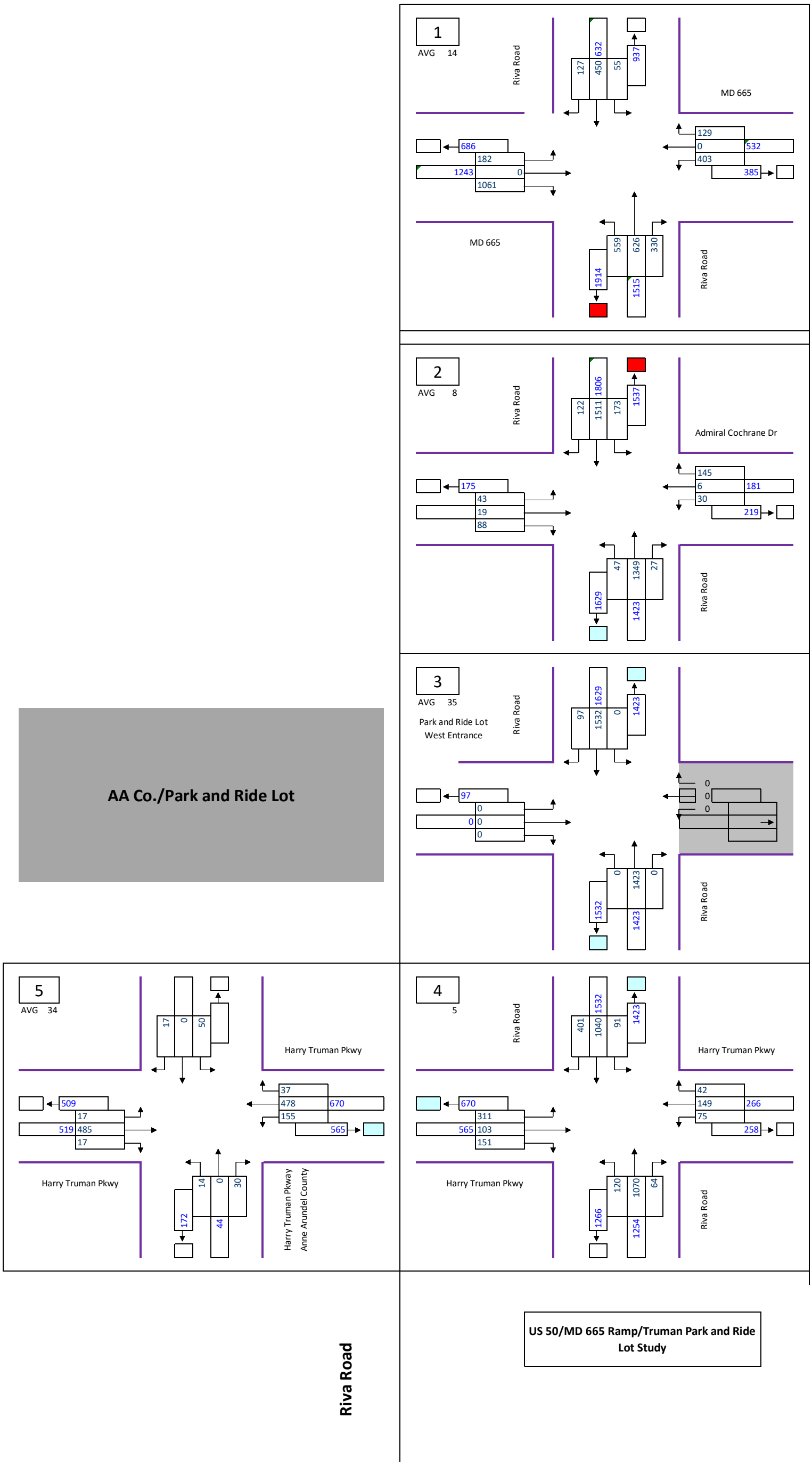

Figure 3-9: Existing AM Volumes

Figure 3-10: Existing PM Volumes

Existing Synchro Analysis

The existing year analysis was performed based upon existing geometric lane configurations, existing traffic volumes, and existing signal timings provided by Anne Arundel County. The operational analyses at the study area intersections were performed for both AM and PM peak hours on a typical weekday. Synchro 11 traffic simulation software was used to perform all intersection operational analyses.

The study area consists of both un-signalized and signalized intersections. The capacity analyses performed followed the guidelines and procedures outlined in the Highway Capacity Manual (HCM 6). The HCM 6 does not support analysis of intersections with shared and exclusive lanes; therefore, Riva Road at Truman Parkway was analyzed with Synchro 11's Lanes, Volumes, Timings analysis. Full Synchro reports are found in **Appendix C**.

Signalized Intersection Analysis

The control delay for a signalized intersection is determined for each lane group and aggregated for each approach and for the intersection and, divided by the number of vehicles. Based on these delay values, a grade or LOS ranging from LOS A, the best, to LOS F, the worst, are assigned. Each LOS represents a range of driver delay.

Table 3-13 presents the LOS criteria for signalized intersections, which is directly related to the average intersection control delay value. The intersection LOS grades for signalized intersections are as follows:

Table 3-13: Signalized Intersections Level of Service (LOS) Criteria

Level of Service	Average Control Delay (seconds/veh)
A	≤ 10.0
B	>10.0 to 20.0
C	> 20.0 to 35.0
D	> 35.0 to 55.0
E	> 55.0 to 80.0
F	> 80.0

Source: Highway Capacity Manual

The signalized intersections operation analysis results are shown in **Table 3-14**.

Table 3-14: Signalized Intersection Analysis

Intersection	AM		PM	
	Delay (s/veh)	LOS	Delay (s/veh)	LOS
Riva Road at Truman Parkway	36.7	D	84.7	F
Riva Road at Admiral Cochrane Drive	16.8	B	63.5	E
Riva Road at MD 665 Ramps	60.6	E	77.8	E
Truman Parkway at Truman Park and Ride	19.1	B	59.4	E

Riva Road at Harry S. Truman Parkway and Riva Road at MD 665 Ramps operate at LOS D or worse in the AM peak hour. All signalized intersections operate at LOS E or worse in the PM peak hour.

Un-Signalized Intersection Analysis

The Synchro analysis results provide an 'approach delay' for approaches at all-way or two-way stop sign controlled intersections. The approach delay is a volume weighted average of the approach control delay. The highest approach delay was picked to represent the intersection control delay since. Based on these delay values, a "grade" of LOS ranging from LOS A, the best, to LOS F, the worst, are assigned. The intersection LOS "grades" as defined by the HCM for stop-controlled intersections are listed in **Table 3-15**.

Table 3-15: Un-signalized Intersections Level of Service (LOS) Criteria

Level of Service	Average Control Delay (seconds/veh)
A	≤ 10.0
B	10.0 to 15.0
C	15.0 to 25.0
D	25.0 to 35.0
E	35.0 to 50.0
F	> 50.0

Source: Highway Capacity Manual

The un-signalized intersections operation analysis results are shown in **Table 3-16**.

Table 3-16: Un-Signalized Intersection Analysis

Intersection	AM		PM	
	Delay (s/veh)	LOS	Delay (s/veh)	LOS
Riva Road at Truman Park and Ride Lot	0	A	0	A

Riva Road at Truman Park and Ride operates at LOS A during both peaks.

Existing VISSIM Analysis

The existing VISSIM analysis estimated segment level travel times, delays, and Level of Service (LOS), with highway segment LOS determined using the criteria in **Table 3-17**. **Table 3-18** shows the results for selected roadways segments in the study area. **Figure 3-11** shows the location of these selected roadway segments.

Table 3-17: LOS Criteria for Urban Arterials

Travel Speed as a Percentage of Base Free Flow Speed (%)	LOS by Volume-to-Capacity Ratio	
	<= 1.0	> 1.0
>85	A	F
>67-85	B	F
>50-67	C	F
>40-50	D	F
>30-40	E	F
<=30	F	F

Table 3-18: Existing Segment Travel Times and Delay

Segment	AM Peak Hour			PM Peak Hour		
	Travel Time (mins/veh)	Delay (mins/veh)	LOS	Travel Time (mins/veh)	Delay (mins/veh)	LOS
WB MD 665 off ramp to SB Riva Road	2.08	1.51	F	1.89	1.32	E
WB MD 665 off ramp to NB Riva Road	0.48	0.15	B	0.53	0.22	C
NB Riva Road to EB MD 665 on ramp	0.52	0.05	A	0.76	0.29	C
NB Riva Road to WB MD 665 on ramp	0.83	0.37	C	1.23	0.78	E
EB MD 665 to SB Riva Road	2.4	1.97	F	1.06	0.67	E
EB MD 665 to NB Riva Road	2.4	2.06	F	1.48	1.13	F
NB Riva Road (Truman Parkway to Admiral Cochrane Drive)	1.88	1.57	F	1.03	0.71	E
SB Riva Road (Admiral Cochrane Drive to Truman Parkway)	0.44	0.13	B	0.6	0.29	C
EB Truman Parkway (Park and Ride Lot to Riva Road)	1.04	0.85	F	2.33	2.15	F
WB Truman Parkway (Riva Road to Park and Ride Lot)	0.24	0.05	B	0.4	0.21	D

ID	Segment
1	WB MD 665 off ramp to SB Riva Road until Admiral Cochrane Drive
2	WB MD 665 off ramp to NB Riva Road until commercial drive
3	NB Riva Road from Admiral Cochrane Drive to EB MD 665 on ramp
4	NB Riva Road from Admiral Cochrane Drive to WB MD 665 on ramp
5	EB MD 665 off ramp to SB Riva Road until Admiral Cochrane Drive
6	EB MD 665 off ramp to NB Riva Road until commercial drive
7	NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
8	SB Riva Road (Admiral Cochrane Drive to Truman Parkway)
9	EB Truman Parkway (Park and Ride to Riva Road)
10	WB Truman Parkway (Riva Road to Park and Ride)

Figure 3-11: VISSIM Roadway Segments

In the AM peak hour, the following segments are failing:

- WB MD 665 off ramp to SB Riva Road
- EB MD 665 to SB Riva Road
- EB MD 665 to NB Riva Road
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
- EB Truman Parkway (Park and Ride Lot to Riva Road)

All other segments are at LOS C or above.

In the PM peak hour, the following segments are at LOS D or below:

- WB MD 665 off ramp to SB Riva Road
- NB Riva Road to WB MD 665 on ramp
- EB MD 665 to SB Riva Road
- EB MD 665 to NB Riva Road
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
- EB Truman Parkway (Park and Ride Lot to Riva Road)
- WB Truman Parkway (Riva Road to Park and Ride Lot)

All other segments are at LOS C or above.

Summary of Existing Traffic Conditions

In the PM hour particularly, many of the study area intersections are operating at LOS E, with Riva Road at Truman Parkway failing in the PM peak hour. The following intersections operate at LOS E in either (or both) the AM and PM peak hours:

- Riva Road at Admiral Cochrane Drive (PM)
- Riva Road at MD 665 Ramps (AM and PM)
- Truman Parkway at Truman Park and Ride Lot (PM)

There are also several segments of the corridor that are failing in either (or both) the AM and PM peak hours. These include:

- WB MD 665 off ramp to SB Riva Road (AM)
- EB MD 665 to SB Riva Road (AM)
- EB MD 665 to NB Riva Road (AM and PM)
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive) (AM)
- SB Truman Parkway (Park and Ride Lot to Riva Road) (AM and PM)

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Section 4: 2045 Travel Demand Forecast

This section describes the methods and assumptions made to modify the travel demand model to develop 2045 forecasts and provides future traffic operational analysis.

Future Year 2045 Travel Demand Forecast

Future Traffic Volumes

The network refinements carried out for the existing year BMC model, as described in the Existing Conditions section, were also applied for the future year BMC model.

The refined base and future year BMC models were then used to estimate the future year growth, for both AM and PM peaks, at an intersection level for study intersections and at an approach level for external entry points. **Figure 4-1** provides an overview of the modeling approach including interconnections between the BMC model and VISSIM model processes and growth methodology. The BMC model performs highway assignment at the peak period level; AM peak (6:30 AM – 9:30 AM) and PM peak (3:30 PM – 6:30 PM). The peak period model volumes were factored to peak hour using the capacity factor from highway assignment.

The NCHRP Report 765 recommended procedure of model post-processing was used to calculate the growth for a) each of turning movement for the study area intersections and b) approach volumes for the external entry points. The procedure recommends applying either a ratio method, a difference method, or an average of the two to the observed turning movement counts.

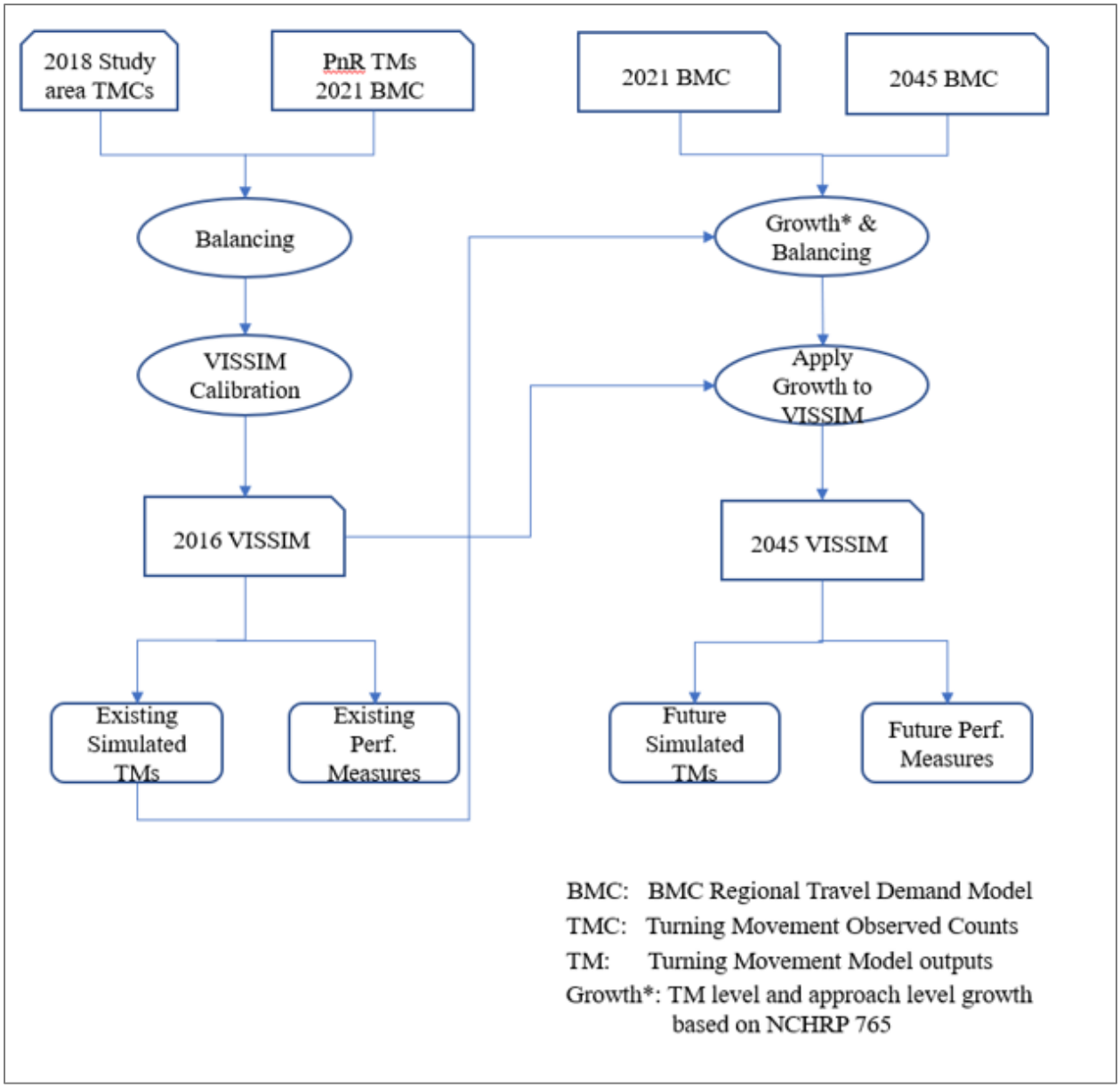


Figure 4-1: Overview of Overall Modeling and Growth Approach

The team also performed checks to account for unreasonably high or low growth projections based on the method described above. These cases were seen a) when observed counts were very low compared to model estimated volumes resulting in unreasonably high growth and b) when observed counts were very high compared to estimated volumes resulting in unreasonably low growth. In such cases, professional judgment was used to either use the ratio or difference method to estimate reasonable future volumes. In a few cases, if both methods did not yield reasonable estimates, growth factors estimated from other intersections were used.

Future Year VISSIM Analysis

The 2045 future year VISSIM analysis was carried out using the balanced volumes from the growth process, as described in the previous section. With the simulation network, no noticeable roadway geometry and lane configuration changes were found in the study area based on the comparison of 2021 and 2045 BMC travel model highway networks. Thus, the future analysis only included 2045 demand updates without making any improvements in the network. The signal timings of the intersections in the model also remained the same as in the existing network. The AM peak hour and PM peak hour volumes are shown in **Figure 4-2** and **Figure 4-3**.

Loading the 2045 demand on the network without capacity and operational improvements caused traffic over-saturation issues at several intersections, and thus not all 2045 demand was able to be loaded onto the network during the peak hours. The vehicles which were unable to load into the model due to congestion in the VISSIM model are reported as latent demand in the model. **Tables 4-1** and **4-2** below show the approach volumes at key entry points for the existing year VISSIM model, future growth from BMC, future year VISSIM model, and latent demand, along with the percentage of trips able to be loaded into the VISSIM model for 2045. As seen in the tables, the existing network without any mitigation a) is able to handle the future AM peak traffic for the most part, except the EB MD 665 ramps; and b) is unable to handle the future PM peak traffic at most of the entry points, with a significant amount of latent demand reported at the EB MD 665 ramps.

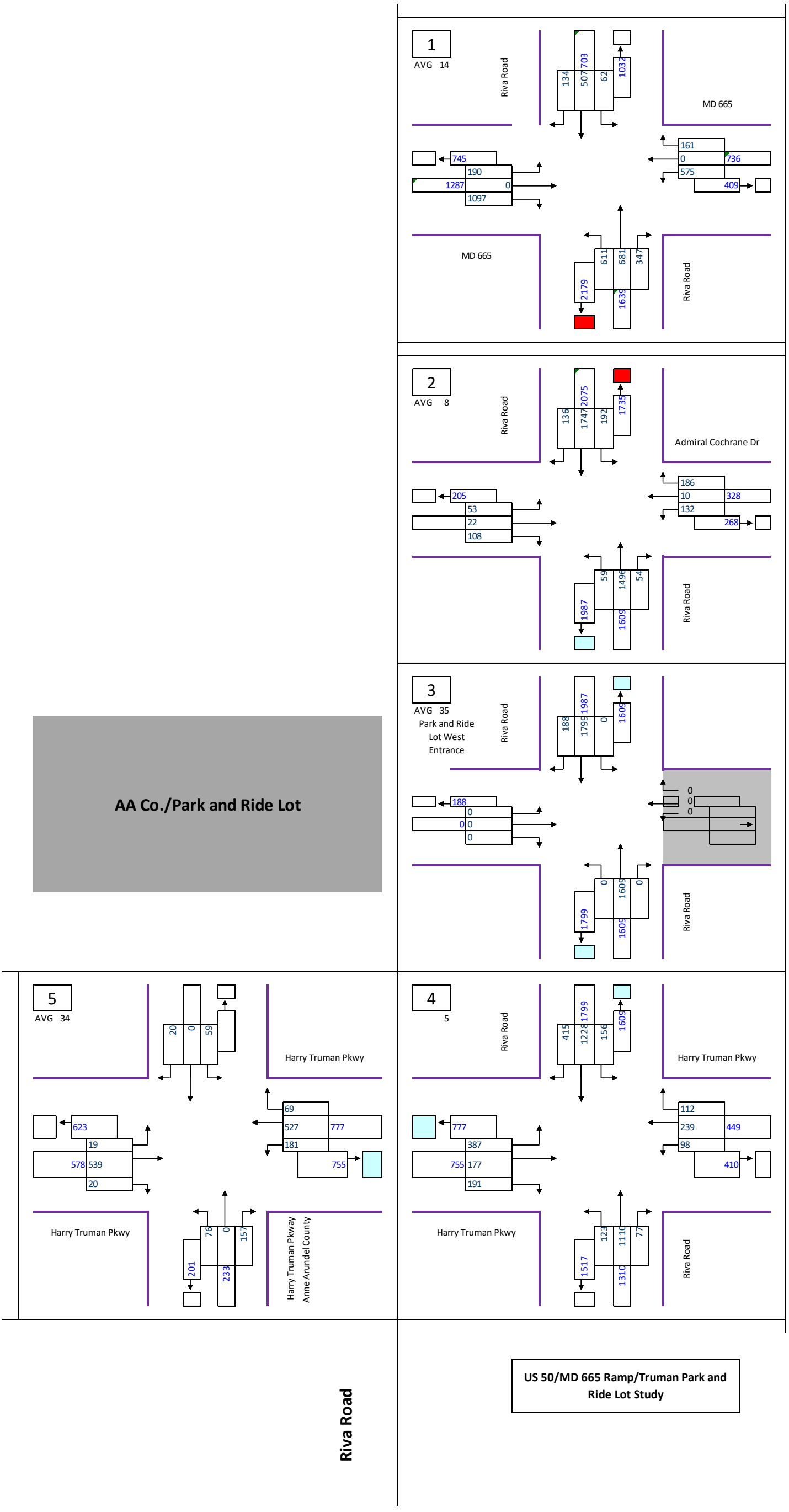


Figure 4-2: Future Year 2045 AM Volumes

Figure 4-3: Future Year 2045 PM Volumes

Table 4-1: AM Peak – Major Approach Volumes and Latent Demand

Key Entry Points	AM Peak				
	Existing VISSIM Model	Future Volumes (BMC Growth)	Future VISSIM Model	% Trips Loaded	Latent Demand
EB MD 665 Ramps	1,243	1,467	1,287	88%	180
WB MD 665 Ramps	532	740	736	99%	4
NB Riva Rd	1,254	1,400	1,310	94%	90
SB Riva Rd	632	788	703	89%	85
WB Harry Truman Parkway	266	450	449	100%	1
EB Harry Truman Parkway	519	632	578	92%	54
Park and Ride lot site	67	87	79	90%	8
AA Hospital site	44	305	233	76%	72

Table 4-2: PM Peak – Major Approach Volumes and Latent Demand

Key entry points	PM Peak				
	Existing VISSIM Model	Future Volumes (BMC Growth)	Future VISSIM Model	% Trips Loaded	Latent Demand
EB MD 665 Ramps	1,040	1,732	1,096	63%	636
WB MD 665 Ramps	468	716	592	83%	124
NB Riva Rd	1,431	1,915	1,784	93%	131
SB Riva Rd	1,123	1,212	1,163	96%	49
WB Harry Truman Parkway	479	727	568	78%	159
EB Harry Truman Parkway	699	827	752	91%	75
Park and Ride lot site	224	431	330	58%	101
AA Hospital site	266	405	368	91%	37

In addition to the latent demand, the segment level travel times, delays, and Level of Service (LOS) were estimated with highway segment LOS determined using the criteria included in **Table 4-3**. **Table 4-4** shows the results for selected roadway segments in the study area.

Table 4-3: LOS Criteria for Urban Arterials

Travel Speed as a Percentage of Base Free Flow Speed (%)	LOS by Volume-to-Capacity Ratio	
	<= 1.0	> 1.0
>85	A	F
>67-85	B	F
>50-67	C	F
>40-50	D	F
>30-40	E	F
<=30	F	F

Table 4-4: Future Segment Travel Times and Delay

Segment	AM Peak Hour			PM Peak Hour		
	Travel Time (mins/veh)	Delay (mins/veh)	LOS	Travel Time (mins/veh)	Delay (mins/veh)	LOS
WB MD 665 off ramp to SB Riva Road	2.49	1.93	F	2.19	1.62	F
WB MD 665 off ramp to NB Riva Road	0.51	0.18	C	0.58	0.28	C
NB Riva Road to EB MD 665 on ramp	0.55	0.08	A	0.89	0.42	C
NB Riva Road to WB MD 665 on ramp	0.74	0.29	C	1.26	0.81	E
EB MD 665 to SB Riva Road	3.91	3.48	F	2.86	2.47	F
EB MD 665 to NB Riva Road	3.70	3.36	F	3.24	2.89	F
NB Riva Road (Truman Parkway to Admiral Cochrane Drive)	3.42	3.10	F	1.39	1.07	F
SB Riva Road (Admiral Cochrane Drive to Truman Parkway)	0.52	0.21	C	0.95	0.64	E
EB Truman Parkway (Park and Ride Lot to Riva Road)	1.59	1.41	F	2.80	2.62	F
WB Truman Parkway (Riva Road to Park and Ride Lot)	0.27	0.09	B	0.42	0.24	D

In the 2045 AM peak hour, the following segments are at LOS F:

- WB MD 665 off ramp to SB Riva Road
- EB MD 665 to SB Riva Road
- EB MD 665 to NB Riva Road
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
- EB Truman Parkway (Park and Ride Lot to Riva Road)

All other segments in the 2045 AM peak hour are at LOS C or better.

In the 2045 PM peak hour, the following segments are at LOS F:

- WB MD 665 off ramp to SB Riva Road
- EB MD 665 to SB Riva Road
- EB MD 665 to NB Riva Road
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
- EB Truman Parkway (Park and Ride Lot to Riva Road)

All other segments in the 2045 PM peak hour are at LOS E or better.

Summary of 2045 Travel Demand Forecast

It should be noted that the findings in this section represent the No Build scenario. The future year 2045 traffic analysis was carried out using the demand growth estimated from the BMC travel model and the 2018 VISSIM model at the intersection level. The future year VISSIM analysis also assumed no network and traffic operational improvements, including signal timings, in the study area.

The BMC regional model analysis showed that traffic volumes in the study area would generally grow at 0.6 to one percent compounding annually with higher growth rates in the PM peak. The main contributor to the traffic growth was the traffic coming from the EB MD 665 ramps to Riva Road in the PM peak. The BMC regional model analysis also suggested that the ridership at the Truman Park and Ride lot would roughly double in size in 2045. This is likely due to the Constrained Long-Range Transportation Plan (CLRP) transit improvements in the US 50 corridor, particularly the addition of US 50 BRT service from Annapolis (Navy Stadium) to the New Carrollton Station.

The future year VISSIM analysis reported more than half (in length) of the study area network would operate at high congestion levels (LOS F) both in the AM peak and PM peak, with the PM peak reporting more segments operating at high congestion levels in the future year. The analysis also reported latent demand at several locations for the trips not able to enter the network due to over-saturated traffic condition in the model. Such latent demand is most significant at the EB MD 665 ramps in the PM peak. The latent demand analysis suggests that the existing network without any mitigation a) is able to handle the future AM peak traffic for the most part, except the EB MD 665 ramps; but b) is unable to handle the future PM peak traffic at most of the entry points. Thus, to improve future traffic conditions and process the significant amount of latent demand in the PM peak, improvements to the roadway network, as well as signal timings, are highly recommended.

Section 5: Concepts, Impacts, and Costs

The 2045 No-Build analysis (Alternative 1) was previously presented in Section 4. This section describes the methodology and assumptions made in the development of the Build Alternative 2, and describes the methods and assumptions made to modify the travel demand model to develop 2045 build forecasts. Future 2045 traffic operational analysis for the Build Alternative 2 are presented with a discussion of potential impacts and associated costs.

Alternatives Development

The proposed Build Alternative (Alternative 2) was developed to address the project Purpose and Need and to minimize impacts to the natural, cultural, and socioeconomic resources within the study area.

The purpose of the US 50/MD 665 Truman Park and Ride Ramp Feasibility Study is to promote and accommodate expanded transit service at the Truman Park and Ride lot and potentially enhance traffic operations and roadway safety along Riva Road and Harry S. Truman Parkway within the study area.

The need for the project is driven by current and projected usage of the Truman Park and Ride lot and traffic congestion and vehicle crash history that cause recurring and non-recurring delay from MD 665 along Riva Road and Harry S. Truman Parkway to the Truman Park and Ride lot.

Prior to conceptual design, various potential alignments were brainstormed and discussed with the County in order to weigh potential constraints and focus design efforts. The Build Alternative focuses on access to the Park and Ride lot – modifications to the Park and Ride lot site layout are not within the scope of this study. Additionally, a Transportation System Management (TSM) alternative that contains minor roadway improvements and other strategies to assist with traffic operations was not part of the scope of work.

The US 50/MD 665 Truman Park and Ride Ramp Alternatives considered for this study include:

- Alternative 1: No-Build
- Alternative 2: Addition of Ramps to Truman Park and Ride lot

Alternative 2 consists of proposed new ramp alignments to/from US 50/MD 665 and the Truman Park and Ride lot that accommodate the anticipated future (2045) traffic and the safe passage of vehicles in the study area. This alternative is described in more detail in the following sections.

No-Build (Alternative 1)

The No-Build Alternative serves as a basis of comparison of the benefits and impacts of the Build Alternative. The future No-Build conditions within the study area roadway network reflect forecasted increases in vehicular traffic volumes associated with transit improvements adopted in the Constrained Long-Range Transportation Plan (CLRP).

The 2045 No-Build analysis was previously presented in Section 4 and assumed no network and traffic operational improvements, including signal timings, in the study area. The traffic model analysis suggested that the ridership at the Truman Park and Ride lot would roughly double in size in 2045, likely due to the CLRP transit improvements in the US 50 corridor, particularly the addition of US 50 BRT service from Annapolis (Navy Stadium) to the New Carrollton Station.

The 2045 No-Build traffic analysis reported more than half (in length) of the study area network would operate at high congestion levels (LOS F) both in the AM peak and PM peak, with the PM peak reporting more segments operating at high congestion levels by 2045. The model analysis also identified latent demand at several locations for the trips not able to enter the network due to over-saturated traffic conditions in the model. Such latent demand is most significant at the eastbound MD 665 ramps in the PM peak. The latent demand analysis also suggests that the existing network, without the application of mitigation measures, is generally able to handle the future AM peak traffic, with the exception of the eastbound MD 665 ramps. However, the analysis findings also suggest the network will be unable to accommodate the future PM peak traffic at most entry points.

Build Alternative (Alternative 2)

Design Criteria

Horizontal geometry for US 50/MD 665 Truman Park and Ride Ramp Feasibility Study is based on Anne Arundel County and Maryland Department of Transportation State Highway Administration (MDOT SHA) design standards, the American Association of State Highway and Transportation Officials (AASHTO) "Green Book", and supporting guidance materials assuming the following guidelines:

- Anne Arundel County functional classification: Minor Arterial
- AASHTO functional classification: Urban Minor Arterial
- Minimum posted speed: 25 mph
- Design speed: 30 mph (where possible, based on County direction)

The project design criteria used to develop the Build Alternative consists of the following:

- Horizontal Alignment
  - Minimum radius
    - 231 ft. (30 mph) (*AASHTO 2011*)
    - 144 ft. (25 mph) (AASHTO 2011)
  - Superelevation (emax): 8% (*County Design Manual "Roads and Streets"*)
- Underclearance height: 16'-9"
- Design vehicle: WB-67
  - Minimum curb radius: 44.8' (*AASHTO 2011*)
- Minimum curb fillet radius
  - Local - Minor Arterial: 20' (*County Design Manual "Roads and Streets"*)
  - Principal Arterial - Minor Arterial: 30' (*County Design Manual "Roads and Streets"*)
- Roundabout
  - Design Speed: 20 mph (*AASHTO 2011*)

- Typical inscribed diameter: 90 to 150’ (*AASHTO 2011*)

Description

Build Alternative 2 Options 1 and 2 (shown in **Figures 5-1** and **5-2**) are intended to improve safety in the study area by adding new dedicated ramps for the Truman Park and Ride lot, while minimizing impacts to property and area resources.

To enter the Park and Ride lot, two off-ramps from the existing MD 665 ramp are proposed. For eastbound US 50 vehicles, an off-ramp was added to the existing eastbound US 50 to eastbound MD 665 ramp, just east of the eastbound US 50 exit, which will require a retaining wall to be constructed to accommodate the change in elevation. To maintain access to the existing utilities between eastbound US 50 and the MD 665 ramp, access would be provided from the new ramp shoulder rather than the existing access road. Additionally, grading (fill) will be necessary to accommodate the 5% maximum grade and some forest impacts are likely. To access the Park and Ride lot, the ramp curves south, joining a two-way access road that crosses under MD 665 through a culvert or over a bridge (to be determined in future stages of design). The roundabout would need to be designed to accommodate a WB-67 design vehicle. The proposed roundabout has a 50’ inscribed radius and grading (fill) will be necessary to accommodate the grade difference between MD 665 and the roundabout.

For westbound US 50 vehicles, an off-ramp was added to the existing westbound US 50 to eastbound MD 665 off-ramp that provides direct access to the proposed roundabout. This ramp impacts wooded areas and a portion of the Annapolis Maryland Department of Transportation Motor Vehicle Administration (MVA) parking lot. Impacts to the recently reconstructed MDOT SHA stormwater management facility should be avoided and/or minimized under this option.

To exit the Park and Ride lot, two additional ramps connect to eastbound US 50 and westbound US 50/MD 665. Both ramps cross under the existing MD 665 bridge over US 50 (MDOT SHA Structure No. 020162001). Under the existing bridge, a guardrail or barrier wall will be required to safely separate the ramp from eastbound US 50 and a proposed retaining wall will tie into the existing structure. Vehicles travelling to eastbound US 50 from the Park and Ride lot will have a yield condition at the existing westbound MD 665 to eastbound US 50 ramp and vehicles travelling to westbound US 50 will merge onto westbound MD 665 prior to the existing MD 665 bridge over US 50. The loop ramp to westbound MD 665 will require a mechanically stabilized earth (MSE) wall and will also have impacts to wooded areas.

Two access options are proposed for the Truman Park and Ride lot from the roundabout – Option 1 connects the roundabout to the lot directly to the south via a culvert over the tributary to Broad Creek and Option 2 includes the same system of ramps from US 50/MD 665 but would connect the roundabout and lot via a slightly different alignment that ties-in at the northeast corner of the Truman Park and Ride lot. Option 2 would also cross over the tributary to Broad Creek. Option 2 would avoid significant impacts to wooded areas; however, it may require additional excavation/grading earthwork to accommodate a 5% maximum grade.

In future phases of design, modifications to site layout will be required to optimize bus circulation for these proposed options.

ASSUMED VERTICAL CLEARANCE 16'-9"

POTENTIAL IMPACT TO OVERHEAD SIGN

POTENTIAL AREA FOR SWM FACILITY

PROP. UTILITY ACCESS

WORK REQUIRED ON EXISTING BRIDGE ABUTMENT SLOPE PAVING

POTENTIAL AREA FOR SWM FACILITY

YIELD CONDITION

POTENTIAL EXPANSION OF EXISTING SWM FACILITY

PROP. MSE WALL TIES INTO EXISTING WALL

IN FUTURE PHASES OF DESIGN, MODIFICATIONS TO SITE LAYOUT WILL BE REQUIRED FOR BUS CIRCULATION

50

MARYLAND 665

ARIS T ALLEN BLVD

HARRY S. TRUMAN PKY

RIVA RD

Legend

- Parcel Lines
- Streams
- MDNR Wetlands
- NWI Wetlands
- Proposed Bridge
- Proposed Asphalt
- Proposed Concrete
- Proposed Limit of Disturbance
- Proposed Concrete Barrier
- Proposed Retaining Wall

US 50/MD 665 TRUMAN PARK AND RIDE RAMP FEASIBILITY STUDY

FIGURE 5-1: BUILD ALTERNATIVE 2 - OPTION 1

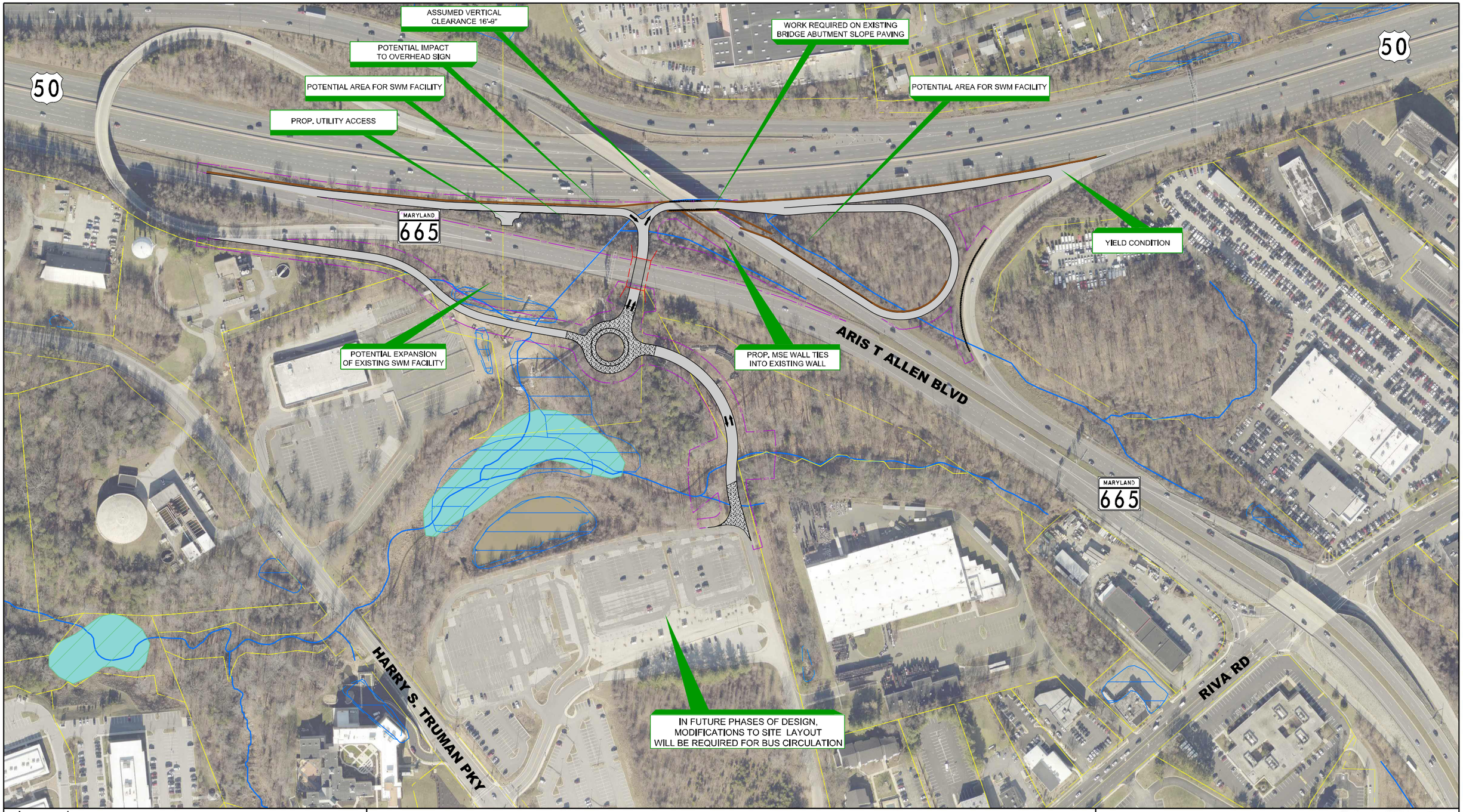
September 2021

120' 0 120' 240'

SCALE: 1"=120'

ANNE ARUNDEL COUNTY MARYLAND

AECOM



Legend

- Parcel Lines
- Streams
- MDNR Wetlands
- NWI Wetlands
- Proposed Bridge
- Proposed Asphalt
- Proposed Concrete
- Proposed Limit of Disturbance
- Proposed Concrete Barrier
- Proposed Retaining Wall

US 50/MD 665 TRUMAN PARK AND RIDE RAMP FEASIBILITY STUDY

FIGURE 5-2: BUILD ALTERNATIVE 2 - OPTION 2

September 2021

120' 0 120' 240'
SCALE: 1"=120'

ANNE ARUNDEL COUNTY MARYLAND

AECOM

Typical Sections

Typical sections for the various components of Alternative 2 include the following:

- Eastbound US 50 to the crossing of MD 665, prior to roundabout: 16’ travel lane, 2' inside shoulder, 2' outside shoulder
- Westbound US 50 to the roundabout: 16’ travel lane, 2' inside shoulder, 2' outside shoulder
- Access from MD 665 crossing to eastbound US 50 and westbound US 50: 16’ travel lane, 2' inside shoulder, 2' outside shoulder
- Two lane section approaching roundabout: two 12’ travel lanes, 2' inside shoulder, 2' outside shoulder
- Park and Ride Lot Access Options 1 and 2: two 12' travel lanes, 2' inside shoulder, 2' outside shoulder

Traffic Modeling Analysis for Build Alternative 2

This section discusses the travel demand and traffic simulation modeling processes and results for the 2045 Build Alternative.

2045 Build Alternative 2

The modeling analysis for the No-Build future year (2045) traffic conditions, as described in Section 4, helped identify roadway capacity deficiencies and additional Park and Ride lot access options in the study area. These provided the basis for the development of the Build Alternative options (**Figures 5-1** and **5-2**).

The Build Alternative 2 Options propose two slightly different access alignments for connecting the Park and Ride lot with US 50 and MD 665. It was determined that the difference between these two access options was minimal from a traffic modeling perspective, and thus only Option 1 was used for the modeling analysis, assuming that Option 2 will provide similar results. It was further assumed that the added ramps and Park and Ride lot access roads in the Build Alternative 2 Options could be used by buses, Park and Ride lot users, and other vehicular traffic in the study area.

Due to the new ramps in the Build Alternative 2, both the travel demand model and traffic simulation model networks were expanded/adjusted to properly incorporate the resulting new traffic movements and routing options from the added ramps. Specifically, the US 50 mainline and on/off ramps between the US 50/MD 665 interchange and the US 50/MD 450 interchange were added into the traffic simulation model network for properly analyzing the traffic on the new ramps, as shown in **Figure 5-3**.

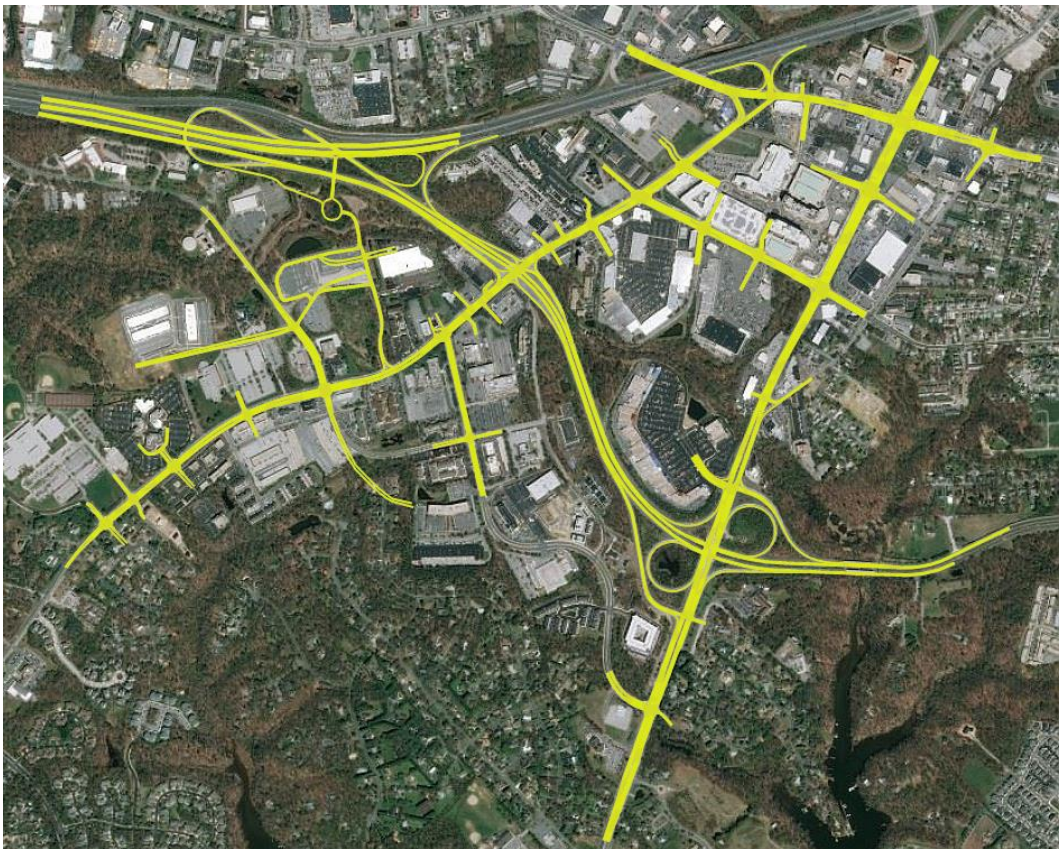


Figure 5-3: VISSIM Model Network for Alternative Analysis

In addition to making similar highway network refinements for the 2045 BMC model, eleven (11) transit routes serving longer-distance trips in the BMC model were adjusted to serve the Park and Ride lot. The newly opened "Parole Sprinter" transit service was also added into the BMC model, per the County's request. The twelve (12) additional transit routes added into the model to serve the Park and Ride lot are:

- MTA Route 210 SB (Baltimore-Annapolis)
- MTA Route 210A NB (Kent Island & Annapolis to Baltimore)
- MTA Route 210B NB (Annapolis to Baltimore)
- MTA Route 215 SB (Annapolis-Baltimore)
- MTA Route 240 (Kent Island-Washington DC)
- MTA Route 250 (Kent Island-Davidsonville-Washington DC)
- MTA Route 260 (Severna Park -Davidsonville-Washington DC)
- MTA-LRT US 50 BRT EB (New Carrollton MARC to Annapolis/Navy Stadium)
- MTA-LRT US 50 BRT WB (Annapolis (Navy Stadium) to New Carrollton MARC)
- MTA YTS 921 EB (New Carrollton MARC-Annapolis)
- MTA YTS 921 WB (Annapolis-New Carrollton MARC)
- Anne Arundel County Parole Sprinter

Future Traffic Volumes

Using the same modeling approach described in Section 4, the refined base year BMC model and future year BMC model for Build Alternative 2 was used to estimate the future year growth for both AM and PM peaks at an intersection level for study intersections and at an approach level for external entry points for the build alternative concept. The BMC model performs highway assignment at the peak period level: AM peak (6:30 AM – 9:30 AM) and PM peak (3:30 PM – 6:30 PM). The peak period model volumes were factored to peak hour using the capacity factor from the highway assignment.

Due to the traffic usage assumption made for the new ramps from the first set of highway assignments, a significant amount of traffic was observed to use the new ramps to and from the Park and Ride lot as a shortcut to avoid the traffic congestion on Riva Road and MD 665. Further network speed adjustments were performed to balance the traffic routing preferences between the new ramps and the local road network. Specifically, the traffic speeds in the Park and Ride lot were reduced to 5 MPH. The speed adjustments resulted in roughly a 30% reduction of traffic using the new ramps in the AM and an approximately 50% reduction in the PM.

As with the 2045 No-Build analysis, the NCHRP Report 765 recommended procedure of model post-processing was used to calculate the growth for a) each of turning movement for the study area intersections and b) approach volumes for the external entry points. The team also performed checks to account for unreasonably high or low growth projections, which resulted in some additional adjustments to the turning movement volumes estimated by the BMC model.

Table 5-1 below compares the AM and PM travel demand from both the 2045 No-Build and the 2045 Build Alternative (Alternative 2).

Table 5-1: Travel Demand Comparison (No-Build vs. Build)

Peak Hour	No-Build (Alternative 1)	Build Alternative (Alternative 2)	% Change
AM	20,386	21,311	4.5%
PM	26,041	27,291	4.8%

Overall, the travel demand provided by the BMC model for the Build alternative concept traffic simulation analysis is 4.5% - 4.8% greater than for No-Build condition. This is largely because of both the added ramps and/improved network connectivity, as well as enhanced Park and Ride lot utilization from rerouted and added transit services in the study area.

The ridership output from the BMC travel demand model is shown in **Table 5-2** and the derived peak hour Drive-Access ridership is shown in **Table 5-3**. It is worth noting that the Drive-Access mode includes both drive and park at the Park and Ride lot and pick-up/drop-off trips.

Table 5-2: BMC Model Transit Ridership at Park and Ride Lot Location

Access Mode	Peak Period	Off-Peak Period	Daily
Walk-Access	77	20	97
Drive-Access	2,333	1,154	3,487
Walk-Egress	186	28	214
Total	2,596	1,201	3,797

Table 5-3: Derived Peak Hour Transit Ridership at Park and Ride Lot Location

Access Mode	AM Peak Hour Inbound	PM Peak Hour Outbound
Drive-Access	840	1,027

Future Year VISSIM Analysis

The 2045 future year VISSIM analysis was carried out using the balanced volumes from the growth process described above and the new ramps in Build Alternative 2 were added into the network. The network was expanded/adjusted to incorporate the resulting new traffic movements and routing changes resulting from the added ramps. Facilities such as US 50 mainline and the on/off ramps between the US 50/MD 665 interchange were added into the traffic simulation model network based on the build alternative concept. Thus, the future year analysis included the Build Alternative 2 network updates, 2045 demand updates, and changes in the travel patterns of the trips because of the new ramps. However, no changes have been made to the signal timings of the intersections in the model. The AM peak hour and PM peak hour volumes are shown in **Figure 5-4** and **Figure 5-5**.

Loading the 2045 demand on the network without capacity and operational improvements caused traffic over-saturation issues at several intersections, and thus not all 2045 demand was able to load onto the network during the peak hours. The vehicles which were unable to load into the model due to congestion in the VISSIM model are reported as latent demand in the model. The **Tables 5-4** and **5-5** below show the approach volumes at key entry points for the existing year VISSIM model, future growth from BMC, future year VISSIM model, and latent demand, along with the percentage of trips able to load into the VISSIM model for 2045. As shown in the tables, the existing network without any mitigation a) is unable to handle the future AM peak traffic for the most of the entry points with significant latent demand at various approaches; and b) is unable to handle the future PM peak traffic at most of the entry points with significant amount of latent demand reported at the SB MD 665 ramps. Therefore, for the intersections where the volumes have been under-estimated due to high demand and severe congestion, a growth factor based on the travel demand model has been applied to the intersection turning movements. A similar methodology was applied to the No-Build (Alternative 1).

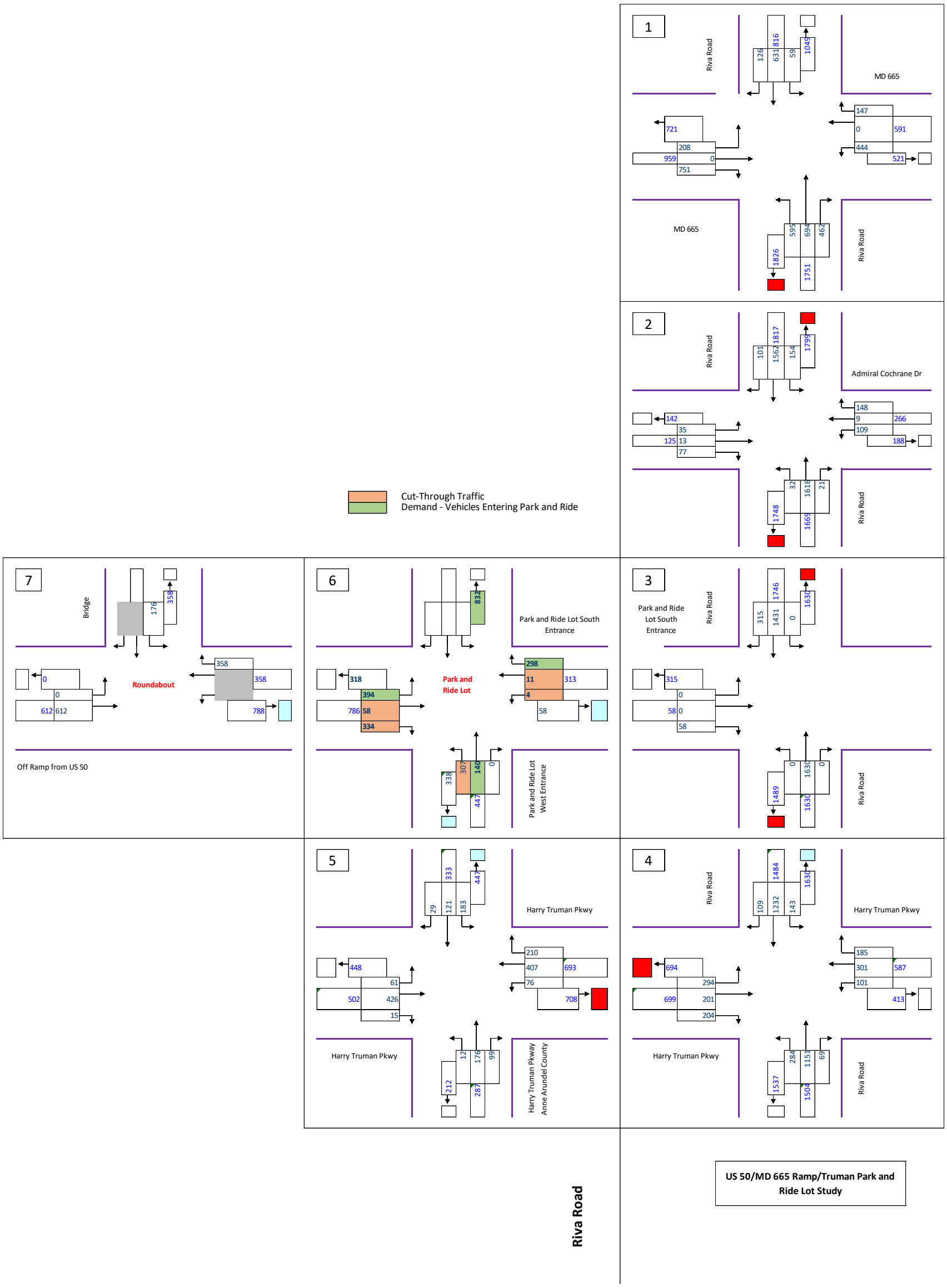


Figure 5-4: Future Year 2045 AM Volumes – Build Alternative 2

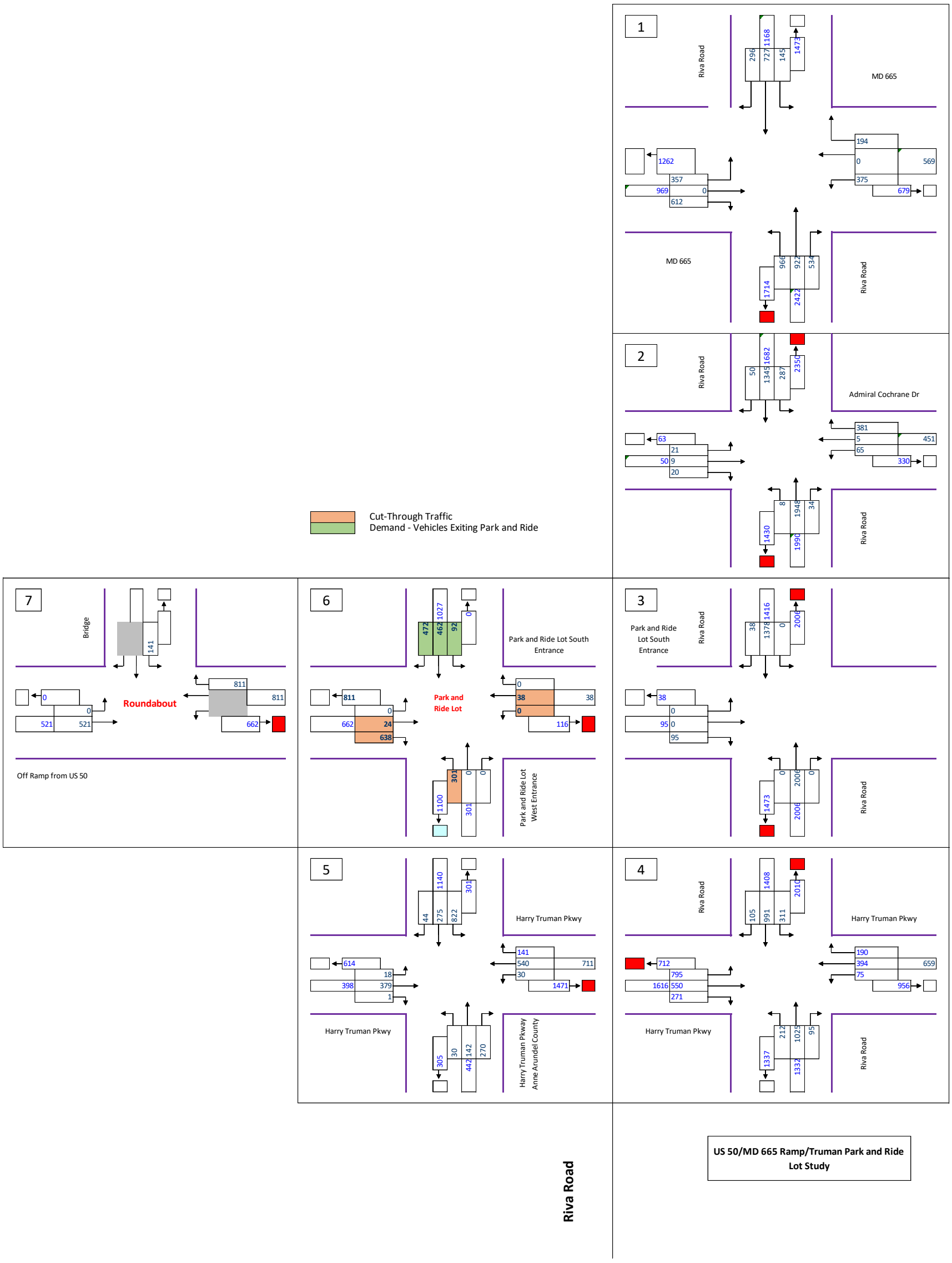


Figure 5-5: Future Year 2045 PM Volumes – Build Alternative 2

Table 5-4: AM Peak Major Approach Volumes and Latent Demand – Build Alternative 2

Key Entry Points	AM Peak				
	Existing VISSIM Model	Future Volumes (BMC Growth)	Future VISSIM Model	% Trips Loaded	Latent Demand
EB MD 665 Ramps	1,243	1,294	959	74%	335
WB MD 665 Ramps	532	875	591	68%	284
NB Riva Rd	1,254	1,575	1,504	95%	71
WB Harry Truman Parkway	266	545	517	95%	28
EB Harry Truman Parkway	519	651	479	74%	172
AA Hospital Site	44	359	247	69%	112
EB On Ramp	N/A	633	612	97%	21
Bridge	N/A	196	176	90%	20

Table 5-5: PM Peak Major Approach Volumes and Latent Demand – Build Alternative 2

Key Entry Points	PM Peak				
	Existing VISSIM Model	Future Volumes (BMC Growth)	Future VISSIM Model	% Trips Loaded	Latent Demand
EB MD 665 Ramps	1,040	1,214	969	80%	245
WB MD 665 Ramps	468	725	569	78%	156
NB Riva Rd	1,431	1,483	1,349	91%	134
WB Harry Truman Parkway	479	814	659	81%	155
EB Harry Truman Parkway	699	499	398	80%	101
AA Hospital site	266	598	442	74%	156
EB On Ramp	N/A	547	521	95%	26
Bridge	N/A	167	141	84%	26

In addition to the latent demand, the segment level travel times, delays, and Level of Service (LOS) were estimated with highway segment LOS determined using the criteria included in **Table 5-6**. **Table 5-7** shows the travel times and delay results for selected roadway segments in the study area.

Table 5-6: LOS Criteria for Urban Arterials

Travel Speed as a Percentage of Base Free Flow Speed (%)	LOS by Volume-to-Capacity Ratio	
	<= 1.0	> 1.0
>85	A	F
>67-85	B	F
>50-67	C	F
>40-50	D	F
>30-40	E	F
<=30	F	F

Table 5-7: 2045 Build Alternative 2 Segment Travel Times and Delay

Segment	AM Peak Hour			PM Peak Hour		
	Travel Time (mins/veh)	Delay (mins/veh)	LOS	Travel Time (mins/veh)	Delay (mins/veh)	LOS
WB MD 665 off ramp to SB Riva Road	1.61	1.08	E	2.31	1.86	F
WB MD 665 off ramp to NB Riva Road	2.12	1.85	F	0.51	0.31	E
NB Riva Road to EB MD 665 on ramp	2.17	1.74	F	1.57	1.14	F
NB Riva Road to WB MD 665 on ramp	1.09	0.68	E	1.12	0.71	E
EB MD 665 to SB Riva Road	2.79	2.36	F	4.53	4.10	F
EB MD 665 to NB Riva Road	5.27	4.91	F	4.75	4.39	F
NB Riva Road (Truman Parkway to Admiral Cochrane Drive)	3.10	2.79	F	1.42	1.10	F
SB Riva Road (Admiral Cochrane Drive to Truman Parkway)	0.75	0.45	D	1.61	1.30	F
EB Truman Parkway (Park and Ride Lot to Riva Road)	2.78	2.61	F	3.14	2.96	F
WB Truman Parkway (Riva Road to Park and Ride Lot)	0.47	0.29	E	0.42	0.24	D
US 50 East Ramp to Park and Ride Lot	4.65	3.54	F	37.84	36.73	F
US 50 West Ramp to Park and Ride Lot	2.39	1.74	F	34.12	33.48	F

In the AM peak hour, the following segments are at LOS F:

- WB MD 665 off ramp to NB Riva Road
- NB Riva Road to EB MD 665 on ramp
- EB MD 665 to SB Riva Road
- EB MD 665 to NB Riva Road
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
- EB Truman Parkway (Park and Ride Lot to Riva Road)
- US 50 East Ramp to Park and Ride Lot
- US 50 West Ramp to Park and Ride Lot

All other segments in AM peak hour are at LOS E or better.

In the PM peak hour, the following segments are at LOS F:

- WB MD 665 off ramp to SB Riva Road
- NB Riva Road to EB MD 665 on ramp
- EB MD 665 to SB Riva Road
- EB MD 665 to NB Riva Road
- NB Riva Road (Truman Parkway to Admiral Cochrane Drive)
- SB Riva Road (Admiral Cochrane Drive to Truman Parkway)
- EB Truman Parkway (Park and Ride Lot to Riva Road)
- US 50 East Ramp to Park and Ride Lot
- US 50 West Ramp to Park and Ride Lot

All other segments in PM peak hour are at LOS E or better.

Traffic Analysis Summary

The 2045 traffic analysis for Build Alternative 2 was carried out using the demand growth estimated from the BMC travel model and the 2018 VISSIM model at the intersection level. With the new ramps and access road to and from the Park and Ride lot, the modeling analysis for Build Alternative 2 assumed no other traffic operational improvements, including signal timings, in the study area.

The 2045 VISSIM analysis for Build Alternative 2 reported more than half (in length) of the study area network would operate at high congestion levels (LOS F) in both the AM peak and PM peak hours, with both AM and PM peak hours reporting more segments operating at high congestion levels in 2045 than in the No-Build (Alternative 1).

The 2045 No-Build Traffic Analysis is shown alongside the 2045 Build Traffic Analysis in **Table 5-8**. Generally, the Build condition worsens from the No-Build condition. This is at least partially due to the future Build condition including re-routed longer-distance transit trips through the Park and Ride as a result of enhanced access. The only roadway segment that shows

a Level of Service improvement between the No-Build and the Build condition is the westbound MD 665 off ramp to southbound Riva Road in the AM peak hour.

Table 5-8: 2045 Build vs. No-Build Traffic Analysis (Roadway Segments)

Segment	AM Peak Hour						PM Peak Hour					
	Build			No-Build			Build			No-Build		
	Travel Time (mins/veh)	Delay (mins/veh)	LOS	Travel Time (mins/veh)	Delay (mins/veh)	LOS	Travel Time (mins/veh)	Delay (mins/veh)	LOS	Travel Time (mins/veh)	Delay (mins/veh)	LOS
WB MD 665 off ramp to SB Riva Road	1.61	1.08	E	2.49	1.93	F	2.31	1.86	F	2.19	1.62	F
WB MD 665 off ramp to NB Riva Road	2.12	1.85	F	0.51	0.18	C	0.51	0.31	E	0.58	0.28	C
NB Riva Road to EB MD 665 on ramp	2.17	1.74	F	0.55	0.08	A	1.57	1.14	F	0.89	0.42	C
NB Riva Road to WB MD 665 on ramp	1.09	0.68	E	0.74	0.29	C	1.12	0.71	E	1.26	0.81	E
EB MD 665 to SB Riva Road	2.79	2.36	F	3.91	3.48	F	4.53	4.10	F	2.86	2.47	F
EB MD 665 to NB Riva Road	5.27	4.91	F	3.70	3.36	F	4.75	4.39	F	3.24	2.89	F
NB Riva Road (Truman Parkway to Admiral Cochrane Drive)	3.10	2.79	F	3.42	3.10	F	1.42	1.10	F	1.39	1.07	F
SB Riva Road (Admiral Cochrane Drive to Truman Parkway)	0.75	0.45	D	0.52	0.21	C	1.61	1.30	F	0.95	0.64	E
EB Truman Parkway (Park and Ride Lot to Riva Road)	2.78	2.61	F	1.59	1.41	F	3.14	2.96	F	2.80	2.62	F
WB Truman Parkway (Riva Road to Park and Ride Lot)	0.47	0.29	E	0.27	0.09	B	0.42	0.24	D	0.42	0.24	D
US 50 East Ramp to Park and Ride Lot	4.65	3.54	F	Ramp not present			37.84	36.73	F	Ramp not present		
US 50 West Ramp to Park and Ride Lot	2.39	1.74	F	Ramp not present			34.12	33.48	F	Ramp not present		

An increased Park and Ride demand has been noticed. This is because of rerouted and added transit services in Build Alternative 2. Furthermore, the new ramps have altered the travel patterns of trips. The new ramps facilitate easy access to US 50 and MD 665 and the easy access to these major facilities has attracted trips from neighboring regions which use the Park and Ride lot as a pass-through to reach the destination. Thus, to a small degree, these new ramps have increased the travel demand in the study area.

The analysis also reported latent demand at several locations for the trips not able to enter the network due to over-saturated traffic conditions in the model. Such latent demand is most

significant at the MD 665 ramps and the Harry S. Truman Parkway approaches. The latent demand analysis suggests that the existing network is unable to handle the future AM and PM peak traffic. The new ramps are congested, as well, due to the increased Park and Ride lot demand and the additional through traffic through the Park and Ride lot. In order to improve the traffic conditions and to process the significant amount of latent demand in the PM peak, additional improvements in the network, as well as signal timing modifications, are highly recommended.

Traffic operations on the new ramps would be improved if through traffic was prohibited; however, other study area intersections and roadways segments would be adversely affected. The entire 2045 roadway network in the study area is highly congested in the AM and PM peak. Evaluating additional improvements to the roadway network was not within the scope of this study.

Impacts and Costs

The Study Team identified the preliminary impacts of the two Build Alternative 2 Options. The impacts are summarized in **Table 5-9**. Impacts will be refined in later stages of design.

Table 5-9: Impacts Summary – Build Alternative 2 Options

Description	Impact	
	Option 1	Option 2
Parcels Affected	3	4
Non-MDOT SHA or County Right-of-Way	0	37 SF
Displacements (Commercial or Residential)	0	0
Forest	15.3 AC	7.2 AC
Stream	2,312 LF	2,487 LF

The addition of roadway under the MD 665 bridge over US 50 (MDOT SHA Structure Number 020162001) will likely require some modifications to the bridge structure which may increase impacts at that location. Impacts will be refined as design progresses.

Preliminary cost estimates were developed for the two Build Alternative 2 Options using the MDOT SHA Highway Construction Cost Estimating Manual and recent project unit costs. The cost estimates are summarized in **Table 5-10**. Preliminary engineering costs were estimated as 30 percent of the construction costs, based on MDOT SHA recommendations. Right-of-way costs were not included due to impacts occurring on parcels owned by MDOT SHA and Anne Arundel County – there is a small commercial property impact for Option 2, which may be avoided in future design phases. Additionally, no Park and Ride site layout modifications are included in the cost estimates.

Table 5-10: Cost Estimate Summary

Category	Option 1	Option 2
Construction Project Cost	$21,900,000	$22,500,000
Engineering Cost	$6,600,000	$6,800,000
Total	**$28,500,000**	**$29,300,000**

Detailed cost estimates for Build Alternative 2 Options 1 and 2 are included in **Appendix D**. Some additional cost estimating assumptions are detailed below:

Category 3 (Drainage)

- Assume storm sewers are located along barrier if on the low side of roadway; all other sections assume open ditches or trench inlets

Category 4 (Structures)

- Bridge structure includes 2' shoulders as well as 2' parapets on each side of the structure

Category 5 (Paving)

- Concrete pavement at intersections extends approximately 100' behind the stop bar. Concrete was assumed within the roundabout. Asphalt pavement is included on shoulders.
- Curb and gutter located on roundabout island, the culvert under the existing US 50/MD 665 ramp, and the tie-in to the parking lot. All other roadway sections assume open sections with ditches.

Category 6 (Shoulders)

- Includes barrier and guardrail (guardrail assumed along 20% of the alignment length)
- No sidewalk included on ramps or access roads

Summary

The US 50/MD 665 Truman Park and Ride Lot Alternatives considered for this study include Alternative 1: No-Build and Alternative 2, Options 1 and 2: Addition of Ramps to Truman Park and Ride lot. Preliminary cost estimates were developed for the Build Alternative 2 Options, which do not include Park and Ride site layout modifications – $28.5 M for Option 1 and $29.3 M for Option 2.

Future 2045 traffic operational analysis for the Build alternative concept reported more than half (in length) of the study area network would operate at high congestion levels (LOS F) in both the AM peak and PM peak hours, with both AM and PM peak hours reporting more segments operating at high congestion levels in 2045 than in the No-Build condition.

An increased Park and Ride lot demand has been noticed. This is because of rerouted and added transit services in the Build alternative concept. Furthermore, the new ramps have altered the travel patterns of trips. The new ramps facilitate easy access to US 50 and MD 665 and the easy access to these major facilities has attracted trips from neighboring regions which use the Park and Ride lot as a pass-through to reach the destination.

The analysis also reported latent demand at several locations for the trips not able to enter the network due to over-saturated traffic conditions in the model. The latent demand analysis suggests that the existing network is unable to handle the future AM and PM peak traffic. The new ramps are congested, as well, due to the increased Park and Ride lot demand and the additional through traffic through the Park and Ride lot. In order to improve the traffic conditions and to process the significant amount of latent demand in the PM peak, additional improvements in the network, as well as signal timing modifications, are highly recommended.

Traffic operations on the new ramps would be improved if through traffic was prohibited. While the limited traffic on the ramps may improve, other study area intersections and roadways segments would be adversely affected. The entire 2045 roadway network in the study area is highly congested in the AM and PM peak. Evaluating additional improvements to the roadway network was not within the scope of this study.

Section 6: Public Outreach

A public outreach presentation was prepared, and the information was posted on the County's US 50/MD 665 Truman Park and Ride Ramp Feasibility Study project website. The public comment period was open from May 13, 2022 to June 10, 2022 and input was accepted through email, phone, and the feedback form on the project website. The three comments received are presented below in **Table 6-1** and were not in support of the direct connection ramps to and from US 50/MD 665 to the Harry S. Truman Park and Ride lot. County responses to the comments are also included and this information will be considered in future phases if the project is selected to move forward.

Table 6-1: Public Comments Received

Comment Number	Comment	County Response
1	Sell the park & ride and let someone develop the property into something useful. I'm pretty sure it's only used by the MVA to do drivers tests in. This lot is not located near any attraction, rail station, bus station, or airport. If you park there where would you ride to and how? A highway ramp to 50 or 665 is completely unnecessary considering there is an existing ramp to 665 in close proximity on Riva Rd. This project is a massive waste of tax dollars which means it's inevitable under Pittman's regime.	Thank you for providing input on this project. Your preference for no direct connection ramps to and from US 50/MD 665 to the Harry S. Truman Park and Ride lot is noted.
2	The build alternatives don't acknowledge the large stream restoration project that was constructed on the stream segments between the MVA and the Park and Ride Lot by SHA and Arundel Rivers Federation at great cost to the state. The stream restoration areas should be avoided. These concepts make it appear that the restoration area would be built over.	Thank you for providing input on this project. If this project is selected to move forward, avoidance of the stream restoration areas will be considered in future phases.
3	I have viewed the Outreach Presentation video. I have the following comments and questions. 1) the existing environmental conditions no longer represent what is actually on the ground. There has since been a steam/wetland restoration project that extends from Truman Pkwy to Aris T Allen. the current plan would have additional stream and wetland impacts to that project. Additionally, SHA has recently completed the stormwater "expansion" project that is called out on the plans. 2) The project proposes a yield condition for merging at the off ramp from Aris T Allen to US 50. The merge on to US50 is already very difficult to negotiate. Hard to imagine merging traffic coming from the left before merging on to US50. 3) I recommend dropping further study of direct connection ramps to and from US 50/MD 665 to Harry S. Truman Park and Ride. 4) While feasible, the cost is very high and the improvements appear do little to enhance traffic operations along Riva Rd.	Thank you for providing input on this project. Your preference for dropping further study of direct connection ramps to and from US 50/MD 665 to the Harry S. Truman Park and Ride lot is noted. However, if this project is selected to move forward, updated existing environmental conditions and additional traffic considerations would be included in future phases.

Section 7: Study Summary, Recommendation, and Next Steps

Study Summary and Recommendation

In summary, the Anne Arundel County Office of Transportation studied the feasibility of constructing additional access ramps both to ingress and egress the Harry S. Truman Park and Ride lot to and from US 50 via MD 665. This study concludes that it is feasible to construct the access ramps. However, traffic growth cannot be addressed with only the addition of direct access from the Park and Ride lot to and from US 50/MD 665. Improvements to the area roadway network will be necessary and were not within the scope of this study.

The proposed new ramps in the Build Alternative alter the travel patterns within the Study Area and facilitate easy access to US 50 and MD 665. The enhanced access to and from these roadways attracts travelers who use the Park and Ride lot as a pass-through to reach their destination. Traffic operations on the new ramps would be improved if through traffic was prohibited. However, other study area intersections and roadway segments would be adversely affected. Stated differently, any necessary improvements to reduce or prohibit through-traffic would enhance access for Park and Ride users, but other roadway and intersection upgrades would still be needed to improve traffic operations elsewhere.

Based on the findings of US 50/MD 665 Truman Park and Ride Ramp Feasibility Study, it is not recommended to move forward with this project at this time and to drop further study of direct connection ramps to and from US 50/MD 665 to the Harry S. Truman Park and Ride lot. While the direct connection ramps are feasible, the benefit of the proposed ramps are minor at a very high cost. Additionally, the improvements do not enhance traffic operations along Riva Road. At this time, the study will not move forward, but the improvements will remain an option for consideration in the future.

Future Next Steps

On April 19, 2021, the County Council approved an amendment to Plan 2040 (the General Development Plan for Anne Arundel County) which officially makes Parole Town Center a transit-oriented development (TOD). This designation fully supports the implementation of an improved Truman Park and Ride lot, along with the direct ingress and egress for the Park and Ride lot to and from US 50 via MD 665. The Parole Town Center TOD designation will continue to promote transit use through the future (2045) timeframe.

If, sometime in the future, funding is available and the project was selected to move forward, next steps would then include the development of roadway, transit, pedestrian, and bicycle improvement options that address future growth. In coordination with the Maryland Department of Transportation State Highway Administration (MDOT SHA), the Build Alternative would be refined and the processes for Interstate Access Point Approval and National Environmental Policy Act approval would be initiated with the Federal Highway Administration.

As part of the current study, MDOT SHA Park and Ride Program staff provided the following comments that would be considered and evaluated during future phases if the project were to move forward:

- FHWA coordination regarding Interstate Access Point Approval would be required before design of the proposed interchange could begin. MDOT SHA would facilitate this coordination.
- MDOT SHA states concern about impacts of a future interchanger on commuter parking at the Truman Road Park and Ride lot. We propose future study of the build alternative consider:
  - Traffic impacts of proposed ramps on parking lot operations
  - Forecast of traffic within the parking lot due to ramp traffic
  - Evaluation of conflicts between parking vehicles and cut-through vehicles
  - Evaluation of speed of cut-through traffic
  - Evaluation of additional vehicle circulation needed for cut-through traffic
  - Loss of parking spaces due to increased circulation lanes
- MDOT SHA notes that the feasibility study acknowledges traffic growth in the area roadway network cannot be addressed with only an interchange between US 50 and the Truman Park and Ride lot via MD 665. If this study is pursued as a capital project, MDOT SHA recommends a discussion of costs and benefits be conducted, using identified traffic impacts of the proposed interchange on the MDOT SHA Park and Ride lot, to determine the best future solution.

In future phases of design, detailed survey and utility identification will be necessary. Enhanced pedestrian and bicycle design elements in and around the Park and Ride site will be developed, in addition to site layout modifications to the Park and Ride lot for bus circulation, safe interactions between all modes, and to potentially to make the ramps less desirable for through traffic. Commuter parking impacts at the Park and Ride lot will be evaluated, including the traffic impacts of proposed ramps on parking lot operations.

Appendix A:
U.S. Fish and Wildlife IPAC Resource List

IPaC Information for Planning and Consultation **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Anne Arundel County, Maryland

Local office

Chesapeake Bay Ecological Services Field Office

(410) 573-4599
(410) 266-9127

177 Admiral Cochrane Drive
Annapolis, MD 21401-7307

http://www.fws.gov/chesapeakebay/
http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species

[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis Wherever found This species only needs to be considered if the following condition applies: • Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act [1] and the Bald and Golden Eagle Protection Act [2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31

Canada Warbler Cardellina canadensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Kentucky Warbler Oporornis formosus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prairie Warbler Dendroica discolor This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler Protonotaria citrea This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird Euphagus carolinus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix B:
Crash Data

39085

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel Town/Place: Annapolis
Route: MD 665 (ARIS T. ALLEN BLVD) Log Mile: N/A
☐ at MD # (NAME)
☐ at
☒ from 000.00 to 001.566

Purpose Needed:
☐ Signal Study ☐ Surface Evaluation ☐ Pavement Marking Study
☐ Sign Study ☐ Lighting Study ☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary ☒ Accident History ☒ Accident Rates
☒ Study Worksheet ☒ Collision/Line Diagram ☐ Other (Explain in Remarks)

☐ One Year ☐ Two Years
☒ Three Years ☐ Combined Years
☐ Specific Date(s) to

Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler Title: Planning Administrator
Department: Office of Transportation District: Anne Arundel County#
Phone: 410-222-7462# Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/19/2021

Location: MD 665 (Aris T Allen Blvd) From: US 50 To: MD 2

Logmiles: From 0 To 1.56 Length: 1.56

County: Anne Arundel, D5

Period: January 01, 2017 To December 31, 2019

Note:

Type Controls: 1U-100%

*** Significantly Higher than Statewide**

YEAR >>	2017	2018	2019	Total	Study	StateWd
Fatal	0	0	0	0	0.0	0.3
No. Killed	0	0	0	0		
Injury	6	8	7	21	19.3	15.8
No. Injured	10	14	8	32		
Prop. Damage	14	19	22	55	50.7 *	28.2
Total Crashes	20	27	29	76	70.0 *	44.3
Severity Index	35	50	53	Avg 46		
RATE	56.8	77.3	75.5			
WAADT	61864	61315	67470			
VMT millions	35.2	34.9	38.4	108.6		
Opposite Dir.	0	0	0	0	0.0	0.3
Rear End	10	9	10	29	26.7 *	17.5
Sideswipe	3	3	2	8	7.4	7.5
Left Turn	0	0	0	0	0.0	0.1
Angle	0	0	0	0	0.0	0.5
Pedestrian	0	0	0	0	0.0	0.1
Parked Veh.	0	1	1	2	1.8 *	0.3
Fixed Object	7	10	12	29	26.7 *	11.9
Other	0	4	4	8	7.4 *	0.4
U-Turn	0	0	0	0		
Backing	0	0	1	1		
Animal	0	1	2	3		
Railroad	0	0	0	0		
Fire / Expl.	0	0	1	1		
Overturn	0	1	0	1		
Truck Related	0	0	2	2	1.8	5.0
Night Time	6	10	12	28	37 %	31 %
Wet Surface	1	3	6	10	13 %	21 %
Alcohol	1	0	1	2	3 %	8 %
Intersection	0	0	0	0		
Total Vehicles	37	47	47	131		
Total Trucks	0	0	2	2		
Truck %	0.0	0.0	4.3	1.5		

AADT's Rates are provided from: MDOT Annual Average Daily Traffic (AADT) Locator.

Comments:

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/19/2021

Location: MD 665 (Aris T Allen Blvd) From: US 50 To: MD 2

Logmiles: From 0 To 1.56 Length: 1.56

County: Anne Arundel, D5 Period: January 1, 2017 To December 31, 2019

Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		21	55	76
Veh Occ		32		
Pedestrian				

AVG Severity Index: 46

DAY OF THE WEEK	SUN	MON	TUE	WED	THU	FRI	SAT	UNK
	12	10	7	19	12	7	9	

MONTH OF THE YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
	6	4	3	5	5	3	6	7	8	9	7	13	

CONDITION	DRIVER	PED
Normal:	106	
Alcohol:	2	
Other:	26	

TIME	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:	3	1	1	2	2	3	6	3	7	1		1	
PM:	5	1	5	2	6	11	7	4	1	1	1	2	

VEHICLES INVOLVED PER ACCIDENT	1	2	3	4	5	6+	UNK	TOTAL
	33	34	3	4	1		1	131

VEHICLE TYPE			
3	Motorcycle/Moped	1	Tractor Trailer
79	Passenger Vehicle		Passenger Bus
16	Sport Utility Veh		School Bus
9	Pick-Up Truck	5	Emergency Veh
1	Trucks (2+3 axles)	52	Other Types

SURFACE	
10	Wet
58	Dry
5	Sno/Ice
	Mud
3	Other

MOVEMENTS	NORTH			SOUTH			EAST			WEST		
	LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
								48			67	

OTHER MOVEMENTS 17

PROBABLE CAUSES

2	Influence of Drugs	1	Improper Lane Change
	Influence of Alcohol	1	Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
1	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
13	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
5	Fail to Drive in Single Lane		Clothing Not Visible
	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
1	Exceeded Speed Limit		Debris or Obstruction
1	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
4	Too Fast for Conditions		Traffic Control Device Inop.
5	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	42	Other or Unknown

COLLISION TYPES		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:				
	UnRelated:				
Rear End	Related:				
	UnRelated:		9	20	29
Sideswipe	Related:				
	UnRelated:		2	6	8
Left Turn	Related:				
	UnRelated:				
Angle	Related:				
	UnRelated:				
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:				
	UnRelated:		1	1	2
Other Collision	Related:				
	UnRelated:		2	6	8

F	Bridge	01			
I	Building	02			
X	Culvert/Ditch	03		1	1
E	Curb	04	3	12	15
D	Guardrail/Barrier	05	4	8	12
	Embankment	06			
O	Fence	07			
B	Light Pole	08		1	1
J	Sign Pole	09			
E	Other Pole	10			
C	Tree/Shrubbery	11			
T	Contr. Barrier	12			
S	Crash Attenuator	13			
	Other Fixed Object				

WEATHER		ILLUMINATION		TOTALS	
59	Clear / Cloudy	42	Day	17-19	76
1	Foggy	2	Dawn/Dusk		
7	Raining	15	Dark - Lights On		
3	Snow / Sleet	13	Dark - No Lights		
6	Other	4	Other		

39086

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel Town/Place: Annapolis
Route: Riva Road **(CO 2749)** Log Mile: N/A
☒ at Admiral Cochrane Dr (CO 4155) at
☐ from
☐ to

Purpose Needed:
☐ Signal Study ☐ Surface Evaluation ☐ Pavement Marking Study
☐ Sign Study ☐ Lighting Study ☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary ☒ Accident History ☒ Accident Rates
☒ Study Worksheet ☒ Collision/Line Diagram ☐ Other (Explain in Remarks)

☐ One Year ☐ Two Years
☒ Three Years ☐ Combined Years
☐ Specific Date(s) to

Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler Title: Planning Administrator
Department: Office of Transportation District: Anne Arundel County#
Phone: 410-222-7462# Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: Riva Rd (CO2749) @ Admiral Cochrane Rd (CO4155) Logmiles: 5.1 At 0 Radius: 250 ft.

County: Anne Arundel, D5 Period: January 01, 2017 To December 31, 2019 Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	2	3	0	5
No. Injured	3	3	0	6
Prop. Damage	4	2	5	11
Total Crashes	6	5	5	16
Severity Index	10	8	5	Avg 8
Opposite Dir.	0	0	0	0
Rear End	1	3	2	6
Sideswipe	0	1	0	1
Left Turn	3	1	1	5
Angle	2	0	1	3
Pedestrian	0	0	0	0
Parked Veh.	0	0	1	1
Fixed Object	0	0	0	0
Other	0	0	0	0
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	0	0	0	0
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	1	0	0	1
Night Time	0	0	3	3
Wet Surface	0	0	0	0
Alcohol	0	0	0	0
Intersection	6	5	5	16
Total Vehicles	12	13	10	35
Total Trucks	1	0	0	1
Truck %	8.3	0.0	0.0	2.9

Comments:

Maryland State Highway Administration
Office of Traffic and Safety - Traffic Development and Support
SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg
Date: 01/15/2021

Location: Riva Rd (CO2749) @ Admiral Cochrane Rd (CO4155) Logmiles: 5.1 At 0 Radius: 250 ft.
County: Anne Arundel, D5 Period: January 1, 2017 To December 31, 2019 Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		5	11	16
Veh Occ		6		
Pedestrian				

AVG Severity Index: 8

DAY OF THE WEEK

SUN	MON	TUE	WED	THU	FRI	SAT	UNK
1	3	2	2	3	2	3	

MONTH OF THE YEAR

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
1	1	3	1	1			1	3	2	1	2	

CONDITION	DRIVER	PED
Normal:	27	
Alcohol:		
Other:	9	

TIME

	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:								1	2	2	2		
PM:	1		1	2	1	1			3				

VEHICLES INVOLVED PER ACCIDENT

1	2	3	4	5	6+	UNK	TOTAL
1	11	4					35

VEHICLE TYPE

	Motorcycle/Moped		Tractor Trailer
23	Passenger Vehicle		Passenger Bus
5	Sport Utility Veh		School Bus
3	Pick-Up Truck		Emergency Veh
1	Trucks (2+3 axles)	4	Other Types

SURFACE

	Wet
16	Dry
	Sno/Ice
	Mud
	Other

MOVEMENTS

NORTH			SOUTH			EAST			WEST		
LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
1	1		1	5		3	9		3	7	1

OTHER MOVEMENTS 4

PROBABLE CAUSES

1	Influence of Drugs		Improper Lane Change
	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
2	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
	Fail to Drive in Single Lane		Clothing Not Visible
	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
3	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
	Exceeded Speed Limit		Debris or Obstruction
	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
3	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	7	Other or Unknown

COLLISION TYPES

		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:				
	UnRelated:				
Rear End	Related:		1	5	6
	UnRelated:				
Sideswipe	Related:		1		1
	UnRelated:				
Left Turn	Related:		3	2	5
	UnRelated:				
Angle	Related:			3	3
	UnRelated:				
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:			1	1
	UnRelated:				
Other Collision	Related:				
	UnRelated:				

F	Bridge	01
I	Building	02
X	Culvert/Ditch	03
E	Curb	04
D	Guardrail/Barrier	05
	Embankment	06
O	Fence	07
B	Light Pole	08
J	Sign Pole	09
E	Other Pole	10
C	Tree/Shrubbery	11
T	Contr. Barrier	12
S	Crash Attenuator	13
	Other Fixed Object	

WEATHER

16	Clear / Cloudy
	Foggy
	Raining
	Snow / Sleet
	Other

ILLUMINATION

13	Day
	Dawn/Dusk
3	Dark - Lights On
	Dark - No Lights
	Other

TOTALS

17-19	16

39087

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel
Town/Place: Annapolis
Route: Riva Road **(CO 2749)**
Log Mile: N/A
☒ at MD 665 Ramps
☐ at
☐ from
to

Purpose Needed:
☐ Signal Study
☐ Surface Evaluation
☐ Pavement Marking Study
☐ Sign Study
☐ Lighting Study
☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary
☒ Accident History
☒ Accident Rates
☒ Study Worksheet
☒ Collision/Line Diagram
☐ Other (Explain in Remarks)

☐ One Year
☒ Three Years
☐ Specific Date(s)
☐ Two Years
☐ Combined Years
to

Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler
Title: Planning Administrator
Department: Office of Transportation
District: Anne Arundel County#
Phone: 410-222-7462#
Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book
MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: MD 665 (Aris T Allen Blvd) @ Riva Rd (CO2749) Logmiles: 0.93 At 5.27 Radius: 250 ft.

County: Anne Arundel, D5 Period: January 01, 2017 To December 31, 2019 Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	10	4	5	19
No. Injured	12	4	5	21
Prop. Damage	8	5	6	19
Total Crashes	18	9	11	38
Severity Index	34	13	16	Avg 21
Opposite Dir.	0	0	0	0
Rear End	9	6	6	21
Sideswipe	4	1	1	6
Left Turn	1	0	1	2
Angle	1	2	0	3
Pedestrian	0	0	0	0
Parked Veh.	0	0	0	0
Fixed Object	3	0	2	5
Other	0	0	1	1
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	0	0	0	0
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	1	0	1	2
Night Time	3	0	2	5
Wet Surface	6	1	3	10
Alcohol	1	0	0	1
Intersection	18	9	11	38
Total Vehicles	33	19	19	71
Total Trucks	1	0	1	2
Truck %	3.0	0.0	5.3	2.8

Comments:

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: MD 665 (Aris T Allen Blvd) @ Riva Rd (CO2749)

Logmiles: 0.93 At 5.27 Radius: 250 ft.

County: Anne Arundel, D5

Period: January 1, 2017 To December 31, 2019

Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		19	19	38
Veh Occ		21		
Pedestrian				

AVG Severity Index: 21

DAY OF THE WEEK

SUN	MON	TUE	WED	THU	FRI	SAT	UNK
4	6	4	7	5	7	5	

MONTH OF THE YEAR

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
1	2	6	2	4	2	3	6	3	1	2	6	

CONDITION	DRIVER	PED
Normal:	60	
Alcohol:	1	
Other:	9	

TIME	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:							1	2	1	3	5	4	
PM:		2	4	2	3	5		3	1	1	1		

VEHICLES INVOLVED PER ACCIDENT

1	2	3	4	5	6+	UNK	TOTAL
6	31	1					71

VEHICLE TYPE

1	Motorcycle/Moped		Tractor Trailer
55	Passenger Vehicle	1	Passenger Bus
5	Sport Utility Veh	1	School Bus
4	Pick-Up Truck		Emergency Veh
2	Trucks (2+3 axles)	8	Other Types

SURFACE

10	Wet
26	Dry
1	Sno/Ice
	Mud
1	Other

MOVEMENTS

NORTH			SOUTH			EAST			WEST		
LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
3	8		6	25	7	4	10	1		6	

OTHER MOVEMENTS 1

PROBABLE CAUSES

	Influence of Drugs		Improper Lane Change
1	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
6	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
2	Fail to Drive in Single Lane		Clothing Not Visible
1	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
1	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
1	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
	Exceeded Speed Limit		Debris or Obstruction
	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
5	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	21	Other or Unknown

COLLISION TYPES		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:				
	UnRelated:				
Rear End	Related:		13	8	21
	UnRelated:				
Sideswipe	Related:		1	5	6
	UnRelated:				
Left Turn	Related:		2		2
	UnRelated:				
Angle	Related:			3	3
	UnRelated:				
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:				
	UnRelated:				
Other Collision	Related:		1		1
	UnRelated:				

F	Bridge	01		1	1
I	Building	02			
X	Culvert/Ditch	03			
E	Curb	04	1	2	3
D	Guardrail/Barrier	05	1		1
	Embankment	06			
O	Fence	07			
B	Light Pole	08			
J	Sign Pole	09			
E	Other Pole	10			
C	Tree/Shrubbery	11			
T	Contr. Barrier	12			
S	Crash Attenuator	13			
	Other Fixed Object				

WEATHER

30	Clear / Cloudy
	Foggy
5	Raining
1	Snow / Sleet
2	Other

ILLUMINATION

30	Day
2	Dawn/Dusk
4	Dark - Lights On
1	Dark - No Lights
1	Other

TOTALS

17-19	38

39088

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel
Town/Place: Annapolis
Route: Riva Road **(CO 2749)**
Log Mile: N/A
☒ at Park and Ride Entrance
☐ at
☐ from
to

Purpose Needed:
☐ Signal Study
☐ Surface Evaluation
☐ Pavement Marking Study
☐ Sign Study
☐ Lighting Study
☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary
☒ Accident History
☒ Accident Rates
☒ Study Worksheet
☒ Collision/Line Diagram
☐ Other (Explain in Remarks)

☐ One Year
☒ Three Years
☐ Specific Date(s)
☐ Two Years
☐ Combined Years
to

Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler
Title: Planning Administrator
Department: Office of Transportation
District: Anne Arundel County#
Phone: 410-222-7462#
Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book
MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: Riva Rd (CO2749) @ Park and Ride Entrance

Logmiles: 5 At 0 Radius: 250 ft.

County: Anne Arundel, D5

Period: January 01, 2017 To December 31, 2019

Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	0	1	0	1
No. Injured	0	1	0	1
Prop. Damage	1	0	2	3
Total Crashes	1	1	2	4
Severity Index	1	2	2	Avg 2
Opposite Dir.	0	0	0	0
Rear End	0	0	1	1
Sideswipe	0	0	0	0
Left Turn	0	0	0	0
Angle	0	0	0	0
Pedestrian	0	0	0	0
Parked Veh.	0	0	0	0
Fixed Object	0	1	1	2
Other	1	0	0	1
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	1	0	0	1
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	0	0	0	0
Night Time	1	0	2	3
Wet Surface	0	1	0	1
Alcohol	0	0	0	0
Intersection	0	0	0	0
Total Vehicles	1	1	3	5
Total Trucks	0	0	0	0
Truck %	0.0	0.0	0.0	0.0

Comments:

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: Riva Rd (CO2749) @ Park and Ride Entrance

Logmiles: 5 At 0 Radius: 250 ft.

County: Anne Arundel, D5

Period: January 1, 2017 To December 31, 2019

Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		1	3	4
Veh Occ		1		
Pedestrian				

AVG Severity Index: 2

DAY OF THE WEEK

SUN	MON	TUE	WED	THU	FRI	SAT	UNK
1		2			1		

MONTH OF THE YEAR

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
			1				1		1	1		

CONDITION	DRIVER	PED
Normal:	4	
Alcohol:		
Other:	1	

TIME	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:					1								
PM:									2			1	

VEHICLES INVOLVED PER ACCIDENT

1	2	3	4	5	6+	UNK	TOTAL
3	1						5

VEHICLE TYPE

	Motorcycle/Moped		Tractor Trailer
4	Passenger Vehicle		Passenger Bus
	Sport Utility Veh		School Bus
1	Pick-Up Truck		Emergency Veh
	Trucks (2+3 axles)	3	Other Types

SURFACE

1	Wet
2	Dry
	Sno/Ice
	Mud
1	Other

MOVEMENTS

NORTH			SOUTH			EAST			WEST		
LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
										4	1

OTHER MOVEMENTS

PROBABLE CAUSES

1	Influence of Drugs		Improper Lane Change
	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
1	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
	Fail to Drive in Single Lane		Clothing Not Visible
	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
	Exceeded Speed Limit		Debris or Obstruction
	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	2	Other or Unknown

COLLISION TYPES		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:				
	UnRelated:				
Rear End	Related:				
	UnRelated:			1	1
Sideswipe	Related:				
	UnRelated:				
Left Turn	Related:				
	UnRelated:				
Angle	Related:				
	UnRelated:				
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:				
	UnRelated:				
Other Collision	Related:				
	UnRelated:			1	1

F	Bridge	01			
I	Building	02			
X	Culvert/Ditch	03			
E	Curb	04			
D	Guardrail/Barrier	05			
	Embankment	06			
O	Fence	07			
B	Light Pole	08	1	1	2
J	Sign Pole	09			
E	Other Pole	10			
C	Tree/Shrubbery	11			
T	Contr. Barrier	12			
S	Crash Attenuator	13			
	Other Fixed Object				

WEATHER

3	Clear / Cloudy
	Foggy
1	Raining
	Snow / Sleet
	Other

ILLUMINATION

	Day
	Dawn/Dusk
2	Dark - Lights On
1	Dark - No Lights
1	Other

TOTALS

17-19	4

39089

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel
Town/Place: Annapolis
Route: Riva Road **(CO 2749)**
Log Mile: N/A
☒ at Harry S. Truman Pkwy
☐ at
☐ from
to

Purpose Needed:
☐ Signal Study ☐ Surface Evaluation ☐ Pavement Marking Study
☐ Sign Study ☐ Lighting Study ☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary ☒ Accident History ☒ Accident Rates
☒ Study Worksheet ☒ Collision/Line Diagram ☐ Other (Explain in Remarks)

☐ One Year ☐ Two Years
☒ Three Years ☐ Combined Years
☐ Specific Date(s) to

Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler
Title: Planning Administrator
Department: Office of Transportation
District: Anne Arundel County#
Phone: 410-222-7462#
Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: Riva Rd (CO2749) @ Harry S Truman Pkwy (CO2838) Logmiles: 4.85 At 0.34 Radius: 250 ft.

County: Anne Arundel, D5 Period: January 01, 2017 To December 31, 2019 Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	1	5	2	8
No. Injured	4	6	3	13
Prop. Damage	4	2	7	13
Total Crashes	5	7	9	21
Severity Index	6	16	11	Avg 11
Opposite Dir.	0	0	1	1
Rear End	3	2	3	8
Sideswipe	1	2	1	4
Left Turn	1	2	2	5
Angle	0	1	2	3
Pedestrian	0	0	0	0
Parked Veh.	0	0	0	0
Fixed Object	0	0	0	0
Other	0	0	0	0
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	0	0	0	0
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	0	1	0	1
Night Time	0	0	2	2
Wet Surface	1	2	1	4
Alcohol	0	0	0	0
Intersection	5	7	9	21
Total Vehicles	10	15	20	45
Total Trucks	0	2	0	2
Truck %	0.0	13.3	0.0	4.4

Comments:

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: Riva Rd (CO2749) @ Harry S Truman Pkwy (CO2838) Logmiles: 4.85 At 0.34 Radius: 250 ft.

County: Anne Arundel, D5 Period: January 1, 2017 To December 31, 2019 Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		8	13	21
Veh Occ		13		
Pedestrian				

AVG Severity Index: 11

DAY OF THE WEEK

SUN	MON	TUE	WED	THU	FRI	SAT	UNK
1	4	6	3	2	2	3	

MONTH OF THE YEAR

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
	3	1	1	4	2	2	1	3	1	2	1	

CONDITION	DRIVER	PED
Normal:	39	
Alcohol:		
Other:	6	

TIME

	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:								4	1	2	2		
PM:			2	4	3	2	1						

VEHICLES INVOLVED PER ACCIDENT

1	2	3	4	5	6+	UNK	TOTAL
19	1	1					45

VEHICLE TYPE

	Motorcycle/Moped		Tractor Trailer
30	Passenger Vehicle	1	Passenger Bus
4	Sport Utility Veh	3	School Bus
2	Pick-Up Truck		Emergency Veh
2	Trucks (2+3 axles)	3	Other Types

SURFACE

4	Wet
17	Dry
	Sno/Ice
	Mud
	Other

MOVEMENTS

NORTH			SOUTH			EAST			WEST		
LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
1	2		4	9	1	2	6	1	5	11	

OTHER MOVEMENTS 3

PROBABLE CAUSES

	Influence of Drugs		Improper Lane Change
	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
3	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
	Fail to Drive in Single Lane		Clothing Not Visible
	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
2	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
1	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
2	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
	Exceeded Speed Limit		Debris or Obstruction
	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
1	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	12	Other or Unknown

COLLISION TYPES

		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:			1	1
	UnRelated:				
Rear End	Related:		2	6	8
	UnRelated:				
Sideswipe	Related:			4	4
	UnRelated:				
Left Turn	Related:		4	1	5
	UnRelated:				
Angle	Related:		2	1	3
	UnRelated:				
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:				
	UnRelated:				
Other Collision	Related:				
	UnRelated:				

F	Bridge	01
I	Building	02
X	Culvert/Ditch	03
E	Curb	04
D	Guardrail/Barrier	05
	Embankment	06
O	Fence	07
B	Light Pole	08
J	Sign Pole	09
E	Other Pole	10
C	Tree/Shrubbery	11
T	Contr. Barrier	12
S	Crash Attenuator	13
	Other Fixed Object	

WEATHER

19	Clear / Cloudy
	Foggy
1	Raining
1	Snow / Sleet
	Other

ILLUMINATION

18	Day
1	Dawn/Dusk
2	Dark - Lights On
	Dark - No Lights
	Other

TOTALS

17-19	21

39090

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:

County: Anne Arundel — Town/Place: Annapolis
Route: Riva Road **(CO 2749)** — Log Mile: N/A
☐ at
☐ at
☒ from Harry S. Truman Pkwy — To MD 665

Purpose Needed:

☐ Signal Study ☐ Surface Evaluation ☐ Pavement Marking Study
☐ Sign Study ☐ Lighting Study ☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:

☒ Accident Summary ☒ Accident History ☒ Accident Rates
☒ Study Worksheet ☒ Collision/Line Diagram ☐ Other (Explain in Remarks)

☐ One Year ☐ Two Years
☒ Three Years ☐ Combined Years
☐ Specific Date(s) to

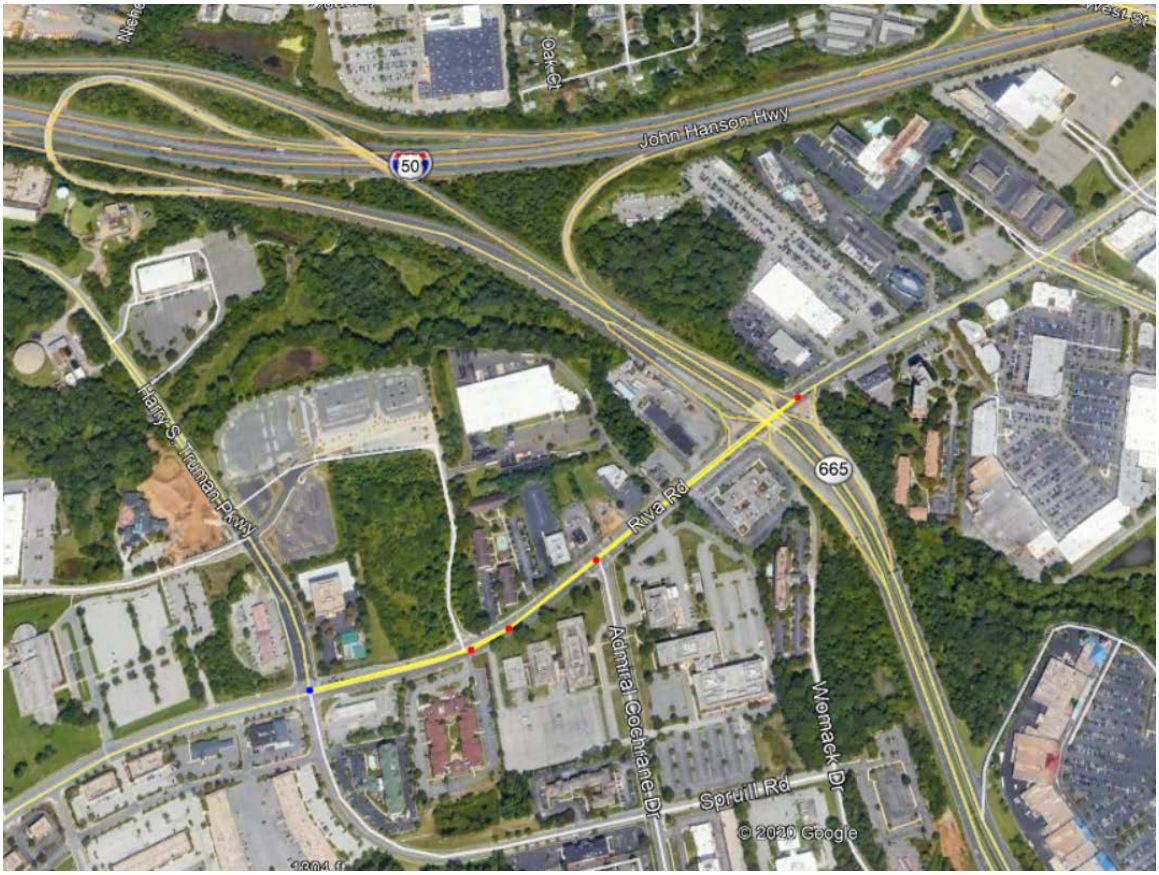
Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler — Title: Planning Administrator
Department: Office of Transportation — District: Anne Arundel County#
Phone: 410-222-7462# — Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map



Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/19/2021

Location: Riva Rd (CO2749) From: Harry S Truman Pkwy To: MD 665 Logmiles: From 4.85 To 5.32 Length: 0.47

County: Anne Arundel, D5 Period: January 01, 2017 To December 31, 2019 Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	9	13	6	28
No. Injured	16	14	7	37
Prop. Damage	17	10	16	43
Total Crashes	26	23	22	71
Severity Index	41	47	28	Avg 39
Opposite Dir.	0	0	1	1
Rear End	7	9	8	24
Sideswipe	4	3	1	8
Left Turn	5	3	3	11
Angle	5	5	4	14
Pedestrian	0	1	0	1
Parked Veh.	0	0	1	1
Fixed Object	4	1	3	8
Other	1	1	1	3
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	1	1	0	2
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	2	1	1	4
Night Time	5	0	8	13
Wet Surface	5	3	4	12
Alcohol	1	0	0	1
Intersection	22	13	18	53
Total Vehicles	47	47	42	136
Total Trucks	2	1	1	4
Truck %	4.3	2.1	2.4	2.9

Comments:

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/19/2021

Location: Riva Rd (CO2749) From: Harry S Truman Pkwy To: MD 665

Logmiles: From 4.85 To 5.32 Length: 0.47

County: Anne Arundel, D5 Period: January 1, 2017 To December 31, 2019

Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		28	43	71
Veh Occ		36		
Pedestrian		1		

AVG Severity Index: 39

DAY OF THE WEEK	SUN	MON	TUE	WED	THU	FRI	SAT	UNK
	7	13	16	10	8	9	8	

MONTH OF THE YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
	5	4	8	4	5	3	5	9	9	6	4	9	

CONDITION	DRIVER	PED
Normal:	111	1
Alcohol:	1	
Other:	22	

TIME	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:					1			5	3	6	9	6	
PM:	1	3	7	5	5	9	1	2	6		1	1	

VEHICLES INVOLVED PER ACCIDENT	1	2	3	4	5	6+	UNK	TOTAL
	13	52	5	1				136

VEHICLE TYPE			
1	Motorcycle/Moped		Tractor Trailer
102	Passenger Vehicle		Passenger Bus
13	Sport Utility Veh	2	School Bus
8	Pick-Up Truck		Emergency Veh
4	Trucks (2+3 axles)	19	Other Types

SURFACE	
12	Wet
57	Dry
1	Sno/Ice
	Mud
1	Other

MOVEMENTS

NORTH			SOUTH			EAST			WEST		
LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
7	3	1	11	16	4	8	33	1	7	36	2

OTHER MOVEMENTS 7

PROBABLE CAUSES

2	Influence of Drugs		Improper Lane Change
1	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
1	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
9	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
1	Fail to Drive in Single Lane		Clothing Not Visible
1	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
9	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
1	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
1	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
	Exceeded Speed Limit		Debris or Obstruction
	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
5	Followed too Closely		Shoulders Low, Soft or High
1	Improper Turn	39	Other or Unknown

COLLISION TYPES		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:			1	1
	UnRelated:				
Rear End	Related:		7	12	19
	UnRelated:		2	3	5
Sideswipe	Related:		2	5	7
	UnRelated:			1	1
Left Turn	Related:		8	3	11
	UnRelated:				
Angle	Related:		1	7	8
	UnRelated:		3	3	6
Pedestrian	Related:				
	UnRelated:		1		1
Parked Vehicle	Related:			1	1
	UnRelated:				
Other Collision	Related:		1		1
	UnRelated:			2	2

F	Bridge	01		1	1
I	Building	02			
X	Culvert/Ditch	03			
E	Curb	04	1	3	4
D	Guardrail/Barrier	05	1		1
	Embankment	06			
O	Fence	07			
B	Light Pole	08	1	1	2
J	Sign Pole	09			
E	Other Pole	10			
C	Tree/Shrubbery	11			
T	Contr. Barrier	12			
S	Crash Attenuator	13			
	Other Fixed Object				

WEATHER		ILLUMINATION		TOTALS	
58	Clear / Cloudy	54	Day	17-19	71
	Foggy	2	Dawn/Dusk		
8	Raining	12	Dark - Lights On		
2	Snow / Sleet	1	Dark - No Lights		
3	Other	2	Other		

39091

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel Town/Place: Annapolis
Route: Harry S. Truman Pkwy (CO 2838) Log Mile: N/A
☒ at Park and Ride Entrance
☐ at
☐ from To

Purpose Needed:
☐ Signal Study ☐ Surface Evaluation ☐ Pavement Marking Study
☐ Sign Study ☐ Lighting Study ☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary ☒ Accident History ☒ Accident Rates
☒ Study Worksheet ☒ Collision/Line Diagram ☐ Other (Explain in Remarks)

☐ One Year ☐ Two Years
☒ Three Years ☐ Combined Years
☐ Specific Date(s) to

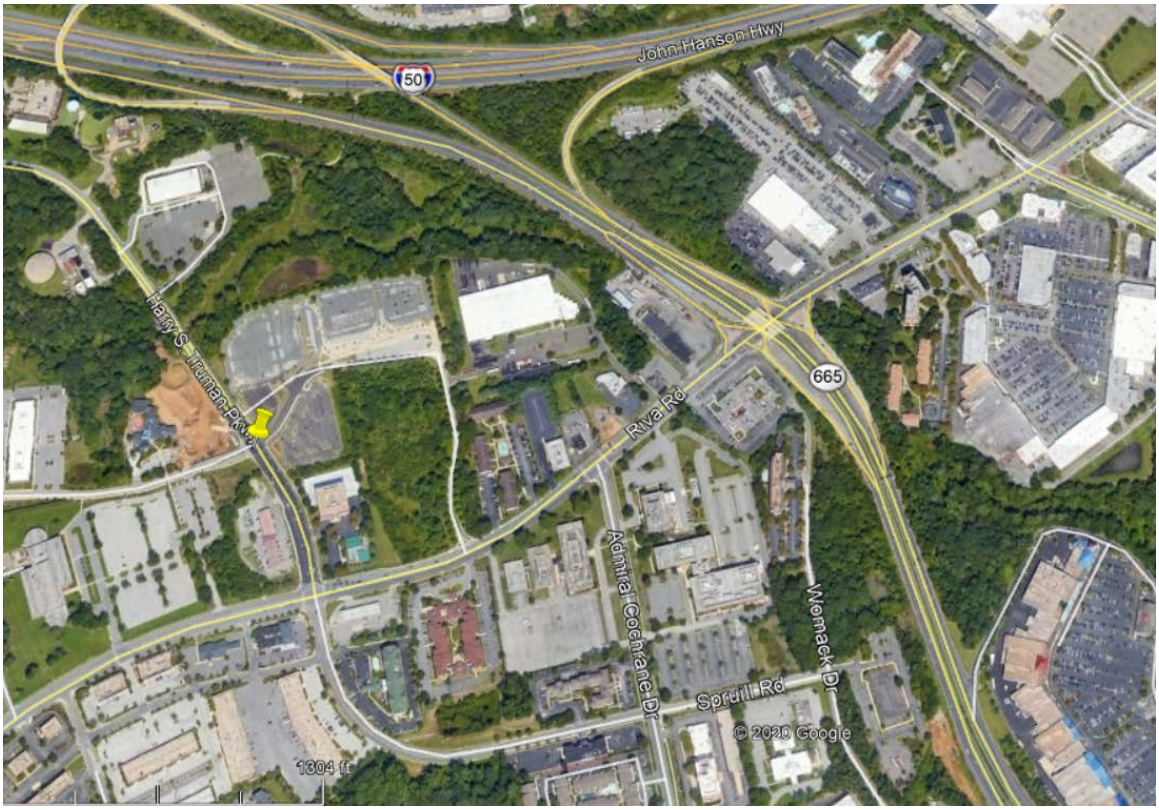
Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler Title: Planning Administrator
Department: Office of Transportation District: Anne Arundel County#
Phone: 410-222-7462# Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map



Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/15/2021

Location: Harry S Truman Pkwy (CO2838) @ Park and Ride Entrance

Logmiles: 0.5 At 0 Radius: 250 ft.

County: Anne Arundel, D5

Period: January 01, 2017 To December 31, 2019

Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	1	0	0	1
No. Injured	2	0	0	2
Prop. Damage	0	2	1	3
Total Crashes	1	2	1	4
Severity Index	4	2	1	Avg 2
Opposite Dir.	0	0	0	0
Rear End	0	0	0	0
Sideswipe	0	0	1	1
Left Turn	1	0	0	1
Angle	0	1	0	1
Pedestrian	0	0	0	0
Parked Veh.	0	0	0	0
Fixed Object	0	1	0	1
Other	0	0	0	0
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	0	0	0	0
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	0	0	0	0
Night Time	0	0	0	0
Wet Surface	0	0	0	0
Alcohol	0	0	0	0
Intersection	1	2	1	4
Total Vehicles	2	3	2	7
Total Trucks	0	0	0	0
Truck %	0.0	0.0	0.0	0.0

Comments:

Maryland State Highway Administration
Office of Traffic and Safety - Traffic Development and Support
SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg
Date: 01/15/2021

Location: Harry S Truman Pkwy (CO2838) @ Park and Ride Entrance
Logmiles: 0.5 At 0 Radius: 250 ft.
County: Anne Arundel, D5
Period: January 1, 2017 To December 31, 2019
Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		1	3	4
Veh Occ		2		
Pedestrian				

AVG Severity Index: 2

DAY OF THE WEEK

SUN	MON	TUE	WED	THU	FRI	SAT	UNK
	1	1	1	1			

MONTH OF THE YEAR

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
1		1			1		1					

CONDITION	DRIVER	PED
Normal:	4	1
Alcohol:		
Other:	2	

TIME

	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:								1			1		
PM:				1	1								

VEHICLES INVOLVED PER ACCIDENT

	1	2	3	4	5	6+	UNK	TOTAL
	1	3						7

VEHICLE TYPE

	Motorcycle/Moped		Tractor Trailer
6	Passenger Vehicle		Passenger Bus
1	Sport Utility Veh		School Bus
	Pick-Up Truck		Emergency Veh
	Trucks (2+3 axles)	1	Other Types

SURFACE

	Wet
3	Dry
	Sno/Ice
	Mud
1	Other

MOVEMENTS

NORTH			SOUTH			EAST			WEST		
LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
	2		1	2	1				1		

OTHER MOVEMENTS

PROBABLE CAUSES

	Influence of Drugs		Improper Lane Change
	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
1	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
	Fail to Drive in Single Lane		Clothing Not Visible
	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
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	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	3	Other or Unknown

COLLISION TYPES		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:				
	UnRelated:				
Rear End	Related:				
	UnRelated:				
Sideswipe	Related:			1	1
	UnRelated:				
Left Turn	Related:		1		1
	UnRelated:				
Angle	Related:			1	1
	UnRelated:				
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:				
	UnRelated:				
Other Collision	Related:				
	UnRelated:				

F	Bridge	01			
I	Building	02			
X	Culvert/Ditch	03			
E	Curb	04		1	1
D	Guardrail/Barrier	05			
	Embankment	06			
O	Fence	07			
B	Light Pole	08			
J	Sign Pole	09			
E	Other Pole	10			
C	Tree/Shrubbery	11			
T	Contr. Barrier	12			
S	Crash Attenuator	13			
	Other Fixed Object				

WEATHER

3	Clear / Cloudy
	Foggy
	Raining
	Snow / Sleet
1	Other

ILLUMINATION

2	Day
	Dawn/Dusk
	Dark - Lights On
	Dark - No Lights
2	Other

TOTALS

17-19	4

39092

Office of Traffic and Safety
Traffic Development & Support Division

Accident Data/Analysis Request Form

Request Date: January 13, 2021

Location:
County: Anne Arundel Town/Place: Annapolis
Route: Harry S. Truman Pkwy (CO 2838) Log Mile: N/A
☐ at
☐ at
☒ from Riva Rd To Park and Ride Entrance

Purpose Needed:
☐ Signal Study ☐ Surface Evaluation ☐ Pavement Marking Study
☐ Sign Study ☐ Lighting Study ☒ General Traffic Study
☐ Other (Explain)

Originally Requested By: Margaret Kaii-Ziegler
When Needed: ASAP

Work Requested:
☒ Accident Summary ☒ Accident History ☒ Accident Rates
☒ Study Worksheet ☒ Collision/Line Diagram ☐ Other (Explain in Remarks)

☐ One Year ☐ Two Years
☒ Three Years ☐ Combined Years
☐ Specific Date(s) to

Additional Instructions or Remarks: None

Requested by: Margaret Kaii-Ziegler Title: Planning Administrator
Department: Office of Transportation District: Anne Arundel County#
Phone: 410-222-7462# Fax: #

Please indicate map coordinates of location to be studied.
ADC Map Book MD General Hwy. Grid Map

Send to: Traffic Development & Support Division, 7491 Connelley Drive
Hanover, Maryland 21076
Phone: (410) 787-5831
Fax: (410) 582-9469

Location Map

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Study Worksheet Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/19/2021

Location: Harry S Truman Pkwy (CO2838) From: Riva Rd To: Park & Ride Entrance Logmiles: From 0.34 To 0.5 Length: 0.16

County: Anne Arundel, D5 Period: January 01, 2017 To December 31, 2019 Note:

YEAR >>	2017	2018	2019	Total
Fatal	0	0	0	0
No. Killed	0	0	0	0
Injury	1	2	1	4
No. Injured	2	2	1	5
Prop. Damage	1	4	5	10
Total Crashes	2	6	6	14
Severity Index	5	10	7	Avg 7
Opposite Dir.	0	0	0	0
Rear End	0	1	1	2
Sideswipe	0	1	2	3
Left Turn	1	0	1	2
Angle	0	3	2	5
Pedestrian	0	0	0	0
Parked Veh.	0	0	0	0
Fixed Object	1	1	0	2
Other	0	0	0	0
U-Turn	0	0	0	0
Backing	0	0	0	0
Animal	0	0	0	0
Railroad	0	0	0	0
Fire / Expl.	0	0	0	0
Overturn	0	0	0	0
Truck Related	0	1	0	1
Night Time	0	0	0	0
Wet Surface	0	2	0	2
Alcohol	0	0	0	0
Intersection	1	5	4	10
Total Vehicles	3	12	14	29
Total Trucks	0	2	0	2
Truck %	0.0	16.7	0.0	6.9

Comments:

Maryland State Highway Administration

Office of Traffic and Safety - Traffic Development and Support

SHA ADC Summary Output rev. 10/2017-1

Name: Matthew Jagg

Date: 01/19/2021

Location: Harry S Truman Pkwy (CO2838) From: Riva Rd To: Park & Ride Entrance

Logmiles: From 0.34 To 0.5 Length: 0.16

County: Anne Arundel, D5

Period: January 1, 2017 To December 31, 2019

Note:

SEVERITY	FATAL	INJURY	P-DAMAGE	TOTAL
Accidents		4	10	14
Veh Occ		5		
Pedestrian				

AVG Severity Index: 7

DAY OF THE WEEK	SUN	MON	TUE	WED	THU	FRI	SAT	UNK
		3	2	5	2	1	1	

MONTH OF THE YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	UNK
	1	2	3		2	2	1	2	1				

CONDITION	DRIVER	PED
Normal:	19	1
Alcohol:		
Other:	8	

TIME	12	01	02	03	04	05	06	07	08	09	10	11	UNK
AM:								2		2	2		
PM:	1		1	4	2								

VEHICLES INVOLVED PER ACCIDENT	1	2	3	4	5	6+	UNK	TOTAL
	2	10	1	1				29

VEHICLE TYPE			
	Motorcycle/Moped		Tractor Trailer
18	Passenger Vehicle	1	Passenger Bus
1	Sport Utility Veh	2	School Bus
2	Pick-Up Truck		Emergency Veh
2	Trucks (2+3 axles)	5	Other Types

SURFACE	
2	Wet
11	Dry
	Sno/Ice
	Mud
1	Other

MOVEMENTS	NORTH			SOUTH			EAST			WEST		
	LF	ST	RT	LF	ST	RT	LF	ST	RT	LF	ST	RT
		4		3	11	1	1	1	1	3	1	

OTHER MOVEMENTS 3

PROBABLE CAUSES

	Influence of Drugs		Improper Lane Change
	Influence of Alcohol		Improper Backing
	Influence of Medication		Improper Passing
	Influence of Combined Subst.		Improper Signal
	Physical/Mental Difficulty		Improper Parking
	Fell Asleep/Fainted, etc.		Passenger Interfere/Obstruct.
5	Fail to give full Attention		Illegally in Roadway
	Lic. Restr. Non-compliance		Bicycle Violation
	Fail to Drive in Single Lane		Clothing Not Visible
	Improper Right Turn on Red		Sleet, Hail, Freezing Rain
1	Fail to Yield Right-of-way		Severe Crosswinds
	Fail to Obey Stop Sign		Rain, Snow
1	Fail to Obey Traffic Signal		Animal
	Fail to Obey Other Control		Vision Obstruction
1	Fail to Keep Right of Center		Vehicle Defect
	Fail to Stop for School Bus		Wet
	Wrong Way on One Way		Icy or Snow Covered
	Exceeded Speed Limit		Debris or Obstruction
	Operator Using Cell Phone		Ruts, Holes or Bumps
	Stopping in Lane Roadway		Road Under Construction
	Too Fast for Conditions		Traffic Control Device Inop.
1	Followed too Closely		Shoulders Low, Soft or High
	Improper Turn	5	Other or Unknown

COLLISION TYPES		FATAL	INJURY	PROP	TOTAL
Opposite Dir	Related:				
	UnRelated:				
Rear End	Related:		1	1	2
	UnRelated:				
Sideswipe	Related:			3	3
	UnRelated:				
Left Turn	Related:		2		2
	UnRelated:				
Angle	Related:		1	1	2
	UnRelated:			3	3
Pedestrian	Related:				
	UnRelated:				
Parked Vehicle	Related:				
	UnRelated:				
Other Collision	Related:				
	UnRelated:				

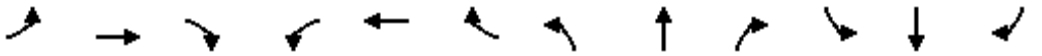
F	Bridge	01			
I	Building	02			
X	Culvert/Ditch	03			
E	Curb	04		1	1
D	Guardrail/Barrier	05			
	Embankment	06			
O	Fence	07			
B	Light Pole	08			
J	Sign Pole	09			
E	Other Pole	10		1	1
C	Tree/Shrubbery	11			
T	Contr. Barrier	12			
S	Crash Attenuator	13			
	Other Fixed Object				

WEATHER	
12	Clear / Cloudy
	Foggy
	Raining
1	Snow / Sleet
1	Other

ILLUMINATION	
12	Day
	Dawn/Dusk
	Dark - Lights On
	Dark - No Lights
2	Other

TOTALS	
17-19	14

Appendix C:
Synchro Results (Existing Conditions)



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	1070	64	91	1040	401	75	149	42	311	103	151
Future Volume (vph)	120	1070	64	91	1040	401	75	149	42	311	103	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	280		450	325		260	175		175	310		300
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.998		0.950		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1681	1766	1583	3433	1863	1583
Flt Permitted	0.950			0.950			0.950	0.998		0.950		
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1681	1766	1583	3433	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			94			376			94			164
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		652			651			333			684	
Travel Time (s)		11.1			11.1			6.5			13.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	1163	70	99	1130	436	82	162	46	338	112	164
Shared Lane Traffic (%)							10%					
Lane Group Flow (vph)	130	1163	70	99	1130	436	74	170	46	338	112	164
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		8	8		4	4	
Permitted Phases			6			2			8			4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	1	6	6	5	2	2	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0	30.0	15.0	15.0	15.0	30.0	30.0	30.0
Total Split (s)	20.0	65.0	65.0	20.0	65.0	65.0	25.0	25.0	25.0	30.0	30.0	30.0
Total Split (%)	14.3%	46.4%	46.4%	14.3%	46.4%	46.4%	17.9%	17.9%	17.9%	21.4%	21.4%	21.4%
Maximum Green (s)	15.0	60.0	60.0	15.0	60.0	60.0	20.0	20.0	20.0	25.0	25.0	25.0
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.5	1.0	1.0	1.5	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	2.0	5.0	5.0	5.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		18.0	18.0		18.0	18.0	3.0	3.0	3.0	18.0	18.0	18.0
Pedestrian Calls (#/hr)		0	0		0	0	0	0	0	0	0	0
Act Effct Green (s)	13.5	68.8	68.8	13.8	69.1	69.1	17.6	17.6	17.6	19.8	19.8	19.8
Actuated g/C Ratio	0.10	0.49	0.49	0.10	0.49	0.49	0.13	0.13	0.13	0.14	0.14	0.14
v/c Ratio	0.76	0.67	0.08	0.57	0.65	0.45	0.35	0.77	0.16	0.70	0.43	0.45
Control Delay	88.5	31.0	2.2	66.4	32.1	11.9	59.7	80.9	1.2	64.8	59.0	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	88.5	31.0	2.2	66.4	32.1	11.9	59.7	80.9	1.2	64.8	59.0	11.2
LOS	F	C	A	E	C	B	E	F	A	E	E	B
Approach Delay		35.0			28.8			62.9			49.4	
Approach LOS		D			C			E			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 30 (21%), Referenced to phase 2:WBT and 6:EBT, Start of Green			
Natural Cycle: 85			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 36.7		Intersection LOS: D	
Intersection Capacity Utilization 68.8%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 1: Harry S. Truman Pkwy & Riva Rd

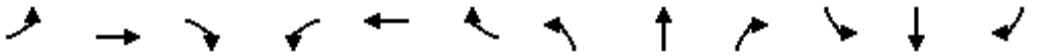
Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	1423	1532	97	0	0
Future Vol, veh/h	0	1423	1532	97	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	Free
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1547	1665	105	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	-	-	0	0	0
Stage 1	0	-	-	0	0	0
Stage 2	0	-	-	0	0	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	-
HCM Lane V/C Ratio	-	-	-
HCM Control Delay (s)	-	-	0
HCM Lane LOS	-	-	A
HCM 95th %tile Q(veh)	-	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	1349	27	173	1511	122	30	6	145	43	19	88
Future Volume (veh/h)	47	1349	27	173	1511	122	30	6	145	43	19	88
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	51	1466	29	188	1642	133	33	7	158	47	21	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	65	2333	46	216	2463	198	179	34	180	128	50	
Arrive On Green	0.07	1.00	1.00	0.12	0.74	0.74	0.11	0.11	0.11	0.11	0.11	0.00
Sat Flow, veh/h	1781	3564	70	1781	3332	267	1166	297	1585	743	437	1585
Grp Volume(v), veh/h	51	730	765	188	868	907	40	0	158	68	0	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1858	1781	1777	1822	1464	0	1585	1180	0	1585
Q Serve(g_s), s	3.9	0.0	0.0	14.5	34.9	36.1	0.0	0.0	13.7	5.4	0.0	0.0
Cycle Q Clear(g_c), s	3.9	0.0	0.0	14.5	34.9	36.1	3.4	0.0	13.7	8.8	0.0	0.0
Prop In Lane	1.00		0.04	1.00		0.15	0.82		1.00	0.69		1.00
Lane Grp Cap(c), veh/h	65	1163	1216	216	1314	1347	213	0	180	177	0	
V/C Ratio(X)	0.78	0.63	0.63	0.87	0.66	0.67	0.19	0.00	0.88	0.38	0.00	
Avail Cap(c_a), veh/h	76	1163	1216	573	1314	1347	245	0	215	208	0	
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	64.3	0.0	0.0	60.4	9.3	9.5	56.5	0.0	61.1	59.5	0.0	0.0
Incr Delay (d2), s/veh	29.7	2.6	2.5	10.2	2.6	2.7	0.2	0.0	25.5	0.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.8	0.8	7.1	12.5	13.2	1.3	0.0	6.8	2.3	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	94.0	2.6	2.5	70.6	11.9	12.2	56.6	0.0	86.6	60.1	0.0	0.0
LnGrp LOS	F	A	A	E	B	B	E	A	F	E	A	
Approach Vol, veh/h		1546			1963			198			68	A
Approach Delay, s/veh		5.5			17.7			80.5			60.1	
Approach LOS		A			B			F			E	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.1	109.0		20.9	22.0	97.1		20.9				
Change Period (Y+Rc), s	5.0	5.5		5.0	5.0	5.5		5.0				
Max Green Setting (Gmax), s	6.0	99.5		19.0	45.0	60.5		19.0				
Max Q Clear Time (g_c+I1), s	5.9	38.1		10.8	16.5	2.0		15.7				
Green Ext Time (p_c), s	0.0	44.5		0.1	0.5	33.4		0.1				

Intersection Summary			
HCM 6th Ctrl Delay		16.8	
HCM 6th LOS		B	

Notes

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	559	626	330	55	450	127	403	0	129	182	0	1061
Future Volume (veh/h)	559	626	330	55	450	127	403	0	129	182	0	1061
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	0	1870	1870	0	1870
Adj Flow Rate, veh/h	608	680	0	60	489	0	438	0	0	198	0	1153
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	0	2	2	0	2
Cap, veh/h	646	971		750	1180		512	0		264	0	0
Arrive On Green	0.12	0.09	0.00	0.42	0.33	0.00	0.15	0.00	0.00	0.15	0.00	0.00
Sat Flow, veh/h	1781	3647	0	1781	3554	1585	3456	438		1781	198	
Grp Volume(v), veh/h	608	680	0	60	489	0	438	62.3		198	61.4	
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1585	1728	E		1781	E	
Q Serve(g_s), s	47.4	26.0	0.0	2.8	14.9	0.0	17.3			14.9		
Cycle Q Clear(g_c), s	47.4	26.0	0.0	2.8	14.9	0.0	17.3			14.9		
Prop In Lane	1.00		0.00	1.00		1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	646	971		750	1180		512			264		
V/C Ratio(X)	0.94	0.70		0.08	0.41		0.85			0.75		
Avail Cap(c_a), veh/h	725	1878		750	1180		889			458		
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00			1.00		
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00			1.00		
Uniform Delay (d), s/veh	60.1	58.1	0.0	24.3	36.2	0.0	58.1			57.1		
Incr Delay (d2), s/veh	19.3	4.2	0.0	0.0	1.1	0.0	4.2			4.2		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0		
%ile BackOfQ(50%),veh/ln	26.2	13.0	0.0	1.2	6.6	0.0	7.9			7.0		
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.4	62.3	0.0	24.3	37.3	0.0	62.3			61.4		
LnGrp LOS	E	E		C	D		E			E		
Approach Vol, veh/h		1288	A		549	A						
Approach Delay, s/veh		70.4			35.9							
Approach LOS		E			D							

Timer - Assigned Phs	1	2	3		5	6	7
Phs Duration (G+Y+Rc), s	57.8	53.5	28.8		66.0	45.3	28.8
Change Period (Y+Rc), s	7.0	7.0	8.0		7.0	7.0	8.0
Max Green Setting (Gmax), s	50.8	25.0	36.0		8.0	74.0	36.0
Max Q Clear Time (g_c+I1), s	49.4	16.9	16.9		4.8	28.0	19.3
Green Ext Time (p_c), s	1.4	3.0	0.5		0.0	10.2	1.5

Intersection Summary	
HCM 6th Ctrl Delay	60.6
HCM 6th LOS	E

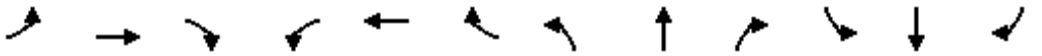
Notes

Unsignalized Delay for [NBR, EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	0	30	50	0	17	155	478	37	17	485	17
Future Volume (veh/h)	14	0	30	50	0	17	155	478	37	17	485	17
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	15	0	33	54	0	18	168	520	40	18	527	18
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	65	0	58	72	0	24	201	1299	1101	35	2090	71
Arrive On Green	0.04	0.00	0.04	0.06	0.00	0.06	0.11	0.69	0.69	0.02	0.60	0.60
Sat Flow, veh/h	1781	0	1585	1296	0	432	1781	1870	1585	1781	3506	120
Grp Volume(v), veh/h	15	0	33	72	0	0	168	520	40	18	267	278
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1728	0	0	1781	1870	1585	1781	1777	1849
Q Serve(g_s), s	0.8	0.0	2.1	4.1	0.0	0.0	9.3	11.8	0.8	1.0	7.2	7.2
Cycle Q Clear(g_c), s	0.8	0.0	2.1	4.1	0.0	0.0	9.3	11.8	0.8	1.0	7.2	7.2
Prop In Lane	1.00		1.00	0.75		0.25	1.00		1.00	1.00		0.06
Lane Grp Cap(c), veh/h	65	0	58	96	0	0	201	1299	1101	35	1059	1102
V/C Ratio(X)	0.23	0.00	0.57	0.75	0.00	0.00	0.83	0.40	0.04	0.51	0.25	0.25
Avail Cap(c_a), veh/h	177	0	158	429	0	0	266	1299	1101	274	1059	1102
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.1	0.0	47.7	46.9	0.0	0.0	43.7	6.5	4.8	48.9	9.7	9.7
Incr Delay (d2), s/veh	1.8	0.0	8.4	11.3	0.0	0.0	12.5	0.9	0.1	11.2	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	1.0	2.1	0.0	0.0	4.7	4.2	0.2	0.6	2.7	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	48.8	0.0	56.1	58.1	0.0	0.0	56.2	7.4	4.9	60.0	10.2	10.2
LnGrp LOS	D	A	E	E	A	A	E	A	A	E	B	B
Approach Vol, veh/h		48			72			728			563	
Approach Delay, s/veh		53.8			58.1			18.6			11.8	
Approach LOS		D			E			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.5	74.9		8.7	16.4	65.0		10.6				
Change Period (Y+Rc), s	4.5	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	15.5	60.0		10.0	15.0	60.0		25.0				
Max Q Clear Time (g_c+I1), s	3.0	13.8		4.1	11.3	9.2		6.1				
Green Ext Time (p_c), s	0.0	8.1		0.0	0.1	7.4		0.3				

Intersection Summary		
HCM 6th Ctrl Delay		19.1
HCM 6th LOS		B



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	1191	122	243	965	275	69	296	114	701	146	173
Future Volume (vph)	118	1191	122	243	965	275	69	296	114	701	146	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	280		450	325		260	175		175	310		300
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.95	0.95	1.00	0.97	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950	0.999		0.950		
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1681	1768	1583	3433	1863	1583
Flt Permitted	0.950			0.950			0.950	0.999		0.950		
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	1681	1768	1583	3433	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			133			278			94			188
Link Speed (mph)		40			40			35			35	
Link Distance (ft)		652			406			333			391	
Travel Time (s)		11.1			6.9			6.5			7.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	128	1295	133	264	1049	299	75	322	124	762	159	188
Shared Lane Traffic (%)							10%					
Lane Group Flow (vph)	128	1295	133	264	1049	299	67	330	124	762	159	188
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	Perm	Split	NA	Perm
Protected Phases	1	6		5	2		8	8		4	4	
Permitted Phases			6			2			8			4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	1	6	6	5	2	2	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0	30.0	20.0	20.0	20.0	30.0	30.0	30.0
Total Split (s)	20.0	65.0	65.0	20.0	65.0	65.0	20.0	20.0	20.0	35.0	35.0	35.0
Total Split (%)	14.3%	46.4%	46.4%	14.3%	46.4%	46.4%	14.3%	14.3%	14.3%	25.0%	25.0%	25.0%
Maximum Green (s)	15.0	60.0	60.0	15.0	60.0	60.0	15.0	15.0	15.0	30.0	30.0	30.0
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.5	1.0	1.0	1.5	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Min	C-Min	None	C-Min	C-Min	None	None	None	None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		18.0	18.0		18.0	18.0	8.0	8.0	8.0	18.0	18.0	18.0
Pedestrian Calls (#/hr)		0	0		0	0	0	0	0	0	0	0
Act Effct Green (s)	13.2	59.3	59.3	15.0	61.1	61.1	15.0	15.0	15.0	30.7	30.7	30.7
Actuated g/C Ratio	0.09	0.42	0.42	0.11	0.44	0.44	0.11	0.11	0.11	0.22	0.22	0.22
v/c Ratio	0.77	0.86	0.18	1.40	0.68	0.35	0.37	1.75	0.49	1.01	0.39	0.38
Control Delay	90.1	43.9	4.3	246.1	50.2	16.6	64.6	391.9	24.9	89.7	50.3	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.1	43.9	4.3	246.1	50.2	16.6	64.6	391.9	24.9	89.7	50.3	8.3
LOS	F	D	A	F	D	B	E	F	C	F	D	A
Approach Delay		44.3			76.1			262.4			70.3	
Approach LOS		D			E			F			E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 30 (21%), Referenced to phase 2:WBT and 6:EBT, Start of Green			
Natural Cycle: 120			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.75			
Intersection Signal Delay: 84.7		Intersection LOS: F	
Intersection Capacity Utilization 98.6%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 1: Harry S. Truman Pkwy & Riva Rd

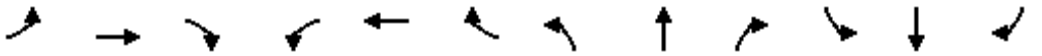
Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	2006	1443	30	0	38
Future Vol, veh/h	0	2006	1443	30	0	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Free	-	Free
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	2180	1568	33	0	41

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	-	-	0	0	0
Stage 1	0	-	-	0	0	0
Stage 2	0	-	-	0	0	0
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	-
HCM Lane V/C Ratio	-	-	-
HCM Control Delay (s)	-	-	0
HCM Lane LOS	-	-	A
HCM 95th %tile Q(veh)	-	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	1970	31	277	1408	34	45	1	315	14	8	21
Future Volume (veh/h)	5	1970	31	277	1408	34	45	1	315	14	8	21
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	5	2141	34	301	1530	37	49	1	342	15	9	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	9	2161	34	318	2756	67	206	4	170	103	53	
Arrive On Green	0.01	1.00	1.00	0.18	0.78	0.78	0.11	0.11	0.11	0.11	0.11	0.00
Sat Flow, veh/h	1781	3580	57	1781	3546	86	1451	35	1585	576	495	1585
Grp Volume(v), veh/h	5	1060	1115	301	765	802	50	0	342	24	0	0
Grp Sat Flow(s),veh/h/ln	1781	1777	1860	1781	1777	1855	1485	0	1585	1071	0	1585
Q Serve(g_s), s	0.4	0.0	0.0	23.4	23.6	23.7	0.0	0.0	15.0	0.7	0.0	0.0
Cycle Q Clear(g_c), s	0.4	0.0	0.0	23.4	23.6	23.7	3.9	0.0	15.0	4.6	0.0	0.0
Prop In Lane	1.00		0.03	1.00		0.05	0.98		1.00	0.62		1.00
Lane Grp Cap(c), veh/h	9	1072	1123	318	1381	1441	210	0	170	156	0	
V/C Ratio(X)	0.56	0.99	0.99	0.95	0.55	0.56	0.24	0.00	2.01	0.15	0.00	
Avail Cap(c_a), veh/h	76	1072	1123	318	1381	1441	210	0	170	156	0	
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	69.1	0.0	0.0	56.8	6.1	6.1	57.5	0.0	62.5	57.2	0.0	0.0
Incr Delay (d2), s/veh	18.4	24.8	25.3	36.4	1.6	1.6	0.2	0.0	476.4	0.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	7.4	7.9	13.6	7.8	8.1	1.7	0.0	28.5	0.8	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	87.5	24.8	25.3	93.3	7.7	7.7	57.8	0.0	538.9	57.4	0.0	0.0
LnGrp LOS	F	C	C	F	A	A	E	A	F	E	A	
Approach Vol, veh/h		2180			1868			392			24	A
Approach Delay, s/veh		25.2			21.5			477.5			57.4	
Approach LOS		C			C			F			E	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.7	114.3		20.0	30.0	90.0		20.0				
Change Period (Y+Rc), s	5.0	5.5		5.0	5.0	5.5		5.0				
Max Green Setting (Gmax), s	6.0	103.5		15.0	25.0	84.5		15.0				
Max Q Clear Time (g_c+I1), s	2.4	25.7		6.6	25.4	2.0		17.0				
Green Ext Time (p_c), s	0.0	42.1		0.0	0.0	71.3		0.0				

Intersection Summary			
HCM 6th Ctrl Delay		63.5	
HCM 6th LOS		E	

Notes

Unsignalized Delay for [SBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	896	1002	437	135	707	281	313	0	155	341	0	699
Future Volume (veh/h)	896	1002	437	135	707	281	313	0	155	341	0	699
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	0	1870	1870	0	1870
Adj Flow Rate, veh/h	974	1089	0	147	768	0	340	0	0	371	0	760
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	0	2	2	0	2
Cap, veh/h	852	1319		621	858		425	0		425	0	0
Arrive On Green	0.32	0.25	0.00	0.35	0.24	0.00	0.12	0.00	0.00	0.12	0.00	0.00
Sat Flow, veh/h	1781	3647	0	1781	3554	1585	3456	340		3456	371	
Grp Volume(v), veh/h	974	1089	0	147	768	0	340	67.7		371	74.6	
Grp Sat Flow(s),veh/h/ln	1781	1777	0	1781	1777	1585	1728	E		1728	E	
Q Serve(g_s), s	67.0	40.6	0.0	8.2	29.3	0.0	13.4			14.8		
Cycle Q Clear(g_c), s	67.0	40.6	0.0	8.2	29.3	0.0	13.4			14.8		
Prop In Lane	1.00		0.00	1.00		1.00	1.00			1.00		
Lane Grp Cap(c), veh/h	852	1319		621	858		425			425		
V/C Ratio(X)	1.14	0.83		0.24	0.90		0.80			0.87		
Avail Cap(c_a), veh/h	852	2158		621	858		494			494		
HCM Platoon Ratio	0.67	0.67	0.67	1.00	1.00	1.00	1.00			1.00		
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00			1.00		
Uniform Delay (d), s/veh	47.6	48.3	0.0	32.4	51.4	0.0	59.7			60.3		
Incr Delay (d2), s/veh	78.1	6.0	0.0	0.2	13.9	0.0	8.0			14.2		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0		
%ile BackOfQ(50%),veh/ln	48.8	19.6	0.0	3.6	14.5	0.0	6.4			7.3		
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	125.6	54.3	0.0	32.5	65.3	0.0	67.7			74.6		
LnGrp LOS	F	D		C	E		E			E		
Approach Vol, veh/h		2063	A		915	A						
Approach Delay, s/veh		88.0			60.0							
Approach LOS		F			E							

Timer - Assigned Phs	1	2	3		5	6	7
Phs Duration (G+Y+Rc), s	84.0	40.8	25.2		55.8	59.0	25.2
Change Period (Y+Rc), s	7.0	7.0	8.0		7.0	7.0	8.0
Max Green Setting (Gmax), s	67.0	31.0	20.0		13.0	85.0	20.0
Max Q Clear Time (g_c+I1), s	69.0	31.3	16.8		10.2	42.6	15.4
Green Ext Time (p_c), s	0.0	0.0	0.4		0.1	9.4	0.5

Intersection Summary	
HCM 6th Ctrl Delay	77.8
HCM 6th LOS	E

Notes

Unsignalized Delay for [NBR, EBR, WBR] is excluded from calculations of the approach delay and intersection delay.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	89	0	177	198	1	25	42	627	7	1	697	1
Future Volume (veh/h)	89	0	177	198	1	25	42	627	7	1	697	1
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	97	0	192	215	1	27	46	682	8	1	758	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	137	0	122	242	1	30	59	1145	970	2	2113	3
Arrive On Green	0.08	0.00	0.08	0.16	0.16	0.16	0.03	0.61	0.61	0.00	0.58	0.58
Sat Flow, veh/h	1781	0	1585	1555	7	195	1781	1870	1585	1781	3642	5
Grp Volume(v), veh/h	97	0	192	243	0	0	46	682	8	1	370	389
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1757	0	0	1781	1870	1585	1781	1777	1869
Q Serve(g_s), s	6.9	0.0	10.0	17.6	0.0	0.0	3.3	28.9	0.3	0.1	14.3	14.3
Cycle Q Clear(g_c), s	6.9	0.0	10.0	17.6	0.0	0.0	3.3	28.9	0.3	0.1	14.3	14.3
Prop In Lane	1.00		1.00	0.88		0.11	1.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	137	0	122	274	0	0	59	1145	970	2	1031	1085
V/C Ratio(X)	0.71	0.00	1.57	0.89	0.00	0.00	0.77	0.60	0.01	0.41	0.36	0.36
Avail Cap(c_a), veh/h	137	0	122	338	0	0	206	1145	970	206	1031	1085
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	58.6	0.0	60.0	53.8	0.0	0.0	62.3	15.4	9.8	64.9	14.5	14.5
Incr Delay (d2), s/veh	15.4	0.0	294.2	20.7	0.0	0.0	7.7	2.3	0.0	36.5	1.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	14.0	9.4	0.0	0.0	1.6	12.4	0.1	0.1	5.9	6.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.0	0.0	354.2	74.4	0.0	0.0	70.1	17.7	9.8	101.4	15.4	15.4
LnGrp LOS	E	A	F	E	A	A	E	B	A	F	B	B
Approach Vol, veh/h		289			243			736			760	
Approach Delay, s/veh		260.1			74.4			20.9			15.5	
Approach LOS		F			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.2	84.6		15.0	9.3	80.4		25.2
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0
Max Green Setting (Gmax), s	15.0	60.0		10.0	15.0	60.0		25.0
Max Q Clear Time (g_c+I2), s	2.1	30.9		12.0	5.3	16.3		19.6
Green Ext Time (p_c), s	0.0	9.9		0.0	0.0	11.1		0.6

Intersection Summary	
HCM 6th Ctrl Delay	59.4
HCM 6th LOS	E

Appendix D:
Cost Estimates

DATE:	**AUGUST 2021**			**PREPARED BY:**	**AECOM**
PROJECT LIMITS	**RIVA ROAD WEST SIDE TO US 50 - HARRY S. TRUMAN PKWY TO MD 665**			**PRJ LENGTH:**	**1.06 mi.**
JOB DESCRP:	**US 50 / MD 665 TRUMAN PARK AND RIDE ACCESS: BUILD ALTERNATIVE 2 - OPTION 1**				

ITEM NO.	CAT. 1 (PRELIMINARY) - DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
1001	35% Categories 2, 4, 5, and 6 INCLUDES MAINTENANCE OF TRAFFIC, MOBILIZATION, ETC.	1	LS	$ 3,083,326.41	$3,083,326
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$1,233,331
SUBTOTAL CATEGORY 1 COST					$4,316,657
ITEM NO.	**CAT. 2 (GRADING) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
2001	CLASS II EXCAVATION	22,804	CY	$ 75.00	$1,710,283
2002	COMMON BORROW	7,993	CY	$ 40.00	$319,721
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$812,001.74
SUBTOTAL CATEGORY 2 COST					$2,842,006
ITEM NO.	**CAT. 3 (DRAINAGE) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
3001	30% Categories 2, 4, 5, and 6 (INCLUDES SWM AND WATER QUALITY TREATMENT)	1	LS	$ 2,642,851.21	$2,642,851
3002	60" REINFORCED CONCRETE PIPE (CULVERT SOUTH OF ROUNDABOUT)	40	LF	$ 600.00	$24,000
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$1,066,740
SUBTOTAL CATEGORY 3 COST					$3,733,592
ITEM NO.	**CAT. 4 (STRUCTURES) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
4001	MSE WALL	16,117	SF	$ 150.00	$2,417,475
4002	BRIDGE OVER MD 665 (28' W x 81' L)	2,268	SF	$ 200.00	$453,600
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$1,148,430
SUBTOTAL CATEGORY 4 COST					$4,019,505
ITEM NO.	**CAT. 5 (PAVING) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
5001	HOT MIX ASPHALT - SURFACE LAYER (2")	1,386	TONS	$ 100.00	$138,562
5002	HOT MIX ASPHALT - BASE LAYER (10")	6,928	TONS	$ 70.00	$484,967
5003	GRADED AGGREGATE BASE COURSE FOR ASPHALT (12")	11,778	SY	$ 18.00	$212,000
5004	PORTLAND CEMENT CONCRETE (PCC) (10")	2,015	SY	$ 90.00	$181,310
5005	PORTLAND CEMENT CONCRETE (PCC) FOR TRAFFIC CIRCLE ISLAND (5")	368	SY	$ 25.00	$9,211
5006	GRADED AGGREGATE BASE COURSE FOR PCC (12")	2,383	SY	$ 18.00	$42,894
5007	STANDARD TYPE A COMBINATION CURB AND GUTTER 12 INCH GUTTER PAN 8 INCH MINIMUM	391	LF	$ 32.00	$12,512
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$432,583
SUBTOTAL CATEGORY 5 COST					$1,514,039
ITEM NO.	**CAT. 6 (SHOULDERS) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
6001	CONCRETE BARRIER	1,715	LF	$ 135.00	$231,525
6002	GUARDRAIL	1,121	LF	$ 70.00	$78,442
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$123,987
SUBTOTAL CATEGORY 6 COST					$433,954
ITEM NO.	**CAT. 7 (LANDSCAPING) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
7001	12% Categories 2, 5, and 6	1	LS	$ 505,096.81	$505,097
7002	FOREST IMPACT MITIGATION	15.3	AC	$ 10,000.00	$153,000
CONTINGENCY			40%		$263,239
SUBTOTAL CATEGORY 7 COST					$921,336
ITEM NO.	**CAT. 8 (TRAFFIC) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
8001	OVERHEAD SIGN REPLACEMENT (NO STRUCTURE)	700	SF	$ 35.00	$24,500
8002	NEW/RELOCATED OVERHEAD SIGN AND STRUCTURE	3	EA	$ 90,000.00	$270,000
8003	SIGNING (GENERAL)	1.06	MI	$ 51,160.00	$54,299
8004	LIGHTING (GENERAL, 180' SPACING)	1.06	MI	$ 762,580.00	$809,371
8005	PAVEMENT MARKINGS (GENERAL)	1.06	MI	$ 36,960.00	$39,178
8006	ROADWAY LIGHTING STRUCTURE RELOCATION	1	EA	$ 1,500.00	$1,500
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$479,539
SUBTOTAL CATEGORY 8 COST					$1,678,387
ITEM NO.	**CAT. 9 (UTILITIES) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
9001	20% Categories 2, 4, 5, and 6	1	LS	$ 1,761,900.80	$1,761,901
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$704,760
SUBTOTAL CATEGORY 9 COST					$2,466,661

CATEGORY	DESCRIPTION	TOTAL
1	PRELIMINARY	$4,316,657
2	GRADING	$2,842,006
3	DRAINAGE	$3,733,592
4	STRUCTURES	$4,019,505
5	PAVING	$1,514,039
6	SHOULDERS	$433,954
7	LANDSCAPING	$921,336
8	TRAFFIC	$1,678,387
9	UTILITIES	$2,466,661
	TOTAL CONSTRUCTION PROJECT COST	**$21,926,137**
	RIGHT OF WAY - ALL IMPACTED PARCELS OWNED BY MDOT SHA OR ANNE ARUNDEL COUNTY	$0
	SWM RIGHT OF WAY - ASSUME SWM FACILITIES IN PARCELS OWNED BY MDOT SHA OR ANNE ARUNDEL COUNTY	$0
	ENGINEERING COST (SURVEYING, RIGHT-OF-WAY PLATS, DESIGN, AND CONSTRUCTION PHASE SERVICES) - 30% OF CONST. COST	$6,577,841
	TOTAL COST	**$28,503,978**

DATE:	**AUGUST 2021**			**PREPARED BY:**	**AECOM**
PROJECT LIMITS	**RIVA ROAD WEST SIDE TO US 50 - HARRY S. TRUMAN PKWY TO MD 665**			**PRJ LENGTH:**	**1.09 mi.**
JOB DESCRP:	**US 50 / MD 665 TRUMAN PARK AND RIDE ACCESS: BUILD ALTERNATIVE 2 - OPTION 2**				

ITEM NO.	CAT. 1 (PRELIMINARY) - DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
1001	35% Categories 2, 4, 5, and 6 INCLUDES MAINTENANCE OF TRAFFIC, MOBILIZATION, ETC.	1	LS	$ 3,192,150.34	$3,192,150
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$1,276,860
SUBTOTAL CATEGORY 1 COST					$4,469,010
ITEM NO.	**CAT. 2 (GRADING) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
2001	CLASS II EXCAVATION	25,064	CY	$ 75.00	$1,879,800
2002	COMMON BORROW	8,426	CY	$ 40.00	$337,040
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$886,736.00
SUBTOTAL CATEGORY 2 COST					$3,103,576
ITEM NO.	**CAT. 3 (DRAINAGE) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
3001	30% Categories 2, 4, 5, and 6 (INCLUDES SWM AND WATER QUALITY TREATMENT)	1	LS	$ 2,736,128.86	$2,736,129
3002	60" REINFORCED CONCRETE PIPE (CULVERT SOUTH OF ROUNDABOUT)	40	LF	$ 600.00	$24,000
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$1,104,052
SUBTOTAL CATEGORY 3 COST					$3,864,180
ITEM NO.	**CAT. 4 (STRUCTURES) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
4001	MSE WALL	16,117	SF	$ 150.00	$2,417,475
4002	BRIDGE OVER MD 665 (28' W x 81' L)	2,268	SF	$ 200.00	$453,600
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$1,148,430
SUBTOTAL CATEGORY 4 COST					$4,019,505
ITEM NO.	**CAT. 5 (PAVING) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
5001	HOT MIX ASPHALT - SURFACE LAYER (2")	1,431	TONS	$ 100.00	$143,073
5002	HOT MIX ASPHALT - BASE LAYER (10")	7,154	TONS	$ 70.00	$500,756
5003	GRADED AGGREGATE BASE COURSE FOR ASPHALT (12")	12,161	SY	$ 18.00	$218,902
5004	PORTLAND CEMENT CONCRETE (PCC) (10")	2,071	SY	$ 90.00	$186,420
5005	PORTLAND CEMENT CONCRETE (PCC) FOR TRAFFIC CIRCLE ISLAND (5")	368	SY	$ 25.00	$9,211
5006	GRADED AGGREGATE BASE COURSE FOR PCC (12")	2,440	SY	$ 18.00	$43,916
5007	STANDARD TYPE A COMBINATION CURB AND GUTTER 12 INCH GUTTER PAN 8 INCH MINIMUM	451	LF	$ 32.00	$14,432
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$446,684
SUBTOTAL CATEGORY 5 COST					$1,563,395
ITEM NO.	**CAT. 6 (SHOULDERS) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
6001	CONCRETE BARRIER	1,715	LF	$ 135.00	$231,525
6002	GUARDRAIL	1,121	LF	$ 70.00	$78,442
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$123,987
SUBTOTAL CATEGORY 6 COST					$433,954
ITEM NO.	**CAT. 7 (LANDSCAPING) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
7001	12% Categories 2, 5, and 6	1	LS	$ 505,096.81	$505,097
7002	FOREST IMPACT MITIGATION	7.2	AC	$ 10,000.00	$72,000
CONTINGENCY			40%		$230,839
SUBTOTAL CATEGORY 7 COST					$807,936
ITEM NO.	**CAT. 8 (TRAFFIC) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
8001	OVERHEAD SIGN REPLACEMENT (NO STRUCTURE)	700	SF	$ 35.00	$24,500
8002	NEW/RELOCATED OVERHEAD SIGN AND STRUCTURE	3	EA	$ 90,000.00	$270,000
8003	SIGNING (GENERAL)	1.09	MI	$ 51,160.00	$55,764
8004	LIGHTING (GENERAL, 180' SPACING)	1.09	MI	$ 762,580.00	$831,212
8005	PAVEMENT MARKINGS (GENERAL)	1.09	MI	$ 36,960.00	$40,286
8006	ROADWAY LIGHTING STRUCTURE RELOCATION	1	EA	$ 1,500.00	$1,500
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$489,305
SUBTOTAL CATEGORY 8 COST					$1,712,568
ITEM NO.	**CAT. 9 (UTILITIES) - DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**
9001	20% Categories 2, 4, 5, and 6	1	LS	$ 1,824,085.91	$1,824,086
CONTINGENCY at 40% BASED ON CONCEPT-LEVEL DESIGN PHASE & SIZE OF PROJECT			40%		$729,634
SUBTOTAL CATEGORY 9 COST					$2,553,720

CATEGORY	DESCRIPTION	TOTAL
1	PRELIMINARY	$4,469,010
2	GRADING	$3,103,576
3	DRAINAGE	$3,864,180
4	STRUCTURES	$4,019,505
5	PAVING	$1,563,395
6	SHOULDERS	$433,954
7	LANDSCAPING	$807,936
8	TRAFFIC	$1,712,568
9	UTILITIES	$2,553,720
	TOTAL CONSTRUCTION PROJECT COST	**$22,527,844**
	RIGHT OF WAY - ALL IMPACTED PARCELS OWNED BY MDOT SHA OR ANNE ARUNDEL COUNTY	$0
	SWM RIGHT OF WAY - ASSUME SWM FACILITIES IN PARCELS OWNED BY MDOT SHA OR ANNE ARUNDEL COUNTY	$0
	ENGINEERING COST (SURVEYING, RIGHT-OF-WAY PLATS, DESIGN, AND CONSTRUCTION PHASE SERVICES) - 30% OF CONST. COST	$6,758,353
	TOTAL COST	**$29,286,198**